Bangor University

DOCTOR OF PHILOSOPHY

Inferencing unknown words in reading

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Award date:
1991

Awarding institution:
Bangor University

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<u>Title</u>

Inferencing Unknown Words in Reading

by

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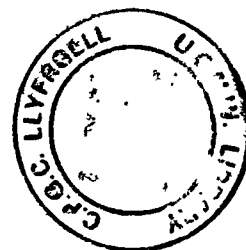
Degree of Philosophiae Doctor

Department of Linguistics

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Bangor

1991

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Abstract

We've probably all had the experience, when reading, of coming across an unfamiliar word and trying to guess some of its meaning. This thesis is a study of the guessing strategy used. Independent variables are: word meaning (known/unknown), form of presentation (cloze/pseudoword), word class (noun/verb), amount of information (3 amounts), orders of types of information (6). Dependent variables are: accuracy, confidence (belief in one's accuracy) and uncertainty (the number of alternative hypotheses held). Subjects are native speaker university students.

The main result is that subjects tend not to guess unknown meanings. They treat them as known meanings (ie. they guess a familiar single word rather than a new meaning) by regarding the meaning cues, as they appear across varying amounts of information, as inconsistent items of information. Whilst there are interesting differences for form, the presence or absence of an unfamiliar form does not materially affect this process. There are also interesting differences for order. However, an interpretation of this finding in terms of a principle of costs and benefits suggests subjects would not employ an order based strategy in real life.

The effectiveness of guessing as a communication and as a learning strategy is evaluated in the light of these findings.

Acknowledgements

I would like to acknowledge the following contributions here.

First, I would like to thank to Phil Scholfield not only for acting as supervisor for this thesis, but for also making the last three years a most valuable learning experience.

My thanks also to Dr Robert Borsley and Dr Carl James who were always ready to discuss ideas and whose lectures, together with those of Phil Scholfield, were always a good source of ideas.

I'd also like to thank all members of the Department of Linguistics at University College of North Wales, Bangor, for their help and cooperation over the last three years. My thanks also to all those members of other departments at the university who helped me find subjects for experiments and to those students who took part in the experiments as subjects.

Finally, a special thank you to my parents. Without their financial and moral support I could not have attempted this study.

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Chapter 1

In Search of a Question

We've probably all had the experience of coming across an unknown word when reading and trying to use the context to guess at least some of its meaning rather than going to the dictionary. The tangibility of this phenomenon has perhaps been one of the factors which has attracted research into guessing word meanings, but there are at least two other reasons why this topic maintains its popularity.

Firstly, guessing word meanings is seen as an important communication strategy. Here, the work of Hosenfeld (1977) forms a background. Guessing is seen as a way of maintaining reading fluency in preference to breaking off to use a dictionary or glossary whenever an unknown word appears. Subjects who adopt such strategies are often termed risk takers in that they are prepared to gamble on a guess which may only be partially correct, or even wrong, rather than rely on an appeal to external authority as do subjects who are not risk takers. Communication strategies like guessing are particularly important in the world of foreign language teaching where students can encounter high numbers of unknown words, but there is no reason why they should not also be of relevance to native speakers.

Secondly, guessing words is seen as an important learning strategy. Here native speaker children are the main focus although there is no reason why this should not also apply to

foreign language learners. The motivation behind this work is the observation that children seem to learn large numbers of words very quickly but don't seem to rely on dictionaries or teachers. To quote one group of researchers in this area, Jenkins et al (1984), "Although it is too early to dismiss direct instruction as a factor in vocabulary development, the available evidence is far from supportive. Given the changes in vocabulary knowledge which are said to occur, the results of classroom observations, which find little vocabulary instruction ... it is hard to resist the conclusion that changes in word knowledge must result from something other than direct instruction ... The next most plausible explanation is that increases in word knowledge are largely a function of learning from oral and written context."

Perhaps, with relevance to learning strategies, we should take the work of Seliger (1977) as a background, although he is concerned with foreign language learners not natives. The good learner is termed a high input generator. This subject seeks out opportunities to use language and rejects a passive role. Another idea connected with this is that depth of processing encourages learning. In terms of guessing, we might envisage such a subject going over and over the context in the area of an unknown word or target as it is often referred to in experimentation in an attempt to get as much of its meaning as possible. Low input generators might seek to avoid targets to a greater extent. The more times a subject goes over the unknown the better are his chances of remembering it. Perhaps

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we should also note here the work of Fillmore (1979) in second language acquisition. She describes a successful subject, Nora, as someone who seeks interaction which tends to suggest a high input generator. But the way in which Nora seeks to keep conversation going also suggests something of a risk taker. Fillmore suggests that her motivation is the key in that she identifies with the foreign language and perhaps this is a common element between risk takers and high input generators. Fillmore also describes subjects who are poor language learners. These are pretty much the opposite of Nora in that they don't seek interaction or try to keep the conversation going.

Since guessing words, then, is a popular topic, it is important to take a brief look at the literature to see what questions have been asked partly to help formulate a question of our own and also to provide a background to such a question. Before doing this we need two things. First, a rough definition of the term <u>guessing</u> in order that we can get a fairly clear picture of what is going on in the literature and second some categories to divide the literature into.

As to a definition, try and guess the following word:

1. a) _ _ o p _ _ _
   b) This is a kind of cat.
   c) l _ o p _ _ d

In order to guess or form a hypothesis as to the word (I'll use the term _target_ in future to refer to the object which has to be guessed) at 1, we need clues. (From now on I'll use the more technical term _cue_ in place of _clue_.) Also, in terms of the hypotheses we form, we need to know whether we are correct ie. Are we accurate in our guesses? Guessing then can be viewed as a relationship between cues or information and the accuracy of the hypotheses we form on the basis of this information. In any empirical study, information would form an independent variable and accuracy a dependent variable and we can ask questions as to whether two letters in the middle of the disguised or unknown word, or _target_ as I will refer to it, is a better cue than one letter at the beginning of the target and one at the end or whether the type of "meaningful" cue at 1b) is better than the letter cues at 1a) and 1c). In other words we can ask questions about type of cues. We could also ask whether two cues are more effective than one and whether three cues are more effective than two. In other words we can ask questions about amount of information. We could also ask whether using the information at 1 in the sequence _abc_ is more effective than in the sequence _cba_ etc. In other words we can ask questions about the order of cues.

Moving on to the to see what has been done in terms of guessing unknown words. As to categories which could be used to organise this background review, the obvious division is into communication and learning strategies. This division, however, I am not going to adopt. Rather, to begin with, I am

going to disregard any difference between communication and learning strategies in an attempt to look at the information and accuracy variables. Admittedly- though many since have blurred this distinction- Corder (1978) warns against not drawing a distinction between the two types of strategy. But information is common ground to both since learning can be viewed simply as something not different but rather additional to communication. That is, we guess in order to carry on reading, but then we can go one stage further and retain our guess. In empirical terms, the major difference between communication and learning strategies is the presence of a time gap in the latter which lies between the guessing activity and the test of how much information has been acquired.

The first background area to review then will be concerned with information. Its purpose will not only be to review literature but also to limit what type of cue will be focussed on and to suggest a framework based on amount and order of information which can be used for the research planned in this study. The second background area will be concerned with type of target. Here I plan to pick out a problem which has given rise to some concern amongst researchers and in showing how it can be combined with the research structure in the previous section set the theme for the original work in this study. I will also try to demonstrate the relevance of this theme for communication strategies. The third background area will be concerned with learning strategies and will look briefly at some of the topics more peculiar to this field than

communication strategies and will attempt to show how the theme of this thesis may be of relevance to guessing as a form of learning.

Two further points, briefly. I will confine myself in so far as possible to research covering the last ten years, stepping further back only where something seems to be of real importance. Secondly, articles of the type which give good advice to the teacher abound. Burroughs (1982) is a good example and the title How I Learned to Stop Worrying about Word Lists at once suggests the anecdotal nature of the contents. Such articles are valuable in that they can stir thought, but for the purposes of this study they will be ignored.

Information

The major preoccupations of work in guessing have been to categorise or classify the types of cue available to subjects, to assess them in terms of effectiveness generally using accuracy as the dependent variable and to judge the effect of factors related to information such as cohesion and distance of the cue from target again in terms of accuracy. Another area is the effect of different amounts of information on a dependent variable like accuracy. Yet another area is concerned with the order in which subjects use information. These five areas, then, give us our sub-headings for looking at the information variable.

<u>Cue classifications</u>:

Most cue classifications are now dated so I must step outside my ten year limit. The interested reader is referred to the following classifications: Ames (1966), Dulin (1970), Ffrench (1981) and Sternberg et al (1982). The most detailed classification is that of Ffrench but it is too lengthy to give here. As an example, so that we can get some idea of the kind of cues which have been identified I will give the Ames classification at 2. This is probably the most frequently quoted classification and is based on responses of graduate native speaker students as subjects. There is also a replication of this study by Quealy (1969) using senior high school students. Ames creates targets by using made up word forms or pseudowords to replace real words in a text. I'll simply give the real word to be guessed in brackets.

2. <u>Cue Type</u>   <u>Example</u>
   a. Familiar expressions   Written all over their (faces)

   b. Modifying phrases/clauses   He knocked her down and
                                     (slashed) her repeatedly with
                                     a knife

   c. Definition/description   ...professional (donor). A few
                                     who sell blood

   d. Words connected   sonnets and (plays)

   e. Comparison/contrast   .. a blessing or a (curse)

f. Synonym

It (provoked)- and still provokes

g. Tone/setting/mood of of a selection

Maybe the space age does belong to us after all. ....it is necessary for (astronauts) to be ambidextrous in order to manipulate the keys..on their instrument panels from their strapped and cramped positions.

h. Referral cues

Knowing that women don't want anything they have to scrape, chop or wash through three waters, Jenkins started doing these (things) at the store.

i. Association

Little boys wear short (trousers)

j. Cues derived from main idea an supporting ideas of paragraph organisation

I soon found a (practical) use for it. I began storing orange juice in it since it fitted inside the refrigerator.

k. Cues provided through question and answer paragraph organisation.

And what about (writing) itself? The English language has been designed by right- handers to be written with the right hand ie. from left to right.

l. Preposition cues

He sped northward along the (freeway)

m. Non-restrictive relative   A mother's stay is limited to
   clauses/appositive phrases   24 hours- (hardly) a sufficient
                                    period for her infant to
                                    stabilize

n. cause/effect patterns   By cheating the insurance
                                    companies, they are only
                                    pushing their own premiums
                                    (higher).

One can pick holes in this classification. Cue 2a is only going to be available to native speakers. Cue 2f is really repetition rather than synonym. However, I don't want to get bogged down in detail here.

What general points can we draw from a classification such as that given at 2?

The first point is that it is incomplete. Conspicuous by its absence is the category of cues in the word form. For example, the morphology of a target word form could provide us with an idea of its meaning. One possible reason why Ames does not mention this category is that researchers tend to make a distinction between contextual cues such as those at 2 and word form cues. One tends to focus on one or the other. So we need to make a decision. Do we focus on context cues or word form cues? In answer to this, I intend to focus on context cues such as those given by Ames and ignore word form cues. The reason for this, I'll come to later.

A second point is that we should ask how the cue types at 2 work. Well, leaving aside fairly explicit definitions like

cue c) the relationship between cue and target depends on some form of meaning relationship. These meaning relationships can be seen as either definitional or pragmatic and purely associational.

As an example of a definitional link between cue and target we can take beauty-> ugliness. Both have has part of their meanings the idea of ESTHETIC (the first being pleasingly so the other not) so if they were to appear in a contrast as at e) with one of them as a target we would be able to guess this part of the definition of the target and since Ames is using pseudowords, choose the only available hyponym ugliness. A word of caution here. Contrast may not always lead us to the exact opposite since there may not be one. A contrast on iron could lead us to get any metal. So it would be better, following authors like Blakemore (1987), to see the constraint on the target as NOT IRON. This would still, however, give us the definitional information METAL. In a synonym cue like f), pleasing would give us definitional information on beauty as a target. Another example of a definitional relationship would be where selection restrictions operate. Weinreich (1971) points out that in a phrase like pretty children then children is interpreted as girls. When the noun in this phrase is ANIMATE the adjective also selects FEMALE. In the same way, the verb wear at cue i) selects CLOTHING and passes on this part of the target's definition. (granted one can wear a smile).

If we turn to associative links between cue and target we

could form a contrast purely on pragmatic/associative lines: beautiful-> intelligent. Similarly, pragmatic synonyms would be beautiful-> stupid or empty-> harmless. Also, with cue i), a selection restriction might only pass on a very vague aspect of the target's definition. The selection restriction on the verb eat is not FOOD but SOLID and it is only association which would lead us to guess steak before light bulb. Similarly, although the preposition at cue 1) imposes limitations on the noun we would not get far without the association sped. When we come to cue type g) the relationship is wholly pragmatic. The target astronaut is surrounded by a set of purely familiar associations like space age, instrument panel etc. Much the same could be said for the paragraph structure cue at j). Here, in the way in which we are talking about sets of familiar associations we are coming close to the idea of schema which I'll come to shortly.

Ames and others classify cues by what they are. An alternative approach based on the above is to classify them in terms of how they work or rather the kind of information they give. We can, then, talk perhaps of three broad cue types which cut across the classification at 2.

Explicit definitional cues. Here the meaning of a target is quite simply stated. Ideally, this cue type would be more overt than 2c where recognition of the cohesive link between target and definition is important.

Implicit definitional cues. Here a cue shares some of the definitional elements of the target.

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Implicit associational cues. Here the link between cue and target is in the main or purely associational and pragmatic.

Effectiveness of cue types:

Here I'm going to focus on three areas involving the cue types from the last section: between cue comparisons or explicitness, schema and cues in the word form in order to give a picture of what is being done in terms of experimentation in this field in linguistics.   I'll clarify each area as I come to it.   A point to remember is that in linguistic studies the dependent variable almost universally used is accuracy. Unless I state otherwise the reader can take it that this is the case.

Explicitness or Between Cue Type Comparisons: A term which one frequently comes across in the literature is explicitness. It is usually a way of referring to comparisons in terms of effectiveness between cues of the contextual type I'll mention three studies in connection with this topic.

First, Carroll and Drum (1983) contrast cues which give a precise definition and are termed explicit with cues that require a guess, these being termed implicit.   An example is given at 3 where the target is underlined. Subjects are native speaker 11th and 12th graders. The example at 3a gives a definition where we can see that the subject is informed by the words we call it that he is being given the meaning of the target it much the same way as he would find it in a

dictionary.   Such cues are termed _explicit_ in this study and

I've   ⁊

3 a) If energy is absorbed in a chemical reaction, we call it
an _endothermic_ reaction.

   b) Previously, sailors depended on landmarks.   Now the
compass, the _astrolabe_ and the development of more accurate
mapmaking enable them to navigate.

labelled them above as explicit definitional. Really, a guess

is not required. With the cue at 3b we should be able to guess

at least some of the meaning and identify _astrolabe_ as _a kind_

of navigational instrument since cues and target share this

meaning component. This cue is seen as implicit in this study.

I'd tend to say that the cue is implicit definitional.

      Second, Carnine et al (1984) tested the following cline

of explicitness in cues: synonym, contrast and inference or

deduction. The synonym is seen as the most explicit. An

example is at 4. Subjects are native speaker 4th/5th and 6th

graders.

   4. The starfish has a most _idiosyncratic_ way of eating.
      a) It's certainly very strange. (synonym)
      b) It's certainly not normal. (contrast)
      c) Most animals do not eat in this way. (deduction)

All three cues at 4 are pretty much paraphrases of the target

and I would tend to see them as all being fairly explicit

definitional.

Third, Carroll and Drum (1982) contrast definition and synonym cues. They don't give examples, unfortunately, but it looks as though we might have a contrast between explicit definitional and implicit definitional cues. Subjects are native speaker 8th graders.

The key question is can we see any difference in effectiveness for the different types?

Carroll and Drum (1983) find definition (explicit definitional) superior to cues requiring a guess (implicit definitional). We do need to be careful here, though, as there is an important point concerning the amount of information given to subjects. If we look back at 3a) we are given basically a dictionary definition of <u>endothermic</u>. We have a general category or genus in that this word describes reactions <u>involving heat</u>. It holds this feature in common with other words in the same family such as <u>exothermic</u>. We also have a more specific item of information in that heat is <u>absorbed</u> not <u>given off</u> which we can call a differentia and serves to distinguish this word from <u>exothermic</u>. However, if we look at 3b where we have a cue involving a guess we are only in a position to find a genus category and identify <u>an astrolabe</u> as <u>a navigational instrument</u>. In other words the superiority of the definition cue may be coming not from the fact that this is an easier cue to handle but rather that subjects are given more information in this condition. We need to correct this disadvantage by giving a cue to the differentia of <u>astrolabe</u> in

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order to compare the two types of cue on equal terms.

With the Carroll and Drum (1982) study we do in fact find no difference between definition (explicit definitional) and synonym (explicit and implicit definitional functions). But there is a problem here, also. Unfortunately they don't give examples so I would be very cautious here. The authors replace words in a text with pseudowords. So what might be happening is that the synonym might simply be a repetition of the actual word which has been replaced by a pseudoword and so gives a complete description of the target just as a definition would. A normal synonym would usually differ from the target in some respects.

Carnine et al found that synonym was better than deduction but there was no difference between synonym and contrast or contrast and deduction. I don't find this lack of any fine distinctions surprising since all these cues seem to be paraphrases and are fairly explicit definitional in function.

It is reasonable to think of different cue types having different powers. If we turn to the psychological literature work in this area, then, Neely (1982) when asking subjects to predict which of a pair of candidates would win an election found that subjects based decisions on both the number of wins a candidate had and the strength of opposition he had defeated. But a candidate who had won a few times against strong opposition was generally preferred to one who had won many times against weak opposition. Strength of opposition defeated

seems to be the more powerful type of cue. Different types of cue and their respective powers needs to be kept in mind in any experiment.

Returning to the linguistic studies mentioned we can sum up what has been done and what needs to be done. We've identified three broad cues in terms of the information they give. There is the possibility that explicit definitional cues are superior to implicit definitional, but we do need to be careful here because of the problem with amount of information. Also, a very interesting place to look for a contrast would be between implicit definitional and implicit associational cues. One would expect the former to be more powerful than the latter. But to the best of my knowledge this contrast has not been explored. So an important piece of work would be to compare these cues carefully. Also we have 14 cue types mentioned by Ames. Can these cue types be classified by the kind of information they give? Contrast at 2e) can give information in two ways, but perhaps we can suggest that it favours the implicit definitional type whilst tone and setting 2g) seems to operate completely in an implicit associational way.

Schema: Again we are looking at the effectiveness of a type of information. The term schema refers to familiar patterns of knowledge. Bower et al (1979) investigate the knowledge people have of routine activities such as eating in a restaurant. We may, for example, know that the first thing

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that happens in such a schema is being shown to a table and the last, tipping the waiter. What we really looking at is sets of familiar associations (we're very close to cue type 2g) and so we are in the area of implicit associational cues. However, researchers seem not to contrast schema with other cue types. Rather, they are interested in whether or not schema has any effect or not.

Anderson et al(1976) shows how general terms are instantiated by schema as in:

5. The woman was outstanding in the theatre.

where our knowledge of the theatre would lead us to substitute actress for woman. In much the same way, schema might help us to guess.

6. I ____ the waiter before leaving.

Knowing that tipping is the last act in a restaurant scene, we should be able to fill the space at 6 with this verb, or if the word form is unknown, with a phrase like gave the waiter money. From what is said broadly in the text we recognise a familiar pattern of knowledge ie. associations which we are able to draw on to guess the target.

As to empirical studies involving guessing, Adams (1982) using a mixed group of native and non-native speakers guessing targets in a passage which have been replaced by pseudowords

ie. nonsense words, gets an effect for schema, with those subjects operating in the schema condition performing more accurately than those without schema. There was no interaction between type of subject and schema non schema condition so both native and foreign speakers seem to benefit fairly equally.

One problem with this experiment is that Adams uses schema or script activators: a very brief account of what the passage is about. Those in the schema condition get this activator those in the non schema condition do not. Perhaps a safer method would have been to give subjects in the schema condition a passage about which they had familiar background knowledge and denying this advantage to the non schema subjects. The use of script activators leaves her open to the criticism that those in the schema condition have received more information than those in the non schema condition. On reflection, though, the script activator only repeats information subjects get in the passage and doesn't add anything new so I'd tend to accept this result.

Freebody and Anderson (1981a) and Anderson and Freebody (1983) using only native speaker subjects look at the idea of whether the presence of a schema is helpful in the presence of unfamiliar words. Their experiment is fairly complex. They are not looking directly at guessing unknown words. Rather they are looking at something called the compensatory hypothesis. This suggests that if one source of information in a text is damaged another source can compensate for it. So if we have some unknown words in a text then a familiar schema may

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make up the deficit. But note that the measure is in reading comprehension not in terms of stating the meanings of the targets and this is a complication.

Also, in order to support the compensatory hypothesis, Freebody and Anderson are looking for an interaction. They have a vocabulary condition with easy a difficult levels and a schema condition which is simply the presence or absence of a familiar background (topic) to the text. They predict that the condition of unfamiliar topic and difficult vocabulary will produce a markedly poor performance since it is the only condition which receives absolutely no support or "compensation". They don't get this interaction.

I would make two points with reference to the Freebody and Anderson experiments.

First, I would very cautiously suggest that the interaction they predict is not likely to occur. If we label the schema conditions F and U (Familiar and Unfamiliar) and the vocabulary condition H and E (Hard and Easy) and if we award F and E 2 points because they are helpful and U an H 1 because they cause problems we get the picture at 7.

7.   FE (4)
    UE (3)_____/
                                      FH (3)
    UH (2)_____/

The lines stay parallel.

Secondly, the authors do get a main effect for schema and the familiar schema containing both difficult and easy vocabulary does seem to be superior to the unfamiliar schema containing both vocabulary types.

It seems to me that there is support that familiar schema (and so the implicit associational cues) do help in guessing. The question of whether this is as effective as other cue types remains open though.

Cues in the word form: Morphology is one type of information and some interesting work has been done on its effectiveness. Morphology could be a good source of information where the words formed are not idiomatic and where subjects have some knowledge of morphology. Both these are big "ifs", however.   Otherwise it could be a dangerous source of information.

Anderson and Freebody (1983), using false alarms as a test ie. claiming to know the meaning of a word when one doesn't, found that able native speakers used word formation rules aggressively and dangerously claiming to know words like loyalment. They don't regard this as too serious since, as morphology is used in new word formation, subjects could be trying to create or coin new words. However, low ability subjects tended to false alarm on targets that were phonemically or visually similar, "juggling" the decoding until they found a match with a real word eg. grell -> grill. This

kind of superficial similarity isn't strictly speaking morphological but resembles it in so far as both sources of information lie in the word form. For natives then, ability seems to be a factor here. This is supported by Carroll and Drum (1982) who found that low ability subjects, native speaker school children in this case, sometimes substitute look alikes for the target. Boettcher (1980 p153) using native speaker 12th graders also finds that subjects make this kind of error. However, she finds no effect for ability but does get one for part of speech. It's more likely to happen on nouns. This latter part of the result might be something of an accident. On the whole, I would go along that this kind of error is more likely to happen with low ability subjects.

With foreign language learners, there is a series of papers: Bensoussan and Laufer (1984), Laufer and Sim (1985) and Laufer (1987a) which suggest that this type of subject both uses morphology badly and is deceived by the surface resemblance of the target to another word. As an example of the former, in the (1984) article, they cite mistranslating outline as the sum of it's components and getting out of line, and of the latter, misidentifying implication as application. These are serious errors and span both high and low ability subjects.

Two other researchers, van Parreren and Schouten van Parreren (1981) note that not only do language learners make errors off morphology but feel very sure about the correctness of such guesses. It's little wonder that more recently, Laufer

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(1987b) advocates direct teaching of vocabulary rather than guessing. There is an interesting footnote in an article by Laufer and Bensoussan (1982), however: "But the reality is that in the course of their academic studies our students have to face authentic academic bibliographies." We seem to be talking about courses in English for Specific Purposes as advocated by Munby (1978) which, by tending to focus on the target level rather than the starting level of students, can produce a problem. My suspicion is that much of what has been noted above is down to the texts used by these researchers being too difficult for the subjects. Granted, morphology should function in isolation from the context, but in real life subjects probably balance morphological guesses against the rest of the context to see how well they fit. If, however, subjects don't understand the context they do become easy victims to the possibly idiomatic nature of morphological information. (Note that in word association tests, responses using only sound: chair->hair seem a last resort. See Meara 1982).

Certainly, if one turns to Japanese then work by Hatano et al (1981) suggests that morphology is very helpful to language learners. Probably, this type of information is more systematic in Japanese than English and so subjects become more aware of it. Possibly also it is less idiomatic. Interestingly, here Kaye et al (1987) with native speaker subjects found that adults performed better than adolescents with morphology but that this was linked to another independent

variable, metacognitive knowledge of the system which we mentioned above. This variable probably not only affects age but I suspect ability and one would expect to get an effect for this with foreign language learners if text difficulty is matched with proficiency. That is we'd see low proficiency subjects make slips to similar looking/sounding words and more proficient subjects use morphology more effectively.

Regarding the way in which subjects are deceived by the superficial similarity of targets to other words this might be linked to some interesting psychological work by Esposito (1987) on the effects of fixation ie. staring at words. He records how fixation can alter the shape of letters: E becoming K and L becoming T and its effect on larger units with WAIT becoming WA-IT. Possibly lower ability subject who take more time to puzzle something out are tending to fixate words with this result. It's possible that something like the following might happen. The reader comes across an unknown form like devilope. Fixation could produce devil-ope with the hypothesis being some kind of antelope or de-vilope -> de-velope with the final hypothesis being develop. There might be an interesting parallel dimension here with foreign language learners. Green and Meara (1987) suggest that subjects from different kinds of script background- Roman, Arabic, Chinese etc. produce different patterns of visual search when interpreting a word. This could have an effect on how a reader using a non-native script might break up words when trying to guess from the word form.

To sum up this section, cues in the word form seems to be a particularly interesting area with a lot of work being done and a lot more which can be done. However, I am going to exclude it from this study. The way in which ability and awareness of morphology can create divisions within any group of subjects are going to create differences within any experiment which we won't be able to account for without measuring for these factors before hand. To do this would be to place too great a strain on resources. Also Boettcher (1980) identifies the contextual type of cue as described by Ames as that most frequently used and I intend, therefore, to focus here rather than word form cues.

Information related factors

This section looks at factors which aid or hinder the exploitation of cues, these cues being mainly of the textual sort.

Cohesion: Here we are not so much looking at a type of cue but at a factor which can affect all the various types, namely the clarity of the cues. Herman et al. (1987) contrast four versions of text: the original, a macrostructure revision where titles are made explicit, irrelevant information removed etc., a microstructure revision which makes text relationships like cause/effect etc. explicit by adding signal words and an elaborated version where information about key concepts is added. Note here that in the elaborated version we have not so

much the making explicit of existing text relationships but the addition of cues. So the versions are not balanced in terms of amount of information. The microstructure version can be seen as a maximising of cohesion and the macrostructure as a maximising of the closely related idea of coherence. Two different texts/passages were used in the experiment, each in the original, macrostructure, microstructure and elaborated version giving eight test groups. Subjects were native speaker high school children. Each subject saw only one of the passages but was tested on vocabulary targets contained in both so we have basically a context versus no context situation with four different versions of the latter. The dependent variable was accuracy measured by multiple choice questions directed at low frequency words in the texts. Context was more effective than no context, but if we look at the different versions of contex then the only effect was for the elaborated version which produced higher scores than the other versions. This is not surprising since as noted above this version appears to have an advantage over the others in terms of amount of information. More interesting, neither cohesion nor coherence have an effect.

Is the lack of a result in the above experiment for cohesion in some way aberrant? Anderson and Freebody (1983) and Freebody and Anderson (1981a) also experiment with cohesion using native speaker high school students. Here passages are constructed at three different levels of cohesiveness. Vocabulary difficulty is manipulated by the substitution

unfamiliar synonyms so that each level of cohesiveness is seen in vocabulary familiar and vocabulary unfamiliar conditions. Measures are based on general comprehension and not number of words guessed. It is hoped that in the highly cohesive version the cohesion will compensate for unfamiliar vocabulary in terms of comprehension. Whilst vocabulary difficulty affects subjects' performance (the authors suggest that subjects try to avoid unfamiliar words) there is no main effect for cohesion nor an interaction between vocabulary difficulty and cohesion. Possibly this lack of a result for cohesion comes from using the indirect measure of reading comprehension rather than measuring the number of difficult words guessed. It does, however, support the idea that cohesion may have little impact on guessing.

Cohesion should be seen as part of a wider debate as to what helps make cues relevant to the guesser. One would like to say that knowledge of the language system plays a part and despite the negative results above, this, I suspect, must be to some extent the case. One might try to argue that the lack of a result is due to cohesion being in some way subsumed by coherence but the Herman et al (1987) results seem to rule this out. We should, however, persist with the idea of cohesion.

Importance: The position of the target in terms of importance may play a role in guessing. Anderson and Freebody (1983) and Freebody an Anderson (1981b) asked a group of subjects to rate a set of propositions in a paragraph in terms

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of importance. Two versions of the text were created. One with targets in unimportant positions and one with targets in important positions. A second group was then asked to read the paragraph and after the passage had been removed to summarise it. They found that passages with unfamiliar targets in unimportant positions were better summarised than those with targets in important positions. The conclusion is that subjects try to avoid targets and can do so with less damaging results when they are in unimportant positions. We also need to consider the possibility that a target in an important position can put more pressure on a subject to guess than if a target is in an unimportant position. We might link this factor with cohesion in future experiments. It could be that anything which helped to clarify targets in important positions would be seized upon by subjects.

Similarity: In the psychological literature factors like the surface similarity of the cue to the statement of the problem are discussed as factors which make the cue relevant, see Stein et al (1986). Whilst there is certainly an element of this in the errors noted in the section on cues in the word form, I think we'd want to say that there is more to the idea of relevance in guessing words than a surface similarity between cue and target and that the language system must be involved. Possibly the psychological literature may somewhere hold an idea overlooked by the linguistic.

Time: Another factor mentioned in the psychological literature which could have an effect on relevance is time. Bowden (1985) shows that allowing subjects thinking time increases their ability to pick out relevant information. He takes two groups of subjects. The first group is informed which cues are relevant, the second is not. Clearly, the first group has an advantage, but the subjects in the second group are able to reduce this advantage increasingly as performance is measured at successive points across a two minute time scale. Possible we might get an effect for cohesion by timing subjects' responses on cues which are overtly cohesive as opposed to those that are not with the expectation that the former type would be used more speedily than the latter.

Proximity and direction of cues: With proximity, Madison Carroll and Drum (1982) found that cues near the target were easier to recognise than those further off and Carnine et al (1984) get the same result. Direction is more ambiguous. Carroll and Drum (1982) found cues before the target easier to recognise than after, but Madison, Carroll and Drum (1982) got no result on the same measure. Note that we are again talking of what makes cues relevant here and it would be nice to tie these factors to the linguistic system in some way. Perhaps this could be done through syntax using the complement/adjunct distinction. A cue in the complement being nearer to the target than one in the adjunct. (See for example Radford 1988 pp. 174-179 for an explanation of these terms)

Text type: Are some genres easier to guess from than others? Carroll and Drum (1982) found fiction and biography easier than science in terms of accuracy and ease of spotting cues. One would expect a lot of variation within genres, however, which will complicate things. Selinker and Douglas (1985) in dealing with communication strategies in language production, notice how their subject, Luis, behaves more positively and tenaciously in a technical domain he has knowledge of than in a non-technical domain. Perhaps, we need to take this idea of how a subject regards the domain he is being asked to perform in into account when dealing with the idea of genre in the receptive strategy of guessing.

Looking back at the topics discussed so far, then I've decided to exclude cues in the word form in favour of contextual cues. Also, we need to decide about information related factors like cohesion and text type etc. Whilst a lot of interesting work has been done here and much more in fact can still be be done, they are to some extent peripheral to the guessing process itself, helping or hindering this process. I am going to exclude information related factors from this study in the interests of focussing on the guessing process itself. We must remember, however, that in real life we will come up against these factors.

A second point I would make here is that the independent variable amount of information which is clearly of importance in experiment design in the area of guessing seems to some

extent to be escaping the attention of researchers. There are three cases above: Adams (1982), Herman et al (1987) and Carroll and Drum (1983) where schema, elaborated text versions and definitions are claimed to be superior when in fact these results could be explained in terms of amount of information giving accuracy an advantage. This does not mean that these researchers are wrong. They would, perhaps, have been more clearly right had amount of information been controlled. I want to move now to look at what has been said about the amount of information variable in the linguistic literature.

Amount of information

The impression given so far is that accuracy will increase as information increases. This is not necessarily the case, however. A subject could mistake a cue which is not relevant as relevant and so accuracy could suffer with information. Providing then that subjects can pick out relevant cues, accuracy will rise as information increases.

Carroll and Drum (1982) found a context condition in which targets were presented in short paragraphs containing cues to be better than a no context condition where the paragraph contained no cues; in other words the condition which provided some information produced greater accuracy than that which provided none. In terms of guessing as a form of learning, Duffelmeyer (1984) shows dramatic gains for a context as opposed to a no context condition. Here the no context condition consists of a multiple choice test asking subjects to

identify the meanings of words in isolation. The context condition uses the same test at a later date but this time with targets embedded in a sentence containing cues. Again we have the dependent variable of accuracy responding positively to the independent variable amount of information. Li (1988) compares cue adequate and cue inadequate conditions not only in terms of accuracy but also certainty and gets a positive effect. The main problem with these studies is that the information variable is crude, basically something versus nothing.

Na and Nation (1985) found that unknown words in a text where the density was one target to twenty five words were easier to guess ie. produced greater accuracy, than in a text of one target to every ten words. Here instead of something versus nothing we have two different amounts of information and accuracy appears to be increasing as more information becomes available. Another way in which the variable amount of information makes itself felt in experiments is through repeated exposure to targets in different contexts. An example of such an experiment is McNaughton (1983) who records that after six reading sessions involving exposure to targets accuracy increases quite noticeably. The variable of amount of information is treated more subtly in these studies, but it seems also to be peripheral. The first study is concerned with target frequency and the second with repeated exposures. The idea that amount of information is bound up with these ideas doesn't seem to be explicit.

In an experiment by van Daalen-Kapteijns and Elshout-Mohr

(1981) subjects are given five amounts of information (brief contexts) and asked to deduce verbally- the results being tape recorded- a guess as they see each cue in this series of five. They are interested in the kind grammatical operations used by subjects to decontextualize the meaning of the target and also in the accuracy of the guesses. First they identify two groups of subjects: one group of subjects likely to decontextualize well and one group where the subjects are not so likely to do well. They then use the data collected in the way described above to see if there is a real difference between high ability subjects, termed <u>high verbals</u> and low ability subjects, termed <u>low verbals</u>. The article, I find extremely stimulating, but it must be said that these researchers under use their data. When we come to the statistics it's the Kolmogorov-Smirnov test which is used to differentiate between the two types of subject when it might have been possible to alter the design and use an ANOVA across five means (the amounts of information) for the two groups. Why do this? Well instead of a stark contrast between two types of subject we would have seen the the dependent variables develop across the continuum of five means. For example, accuracy might have involved a steady rise for good subjects and a lower rise for the poorer ones or perhaps the poorer ones might have started low and then caught the good ones up, and at each interesting point we could go to the data and look for an explanation rather than waiting until the end. In short, amount of information used efficiently as an independent variable can give us a description of the guessing

process. Here, however, this possibility is lost. Perhaps I'm being unfair in criticizing the statistical test used. It is appropriate to the intention of the authors which is to differentiate between subject types. What is frustrating is the realisation that amount of information can produce changes in variables, hence the five amounts of information are used to chart a process like decontextualization, but not to have this carried through to the statistics. These authors do, however, give some interesting examples of subjects' guesses which I'll return to later.

Recently the idea of amount of information has been caught up in a debate involving <u>authenticity</u> or naturally occurring contexts and this has, perhaps, distracted attention away from its possible use as a research tool. The argument is briefly that authentic texts do not give us sufficient information to guess from (they also mention the interesting idea that cues might mislead) and that many of the more positive results achieved by researchers have been due to the use of simplified texts which are "over rich" in information. This argument comes to a head with Schatz and Baldwin (1986) who find no difference between a context condition and a word in isolation condition. My feeling is that this result is caused by the construction of the items used to measure success. If we look at an example of one of their test questions given at 8:

8. He takes out an envelope from a drawer, and takes paper money from it. He looks at it ruefully, and then with decision puts it into his pocket, with decision takes down his hat. Then dressed, with indecision looks out of the window to the house of Mrs. Lithebe, and shakes his head.

RUEFULLY

a) sorrowfully
b) thankfully
c) fearfully
d) casually
e) longingly

One could guess that the target means an expression denoting some kind of emotion, which, in my opinion is a reasonable guess and better than one could do for the word in isolation, but since all the distractors are within this category then the choice is random or, in other words, the context condition is no different to a situation where the distractors are presented in isolation without a context. They also use a test involving written definitions but these are marked very tightly as right or wrong and the effect is similar.

To be fair to these authors, they seem really to be trying to discover whether subjects can guess the meaning, in a complete sense, of words we have never seen before. They do not really want to consider the possibility of just guessing some of the meaning. One thing the authors do not do is specify whether they regard guessing as a communication or a learning strategy since in a learning strategy it is arguable that we need a substantial part of a target's meaning whilst

this need not be the case with a communication strategy.

Also, I'm not sure that bringing in the idea of natural or authentic contexts is the way to tackle this problem. Clearly, we need to look at realistic studies of guessing. But does the idea of <u>authenticity</u> really describe 'normal' text? Can a small sample of natural texts be thought to be representative of a vast and diverse reality? I would go along with Widdowson (1990) when he remarks that authenticity "...does not depend on the source from which the language as an object is drawn but on the learners' engagement with it". It is this term "engagement" I would emphasise. It applies not only between reader and text but also between writer and reader. The writer will always write to a preconceived audience- admittedly he will sometimes make a misjudgement- but where he feels he is pushing his audience then he will help by adding information and so simplifying. What this suggests is that we can get large variations of cue density in ordinary writing and it is the effect of cue density ie. various amounts we need to look at and not the authentic distinction.

An idea we should not forget with respect to amount of information is that whenever we put cues together they will stand in some kind of a relationship to each other. Beck et al. (1983) pick up on this idea of what might happen within a cluster of cues all of which are perceived as relevant. They categorise four context types: directive, general, nondirective, misdirective. Here we don't just have differing amounts of information. Whether or not a cue points us in the

right direction is important. The first type points to a specific meaning, the second to just a general idea of the meaning, the third isn't really helpful at all and the last sends us completely in the wrong direction. We can see here that accuracy as a dependent variable might not always rise with number of cues; in a misdirective context it would probably remain low. An interesting question here is what the result of such a context would be on a dependent variable like certainty, mentioned earlier. Beck et al do miss one point, however, in that they tend to see cues as either pointing towards a target, away from a target or in the case of the non directive context there just not being enough of them. But what if one perceived cue points to the target but a second points to a meaning or word which is not the target ie. the cues point in different directions. The inconsistency of cues is a problem pointed out by Carton (1971) and is a problem we can't really avoid once we start looking at amounts of information in real life.

In this study, I will focus on the amount of information variable within directive contexts. The alternative contexts are clearly important, but it will be more logical to look at guessing under favourable conditions prior to unfavourable ones.

Order of cues

Having discussed amount of information and decided that it is a worthwhile variable to explore, if we now bring back

type it becomes more of an unknown quantity. The combination of amount and type of information gives us a new variable, namely sequence or <u>order</u>. The question here is, when there is more than one cue available and these cues are of different types, then will subjects go for one type of cue before the other?

The importance of order is that it can affect outcome in that it might allow us to avoid a difficulty or exploit an advantage. Imagine a farmer who rather than operating in the normal sequence prepared the land in autumn, sowed in winter and came back to harvest in spring. The outcome of the normal sequence is usually a reasonable crop. But in this case he would get nothing.

However, very little work has been done on order. Clarke and Nation (1980) propose an order which they hope will lead to greater accuracy but this is not researched and is in the nature of good advice to the teacher. First, they recommend using cues which give the part of speech, then looking at the clause in which the target occurs. Finally, they suggest looking at relationships between clauses like cause and effect.

The most interesting piece of work on order is by van Parreren and Schouten-van Parreren (1982) and Schouten-van Parreren (1986). Native and foreign speaker subjects take part. The former see targets in a cloze format whilst the word forms are left intact for the latter. The authors use the cue types based on the idea of linguistic levels: syntax-> semantics (textual cues)-> word form cues-> and stylistic cues and suggest that the most effective way to guess, based on the

findings of an error analysis, is by moving systematically through these levels in the order indicated. So adhering to a particular order should generate more accuracy. However, when they come to an examination of expert behaviour they find it "...characterized by estimating how many difficulties guessing a certain word would present and then entering on apparently the most appropriate level. Sometimes, however, this estimation proved to be wrong and in that case the skilled guesser 'went down' or 'moved up' a level". Subjects seem to be be basing their strategies not on order but on limiting the amount of information used by going for specific cue types only.

What we see in this study is a contrast between a desire to find a superior order in research and what actually happens in real life. The distinction, I would suggest, is often controlled by a principle of costs and benefits as described by Payne (1982). Costs, in terms of processing information, are high where order is concerned in that a lot of effort is required of the working memory the capacity of which, as indicated by authors like Chang (1980), is small- approximately one clause. Simply distinguishing a best order from other possibilities is complex to begin with. Also, in reception, information won't come, in all probability, in the order one wants to use it. So cues will have to be found, held and then placed in the appropriate order. A lot of processing is involved, particularly in holding some cues whilst searching for others. The result is that if a sufficiently attractive

benefit is not apparent, order is not going to be considered as a strategy in real life. So research might find superior orders that are not used. On the other hand, one might find that although a superior order does not exist the mind does in fact choose to operate in a specific sequence in real life perhaps because it is programmed to do so. I would not expect this latter case to be likely though.

In the experiments I will conduct, I intend to force subjects to operate in all possible orders in the hope of finding one or more to be superior. We must realise, however, that if a superior order emerges, it does not mean that subjects follow it in real life. subjects do not follow one in real life. This is, however, a good way to begin to look at this variable because of the control it gives us over information.

From a purely empirical point of view, if we combine order with type and amount of information we get a sharper research tool since we can now look at process through the amount of information variable, order and, if there is an effect for order, then the nature of the process going on within order. The structure of our research tool ie. the variables we systematically manipulate, now looks like the representation at 9. Remember also that we have already selected contextual cues as the type with which we will be concerned with in this study so we will be concerned with order within this type. If we say, for example, that order 1 is an implicit definitional cue followed by an implicit association

and that order 2 is the reverse then on one amount of information half our subjects

9.

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        1 amount              2 amounts
         /\                     /\
        /  \                   /  \
       /    \                 /    \
    order 1  order 2      order 1  order 2
```
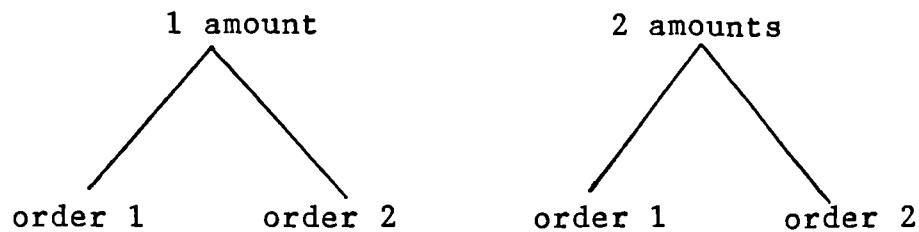
would see an implicit definitional cue and half an implicit association and on two amounts of information those who saw the implicit definitional cue would now see the association and visa versa.

The framework at 9, then gives us a basic experiment design or structure of independent variables through which we can carry out research. The design raises questions like: What will be the effect of amount of information on a dependent variable? What will be the effect of order of type of cue? and so on. But rather than end up simply asking vaguely about the effects of information and order on a dependent variable what we need now is a question, a very precise question, which can be fitted into this design and which any effects produced by information and order can be used to answer.

Target type

What is there about the kind of target we ask subjects to guess that may be of interest?

It's noticeable that some researchers, when designing experiments, take a passage and replace some of the words with a cloze gap. Beck et al (1983) is an example of this. Other researchers make up a nonsense word, a form which obeys the spelling and phonological rules of the language but which doesn't exist in the language, and replace a real word in a passage with one of these. I'll refer to such nonsense words as <u>pseudowords</u> in future. Carroll and Drum (1982) is an example in point. Other researchers keep the word form intact, not replacing it with a cloze blank or pseudoword, but create targets by trying to ensure the subject has never seen the word before. In order to do this a vocabulary test may be given to assess subjects' knowledge of the targets before experimentation begins; Bensoussan and Laufer (1984) ask their foreign speaker subjects to translate targets into their mother tongue one week before they see them in context and Schatz and Baldwin (1986) field test their targets on a similar group of subjects (10th grade native speakers) to those who will sit their experiment. Another way of doing the same thing is to choose low frequency words which we think the subjects wouldn't know. Madison, Carroll and Drum (1982) do this. There is, however, always the risk that a subject might have come across one of the targets. Sometimes we even find a combination of techniques. Na and Nation (1985) replace relatively low

frequency targets with pseudowords, this second step, I suspect, being taken because they are worried that some of the subjects were familiar with some of the targets.

Well, what do we have here? Where a cloze gap or pseudoword replaces a word to form a target then there is a likelihood that subjects will know the meaning of the target. Clearly this is not necessarily the case, but we do run probably a fairly high risk of this happening. We have a situation where targets, then, are unknown simply because their forms are missing or unknown. If a subject can guess that familiar meaning he will gain access to the word's form automatically. In the situation where we use very low frequency words and more particularly, where we use a pretest of vocabulary knowledge the subject cannot guess the form since it is not a part of his knowledge. Rather, he must now only guess the target's unfamiliar meaning.

We have then a contrast between guessing known meanings and guessing unknown meanings. Is there likely to be a difference? Well, many of the researchers who use cloze gaps and pseudowords don't blindly accept that the meaning will be unknown. Most express reservations. I'll quote Na and Nation (1985) on this point. "The research would have been much more realistic if the subjects had been guessing words that they really did not know. The use of nonsense words was an attempt to control this. However, if the subjects already knew the word that they were trying to guess they could use clues like typical collocations to help guess the word." There is a

feeling then that guessing unknown meanings is somehow more difficult than guessing forms where the meanings are known. Other researchers such as Nagy et al (1985) and Beck et al (1983) make much the same point but nobody seems really to have asked why guessing known meanings might be different to guessing unknown meanings. The question I am therefore going to ask in this thesis is: "Is the guessing of known meanings somehow different from guessing unknown meanings and if so in what way?"

The contrast between known and unknown meanings cross classifies with cloze gaps and pseudowords. Therefore, when we fit it into the research design given at 9 we get something along the lines of the design shown at 10. Note here that the pattern of variables beneath <u>cloze</u> should be repeated under <u>pseudoword</u>. A question which needs to be asked here is: Why bring the cloze/pseudoword distinction into guessing known and unknown meanings?. It might be, for example, where the meaning is unknown, that an unknown form ie. pseudoword, might act as a kind of trigger that motivates a subject to treat the target as an unknown meaning whereas the cloze format might not. In such an event we might find that pseudowords over a known meaning have something in common with pseudowords over an unknown meaning and similarly the two remaining cloze situations might have something in common. It might of course turn out that pseudowords are treated in exactly the same way as cloze gaps. The point here is that this distinction has not to the best of my knowledge been researched.

10.
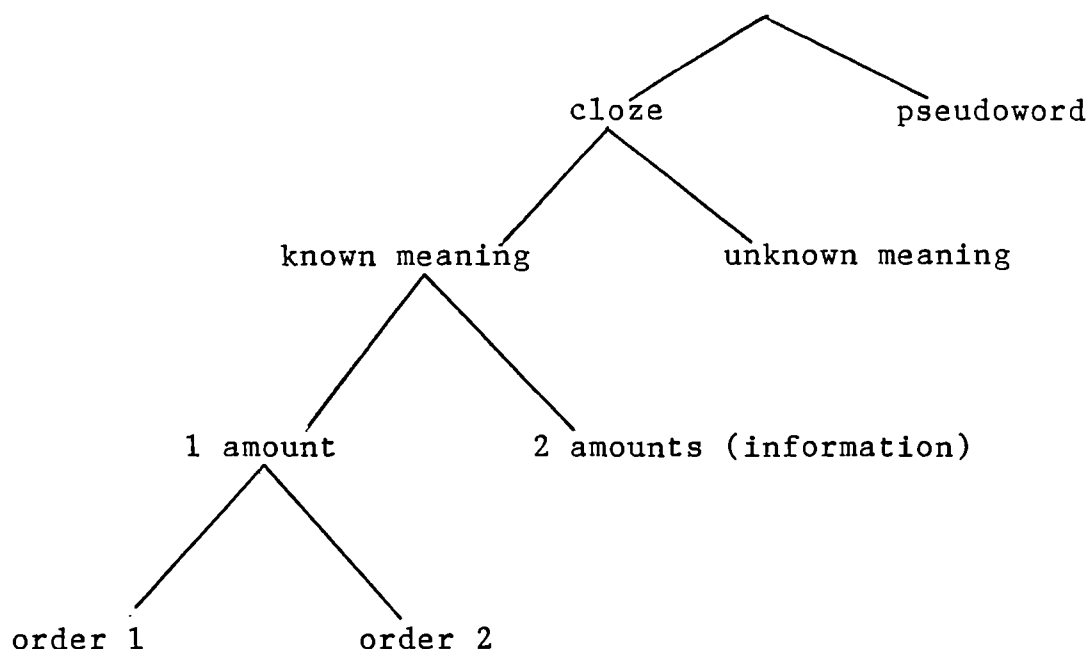
We can see that at 10 there are four possible combinations form and meaning. Let's look at each in turn and at the same time ask what relevance each situation has for communication strategies.

First, we have cloze over a known meaning. Since we are not likely to meet cloze gaps in everyday life, except perhaps where a word form is unintelligible through poor printing or handwriting which is difficult to read and perhaps where a subject creates a cloze gap by making a prediction in order to read quickly, this represents the kind of artificial experimental situation used by researchers in receptive communication strategies to gather data. If we simply go through a passage and delete say every tenth content word there

is clearly a high risk that the meanings of many of these words will be known to the subjects. This situation is interesting to communication strategy workers from an experimental point of view then.

Second, we have a cloze gap over an unknown meaning. Again, because of the cloze, this is of interest more in experimental than real life terms. The point of interest being that if we delete targets we can't take it for granted that the meaning will always be known. A subject could be in the position of lacking both form and meaning and it is of interest to communication strategy researchers to know what might happen here.

Third, we have a pseudoword over a known meaning. This again represents an experimental technique in communication strategies since pseudowords are sometimes used rather than cloze gaps. There is, however, a more realistic counterpart here. Language learners, when they encounter an unknown, will not have seen the form before. This form then becomes the equivalent of a pseudoword. There is a good chance, however, that they will have a counterpart, or rough counterpart to the target in their native language. Whilst the form then is unknown the meaning is known. Native speakers could also find themselves in this position where a reasonable synonym for the target exists and is known by the subject. This situation, though, I would see as mainly of interest to communication strategy researchers in the foreign language field.

Fourth, we have a pseudoword over an unknown meaning.

Both form and meaning are unknown. Clearly, foreign language learners will sometimes find themselves in this position, but in the main this situation applies to native speakers where, if a form is unknown so is the meaning. Full synonyms are rare. This fourth category is interesting if we want to talk about guessing as a communication strategy with native speakers.

By using the amount of information and order variables we should be able to build up a picture of how the guessing process develops in each of these four situations. Then by contrasting these situations we should be able to highlight any differences in process which might occur and decide whether such differences might involve difficulty for subjects. It could be that accuracy might suffer in one or more conditions so that if subject were to use such guesses they would go wrong. Perhaps also if accuracy were to be damaged in a particular situation and subjects were aware of this they would be reluctant to use guesses produced by the attendant process.

- Is there anything of relevance in these four situations to guessing as a learning strategy?

Guessing as a learning strategy

Most of the work in this area concerns native speaker children. Heibeck and Markman (1987) view guessing as a form of learning. They are interested in three things. First, process. They identify a process used by children which they

term _fast mapping_. Essentially, it is the use of contrast cues. For more detail the reader is referred to the article. Second, retention. There is a short break between the guessing task and the test of knowledge. Third, they are interested in numbers. Can this method of guessing account for large gains in word knowledge and justify the assertion that a large part of our vocabulary is picked up through guessing and not from dictionaries or instruction? They do actually record quite high gains in word knowledge.

If we go on to look at the literature, the first thing to notice is that emphasis on process is slight. Largely, learning is seen to involve the same guessing process as communication and the question then becomes one of retention.

If we look at retention the best way to assess learning is by comparing it with other mnemonic strategies. Margosein et al (1982) finds semantic mapping (learning new words by identifying similarities and differences with related known words) superior to guessing and Pressley et al. (1982), Levin et al. (1984) and McDaniel and Tillman (1987) all find the keyword strategy superior to guessing in terms of recall. But nobody is saying that guessing is bad, just that keyword is better- which is really pretty much what one would expect given that keyword is a specifically designed mnemonic technique whereas guessing isn't. Surprisingly, McDaniel and Tillman found that keyword was only superior to guessing in a cued recall condition, in a free recall condition both were equally good.

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If one goes on and looks at other possible learning strategies, like using the dictionary, which haven't been designed as such but which could account for vocabulary gains then Crist (1981) and Gipe and Arnold (1979) both find guessing superior. Again this isn't surprising. O'Brien and Myers (1985) suggest why. They gave subjects a passage to read that contained targets which were predictable or unpredictable targets from cues in the preceding context. The reading time was increased on the unpredictable targets but so was recall. In other words the increased reading time suggests greater work or if we prefer a more technical term, depth of processing. This work translates itself into retention. Since digging at the context involves work it leads to retention, more so than with a dictionary simply because it involves more work and probably a bit less than keyword because it involves less work. That guessing can lead to retention is, I think, pretty much established. If a little anecdotal evidence will help, then two months after sitting an experiment which we'll see later, one subject spotted me and came up to ask what one of the targets he thought he'd guessed badly meant. Since it was a pseudoword over an unknown meaning which was unknown by virtue of being made up I was a little worried. I'd taken pains after the experiment to warn subjects about these targets, but someone had slipped past. It does show how words can stick in the mind though.

The numbers issue is altogether more serious for guessing as a learning strategy since this strategy must be able to

account for fairly large gains or be seen as deficient. Duffelmeyer (1984) records dramatic gains for this strategy. Here the time gap between guessing and testing is two weeks. McKeown (1985) found gains only for good readers not poor ones. Low ability subjects tended to get distracted by personal experience rather than relying on the context. Block (1985) terms such readers non integrators. What we see here is the guessing process, not recall going wrong. Nagy et al (1985) find statistically significant but very small vocabulary gains from guessing. Herman et al. (1987) replicates this. These researchers suggest that the probability of learning a word from one exposure is about 0.1. The Nagy study comments to the effect that although 0.1 seems small, tentative extrapolations from the results and current estimates of the volume of children's reading lead them to believe that incidental learning can account for a substantial proportion of word growth. About 3,000 words a year is the final tally. This is about correct, comments Duffelmeyer (1985), but what about the effects of forgetting? It's a neat, but rhetorical question since he has his answer ready. The studies by Nagy et al and Herman et al deal only with guessing and learning from a written context. Children also learn from aural contexts and this helps make up for the effects of forgetting words learnt from written contexts. (Some experimentation on the effects of forgetting, perhaps comparing aural and written contexts might be interesting). Work by Rice and Woodsmall (1988) using television as a context supports this as does a study by Drum

and Madison (1985) using conversational contexts. Dickinson
(1984) in an experiment with native speaker children using
conversational and story contexts and an explicit definition
condition found some learning in all conditions though older
children benefited more from explicit definitions.

It's fair, I think, to say that there is disquiet about
the numbers issue and a feeling that there might be something
not quite right with guessing as a language learning strategy.
Bialystok (1981) makes an interesting comment. She uses a
questionnaire to try and get subjects, foreign language
learners, to give her information on language learning
strategies of: monitoring, practising and guessing and but
finds that very few people report using guessing as opposed to
the other two. She suggests there may be something wrong with
the questionnaire with respect to this strategy but adds: "The
inferencing strategy is possibly reserved for contextual
situations in which it is necessary to ascertain only the gist
of a difficult utterance." This could be taken in two ways. It
could suggest that the natural context doesn't always contain
sufficient cues, something which Schatz and Baldwin (1986)
would argue. I've suggested above that it's a little dangerous
to generalize on the context in this way. The other thing
which Bialystok may have in mind, and I put this forward very
tentatively because Bialystok may not have intended it, is
that the difficulty is not in the context but in the process
and that guessing only gives partial meaning because somehow,
even if there is sufficient information around it can't all get

processed for some reason. The fourth type of guessing situation mentioned above, a pseudoword covering an unknown meaning, now becomes relevant to guessing as a form of learning. As far as native speakers are concerned then this situation for most of the time is the prelude to learning. If this form of guessing is "inefficient", and we should be able to see not only how the process behaves through the amount of information variable but also contrast it with the processes attendant on the other three situations, then even if subjects go on to retain what they have guessed, this knowledge could be faulty or subjects may not be very confident with it and so not use it. Possibly, if guessing in this fourth situation has inherent problems it might be that subjects need confirmation of their guesses by teachers, parents, dictionaries etc. before they are prepared to commit them to long term memory. It could be a combination of these factors which reduces the results on experiments which test guessing/learning. It could be that foreign language learners actually have an advantage over native speakers in that they will often find themselves in the third situation of pseudoword over a known meaning so that if they have enough cues, they can attach the form to a known meaning and then all they have to do is retain it and iron out the odd point where the L1 definition doesn't quite fit the L2 counterpart.

One final point here. I'm not going to pursue guessing as a learning strategy in the sense that I will not be looking at how well subjects retain guesses. This study is of interest

to guessing as a form of learning only in so far as we can look at the quality of the guess made and the process leading to this point. The main question then becomes to decide whether the process is efficient enough and the guess of a reasonably high enough quality to account for fairly large gains in vocabulary knowledge if guessing is to be seen as a form of learning.

Just to finish this chapter, I'd like to say a few words about subjects I'm going to avoid.

Context facilitation: One occasionally comes across an article like that of Nicholson and Hill (1985) the very title of which tends to give one a scare: <u>Good readers don't guess</u>. The point here, though, is that such articles are not part of the guessing debate but rather of the context facilitation debate. In the '70s psycholinguists– see for example Smith's (1973) collection of articles– held that the reading process itself was a form of guessing and that we used pragmatic, semantic, graphological etc. cues to predict and constrain meaning ie. the context facilitated or helped. Nicholson and Hill are not claiming that humans don't guess, they are simply opposing this method of describing the reading process and argue that instead of predicting we rely more on decoding. Exponents of decoding would not seek to deny that we guess. Rather, reading proceeds by decoding until we hit a problem like a cloze gap and then we have to go to the context. The contrast then is not about whether we use the context but when

we use the context at a very basic level- context facilitation says we use it all the time, decoding only when we hit a problem. A large part of the debate focuses on polysemy. Does the context constrain which meaning we activate (facilitation) or do we decode and activate all possible meanings with the context then deciding which one we accept? The debate still seems to be raging and the last time I looked at it Till et al (1988) were in favour of decoding, van Petten and Kutas (1987) were in favour of facilitation, criticizing the the experimental technique of the facilitation researchers, whilst West et al (1983) seem to go for something in the middle suggesting that the poorer a decoder is the more he relies on context. The only reason I bring these topics up is because they do get a mention in the guessing literature. But as I say nobody is disputing the fact that we guess, rather we are talking about a reading process which takes place at a very basic level well below any sense of consciousness. One reason why it does get pulled in is because facilitation advocates would argue that subjects would complete a cloze test on the basis of their theory, but this is "guessing" at a non-conscious level and I will exclude these arguments from now on. In short, we'll be looking at guessing in a context where subjects are, to some extent, aware of what they are doing because there is a clear local problem to resolve.

Communication strategies in language production: There has been great interest in these strategies lately.

Essentially, they are also concerned with how foreign language students get around gaps in their lexical knowledge but in speaking not reading. A large number of strategies have been described and they involve offering what information the subject has available instead of the correct lexical item. Tarone (1981) gives the interesting example of <u>airball</u> which is really a morphological cue to <u>balloon</u>. Poulisse (1987) talks of holistic and analytic cues. If a subject were trying to describe <u>desk</u> the an example of the former would be <u>table</u> and of the latter, <u>It's got a flat top</u>. In a sense we're dealing with the opposite side of the coin to guessing and are asking what governs the type of cues the subject seeks to give. It would also be interesting to see how the receiver of these cues responds and what quality of guess each type of information produces. I will, however, be avoiding aural contexts in favour of written.

Chapter 2

In Search of a Ruler

In the last chapter we looked at the literature on guessing and in so doing identified some key variables that need further research if we are to get closer to what really goes on. We also put forward a question which might be explored by means of that research design. That question essentially asked whether or not there might be a difference of process involved in the guessing of known meanings as opposed to unknown meanings in cloze and pseudoword presentation. The research design to be applied to this question involved two further independent variables: amount of information and order. Amount of information, I argued, would allow us to see something of the guessing process since we would be able to note how guesses change and develop across information as must happen in real life. The order variable, I argued, would allow us to see whether one order might be more effective than others when different cue types are available and if so we could then use the interaction of order with amount of information to look at process within order. What is needed now is a dependent variable or variables which can be used to quantify the guesses which will be made by subjects and which will respond to the independent variables of meaning (known/unknown), form pseudoword/cloze), amount of information and order. In short, we need a ruler which can be used to measure the possibly varying strengths of responses generated by

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independent variables. Note also that in posing the question of how known and unknown meanings will perform across information etc., we are assuming that any dependent variable we select will somehow respond to the independent variable: it may rise in value, fall in value, remain static or form possible combinations of these responses. It is important, then, as well as noting possible dependent variables to also gather what information is available on their likely responses to the independent variables. Most research concentrates on amount of information. Little seems to have been done on the other independent variables in this study.

In this chapter I am, then, going to look first at possible candidates for the role of dependent variable noting also the way in which such a variable might respond primarily to varying amounts of information. I then want to look at possible ways of measuring these dependent variables. Next, there is a clear gap in my description of independent variables since, although I've talked about known and unknown meanings, I haven't yet offered any way of establishing the difference between them or how meaning cues can be defined. I'm therefore going to have to return to the subject of independent variables.

Dependent Variables

There are three dependent variables which follow from the research question and which can be used to quantify guesses:

<u>accuracy, confidence</u> and <u>uncertainty</u>. I'll define these as I come to them.

Accuracy

Accuracy is an obvious dependent variable since we are interested in measuring the relative "success" of different orders/amounts of information with known versus unknown word meanings in cloze and pseudoword presentation. As we've seen, it's also the most widely used dependent variable in research.

What is <u>accuracy?</u> We could say that accuracy involves using the word with the correct meaning in the correct situation. If we are not sure of this relationship then we check it in a dictionary or ask a teacher or some other person whose knowledge about the language we have reason to trust. What a dictionary or teacher will give us is not a psychologically real description of the word's meaning for one person but rather the collective definition which society has decided upon. This, of course, is where teachers and dictionaries derive their authority from; they are held to be more closely in touch with society's norms than other types of person or book. It may be that such norms are established by research, in which case accuracy is a question of stating: "Most people say X here" and then measuring what the individual says to see how close he gets. It may also be that such norms are simply imposed by society on occasion through the school system. We all fluctuate from such norms to some extent with some people being closer to the norm than others and

consequently having greater authority. The main point about accuracy, though, is that it is a sociolinguistic variable that is external to the speaker either through generalization or through imposition. It does not describe the way in which knowledge is stored in the mind and to regard it as a psycholinguistic variable would be an error.

The question now is: How would we expect accuracy respond to increasing amounts and orders of information and the known/unknown meaning and cloze/pseudoword distinctions? Unfortunately, as pointed out, little seems to have been done on the order variable or the meaning and cloze/pseudoword distinctions and so I will focus on amount of information.

Peterson and Pitz (1988) designed an experiment in which subjects were given cues which described the performance of baseball teams. These cues were <u>earned run average, team batting average</u> and <u>number of home runs</u>. These cues are presented to subjects one at a time- they use a variety of sequences but the order variable is not tested- and the subjects are asked to guess how many games the team these cues relate to, actually won in a season. They found that accuracy increased as amount of information increased.

A second study in this area is by Oskamp (1965). Oskamp is interested in clinical psychology and presents his subjects, who are all psychologically informed, with increasing amounts of information concerning a case history. With each successive amount of information they are asked to make a decision about the personality of the person described in the case history.

Four amounts of information are given and there is no significant increase in accuracy. Peterson and Pitz (1988), commenting on this study, suggest that the effect is due to the fact that people are unable to recognize when information is of no value. That is, they sometimes think that information is relevant when it is not and, conversely, are sometimes unaware of when something actually is relevant. So accuracy can fail to rise because subjects believe that a good cue has no value and also that a poor cue actually has value. This, I think, is probably correct. I intend to avoid this factor in this study by making all cues relevant and directive in the sense that they will all point to the same, correct solution.

It's worth looking at the Oskamp (1965) study a little more closely even though I intend to avoid the problem of relevance. The above situation, I suspect, is being caused by difficulty in the sense of a conflict of cues. In the field of physical health, if spots of a certain size, shape and colour arise we can say at once "measles!" since this condition is well described. Possibly, a second indicator may be body temperature, but it may further be known that body temperature is not a terribly reliable indicator. If, then, the right spots appear but the temperature is not quite what the doctor expects, he can disregard this second cue and still diagnose accurately. In clinical psychology, the various ailments and symptoms are probably less well described, there tends not to be one over-riding pointer and things are more subjective. It, therefore, becomes difficult for subjects to decide which cue

is relevant. For example, Oskamp relates that the person in his case history is a World War 11 veteran, a college graduate and an assistant in a floral decorating shop. When we come to the questions, subjects are asked to say how this person would behave in a congenial social situation. There are five alternatives, but one suggests that he would try to dominate and another that he would be withdrawn. Well, an intelligent ex soldier might well dominate, but the job in a flower shop might suggest a quiet sort of character. This is compounded by the ambiguity in the cue about war. The person may suffer from some sort of trauma. One cue might then point to one answer, but a second cue might point to a different answer. The situation is difficult, then, in that if a subject perceives both cues as relevant but conflicting he can take only one. Unlike the measles situation, he has no grounds on which to dismiss one of the cues. The situation becomes, perhaps, both difficult and dangerous should a subject have some preconceived idea of how the person in the case history should behave. In this case, the subject will take the cue that fits his preconceived notion and dismiss anything else. I use the word "dangerous" to describe this situation involving preconceived notions, since in the pot luck case the subject will probably perceive the difficulty he is in. In the preconceived notion case he probably will not. In either case there is a fifty fifty chance of error so accuracy isn't going to rise. Granted, the example of information I've quoted is from the first amount of information given by Oskamp and which is

designed not to give more than a chance level of success. But since it is the only example of hard information Oskamp gives this is all one has to go on. My suspicion is that when he talks of a chance level he may simply mean that there is not enough information to form a judgement and he may possibly be overlooking the fact that the information is actually ambiguous or "non-directive" in that it points to different solutions. If so, as more information is given, this ambiguity may continue to manifest itself with the resultant effect on accuracy.

A third study is by Ryback (1967). Here subjects are asked to compare some dimension or area of one geometrical figure with another, for example, "Is the perimeter of figure 23 longer than the length of the line in figure 18?". There were five comparable forms of the test so each subject was given five tries. This kind of task repetition does not give subjects more information about the actual answer but rather allows subjects to work out better ways of going about getting an answer. That is, they acquire information about method rather than target. Again accuracy fails to rise with increasing amounts of information. Ryback explains it in the following way: "For example, a blindfolded individual, in attempting to score a bull's eye on a target range, might be misled by an observer falsely and arbitrarily reporting hits and misses without reference to actual performance...No learning would take place with regard to target performance, yet some learning would occur with respect to how the rifle

should be held ..." There's more to it than this division between learning about task and learning about target, though. The subjects aren't blindfolded and the information they acquire about the task should help them increase their accuracy with respect to the targets. Or, are the subjects blindfolded in some way? Difficulty may be creating a blindfold effect in the following way. Subjects may well in fact be able to gather information about the task but this information doesn't send up accuracy for the targets because, possibly, this task of comparing different figures is a very difficult one. In other words, the difficulty of the targets is high enough to wipe out any gains in accuracy that should accrue through familiarity with the task. We have then another example of where information which could be used to improve accuracy fails to do this again because of a psychological constraint. In this case difficulty intervenes to negate the effect of potentially helpful information. I intend to avoid this problem seen in Ryback (1967) by trying to make all targets guessable.

To sum up. In using accuracy as a dependent variable, society, or in this case an experimenter who assumes a kind of social authority, will set a target and judge a subject's response as to it's proximity to the target. Difficulty may then enter perhaps through cues conflicting. But the experimenter must continue to mark to a standard and so ignore this difficulty. This is not a criticism of accuracy. It is a description. (Granted this problem is complex. Teachers can be sympathetic in marking or society can relax its standards

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where too high a standard has been set). This is not to say that it is not a valuable dependent variable. Accuracy is mainly what teachers are interested in and so it is of practical importance. We can't ignore it.

A crucial point here, though, is that what we really must try to discover is whether the subjects themselves are aware of the difficulty of the situation they are in. If so, they will probably be cautious about using any hypotheses they derive from guessing in these situations. If not, they might well try to use an erroneous hypothesis. As well as an external and imposed measure of accuracy we need a subjective assessment of how good or poor subjects feel their hypotheses to be.

Confidence

What the above comments suggest is that if we use accuracy as a dependent variable we need to complement it's weakness by using another dependent variable, in this case one which is psycholinguistic and tells us more about a subject's attitude to his hypotheses rather than society's. On a practical note, it is important if teachers are to understand learners, that they need to know about learners' subjective accuracy. If, for example, learners are not aware of difficulty, then it may be possible to raise their consciousness in such a danger area.

I've used the word certainty in Chapter 1 with respect to Li (1988). Carton (1971) also suggests that guessing should be described in terms of certainty. In the main, though,

linguistic studies of guessing have avoided this variable. In psychological literature the term used to describe what the above two researchers call certainty is _confidence_ and this is the term I will adopt. Peterson and Pitz (1988) define confidence as a belief in factors which should affect the accuracy of a hypothesis. Thus, if a subject thinks that information is relevant then his confidence will go on increasing as more of this information becomes available regardless of the fact that this information may in fact be quite irrelevant. Similarly, he might perceive some order of information as more effective than another. In the Peterson and Pitz (1988) study confidence rises as does accuracy as more information becomes available. This suggests that on low amounts of information, subjects are not that accurate but also that they are aware of the difficulty they face here. (Note here that correlations aren't used so we don't know that if a specific subject is less accurate he is also less confident. The statistic which is used is the ANOVA on confidence and accuracy separately so we are dealing with a group effect). However, in the Oskamp (1965) study and the Ryback (1967) study confidence rises whilst accuracy stays the same over information. In other words, subjects believed the information was relevant and used it so sending confidence up. But the possibilities that some of the information was not relevant in the Oskamp study (the idea of a preconceived notion is probably at work) and probably relevant in the Ryback study but with its positive effects being cancelled out by target difficulty, kept

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accuracy from increasing. We have a subtler form of difficulty
in these last two studies than that which applies simply to low
amounts of information and subjects found themselves in the
dangerous situation of not perceiving the difficulty they were
in. None of these studies deal with order as an independent
variable.

Uncertainty

Another interesting dependent variable one comes across
in the psychological literature which can be used to quantify
guessing is uncertainty, described by Peterson and Pitz (1988)
as the number of alternative hypotheses a subject holds when
asked to make a guess. If we look at 1:

1. The man went to work by ____ .

then not one but several alternative hypotheses are available:
car, motorbike, pushbike, train etc. This variable should be
responsive to varying amounts of information and we would
expect to see uncertainty reduce as increasing amounts of
information are made available. With 1, for example, if we
were told that the man started the engine this would exclude
the last two hypotheses. If we were told that he fastened his
seat belt this would also exclude the second. Peterson and
Pitz report the strange effect of uncertainty rising with
information. They say nothing about order. This they
attribute to inconsistent information ie. different cues

suggesting different outcomes. In the environment of consistent cues we can expect a decrease, I think, but it would be interesting to see what would happen.

It would be interesting also to try and link uncertainty with confidence. If we look at the histogram at 2 then the relationship I suggest between confidence and uncertainty here is that the fewer the hypotheses we hold the greater our confidence. This is clearly not a logical statement. It is possible to hold a large number of hypotheses and yet be very confident in one or visa versa, to hold a few hypotheses yet lack confidence in them all. Yet from a more pragmatic point of view, one would expect the mind to behave in a reasonably efficient manner and that if one were to be extremely confident in one hypothesis then even if a lot of others were possible the mind would exclude them. Also, if one held only a few hypotheses and yet felt no confidence in any then one would try to look for others. Peterson and Pitz argue against viewing confidence and uncertainty as linked in this way and view them as two distinct variables, but there is, I think a possible link based on a principle of efficiency which needs to be explored.

We have, then, three dependent variables which can be used to quantify guessing. If the reader asked me at this point to revise my definition of guessing from Chapter 1, I would have

2. One possible relationship between confidence and uncertainty

Confidence

```
100 |        |
    |        |
    |        |    |
    |        |    |
    |        |    |    |
    |        |    |    |
    |        |    |    |    |
    |        |    |    |    |
    |        |    |    |    |    |
  0 |_____|____|____|____|____|_____
    0    1    2    3    4    5    6
                        Number of hypotheses
```

to say that it is a method of hypothesis formation which is determined primarily by amount and order and type of information/cues on the one hand and which can be quantified in terms of confidence, accuracy and uncertainty on the other. I wouldn't be particularly happy with that definition since we'd also need to say something about the directiveness of information and relevance. But these factors are peripheral to this study. What I am suggesting here is that we need to look at all three dependent variables in so far as is possible.

With relevance to the topic of this thesis, we've seen that the tendency of confidence in past work is to rise with increasing amounts of information. Will it, however, rise at

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the same rate for known and unknown meanings and in all orders? What will happen with the cloze/pseudoword distinction? There is little indication in the literature here. Uncertainty could also reveal a contrast between guessing the two types of meaning and other independent variables, this time by showing movement in the number of hypotheses. As for accuracy, if confidence and accuracy show similar movement or lack of movement this suggests that subjects are aware of the degree of difficulty attached to the situation they are in. Any disparity, of course, suggests the reverse. As we have seen, previous research has focussed mainly on the relationship between these dependent variables and the independent variable amount of information. Little is said about order, the pseudoword/cloze distinction and the meaning distinction and here we will be on our own.

Measuring the dependent variables

Measurement is always an important subject. Different techniques can produce different results so we need to be careful. What possibilities do we have then for measuring our dependent variables. Specific details will be left to the actual experiments, but it is possible here to point out some general principles and some possible problems.

Measuring confidence

Confidence is perhaps the easiest to deal with so I'll start here.

All we need to do is ask subjects to assign a confidence value to a hypothesis each time they make a guess. Peterson and Pitz (1988) use a scale from 0.33 to 1.0 with subjects being told that 0.33 was the probability of being correct if they guessed at random, so this value is equivalent to zero. This was because they a three choice multiple choice task. Ryback (1967) uses a scale from 1 to 10. There is a problem here in that subjects aren't given the opportunity to express zero confidence. I don't think this materially affects the results of this study but it is a point to remember. I'm going to use a scale from 0 to 6 in all experiments. The reason for this is that Miller (1956) suggests that subjects can effectively make choices only between up to seven categories. One suspects in the Peterson and Pitz experiment that when a subject says that he is 0.52 confident on one hypothesis and then 0.57 confident on a second (and visa versa) he really means he is 0.55 confident on both so there is no difference. Again, this should not affect the results these researchers get since such variation should be fairly evenly distributed amongst the responses. A seven point scale, however, should facilitate ease of decision making by removing the problem of having to make over fine distinctions.

Measuring accuracy

With accuracy we're going to have to impose on the responses some scheme that we consider to be fair. Given this, it's probably better to wait until we see what kinds of

response subjects give rather than try to anticipate. Accuracy marking schemes will be left until the actual experiments, then. The one principle I will try and retain is to make accuracy decisions which are appropriate to the amount of information given and that if, when all the amounts of information are in place, a subject produces a response which fits this information but which I hadn't anticipated then it must score full accuracy marks.

Measuring uncertainty

Peterson and Pitz (1988) measured uncertainty in the following way. Remember, subjects are being asked about the number of wins a baseball team had in a season. They averaged a set of predictions made by subjects on a previous experiment regarding the number of wins a team had made and got an estimate of say 84 wins for a team. Four was then added to and subtracted from this value to get 88 and 80 wins. Each team was presented to a subject three times with the subject being asked on one occasion what the probability was that the team won more than 88, on a second occasion, less than 80 and on a third occasion, what the probability was that the number of wins lay between 80 and 88. Presumably the order of presentation and the number of cues seen on each occasion varied. They found that the probabilities assigned to each of the three regions, especially the extreme regions, increased with more information which leads them to conclude that uncertainty (the number of hypotheses) is increasing with

information. That is, since the extreme regions are becoming
more plausible with information it suggests a gradual widening
in the number of hypotheses away from that central figure of
84.

The first point to note is that we can't use such a
scheme in any comparable experiment involving lexis. We can
see why if we plot Peterson and Pitz's (1988) idea for
measuring uncertainty. This is done at 3. We can see that the
most likely hypothesis in this example is 84 wins and that 80
and 88 wins are a little less likely and fall neatly to either
side of this central hypothesis of 84. The reason for this
neat ordering is that number of wins is a continuous scale, we
can place each hypothesis not only in terms of likelihood on
the y axis but also in terms of distance from each other on the
x axis. With words or phrases, representing meanings as
hypotheses, we might work out from a previous experiment that
rose is the most likely hypothesis and that bluebell and tulip
are the next two most likely hypotheses. We can, then, talk of
probability. What we can't talk of is distance. Words or
meanings are discrete hypotheses and don't have a continuous
scale. Any ordering of these items on the x axis would just be
arbitrary. It therefore becomes impossible to ask a subject to
state what he thinks is the probability that the hypothesis is
less than bluebell. He may be able to attach a probability to
bluebell or any other hypothesis he might hold, but he won't
have any idea of how distant bluebell is from rose or how
distant any

3. The relationship between probability and number of wins
   on a continuous scale.

Probability

```
100% |
      |
      |                    |
      |                    |
      |                    |
      |          |         |         |
      |          |         |         |
      |          |         |         |
      |          |         |         |
 50%  |_____|_____|_____|_____
```

        <80   84   >88   Number of wins
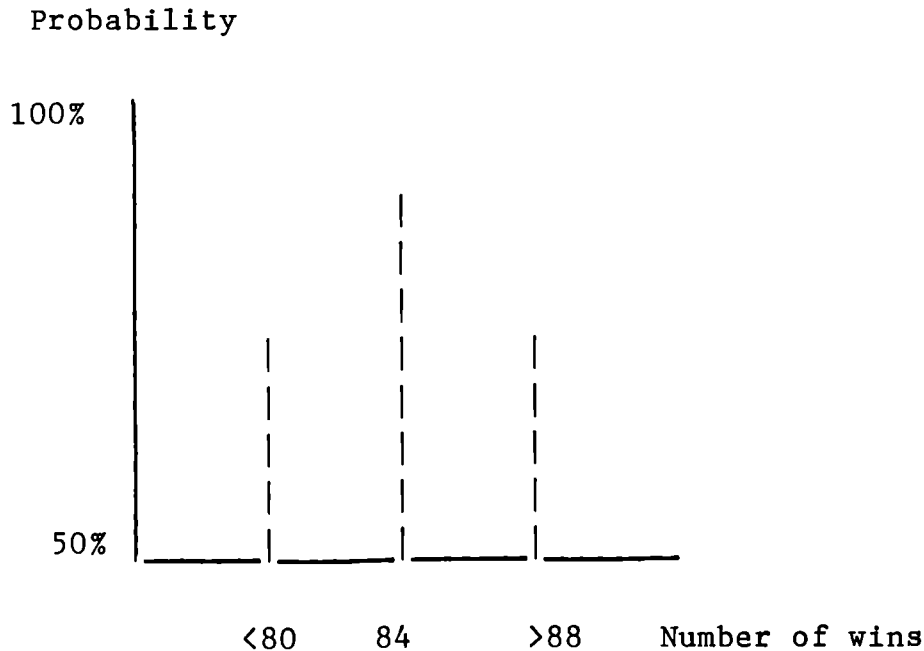
other hypothesis he might hold is from <u>bluebell</u>. So, whilst we
can ask a subject whether <u>daffodil</u> is less probable than
<u>bluebell</u>, we can't ask what the probability is of it being less
ie. further off, than <u>bluebell</u>. This aspect of the scale
doesn't exist for words and without it, it is not so easy to
get a picture of uncertainty increasing or decreasing.

A second point is this. When I first read the above
scheme for measuring uncertainty I thought it was over complex.
The trouble is that one realizes just how good a measure it is
when one considers the alternatives since these are pretty
crude. Given a careful explanation and a little practice,
there shouldn't really be a problem with the Peterson and Pitz
(1988) scheme. One alternative would be to simply ask subjects

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how many alternatives they can see to their guess: zero, one or two, three or four etc. again using seven categories. We've got to get the scale correct. If it finishes at ten but subjects are holding twenty we'll be in trouble. Worse than this, if we ask subjects to add in this way, they'll forget some hypotheses that they were holding or it will actively get them to think of more hypotheses, so we won't get a very good measure. Also, one subject might get rose, tulip, and bluebell and count 3, a second, flower and vegetable and count 2. But we'd really want to say that the second subject's uncertainty is the greater because his hypotheses are more general.

An alternative to the above scheme would be to try and measure uncertainty through the degree to which guesses change over information. Let's say a subject was given three items of information one at a time and asked to guess each time he saw a cue. We might get for example: rose, rose, rose. The second guess is the same as the first and we could argue that since the subject is not changing his mind he is focussing pretty much on this single hypothesis, so we give an uncertainty of 0. The same would apply to the third guess. If, however, a subject changed the second guess to tulip we could argue that he's changed his mind, but not to any great extent since he's still thinking in terms of kinds of flower. Here, we might score 1. If by chance a subject changed his second hypothesis to a word completely outside the flower family then we might score an uncertainty of 2. Note also that if on his third hypothesis he comes back to rose, we have something like:

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<u>rose, carrot, rose</u>. The third hypothesis hasn't so much changed again but has returned to an original value. Perhaps instead of a 2 we should score a 1 here. As with accuracy we're imposing a scheme and it's best to wait until we see actual results before making hard decisions.

We can pick out the weak points of such a scheme though. First, it gets increasingly subjective as it gets increasingly complex. Also, by comparing hypothesis one in this way with hypothesis two we get an uncertainty value for hypothesis two only. The next comparison will give us the value for hypothesis three. The result is we've lost the value for hypothesis one. Worst of all we're using an overtly linguistic technique to measure a psychological variable. The fact that someone changes from <u>rose</u> to <u>carrot</u> gets him an uncertainty of 2. In fact he might have perceived that <u>carrot</u> is the only possible hypothesis and so his uncertainty is actually 0. We are really now redefining uncertainty not as the number of competing hypotheses but as changeability of hypotheses. As far as I can see, however, these makeshift equivalents are the only alternative to the measure of uncertainty Peterson and Pitz (1988) use since we lack a continuous scale

Word Meaning

This study is going to be empirical in nature and is concerned with the contrast between guessing known meanings and unknown meanings from cues of different types in different amounts and orders. We must then have a way of representing

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known and unknown meanings in order to construct targets. Let's look at what possibilities are open to us for the construction of meaning.

Dictionary definitions: If we were to look in a dictionary to find the meaning of the word man we would find something like 4:

4. A human being, esp. an adult male.

The definition at 4 can be broken down traditionally into the components of genus and differentia given at 5.

5. man = human being (genus)
        male adult (differentia)

Here the genus is a general category of meaning and superordinate of words which are semantically related to man: woman, child, boy, girl since all these share the same genus. The differentia is a more specific item which shows how the term man differs from the closely related items listed above. The genus would also serve to differentiate members of this family from those of another

Semantic primitives: Researchers like Katz (1971) would say that meanings are made up from a set of semantic primitives in much the same way that chemical compounds are made up from

elements. There is a limited set of these primitives and they combine and recombine to give us all the words in our language. These components are somehow more basic than words, which is, after all, what we've used to describe meaning at 4 and 5. To quote Katz, these semantic units "...represent the conceptual elements into which a reading decomposes a sense". The term man then will decompose into the primitives at 6:

6. HUMAN   ADULT   MALE

This looks suspiciously like the definition at 4 and leads to the criticism that these primitives are just words and not something that lie behind words. Leech (1974 p.95) rejects such a criticism: "I choose English words as my symbols because I want the notation to suggest the meanings I have in mind, so that the formula will not be completely opaque. But any other graphic symbols will do." We could, then, present meanings in the form of semantic primitives.

Prototypes: Another way of representing meaning is in terms of prototypes. A prototype is essentially a good exemplar of a category. For example, we might think that an alsatian is a better exemplar of the category dog than say pekinese. See Rosch (1975) who pioneered this work.

Which of these forms shall we choose: dictionary definitions, primitives or prototypes?

As to semantic primitives, these only really mean

anything to the theoretical semantist, and are intended for analysis not presentation of cues. (See Finn (1977) for an interpretation of guessing in terms of primitives). I intend, therefore to avoid this theory.

As to prototypes, A way in which this kind of representation of meaning might be used in guessing is suggested to me by a comment by Aitchison (1987 p.51): "...if they saw a pterodactyl, they would decide whether it was likely to be a bird by matching it against the features of a bird-like bird, or, in fashionable terminology, a 'prototypical' bird". We could then present meanings through pictures and ask subjects to guess. The question being whether or not they would match the target against a prototype and if so how they would deal with the non-prototypal residual. The trouble is that much work on prototypes does not involve pictures and this might be of questionable validity. Also, in real life, except for cartoons and children's books, it is rare for pictures to give information about word meaning.

In this study I am concerned with how words in the text act as cues and for this purpose, presenting meaning in terms of the fragments of dictionary definitions rather than prototypes or primitives is the relevant one.

In addition to the components of genus and differentia, we should also consider one further aspect of word meaning here, this being meaning through associations or as it is sometimes termed collocation. As Martin (1983) and many other researchers point out this phenomenon is based on co-

occurrence. We expect one word to appear within the environment of another. If we see <u>cow</u> then <u>milk</u> and <u>farm</u> are much more likely to occur in the vicinity of this word than <u>housing estate</u>. So much so that we see as part of the meaning of <u>cow</u> the ideas that it lives on a farm and gives milk. These associations are not a part of the meaning of <u>cow</u> in the way that <u>animal</u> is. It is perfectly possible for a cow to give no milk and be kept on a housing estate, it's just not that likely. We have, in association, another important aspect of word meaning. However, associations are not essential features of word meaning as are genus and differentia.

Also, there has in fact in the past been some debate as to whether the differentia should be seen as an essential feature of word meaning. Following Jackendoff (1983 p.114) I'd say we have to include it or regard such sentences as 7:

7. ? The man gave birth.

as semantically well formed. In a science fiction context they may be, but not normally.

We can use the idea of genus and differentia and association to point up a contrast between known and unknown meanings. Take the two words: <u>sky light</u> and <u>kolper</u> and their meanings given at 8. We can see that <u>sky light</u> is made up of a combination of genus, differentia and association that is familiar. With <u>kolper</u>, whilst we understand what the genus, differentia and association mean, the combination of the three

is unfamiliar. In fact, this is an unknown word meaning taken from the study by van Daalen-Kapteijns and Elshout-Mohr (1981) to which I've added an association.

8. <u>sky light</u>   <u>kolper</u>

    window   window   (genus)

    in the   that transmits (differentia)
    roof   little light

    can be   is often found
    smashed   in Holland

In terms of defining what we mean by known and particularly unknown meanings, then, we can see that a meaning is not unknown because its components of genus, differentia and association are unknown. If this was the case we really couldn't talk of guessing since we can't guess something outside of our store of knowledge. Rather, whilst the individual components are known it's the combination of components which is unknown and in terms of guessing known and unknown meanings I'm referring to guessing familiar and unfamiliar lexical combinations.

One final point here. I have simplified things when talking of genus, differentia and association. For example, we could sub-classify the link between genus and differentia by noting that differentias can be opposites, functions, locations etc. with respect to the genus. In <u>kolper</u> the differentia is a

function and in <u>sky light</u> a location. We can do the same thing with association and Carter (1987), for example, mentions associations which are syntagmatic eg.<u>dog</u>->__bark and associations which are paradigmatic eg. <u>dog</u>->_cat. We do need to remember, however, that we will need to use the genus, differentia and association categories in experiments and from this point of view we do not want to make things too complex. I am therefore, going to avoid the various sub-divisions mentioned here though we should remember that in so doing I have simplified things.

Cues

I have decided to focus on contextual cues. The main problem with these cues is that we have a large number of of such types within this category. Ames (1966) lists fourteen types and Sternberg et al (1982) list eight types. If we can't limit this number it becomes extremely difficult to deal with the variable of amount and impossible to deal with order.

We must simplify this situation and the method I'm going to use is as follows. We have three components making up the meaning of targets: genus, differentia and association. Ideally, a guess obtained from the context should be one of these meaning components. We can use this idea to classify and therefore talk only of cues to the genus, cues to the differentia and cues to the association and ignore possible manifestations in various types of cue as given by Ames (1966) and factors like cohesion which interfere with their

effectiveness. To give an idea of what I mean, let's look at the made up meaning <u>To crell: This is to worship in a frenzy and is often done by primitive tribes</u>. Possible cues are given at 9.   9a is the genus, 9b the differentia and 9c the association.

In one of their experiments, van Daalen-Kapteijns and Elshout-Mohr (1981) simply give the genus to their subjects on the assumption that they have obtained it from context cues and assume that they will hold this cue intact and not guess from it. We could follow them here and extend the approach to cover differentia and association. (There is a problem here with associations. They could be held as part of a target's meaning or they could be used as cues to the core meaning. So there is ambiguity: Are associations meaning components or cues? The answer is that they are a bit of both. Where they are cues we can view the hypotheses formed as part of the lexicon. Where they are held as part of a target's meaning we can view this as an entry in the encyclopaedia). This approach is exemplified by giving the information in the first column at 9. The association could be marked by a frequency adverb to show it is not an essential part of the definition. This method of presentation is important since it is straightforward and allows us to systematically manipulate amount and order of cues of three types. It does, however, open up criticisms. It is a very explicit and unreal method of giving information, bordering on a situation where guessing does not apply. In real life subjects would have to do a reasonable amount of work

on a text before they arrive at this stage of holding genus, differentia and association. In real life, also, there may be less or more cues available and different guessers may spot

9. | Guess ideally Obtained from Context | Cue giving implicit definitional information | Cue giving implicit associational information |
|---|---|---|
| a. To worship | Some people are non-believers but others crell | in a Temple |
| b. In a frenzy | When you pray you are calm when you crell you are not | Bath of sweat Drugs |
| c. Primitive tribes often do this | Those who pray are thought to be civilized those who crell are not | Loin cloth Spears |

different numbers of them in different orders. And there will be factors like cohesion at work. But we must eliminate these factors to try and get a reasonably clear picture of order and amount of information. This does, however, lead to artificiality.

There is one direction in which we can at least partially escape this artificiality. In Chapter 1 we spoke of a classification based on the kinds of information cues gave. We had, for example, implicit definitional cues. Examples are in the second column at 9. At 9a) the contrast with non-believers

gives the genus <u>worship</u> and so on. We also spoke of implicit associational cues. These are shown in the third column at 9. We could suggest <u>worship</u> by the association <u>in a temple</u> and so on. It's this kind of cue van Daalen-Kapteijns and Elshout-Mohr rely on in their first experiment. By using these cues we make subjects work to get the genus, differentia and association and so we can remove the criticism that cues are explicit and so unreal. Probably in real life most information comes through implicit associational cues. We still use the idea of the guess ideally obtained: genus, differentia and association but we can cross classify in terms of the kind of information a cue gives ie. implicit definitional/implicit associational. Wherever an implicit definitional or implicit associational cue occurs it is always of the type which gives or allows a subject to obtain a genus or a differentia or an association. We still keep an artificial control on order and amount of information by excluding a large but realistic number of cue types.

Our main interest here is to see how these three elements of word meaning: genus, differentia and association combine to form a hypothesis. In terms of any experiment, these three cue types give us three amounts of information and six possible orders of information (3 factorial).

One final point. If we bring word class in terms of nouns and verbs into the experiments it may be possible to reveal a distinction between two types of association cue in terms of the dependent variables.

Mackin (1978) and Cowie (1978 & 1981) talk of collocation in terms of selection restrictions. Other researchers, however, such as Halliday and Hasan (1976 p.286), Halliday (1985 p.312) and Berry (1977) lay stress mainly on the idea of co-occurrence and play down the idea of any semantic relationship in collocation.

It could be, however, that we might have two situations. Co-occurence and selection restriction as opposed to simply co-occurrence. The first having an advantage over the second in terms of the dependent variables used because the selection restriction will create a fairly homogeneous set of hypotheses when guessing whereas the absence of such a restriction might create a more disparate set./

We can get at this distinction by using the noun verb distinctions. Verbs tend to impose selection restrictions, nouns tend not to. So a verb collocation/association cue on a noun target imposes a selection restriction. We might call this intra selectional collocation. A noun association cue on a verb target won't impose a selection restriction. We might call this extra selectional collocation. The intra selectional cues should be the more powerful because of homogeneity of response ie. nouns should be easier to guess than verbs.

We can see something of this in the example at 10.

10. a) He_____ the car.
    b) He drove the _____.
    c) He washed the _____.

We can see at 10a) that the extra selectional collocation <u>car</u> can give a wide range of verbs that have little in common: <u>drive, wash, crash</u> etc. At 10b) the intra selectional collocation <u>drive</u>, however, suggests that all possible hypotheses must have the factor <u>vehicle</u> in common. Granted, things are not quite this simple because of the polysemy on <u>drive</u>- there's the other meaning of <u>driving sheep</u>- but polysemy is a factor which would affect all types of cue and will be common to both types of collocation. There, is a suggestion, then that intra selectional collocation might be stronger than extra selectional. This must just be considered a tendency, however. When we come to 10c) the intra selectional collocation <u>wash</u> gives rise to a set of hypotheses <u>window, car</u> etc. just as disparate as those at 10a) so we are not really talking of some binding rule here.

It is, however, just possible that we have an interesting subdivision in association cues and a word class difference based on this tendency.

Chapter 3

In Search of a Model

We now have a question: Does the guessing of known meanings differ in terms of process from guessing unknown meanings? We have an experiment design which can be used to try and answer this question, this design consisting of the independent variables amount of information and order. There are three amounts of information and also because there are three different types of information, we will have six orders. We also have three dependent variables: accuracy, confidence and uncertainty which can be used to measure the effect of the independent variables. We've also noted some possible hypotheses for the effect of amount of information on these dependent variables. What we need to do now is try and pull things together and construct a model to describe the guessing process. Something which might be used to make predictions and analyse results, such a model itself possibly being modified by results.

I will divide this description of a model into the following sections: Single word hypotheses versus complex hypotheses, the Cost/Benefit Principle, the guessing of known meanings, the guessing of unknown meanings, the effect of form (pseudoword/cloze) remembering that this cross classifies with meaning and finally order. I'll clarify some of the above terminology when I come to the appropriate section.

Single Word vs Complex Hypotheses

I want to look at possible types of responses when guessing and introduce the idea of <u>single word hypotheses</u> and <u>complex hypotheses</u>. A subject, on receiving a series of cues may work out a genus, <u>This is a kind of barrier</u> and a differentia, <u>This is made up of bricks</u>. He might lexicalise these components of meaning and give the response <u>wall</u>. Where such lexicalisation takes place, I will refer to these responses as single word hypotheses. However, a subject might choose not to lexicalise his response. He could keep genus and differentia intact so we have two discrete but related hypotheses: <u>This is a barrier made up of bricks</u>. I will refer to such phrasal responses as complex hypotheses. Associations, whilst they can serve as cues to such a complex hypothesis can also be added. We might add the idea of <u>Children often climb these</u> here.

Typically, one would expect responses on known meanings to be single word hypotheses and responses on unknown meanings to be complex hypotheses.

The Cost/Benefit Principle

The cost/benefit idea has been widely used to describe decision making/hypothesis formation. Payne (1982) gives a good description of the principle. "The idea is that any decision strategy has certain benefits associated with its use and also certain costs. The benefits would include the probability that the strategy will lead to a 'correct'

decision, the speed of making the decision and its justifiability. Costs might include the information acquisition and computational effort involved in using the strategy. Decision rule selection would then involve consideration of both the costs and benefits associated with each possible strategy".

Why introduce this principle? First, it seems plausible to describe the workings of the mind in such terms. As Sperber and Wilson (1986) point out, "Mental processes, like all biological processes, involve a certain effort, a certain expenditure of energy". In return it is not unreasonable to expect some reward. If an adequate reward is not forthcoming then processing effort might well be curtailed or redirected. Secondly, the principle seems relevant to this study since we are talking of information processing so there will be costs. The are also potential benefits not only in terms of high accuracy but also high confidence and low uncertainty.

Known meanings

With known meanings, costs might be increased by factors like inconsistent information, polysemy and ambiguity in cues and poor cohesion. As pointed out, I intend to remove such problems. Cues will be consistent and as clear as I can make them. Processing costs will be straightforward and benefits will be appropriate. So on known meanings, the cost/benefit principle will be in balance and we will have an efficient guessing system to compare unknown meanings with.

As to how this system will operate, Peterson and Pitz (1988) make some interesting points with respect to confidence and amount of information and I'll base my comments on these. If we received a cue: <u>This is an institution</u>, then we might guess <u>church</u> and give perhaps a confidence of 2. If we get a second cue: <u>This helps educate people</u> then we would probably guess <u>school</u> and give a confidence of 5. Note that confidence goes up even though the guess has been changed. This is because although we went wrong initially, our new guess is based not just on the second cue but also on the first. We are able to recognize the familiar combination between the cues and put them together. In the guessing of known quantities then, confidence seems to rise with increasing amounts of information, provided of course we pick up only the relevant information. If a subject managed to guess <u>school</u> off the first cue and maintain this guess with subsequent cues, the effect should be the same. (We could ask if changing will produce the same kind of gain in confidence as holding guesses. The former might involve more processing in that new hypotheses have to be examined and this might undermine confidence to a degree in contrast to the latter. I would expect such an effect to be negligible in an efficient system)

Accuracy should follow confidence and rise across information as there will be no problem in terms of consistency with the information.

With uncertainty, the following should happen. The first cue: <u>This is an institution</u> will generate hypotheses like:

school, church, the monarchy, and the second cue: This helps educate will generate hypotheses like: text book, school, teacher. The first cue in isolation would generate all 3 hypotheses. But the second cue in combination with the first would not be allowed to generate it's full range of possible hypotheses. Also, when the second cue appears, many of the hypotheses considered at cue 1 would also now be rejected. In fact, when the familiar combination of the second cue with the first is recognised, then school is probably the only hypothesis which will be considered. That is only hypotheses which can be lexicalised will form a part of uncertainty where information is consistent. So uncertainty will decline as information increases going from 3 to 1 in the example above. Peterson and Pitz (1988) do, however, record a rising uncertainty even in the context of a rising confidence. They suggest that this is because there is an element of inconsistence in the information they use and "...it is inconsistent information, with features which suggest different outcomes, that is responsible for the increase in uncertainty". This suggests that where a familiar relationship can't be seen between cues then each cue adds hypotheses to those generated by previous cues. This problem with inconsistency should not affect our model.

Unknown Meanings

With unknown meanings, we would expect the typical response to be a complex hypothesis. One cue might suggest

barrier and a second _made up of bushes_ but if the subject does not know the word _hedge_ he can't lexicalise the target and must give a phrasal response consisting of genus and differentia: _This is a barrier made up of bushes_. One very important point. The fact that we might not be able to lexicalise information here does not make that information inconsistent. Cues do in fact point consistently to a new meaning. Rather, inconsistency here would be the product of two inconsistent cues on the genus and the same on the differentia. We are still then looking at consistent information.

The trouble with unknown meanings is that whilst we might expect complex hypotheses as responses we appear to some extent to get single word responses instead. We see some examples of this in the study by van Daalen-Kapteijns and Elshout-Mohr (1981). They see word meaning as consisting of genus and differentia. (They don't use the terms genus and differentia but this distinction is clearly present). There are two experiments. The main difference being that in the first experiment subjects guess genus and differentia whereas in the second they are given the genus and need only to guess a differentia. Subjects are foreign speaker undergraduates. Five cues are given in all to each target. I'll give the first three cues at 1 for the target _kolper_: _A window that transmits little light because there is something in front of it_. The last two cues serve a reinforcing function so I'll omit them.

1. a) When you're used to a broad view it is quite depressing when you come to live in a room with with one or two kolpers fronting a courtyard.

   b) He virtually always studied in the library, as at home he had to work by artificial light all day because of those kolpers.

   c) During a heat wave a lot of people all of a sudden want to have kolpers, so the sales of sunblinds then reach a peak.

The first cue gives the genus and the others the differentia. Subjects are also given a lot of support and are told carefully to work out an aspect of the target's meaning from each sentence before moving to the next. They are also told that there is no synonym for the target. It's interesting that the authors feel the need to give this last piece of advice. Responses are scored in total and not across information so we don't see a development across information.

One thing we can do here is to look at some examples of responses given by these authors. Subjects do use phrases to describe complex hypotheses. But some subjects give _window_ only and refuse to enlarge on this, or they give something like _shutter_ or _nuisance_. They appear to be using single word hypotheses. The authors don't give the frequencies of these response types but it seems reasonable to assume that if this single word response is occurring where a lot of support is being given in terms of pushing subjects towards complex hypotheses, then this single word hypothesis might well be a

fairly frequent response to an unknown meaning.

Is there a logical reason why single word hypotheses should be given as responses on unknown meaning?

We might try to argue here that subjects do not have knowledge of genus and differentia. As a result, they fail to recognise meaning components like genus and differentia so we get a word response like window given above because the subject fails to recognise the differentia cues as relevant. With the shutter response it would be the genus cue which is not recognised. I am reluctant to use this argument. That people, or at least adults, have such knowledge is borne out by word association experiments. Brown and Berko (1960) find that whilst children give syntagmatic responses: send-> letter adults respond with words from within the same syntactic category: send-> deliver ie. paradigmatic responses. Wiegel-Crump and Dennis (1986) support this in that they suggest the more paradigmatic organisation of the adult lexicon is a factor in the speed with which adults access words. We do need to be careful here since as Meara (1982) points out: "Personally, I have always found that this distinction is very difficult to work in practice, especially when you cannot refer back to the testee for elucidation, but this difficulty is not generally commented on in the literature". However, in that many of these adult paradigmatic responses seem to reflect a semantic link with the stimulus in the sense that they are synonyms, opposites, co-ordinates etc., Aitchison (1987 pp 75, 95), we might argue that they betray a knowledge of genus and

differentia.

Since I don't want to argue that subjects do not have the
ability to recognise the components of meaning we need to think
again here. First, I would appeal to intuition and ask the
reader to identify which of the four guessing situations noted
in Chapter 1 seems to be the most straight forward or closest
to the norm of what we would call "guessing". My answer here
would be a cloze gap over a known meaning since there is no
interference from added factors like pseudowords or unfamiliar
combinations of information.

We have seen how this situation develops in the section
on known meanings. We might get a cue which suggests the genus
barrier and another which suggests the differentia made up of
bushes but these are not held, rather these meaning components
are lexicalised to give hedge.

If cues to meaning components act as cues to word forms
in this known meaning situation then presumably the same will
be true in the unknown meaning situation. We're still dealing
with the same meaning component cues. What we really need to
know as we move from guessing known to unknown meanings is
whether some factor will intervene to prevent the cues
suggesting words so that we end up not using genus, differentia
and association, but retaining them to form a new meaning.

One such factor might be the presence of an unfamiliar
form or pseudoword. It is possible that the presence of an
unfamiliar form might block lexicalisation and direct subjects
to build complex hypotheses. However, the balance of evidence

suggests that pseudoword would not have a drastic effect on their own. Studies like Ames (1966) where pseudowords are used over known meanings seem to elicit in the main single word responses on targets. Whilst I would not discount the effect of unknown forms completely, it does not appear that they provide a strong check on the process of lexicalising information. Substitute the form <u>bilk</u> over a series of cues to <u>hedge</u> and the subject will still spot the familiar combination and lexicalise correctly. I'll return to pseudowords later.

A second factor of more relevance here which might intervene is the realisation that genus and differentia can't be lexicalised ie. a single word hypothesis can't be obtained. A subject might learn initially that the target is <u>a window</u> but when he learns it <u>let's in little light</u> he realises that there is no word in English for this and is forced to give a phrasal answer consisting of genus and differentia.

However, as the responses recorded by van Daalen-Kapteijns and Elshout-Mohr (1981) suggest, this process of spotting that cues can't be lexicalised again doesn't produce that strong an effect in terms of blocking lexicalisation. Some subjects, even when told there is no synonym, do appear to end up guessing words which they think could act to some degree as synonyms for the target.

The effect here is to treat new meanings as though they were combinations of inconsistent information. In other words, when genus, differentia and association can't be lexicalised they tend not to view this situation as requiring a complex

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hypothesis, but rather treat it as an inconsistency. We see from the Oskamp (1965) study mentioned in Chapter 2 one possible course of action when inconsistency is present. Subjects reject or abandon some of the cues. This also seems to be what is happening to some extent in the van Daalen-Kapteijns and Elshout-Mohr study with the window response. Here the differentia cues are rejected. With the nuisance response some of the genus information seems to be rejected. There is a possible second type of solution mentioned by Peterson an Pitz (1988). If one cue suggested a team did well and another that it did poorly subjects guess its performance was about average. They seem to force cues together into a compromise solution. This seems to be what is happening when subjects give the response shutter in the van Daalen-Kapteijns and Elshout-Mohr study. Here cue 1a seems to be distorted so that it suggests not window but something in front of a window and so it is made to fit cues 1b and c. A key question here will be to note whether subjects are aware that they are rejecting or forcing. With Oskamp confidence rose which suggests subjects were not aware.

However, this idea of treating new meanings/complex hypotheses as combinations of inconsistent information is a description of what happens not a cause. For the latter we can turn to the cost/benefit principle.

First, let's ask what rules might govern the combination of genus and differentia. A linguist would look at examples. If we take pet- a tame animal, or weed- a flower which is a

nuisance, we can see that the differentias contradict the associative meanings the genus would have were this to be a word form. Flowers are thought to be nice things and animals are usually wild. But things don't end with this pragmatic opposition. We can get logical contradiction. Zombies and vampires are living corpses, a busman's holiday is a working holiday. The moral seems to be that there is little in the way of pragmatic or semantic constraints on combinations. But I have strong doubts that someone not linguistically aware would come to this conclusion. My feeling here is that plausibility would be a major factor in accepting a genus differentia combination. I suspect that if we found someone who didn't know the meaning of zombie we would have a lot of trouble in getting him to guess that meaning as genus and differentia emerged from textual cues. The need for plausibility might send him in the direction of thinking that this was someone mortally wounded but not yet dead. Perhaps the only way we might get the correct definition across would be to mark genus and differentia as definitional by phrases such as This means. Perhaps the virtue of a dictionary is that it speaks with authority and so leads subjects to accept new combinations as complex hypotheses.

In terms of guessing, however, the subject will have to rely on his own intuitions and he will question the plausibility of new combinations. It is not difficult to see how plausibility can push subjects towards single word guesses. In any complex hypothesis, taking kolper as an example,

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subjects are going to assess the link between the components in terms of plausibility. "Is this combination of <u>window</u> and <u>let's in little light</u> sensible". They will be suspicious of the link between the components and this sense of suspicion will undermine confidence so that information is being processed for limited reward. In fact, suspicion is quite probably so strong that in many cases the new combination of meaning components can't be accepted and there is no reward at all. Subjects, then, might well be deflected from this course by lack of benefits. Information can still be processed, however, by transforming the unknown meaning into a known one. This could be done as pointed out by abandoning information. Here they might retain <u>window</u> and abandon <u>let's in little light</u>. It could also be done by forcing information: "Well, perhaps what he means is that it's dirty". That is they distort information by turning the differentia into an association so excluding it from the core of the definition and are left with the word <u>window</u>. When they guess <u>shutter</u> they seem to have decided that cue 1a refers not to <u>window</u> but to <u>something in front of a window</u> and can force this together with other cues to get a common denominator. So in the formation of complex hypotheses benefits, notably confidence, is undermined to such an extent that subjects are deflected into viewing such hypotheses as inconsistent. This gives them some kind of reward, a single word hypothesis, and has the advantage that they are now dealing with something familiar. A known word.

A point to be kept firmly in mind here is that if

subjects do respond to unknown combinations as they would to inconsistency they are in error. Unknown meanings cues in this study, as pointed are not inconsistent, they point consistently to a new meaning. To look at the idea of inconsistency within unknown meanings we would have to look at inconsistency on each of the three meaning components and on combinations thereof. An ultra complex subject which I quickly exclude from this study in that we need to understand something of guessing at a more basic level first. Another point to remember is that I am not suggesting that subjects will never guess complex hypotheses. Simply that they will tend not to. The guessing of complex hypotheses is of interest to this study and I will make an attempt to get at this phenomenon.

Since we are likely to get quite a high frequency of single word responses on unknown meanings, let's consider how this response type might fit into our model.

With respect to accuracy, I would not expect such single word responses to show any increase in accuracy across information. In forcing information the subject is after an increasingly precise synonym. Good synonyms are rare in English so the pursuit of a possible synonym for the target is not likely to pay off. We see also with the nuisance response given above, subjects are forced to give something so general we might criticise it as vague. If information is abandoned then clearly accuracy will again not increase. On the whole, accuracy is likely to be static across information.

If accuracy is damaged, this means that subjects are only

achieving a limited benefit. They are also reducing processing costs most clearly in terms of abandoning but also in terms of forcing since cues are distorted into a more easily manageable form than the unknown combination. Payne (1982) does suggest that the tendency to minimise effort is greater than the tendency to minimise error. How many of us decide to count when playing cards or plan well ahead in chess though such strategies clearly will maximise success?

What about confidence? Will it rise showing that subjects have no intuitions about accuracy and the difficulty they are in? I would suggest not. I've argued that subjects have knowledge of meaning components. So they in the position of forcing and abandoning information they have an awareness and understanding of. This must have an impact on confidence and probably this variable will remain static across information. So subjects not only tolerate error but an awareness of error which is the more important point.

With uncertainty, subjects are responding to cues as though they were inconsistent and given what I've said in the known meaning section this opens the possibility that uncertainty might rise. The diversity of responses noted above: window, shutter, nuisance suggests that there is indeed a possibility of this happening. On the other hand, some subjects do seem to take a response like window and simply repeat it. This lack of changeability suggests the subject might not be prepared to consider many hypotheses in this difficult situation. With these two forces counterbalancing

each other we may get a static uncertainty.

In all probability, single word hypotheses will be the most prevalent and so the most important aspect of the unknown meaning model will be that relevant to these hypotheses. But what about where complex hypotheses are formed? We can expect this to happen some of the time and we need to try and model this response to some extent also. Nothing really seems to have been done on the idea of how dependent variables might behave where we have a series of related hypotheses joining to create a complex hypothesis.

With respect to confidence, if a subject is able to form a complex hypothesis then information is being used so confidence should rise. But the subject will now have a combination of two hypotheses which is new. Even though intense suspicion has been overcome, a degree of suspicion in the combination of components is still going to be factor which is present even if such a complex hypothesis is formed. The subject is going to examine such a combination to see if it "makes sense" and this suspicion of the combination is going to weaken confidence particularly in relation to the situation where genus and differentia can both be lexicalised in the known meaning condition. So whilst confidence will rise across information it will do so at a lower level for unknowns as opposed to knowns. Also we need to ask what might happen where associations are added to the meaning core of genus and differentia to form an encyclopaedic entry. In all probability, confidence will now improve since the subject is

now becoming familiar with the new meaning.

With respect to accuracy there is every opportunity to use information successfully just as in known meanings. So we are in the paradoxical situation of achieving a high accuracy but with a limited confidence in our hypothesis.

With respect to uncertainty on unknown meanings we are dealing with two hypotheses where we have a genus and a differentia combination. So if we consider the genus of _kolper_ we might think of _window_ and _skylight_ and so have an uncertainty of 2. If we think of the differentia we might get _blind_ and _shutter_ as elements which might be attached to the genus in this case. Again uncertainty is 2. Does this mean that we now have a large uncertainty distribution of 4 also reflecting increasing uncertainty across information since we are moving from an uncertainty of 2 on the genus at cue 1 to 4 on the genus differentia combination on cue 2. This is unlikely. Mixing genuses and differentias like this does not make decision making easy in that we'd have to consider all possible combinations. Rather, on the genus cue we would probably think of several hypotheses and then select one before tackling the differentia cue which would then suggest a series of possible hypotheses which could be added to the genus. If there is a difficulty in getting a match then the subject would access the genus uncertainty distribution again. So, if we assume a subject thinks of 3 hypotheses when he gets a cue, the genus cue will produce an uncertainty of 3. A selection of a genus will then be made so disposing of this uncertainty

distribution but the differentia cue will now generate a new uncertainty of 3. That is to say, uncertainty should stay static across information.

Form (Pseudoword/Cloze)

It could be that a pseudoword acts as a trigger, telling subjects right from cue 1 that a complex hypothesis and not a single word hypothesis is present. A cloze gap, on the other hand, should persuade subjects that only a single word hypothesis is present. This contrast should cut across the meaning distinction. Where a pseudoword occurs over an unknown meaning, subjects are appropriately made aware that a complex hypothesis is present but where it occurs over a known meaning they will be deceived into thinking a complex hypothesis is present. Similarly, where a cloze occurs over a known meaning subjects are appropriately made aware that a single word hypothesis is present but that when it occurs over an unknown meaning they are deceived.

Whilst I would not deny that a pseudoword or unfamiliar form can act as a stimulus to complex hypothesis formation I doubt that it will do so frequently. It is much more likely that subjects will replace them with single word hypothesis and in doing so will effectively reduce the pseudoword condition to the same status as that of the cloze space.

Why should this be so? Let's assume the subject sees the form <u>belk</u> and get's one of the meaning components, say a genus, <u>barrier</u>. If the subject wants to consider a complex hypothesis

he must now think in terms of "This is some kind of barrier". That is, he will see the hypothesis as incomplete. This awareness of incompleteness will damage confidence, probably reducing it by 50% in contrast to the comparable known meaning/cloze situation. The sense of suspicion mentioned earlier will again be aroused since the subject will know that the differentia can't be bushes or bricks since these relate to the familiar forms hedge and wall. Again, benefits are reduced and it would be easier to think not in terms of a kind of barrier but reduce the genus to a single word ie. barrier or perhaps wall since this is a fairly typical barrier. Thus the sense of incompleteness and with it a source of difficulty is removed.

If the subject goes on guessing in the unknown meaning situation and spots a differentia he may be able to attach it to the initial guess to form a complex hypothesis but now he is going to have trouble accepting this new combination due to suspicion and the tendency will be to lexicalise.

In effect, the pseudoword condition will be reduced to a cloze gap. In terms of overall results I would not expect a difference between cloze and pseudoword on any of the dependent variables.

Order

Remember, I intend to force subjects to operate in all six orders identified. Order, however, is a complex phenomenon and I am not going to make predictions. Rather, I intend to

await the outcome of experiments. For the sake of convenience I will assume that there is no difference between the orders until statistics show otherwise.

One important point is that we can use the cost benefit principle to generalise from experiments to what might happen in real life. We would probably need a large benefit for a particular order to balance the high processing costs involved to see an order based strategy used in real life.

Word Class

Noun targets should produce more confidence and accuracy and less uncertainty than verb targets in both meaning conditions. This links to intra selectional collocations being superior to extra selectional collocations.

A final point. The proposed model is complex. In order to simplify we could view the experiments which are to come in terms of the following points.

The description of guessing known meanings across information is worthwhile since nothing has really been done along these lines in terms of linguistics. However, given the psychological studies, I would be surprised if the proposed model did not turn out to be quite accurate. The main interest of the known meaning condition will be to provide a description of an "efficient" guessing system against which the intricacies of the unknown meaning condition can be compared.

With respect to the unknown meaning condition, I will be

concerned with the following questions:

Is there evidence to back up my assertion that subjects will try to lexicalise targets and go for single word hypotheses rather than complex hypotheses?

What are the consequences of lexicalisation on the dependent variables and what strategies are best followed when this occurs?

Also, since lexicalisation is a tendency not a rule, we can assume that there will be some instances of complex hypothesis construction. So we also need to ask: What are the consequences of complex hypothesis construction on the dependent variables? What strategies are best followed where this occurs?

Chapter 4

Testing the Ruler

I've divided this chapter into two sections. The first is a general introduction to all the experiments carried out, the second deals with the first two experiments which constitute a pilot study.

General introduction

What I've tried to do here is to construct a series of experiments. This is done partly for the usual reason of developing one's ideas in the light of what experiments reveal. Another reason is that I want to create a cline running from very controlled experiments to more naturalistic ones. In the former, we can look for and examine very specific effects which we think might obtain in a real life situation. In the latter, since it is difficult to get a very clear picture in a realistic situation since it is not easy to exclude interfering variables and conflicting hypotheses we can simply seek confirmation that the effects observed in the controlled experiments do in fact obtain in a more realistic setting. This would then provide some justification for accepting the greater detail given in controlled experiments as a valid description of guessing meanings.

Just to give an overall picture, the series of experiments carried out is given at 1.

1. Experiment 1   June 1989
   Experiment 2   June 1989
   Experiment 3   October 1989
   Experiment 4   January 1990
   Experiment 5   April 1990

Experiments 1 and 2 are brief pilot studies. Experiments 3 and 4 are reasonably powerful studies which try to exploit the pilot studies. Experiment 5 is in attempt to capture some of the results of these previous experiments in a more naturalistic setting.

A brief word should also be said about the subjects who participated in these experiments. The subjects were almost exclusively students, judged to be of similar intelligence and educational level, at University of Wales, Bangor: undergraduates or MA students, and were native speakers. Foreign students would undoubtedly have made an interesting group, but a sufficiently large, homogenous group did not exist at the university. To have used four or five African subjects, four or five from Arab countries etc. would have been asking for trouble in that intra group variation might have obscured any general result. Another type of subject of interest would have been children at say the more advanced primary school level. It is with such subjects that learning through guessing is thought to occur and they might possibly be more inclined to guess than adults who have fairly extensive vocabularies. Children are, however, more difficult to deal with in terms of controlled experimentation than adults and my feeling is that

it's better, if possible, to try and get a picture of what might be happening from an intelligent adult group and leave children for the future.

None of the subjects who took part in the experiments received any form of payment or incentive.

Pilot study

This pilot study consists of Experiments 1 and 2. The linguistic literature on guessing says very little about confidence and nothing about uncertainty. Rather, it relies almost exclusively on accuracy. What I want to do here is take a tentative look at how the first two of these dependent variables behave in a linguistic setting in preparation for future experiments.

Experiment 1
Introduction

Purpose of experiment: The purpose of this experiment is to contrast the guessing of known and unknown meanings across increasing amounts of information and between different orders of cues in terms of the dependent variable confidence. Being a pilot study, I really want to test the measuring instrument, procedure and some of the ideas mentioned in the model etc. in preparation for future experiments.

With known meanings the cues should lead to the guessing of words. What I have termed single hypotheses. As more cues

are given it doesn't matter whether the hypothesis changes or remains the same. Confidence should be a product of amount of information and as this independent variable increases so confidence should increase. So we could give a subject 3 cues in succession: <u>This is a kind of barrier, This is made up of shrubs, This is trimmed sometimes</u> and the subject should eventually give the hypothesis <u>hedge</u> at quite high confidence, perhaps after rejecting and changing from hypotheses like <u>wall</u>.

With unknown meanings, we have identified two situations. Subjects might try and use the cues to guess a single word hypothesis by treating cues as inconsistent. Or subjects might try to construct a new meaning or what I have termed a complex hypothesis. It is the latter of these two situations that I want to focus on in this experiment and I want to look at the process in terms of subjects building a complex right from the start on cue 1 and not when they realise that information can not be lexicalised. This is equivalent to the situation where a pseudoword or unknown form acts as a clear indicator that a complex hypothesis is present.

The main difficulty with trying to look at this idea of guessing new meanings complex/ hypotheses right from the start on cue 1 in the unknown meaning condition is that we can't simply rely on the presence of a pseudoword to persuade subjects to build a complex hypothesis. Subjects might try to go for single word guesses. I'm, therefore, going to force subjects into the situation of building a complex hypothesis right from cue 1 by giving them a cue to one of the meaning

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components and telling them to _add_ a second. Such a situation is artificial especially since I've indicated that complex hypothesis formation might not be that frequent in real life. But it should have the benefit of giving us a fairly clear view of complex hypothesis formation and it is relevant to look at this phenomenon to see if factors like incompleteness and suspicion noted in the model do undermine confidence. Confidence for unknown meanings should rise as information is made available since subjects are being forced to use the information, but it should rise at a lower level for unknown meanings as opposed to known.

Just to illustrate this "adding" instruction. We could give these cues in succession: This is to carry, This is done on the head, African women usually do this. On seeing the first cue and being told to add an idea the subject is forbidden to take this initial cue as the whole meaning. Although a subject might add on the back this is not done on the basis of hard information. There is no retreat to a single word guess and target must be viewed as incomplete: "To carry in some fashion possibly on the back". This should reduce a subject's confidence on cue 1 unknown in contrast to cue 1 known where a single word can be given. Also, together with this incompleteness, subjects should realise that whatever is added can't form a combination which can be lexicalised because of the strange form. So there is also suspicion of anything that is added. This is comparable to the real life situation where a subject sees an unfamiliar form and gets one of the

meaning components of the complex hypothesis but has not yet read on and recovered the second. (That more cues are going to be made available will be made clear to subjects in the instructions in that they will be told that they will see more than one cue).

When the next cue becomes available, he will probably abandon this first guess <u>on the back</u> and accept <u>This is done on the head</u>. He will also add another hypothesis, perhaps <u>by balancing</u>. But he will now have to test the link between <u>To carry</u> and <u>On the head</u> and suspicion in the combination should decrease confidence with respect to known meaning cue 2. Confidence will still rise because the adding instruction forces subjects to process information but it will not rise so sharply for the unknowns as opposed to the knowns. When the third cue comes in, subjects are now becoming more familiar with the new meaning and confidence on the unknown targets might start to catch up with that on the knowns.

The lower confidence on cues 1 and 2 on the unknowns in contrast to the knowns will illustrate the reduced benefits due to incompleteness and suspicion noted in the model.

<u>Predictions</u>: Predictions are given at 2.

2. a) Confidence will be lower overall for unknown meanings as opposed to known meanings.

  b) Confidence will rise with increasing amounts of information.

  c) Confidence will rise more slowly for unknown meanings

across information as opposed to known meanings possibly with the gap closing on cue 3 so we may get an interaction here.

d) There will be no effect for order.

Method

Cases: Six subjects took part in the experiment. Four of the subjects were students at St. Mary's College, Bangor and were doing the post graduate certificate of education course: Teaching English as a Foreign Language. One subject was a lecturer at the above college. The final subject was an employee in the university canteen. A convenience sample. Also not a very homogeneous sample. This experiment took place in June and since students were preparing to sit exams it was difficult to get subjects.

Independent variables: The independent variable of word meaning was dealt with by creating twelve targets, all verbs, six representing known meanings and six representing unknown meanings. These targets are given in Appendix 1. An example of a known and unknown meaning is given at 3. The genus is represented at a), the differentia at b) and the association at c). Known meanings were characterized by having a cloze space set above them and unknown meanings had a pseudoword.

We are using only two of the four possible situations mentioned in Chapter 1: a cloze gap over a known meaning and a pseudoword over an unknown meaning. This was done to keep the pilot study simple. The reason for choosing these two

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situations out of our four possibilities is that they represent extreme cases. I mentioned in Chapter 3 the possibility that the presence of a pseudoword might lead a subject to believe

3. Known meaning   Unknown meaning

   To_____   To klarim

   a) This is to clean   This is to worship
   b) This is done with   This is done in a
      a broom   frenzy
   c) Rooms sometimes have   Primitive tribes
      this done to them   sometimes do this

that he was in the position of dealing with an unknown meaning. Therefore, if this is the case, we need a pseudoword in the unknown condition since it looks a bit more natural. Note that I'm not relying on the pseudoword here to trigger the guessing of complex hypotheses but on an adding instruction.

Known meanings were obtained by using a list of random numbers to identify page numbers in a dictionary (the actual dictionary varied as to what was available) and the first item with a reasonably clear genus, differentia and familiar association was chosen. These known meanings were then tested on friends to see if a reasonable guess could be made. Unknown meanings were simply constructed by myself and then checked through to make sure that no single word form existed which could take as it's definition this combination of genus, differentia and association. The six known meanings were

randomized using a table of random numbers, but this random order of targets was kept the same for each subject. The same thing was done for unknown meanings. The first subject to sit the experiment saw the six known meanings first followed by the six unknown meanings. This was reversed for the second subject and so on.

The independent variable of amount of information was dealt with as follows. The genus, differentia and association were used to provide cues. They were presented to subjects in the forms given at 3 ie. they were presented directly and no attempt was made to camouflage or describe them indirectly. In seeing one of these cues, subjects received one amount of information, in seeing two they received that plus a second (two amounts of information) and in seeing three, that plus a third cue (three amounts of information).

All cues were tried out on friends to ensure that factors like polysemy did not cause any serious problem and that all cues could elicit fairly reasonable responses.

A criticism here is that subjects will realise quickly that there are going to be no more nor less than three cues. So confidence on cue 1 might be coloured by the expectation that more will follow. In real life one would not be able to assume a fixed number of cues.

A second criticism is that all cues are compatible in that they point consistently to a word or a new meaning. In real life one might get two genus cues etc. which were inconsistent. This is too complex a subject to deal with here,

A third criticism is that the presentation of cues is reminiscent of the way teachers used to set mathematical problems. Every item of information given will probably be seen as relevant. In real life, subjects might simply ignore some items of information and there would be a greater freedom to discard information. I will try to move towards more naturalistic experiments.

As to the independent variable of order, there are six possible orders of genus, differentia and association. For the known meanings there are six targets. The first subject saw a different order for each target so that all six orders were covered by that subject. The second subject also saw all six orders, but not on the same targets as the first subject and this variation was repeated until all six subjects had sat the experiment. The result was that each subject saw all six orders and each target was also seen with cues in all six orders. The sequence in which subjects saw these orders is given in a grid in Appendix 1. The reason for varying orders for each subject was to remove any effects related to individual targets.

Procedure: The experiment was conducted in a sound proof room in the phonetics laboratory where subjects were free from interruption. Subjects sat the experiment one at a time and spent approximately thirty minutes doing so, proceeding at their own pace. When the first subject entered the experiment room, he was given an answer sheet which was relevant only to

the known meaning condition and asked to read the instructions.
An example of the answer sheet is given in Appendix 1. The
instructions are at 4.

4. You will see a number of items of information describing
an English word. Can you guess what that word is? Each time
you see an item of information, note down what you think the
word being described is and also how confident you feel in your
guess. Measure your confidence on a scale from 0 to 6. 0 = no
confidence, 6 = maximum confidence. You may change your guess
if you wish.

After the subject had read the instructions and asked any
questions he had, the computer file containing the information
on the words in the known condition was accessed. The subject
was asked to press the DOC PAGE key and the word EXAMPLE came
up on the screen. The subject was told that the first word was
an example just to give practice. This example was seen in the
order: genus, differentia and association. The subject was
asked to press the same key again, the next page then came up
on the screen with the first item of information typed at the
bottom left of the page (all information appeared in this
position) in the form given at 5. The subject noted his guess
and confidence on the answer sheet. He then pressed the key
again and received the second cue in the same format. Subjects
had no trouble completing the example. When the example had
been completed, the prompt NEW WORD in reverse (highlighted)
came up when the DOC PAGE key was pressed. The subject was

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told that this prompt would appear each time he had completed a word. The subject was also told that the prompt THE END would

5. To _____

This is to make a copy

appear when he had completed the experiment. He was then to call me since there was a second section to the experiment. I then left the room.

When the subject called, I returned and gave the subject a new answer sheet for the unknown targets. The instructions are given at 6.

6. You will see a number of items of information describing an infrequent English word. Can you guess what it is? Do this by adding a piece of information which you think fits the word to the item of information you will see on the screen. Note down your guess and your confidence in it at each step. Measure your confidence on a scale from 0 to 6. 0 = no confidence, 6 = maximum confidence.

The response of subjects to these instructions was: "What do you mean by add?" I asked them to wait for the example. The first cue to appear is at 7. If a subject still had difficulty, I urged him to try, but if there was still difficulty I gave the prompt: How help to grow? This seemed to solve the problem. If a subject asked for help on the second

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cue I simply told them to go ahead and try. The unknown

meaning condition then proceeded in the same way as the

7. To losk

This is to help to grow

known. All the subjects were able to carry out the experiment

under these conditions. For the second subject the known and

unknown conditions were reversed and so on.

There is an element of clumsiness in these instructions.

If a subject sees, for example, a genus, he might add a

differentia. When he sees the correct differentia, he will

then have to abandon his guess and accept the differentia he is

given. He will also need to add something, probably an

association now. He will then see another association and must

add something again, most probably another association.

Also note that we are not just talking of a complex

hypothesis consisting only of the two hypotheses of genus and

differentia, but we see the complex hypothesis in this instance

as something being constantly added to. Both these views of

the complex hypothesis are relevant to real life. The first is

relevant to how we might build up lexical entries in our

memory. The second is relevant to how we might go on and build

up encyclopaedic entries.

Scoring: The dependent variable of confidence was scored

on a scale from 0 to 6. The reasons for adopting this scale are given in Chapter 2. On the surface this looks like an interval scale and for practical purposes will be treated as such. But we have no guarantee that the interval between 0 and 1 confidence is the same as that between 5 and 6. Aspects of this scale, at least are ordinal, 1 simply being higher than 0, 2 simply being higher than 1. Also, different subjects might not attach the same value to a score. One might view 3 as highish confidence another as lowish. So we could have a situation where a score of 3 for one subject might be higher than a score of 4 given by a different subject. In practical terms little can be done about this and I would hope that any confidence trend within subjects would be strong enough to bury this between subject variation. Subjects' responses are recorded in Appendix 1.

<u>Apparatus</u>: The computer used in this experiment was an Amstrad 9512 word processor.

There was a problem presenting cues to the subjects on the computer. When a subject saw the second cue, the first cue was no longer present. So on two amounts of information a subject did not see, for example: <u>This is to worship</u> and <u>This is done in a frenzy</u> but only <u>This is done in a frenzy</u>. ie. cues one and two were not present together. Similarly, when a subject saw the third cue, cues one and two were no longer available. This meant that subjects had the extra burden of trying to recall the first cue on two amounts of information

and the first and second cues on three amounts. The reason for this was that if one typed three cues at the bottom of the page, then when a subject pressed the DOC PAGE key and the page scrolled up, some of the old information was now displayed at the top of the page together with the new information at the bottom. An attempt was made to write a programme in BASIC to present cues, but the version of this language used in the Amstrad does not appear to have a straightforward command to clear the screen and cues were always presented in the environment of the programme itself

Experiment Design: The experiment design is one of repeated measures. Each subject performed in the known and unknown meaning condition, each subject saw all three amounts of information and each subject saw all the orders- though on different targets. The design can also be termed factorial since we have more than one independent variable with different levels on each: meaning x 2, information x 3, order x 6.

We should also note that the experiment is small and this has serious consequences for the order variable. We have six orders and each of the six subjects saw each order twice- once in the known meaning condition and once for unknown meanings. This means we have only twelve responses on each order to discriminate between six orders. It really isn't powerful enough and the variance is probably going to obscure any possible result.

Results and Discussion

Three ANOVA tests were run on each dependent variable using the SPSSX package on the university mainframe computer.

ANOVA 1 looked at the effect for the three amounts of information, order and the interaction of information by order for known meanings.

ANOVA 2 looked at the same factors but with relevance to unknown meanings.

ANOVA 3 combined both sets of data used in ANOVAS 1 and 2 and looked at the effects for known and unknown meanings, the three amounts of information, order and any possible interactions.

One further point is that the Mauchly Sphericity test which SPSSX computes automatically where there are more than two levels on a repeated measures independent variable often reaches significance. This test assesses similarity of variance. On, for example, the three levels of information the means could turn out to be significantly different- in fact we are hoping that this happens. But the variance about each mean should be similar for each amount; this being because they are amounts of the same thing, namely confidence. What has happened if the Mauchly Sphericity test reaches significance is that the variances about each amount of information are significantly different and that rather than treat our differing amounts of information as three levels of the same independent variable it is safer to treat them for statistical purposes as three separate independent variables. All this

means in practical terms is that where this test reaches significance, we take the multivariate ANOVA results and not the univariate. This protects against any significant differences being caused by differences in variance rather than differences in means.

Also, in terms of multivariate tests, SPSSX uses three: Pillais, Hotellings and Wilks. Since their results were always in agreement, I will simply quote a result once using the heading multivariate. Where an independent variable has three or more levels but the Mauchly Sphericity test is not significant I will use the heading univariate. Where an independent variable has only two levels the result is always univariate and I will use no heading. I will also give the Mauchly Sphericity result whenever there are three or more levels by stating Mauchly =. The vale for F and the significance of F will always be stated. Means will also be given if a result reaches significance. Whenever means are larger than the original scale used to measure the dependent variable in any experiment they will always be reduced back to the original scale in this case 0-6 for clarity of presentation. Not all possible results will be given. This applies to the more detailed interactions which sometimes don't figure in the discussion. That is, only relevant results and not every single result I obtained will be given. Results which reach the 0.05 level of significance will be marked with a single asterisk, those that reach 0.01 with a double asterisk.

Also, where the Mauchly sphericity test reaches significance it will clearly be worth looking at the differences between standard deviations as well as means. I won't do this consistently but just where there is something interesting happening. Where standard deviations are given a heading standard deviation will appear. One final point. For convenience, it will often be necessary to use a shorthand for referring to the different orders. Here the letters abc will be used:

Genus = a

Differentia = b

Association = c

so the order of: genus, differentia, association will be abc and so on. The above policy applies to the remainder of the thesis.

Results:

ANOVA 1 Known meanings

Result 1:   INFORMATION x 3
            Mauchly= .008 **
            Multivariate   F= 9.295 Sig of F= .031 *

            Means
            1 amount   2 amounts   3 amounts
              2.472   3.278   4.500

            Standard Deviation
              1.980   1.611   1.486

Result 2:   ORDER x 6
            Mauchly= .826
            Univariate   F= 1.41 Sig of F= .256
            (Computer warning: too few degrees of freedom)

ANOVA 2 Unknown meanings

Result 3:   INFORMATION x 3
            Mauchly=.017 *
            Multivariate   F= 7.530 Sig of F= .044 *
            Means

            1 amount   2 amounts   3 amounts
            1.195   2.083   3.389

            Standard Deviation
            1.437   1.630   1.956

Result 4:   ORDER x 6
            Mauchly= .119
            Univariate   F= .28 Sig of F= .922

ANOVA 3 Known and unknown meanings combined

Result 5:   MEANINGS x 2
            F= 5.28 Sig of F= .070

Result 6:   INFORMATION x 3
            Mauchly= .051
            Univariate   F= 26.52 Sig of F= .000 **

            Means
            1 amount   2 amounts   3 amounts
            1.834   2.681   3.945

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Result 7:   MEANING by INFORMATION
           Mauchly= .004 *
           Multivariate   F= .045 Sig of F= .956

Result 8:   ORDER x 6
           Mauchly= .000 **
           Multivariate   F= 1134.905 Sig of F= .023 *

           Means

abc   acb   bac   bca   cab   cba
2.917   2.833   3.000   2.917   2.445   2.806

        (Comment: The equivalent univariate result carried
a warning   that there were too few degrees of freedom. This
result was clearly not significant at .822).

Confidence discussion:

        We   see   at   Result   6   that   confidence   increases
significantly   as   information   increases.   This   is   much   as   we
expected in prediction 2b. More interesting is the possibility
that   known   and   unknown   meanings   show   different   rates   of
increase.   Result 1, significance of F= .031, shows that there
is a significant difference between the information means on
the known targets and Result 3, significance of F= .044, shows
the same for the unknowns. The means are displayed on graph 1.

        Looking at graph 1, we can see that confidence is in fact
consistently lower across information for unknown meanings as
opposed to known meanings.   It looks as though prediction 2c
might be correct.   Unfortunately, Result 5 shows that there

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is no significant difference between known and unknown meanings in terms of the overall confidence they generate so prediction .

Graph 1

Confidence: Meaning x Info
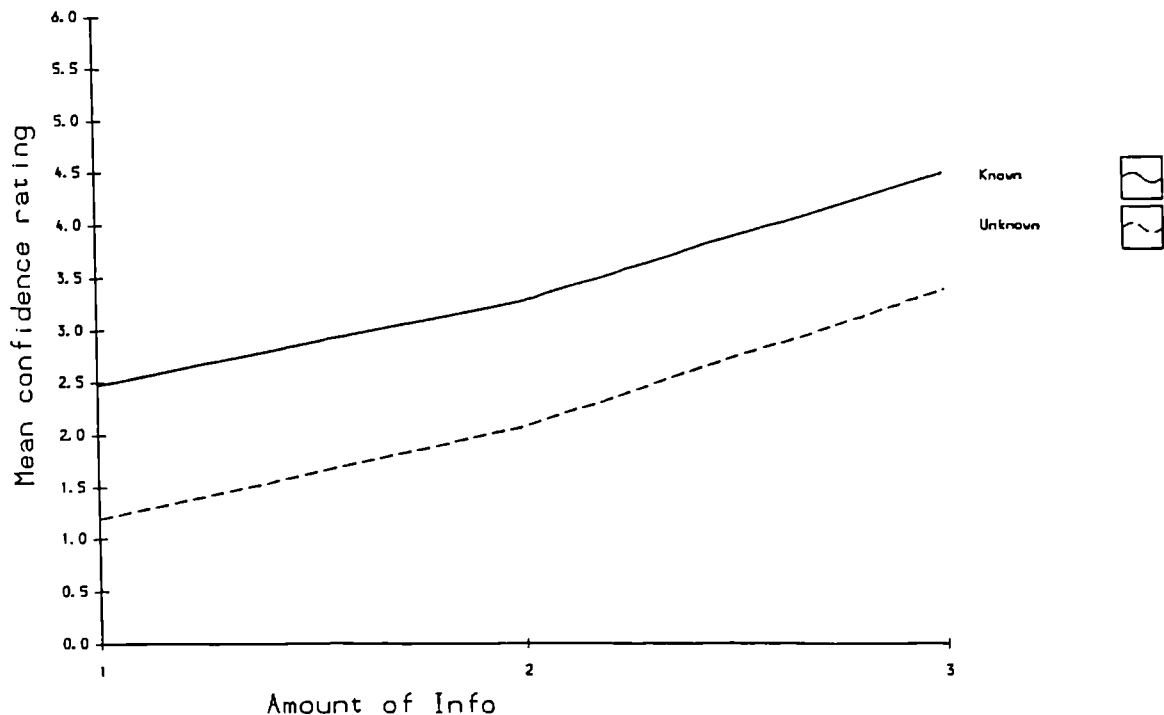
2a fails. This in fact suggests that the two lines on graph 1 could be interchangeable. However, result 5 is not that far off significance, F= .070 especially since we have so few subjects, and it could be that we have a foundation to build on here. In a more powerful experiment we might find a real difference between known and unknown meanings so confirming the first part of prediction 2c Result 5 is suggestive and though not significant it is in accordance with predictions. Also Result 7 shows no interaction between the two meaning

conditions across information. We might have expected one from what was said in the second part of prediction 2c. The gap between known and unknown meanings does appear to be closing on cue 3 and again it might be a case of too few subjects.

Confidence increases apparently as information increases. Let's begin by describing what happens in terms of known meanings.

Cues and responses are given for subject 1 word 4 at 8 below in the order bca. Subject 1 sees the first cue, comes up with the hypothesis chew which appears to fit the information, and gives it a confidence of 3. Cue 2 seems to fit this hypothesis which is retained and confidence rises. The third

8.   <u>Cues</u>   <u>Responses</u>   <u>Confidence</u>

   b) This is done by taking   chew   3
      something into the mouth

   c) Food sometimes has this   chew   4
      done to it

   a) This is to discriminate   taste   6

cue then comes in. He now changes his hypothesis from chew to taste, but confidence continues to rise despite this change. The reason for this seems to be that although cue 8a) forces a change, cues 8b and c) are still appropriate. It's a question of putting the cues together rather than rejecting one or more. There's nothing new in such a description. Peterson and Pitz

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(1988) say something very similar. The moral is that if information is used and it is consistent then confidence goes up. Subject's may use it "wrongly", but they won't know this. If they think it is relevant they will probably use it so increasing confidence. The basis on which subjects combine cues is that they fall into familiar and recognizable relationships with each other. If cues are used "wrongly" then a subject has mistaken the relationship between them, but this is infrequent. The reader, however, should not get the idea that this is some kind of perfect system. There are factors which interfere. Look at the responses of subject 5, particularly at target 5. He starts off very overconfident and even though he's using information decides to reduce his confidence and be a little more cautious.

If we turn now to confidence for the unknown meanings, then confidence also rises, but it appears to do so at a lower level than for the known meanings. It's worth pausing here to look at the responses for unknown meanings and to note how they differ from those for the knowns. Any speculation concerning this contrast must be taken very tentatively since we don't have significant difference at Result 5 to support the points made.

If we look at target 4, To hersk, for subject 2 the cues in the order this subject saw them and the responses are given at 9. Here the subject seems to be behaving in the way we expected. A possible genus is added to cue 1, which is the differentia. On cue 2 when the correct genus is given this

genus guess on cue 1 is seen as erroneous and is rejected. We can see that the correct genus is held now as it shows up in the response at cue 2 as carry. The idea of pot is added and looks like an association. At the third cue an additional association is added. It seems we have a complex hypothesis: To carry something on the head. Usually done to pots of water.

9.	Cue	Response	Confidence
b)	This is done on the head	hit	1
a)	This is to carry	carry large pots	2
c)	African women sometimes do this	of water	4

Confidence is rising, but the way in which the hypothesis is seen as incomplete at cue 1 and then suspicion of the combination on cue 2 leads to a lower rise as compared with the known meaning at 8. This might might lead ultimately to an overall difference between the meaning conditions on a more powerful experiment. Note also that the gap between meaning conditions is at it's widest at the first cue and closes slowly but consistently at successive cues (See graph 1). Perhaps as hypotheses are added, particularly associations, our growing understanding of the concept negates the effect of suspicion. There might be the basis for an interaction of meaning by information here though the the way in which this result does

not come at all near significance in this study suggests that we would need a very powerful experiment to test whether or not such an effect might occur.

However, things are not this simple. On the third and final cue we have a total of thirty six responses and of these approximately sixteen, slightly less than half, could possibly be taken as single, familiar word hypotheses used as a synonym for the target and not complex hypotheses despite the fact that I've tried to force subjects into complex hypotheses. I use the word "possibly" here since it is not always easy to determine whether a single word is part of an "adding" response and so represents a complex hypothesis or whether it is a lexical common denominator between cues ie. a single word hypothesis. Subjects are, however, to some extent applying the process of guessing known meanings to the guessing of unknown meanings despite my attempts to block this.

Let's just look at a few examples of these possible single word responses. Subject 1 gives the responses at 10 on target 1, <u>To mutle</u>. Here we can see confidence rise and then fall. The subject seems to be aware that he is forcing the cues together to generate a single known word. If, however, we look at the same subject's responses on target 4 given at 11, we see that confidence rises with information. It is this pattern of rising confidence which seems most frequent amongst what seem to be single word responses. The subject is deceived and has found what he thinks to be a good single word common

denominator between the cues.

There is the possibility I mentioned that the subject is

10.	Cue	Response	Confidence
c)	Handicapped people sometimes do this	Drop	0
b)	This is done because one can't use one's hands	Tumble	2
a)	This is to use one's feet	Grasp	0

11.	Cue	Response	Confidence
b)	This is done on the head	Groom	0
c)	African women sometimes do this	Plat	1
a)	This is to carry	Balance	3

adding an hypothesis but simply using a single word to do so. I suspect that this might be the case in some of these single word responses but it is not at all easy to tell. With 11 we'd expect _balancing_ not _balance_ at 11a) as an abbreviation of _by balancing_ if the response had been added to this cue. On the other hand _balance_ might have been added to cue 11b) as balance on the head.

So, it's not always easy to interpret whether a single word response is an addition ie. a complex hypothesis or a common denominator ie. a single hypothesis. It must be admitted that there are single word responses present in the

unknown condition despite my attempt to block them. So we have to be very cautious of the difference between the two confidence lines on graph 1 since we are not getting uniform contrast between single word hypotheses on knowns and complex hypotheses on unknowns. We could try and extract all the complex and single word hypotheses and analyse them independently but since it's not easy to discriminate between them I won't do this.

Could it be these single word responses on unknown meanings which are causing the unknown meaning line to rise more slowly than the known on graph 1? As I've mentioned, the trend on this single word response type is for confidence to rise with information. I find this rising confidence as seen at 11 suspicious. If subjects were simply giving a single word hypothesis then they should run into trouble and realise that they are forcing the cues so confidence should stay static. So the adding instruction is probably having some kind of beneficial effect on confidence where single word hypotheses are constructed. Perhaps at 11 the target could have been better constructed since <u>balance</u> is a fairly reasonable single word response. So the target might be at fault. But we do, however, get a response like <u>usury</u> to target 6 on cue 3: <u>This is to invest against the law. The Mafia do this sometimes</u>. The subject should see that this response is not really a good fit since <u>usury</u> is not really thought of as a form of investment. Yet confidence rises across information here as with 11. Other subjects give single word answers like <u>extort</u> or <u>blackmail</u> on

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this target at cue 3 which are even worse fits than usury.
Subjects should see this but these responses still exhibit a
rising confidence. It could be that when subjects are giving
single word responses on unknown targets, they are interpreting
the adding instruction as "add cues together as best you can"
and this might tend to mitigate the difficulty involved in
forcing the cues together. It might also be that this does
not completely mitigate the problem and forming single word
hypotheses involves a bit more of a struggle on the unknowns as
opposed to the knowns. So confidence is held back on the
unknowns across information in comparison to the knowns but
with this being due to the formation of single word hypotheses
on the unknowns.

It is possible that the above accounts in part for the
contrast on Graph 1 on cues 2 and 3. But not on cue 1. If
subjects were giving single word hypotheses here then one would
expect confidence for knowns and unknowns to start at pretty
much the same point on cue 1 since there would be no difficulty
in giving a single word guess here on the unknowns. On cue 1,
the perception of the hypothesis as incomplete must be
undermining confidence. What happens on subsequent cues is
that subjects sometimes go on to form complex hypotheses. On
other instances having encountered a problem with
incompleteness on cue 1 and then a second problem in terms of
suspicion on cue 2 they abandon the idea of complex hypotheses
and go for single word hypotheses.

Remember also that this is a somewhat artificial

situation in that an attempt has been made to force subjects into forming new meanings. In that we do tend to see incompleteness on cue 1 and to some extent suspicion on cue 3 undermine confidence, I suspect that in real life subjects might well avoid the building of new meanings and go for single word hypotheses. We do see this happen to an extent in this experiment which is favourable to the formation of new meanings. We also have an useful indicator for future experiments at cue 1. If pseudowords cause subjects to view hypotheses as incomplete we can expect a substantial reduction (about 50%) in confidence in comparison to the comparable known meaning/cloze situation. If they simply replace the pseudoword with a synonym then there should be no such reduction.

It is also interesting to look at the standard deviations for both meaning conditions across information.

For known meanings Result 1 shows a significant difference and the standard deviation is quite large on cue 1 but progressively reduces on the other two cues. Variations in confidence seem to decrease across information. Probably what happens on cue 1 is that there is a lot of disagreement between subjects. Some are very confident, others less so. As information increases, there is more consensus.

For unknown meanings, Result 3, the standard deviation is lower on cue 1 in comparison to the standard deviation on that cue for known meanings. Possibly, the effect of viewing the hypothesis as incomplete at this point not only reduces confidence but makes subjects who might normally be very

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confident, very cautious. Possibly, lower confidence subjects are not so drastically affected and so there is more agreement. Noticeably, however, variation increases with information here in contrast to known meanings. We have noted that on unknown meanings, single word responses occur as well as complex hypotheses. These differing responses might well create differing levels of confidence so accounting for the increase in variation.

With respect to order. There is only one order result that we need to pay attention to, this being Result 8 where the significance of F= .023 and suggests that one or more of the orders is significantly different from the others but only in the situation where known and unknown meanings are combined. If we look at the means at Result 8. I don't think we need dwell on this. Given we have only twelve scores to distinguish six orders, what we have is a chance result. The equivalent univariate result was not significant and there was a computer warning about too few degrees of freedom. Apart from this, I can't offer an explanation of why cab should stand out as a bit lower. A c first sequence may be less powerful than the others since this cue is not part of the definition. But then cba should also be weak which not the case.

Experiment 2

Introduction

Purpose of Experiment: This experiment deals with uncertainty rather than confidence as a dependent variable. I intend to contrast the two situations of guessing known meanings and unknown meanings across amounts of information and in terms of orders as represented in Experiment 1. I would make the following predictions at 12 based on the model in Chapter 4.

12. a) Uncertainty will decline across information for known meanings.

   b) Uncertainty should remain static across information for unknown meanings.

   c) There will be no effect for order.

Experiment 2 was identical to Experiment 1 except in the following details.

Method

Subjects: The subjects used on Experiment 2 were different from those on Experiment 1, but from a similar background. Four were PGCE students at St. Mary's College, Bangor, one was an MA student doing Applied Linguistics at the university and one was an university employee working in the canteen.

Task: The instructions which were given to subjects for the known meaning condition are at 13. The instructions for the

unknown meaning condition are at 14. The tasks involving the description of uncertainty described at 13 and 14 were made to parallel their confidence equivalents with respect to known and unknown meanings as much as possible.

13. You will see a number of items of information on a word in English. When you see an item of information, try and think of as many words as you can that this item of information describes. Don't add up all the words you can think of. Measure them like this at each step.

A = 0
B = 1 or 2
C = 3 or 4
D = 5 or 6
E = 7 or 8
F = 9 or 10
G = more than 10

14. You will see a number of items of information which describe an unfamiliar word in English. When you see an item of information, try and think of anything you could add to it which might describe the word. Give me a rough idea of the number of alternative items you could add by using the following scale. (The scale at 13 was repeated here).

Scoring: The letters A-G given at 9 were converted to uncertainty scores by making A=0, B=1...G=6. We, therefore end up with a scale from 0-6 just as for confidence and the comments I made concerning confidence on Experiment 1 would also hold here.

The general criticisms I made of Experiment 1 also hold here.

Results and Discussion

ANOVA 1 Known Meanings

RESULT 9:   INFORMATION x 3
            Mauchly= .549
            Univariate   F= 5.84   F= .021 *

            Means

            1 amount   2 amounts   3 amounts
            2.278   1.722   1.334

RESULT 10: ORDER x 6
            Mauchly = .866
            Univariate   F= .63   Sig of F= .680
            (Computer warning: too few degrees of freedom)

ANOVA 2 Unknown Meanings

RESULT 11: INFORMATION x 3
            Mauchly= .649
            Univariate   F= 1.73   Sig of F= .227

RESULT 12: ORDER x 6
            Mauchly= .118
            Univariate   F= 1.30   Sig of F= .294
            (Computer warning: too few degrees of freedom)

ANOVA 3 Known and Unknown Meanings Combined

RESULT 13: MEANINGS x 2

               F= .95 Sig of F= .375

Result 14: INFORMATION x 3

               Mauchly= .057

               Univariate   F= 1.20 Sig of F= .342

RESULT 15: ORDER x 6

               Mauchly= .389

               Univariate   F= 1.36 Sig of F= .271

               (Computer warning: too few degrees of freedom)

Result 16: MEANING by INFORMATION

               Mauchly= .418

               Univariate   F= 9.08 Sig of F =.006 **

               Means

	1 amount	2 amounts	3 amounts
Knowns	2.278	1.722	1.334
Unknowns	1.389	1.361	1.778

Uncertainty Discussion

In terms of the combined data for known and unknown meanings, Result 14 shows there is no significant difference between the information means. Uncertainty seems to be static across information. Similarly, there is no effect across information for unknowns (see Result 11) but amount of information does reach significance in the known meaning condition. Result 9 shows the significance of F to be .021. This suggests the possibility of an interaction and we do

indeed get one. Result 16 where the significance of F= .006 shows that meaning and information interact. The means from Result 16 are displayed on graph 2.

We can see that uncertainty in known meanings is falling significantly across information (Result 9) and prediction 12a is confirmed. In the unknown condition, although there is a slight rise at three amounts, uncertainty is essentially static so prediction 12b does seem to work. The rise in uncertainty on cue 3 should not be ignored though. Result 13 also needs to be noted here. Although known and unknown meanings interact

Graph 2

Uncertainty: Meaning x Info
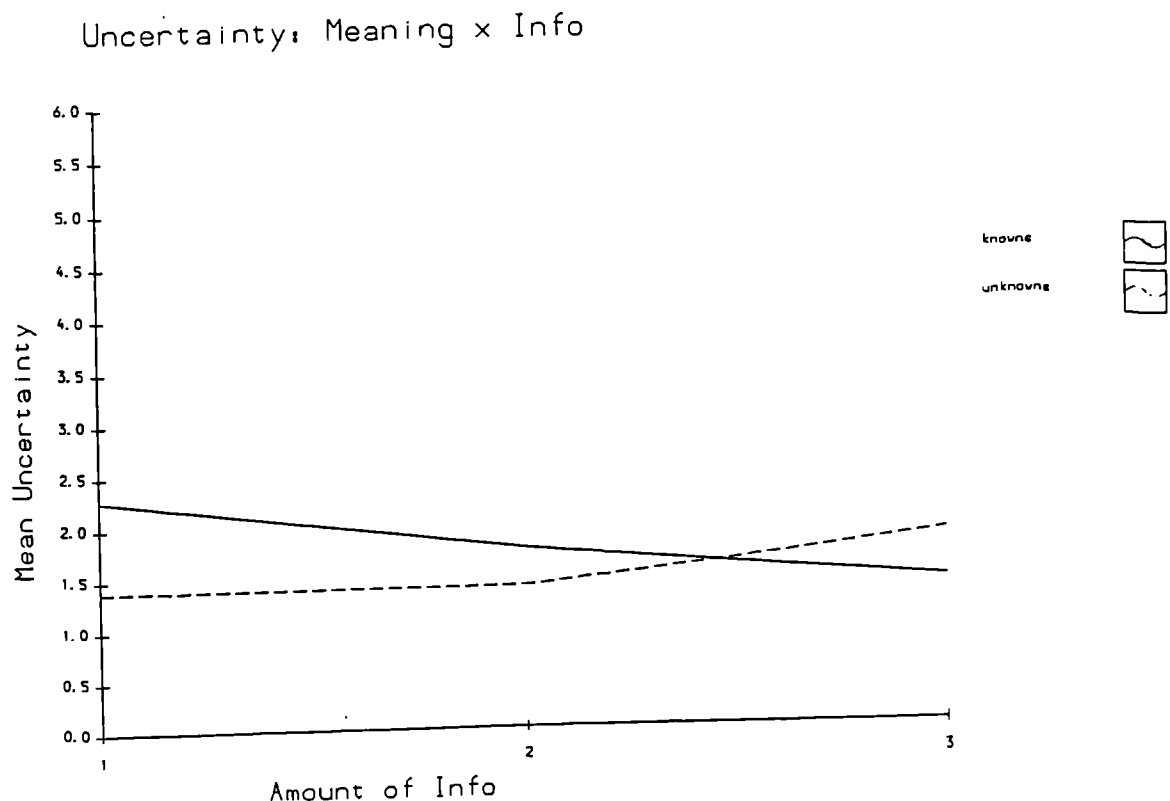
across information, the amount of uncertainty generated by known meanings is not significantly different from that generated by unknown meanings (Result 13) at about 1.6 or 2 to 3 alternative responses

For the known targets uncertainty decreases. If we take the three cues for target 2: <u>This is to clean, Done with a</u> <u>broom, Rooms sometimes have this done to them</u> then each of these cues in isolation could generate a number of possible hypotheses or individual uncertainty ranges as shown by all the items recorded in each line at 15 a, b and c.

15.   UNCERTAINTY RANGE

a) polish, wash, sweep, brush, scrub, dust

b) fly   sweep, brush   hit

c)   decorate   sweep   paint
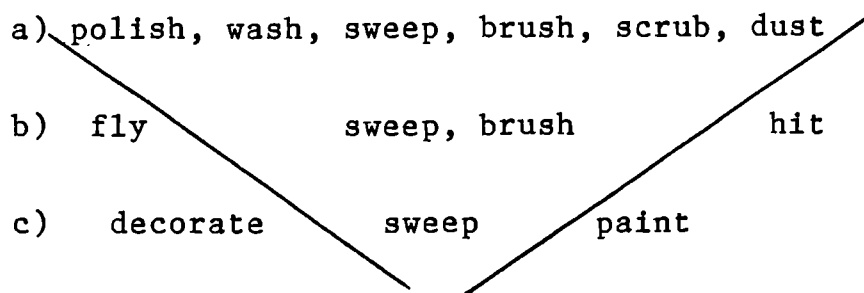
But the cues combine. At cue a) all the hypotheses lie within the V of the uncertainty range. When cue b) combines with cue a) the full range of hypotheses which could be generated by cue b) are not considered. So items like <u>fly</u> at cue b) are not considered and also items like <u>polish</u> and <u>wash</u> from cue a) are discarded. The uncertainty range at b) shrinks to <u>sweep</u> and <u>brush</u>. In the same way cue c) combines with the other two and the uncertainty range now shrinks to <u>sweep</u> as the only item supported by the combination of these cues. What we have is

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not an expansion of the uncertainty range with each cue contributing the total number of hypotheses that a subject can think of, but a contraction across information based on the way cues combine to lexicalise hypotheses until we come, hopefully, to the situation where we have only one hypothesis within the uncertainty range. Granted the representation at 15 may be simplistic. We might fail to include a relevant hypothesis at a), realise that this is the case at b) and discard the entire uncertainty range at a). The principle of combination of cues is the same though.

If we turn now to the unknown meaning line on graph 2, three points emerge.

First, uncertainty on the unknown line is lower at cue 1 than for the knowns. (1 to 2 hypotheses as opposed to 3 to 4). The reason that there is no overall difference between the two meaning conditions is because uncertainty decreases quite rapidly for the knowns. There seems to be a degree of difficulty in generating hypotheses in the unknown meaning condition on cue 1 and also at cue 2 which is at the same level as cue 1. Second, uncertainty is static at cues 1 and 2 for unknowns. Third uncertainty appears to increase slightly at cue 3 for the unknowns.

What might be causing difficulty on the unknowns? With unknown meanings the instruction is to describe a target by recording the number of hypotheses which could be added at each cue. When a subject sees a cue like <u>This is to invest</u> and is asked to add an hypotheses to it then in theory the

possibilities are unlimited. One could add just about anything. We can invest <u>aggressively, in stocks, on Monday mornings</u> etc. Whilst in theory the possibilities are limitless, in reality "anything" may not be too far removed from "nothing" and faced with a wide range of possibilities subjects tend to be very conservative ie. the processing effort is prohibitive.

Another possibility is that with known meanings we are recovering hypotheses from the lexicon but that with building new meanings we need to obtain more propositional information from the encyclopaedia or store of general knowledge. It could be that the latter is more difficult than the former. There is discussion as to whether one can divide the memory in to categories like <u>lexicon</u> and <u>encyclopaedia</u>: see Sperber and Wilson (1986 p.88). Given that we can, the lexicon would not only be smaller than the encyclopaedia but might also be better organised. Aitchison (1987 chpt.7) describes research on the idea of words organised in semantic fields ie. words with similar meanings lie close together. This seems ideally suited to the generation of uncertainty. A meaning cue would lead directly into a number of closely grouped hypotheses. The organisation of the encyclopaedia may be based on schema. But one may need to search through a number of schema such as <u>stocks and shares, property, criminal investment</u> etc. to get hypotheses and this takes more effort than accessing the lexicon.

Second, why is uncertainty static on cues 1 and 2? This is accounted for in the model. Subjects access a new

uncertainty distribution each time a cue is given.

Third, why does uncertainty rise for the unknowns at cue 3? The answer here must be that hypotheses from the uncertainty range of one cue are being added to those of another. What can we say about adding.

I have pointed out in Chapter 3 that it is unlikely that we would add genuses generated by one cue to differentias generated by a second. We'd select one such hypothesis before looking for the second. Also we can't be adding a genus from the uncertainty distribution of one cue to a genus in the uncertainty distribution of a second cue. The same applies to the differentia. This is obvious because we only give one genus cue and one differentia cue. We'd have to give two cues on each meaning component for this to happen and they would probably have to be inconsistent. We could get this in real life though. If such cues were consistent then uncertainty would reduce as with known meanings. If they were inconsistent it might expand with information but this doesn't apply here.

By default we come to associations, and it must be these hypotheses which are added. This seems reasonable. Words have only one genus or one differentia (though we might argue that they are made up of a variety of components) but they have lot's of associations. Also, the various meaning cues might suggest some associations which might then be added together.

Let's take target 6 as an example. The cues are given at 16.

16. a) This is to invest
    b) This is done against the law
    c) The Mafia sometimes do this

The subjects in Experiment 2 did not note down their guesses, but we can see from the confidence responses what is happening to uncertainty.   This is shown at 17 and I've based this roughly on the responses of Subject 2.

At 17a, cue 1, the subject gets a genus and seems to try to add a differentia <u>time</u>. This single hypothesis may probably be the only one he can think of. This guess has been made on the basis of the genus cue though and not the differentia. When Cue b) comes into play, it gives the correct differentia which the subject probably recognises and so the previous guess <u>time</u> is probably eliminated.   This is the only item of information the subject has relevant to the differentia so he must eliminate any previous guess. We don't add differentia to differentia in this context. Also, uncertainty doesn't

17. UNCERTAINTY RANGE

a)   time
b)   in prostitution
c)   prostitution, gambling
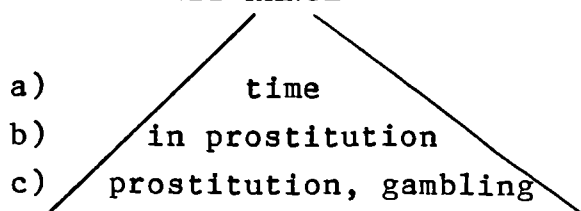
increase by the adding of differentia to genus. A genus has been selected and uncertainty no longer exists with respect to this cue. The subject does appear to think of an association

at this point: <u>in prostitution</u>. Again, graph 2 suggests that this might be the only hypothesis in the uncertainty range at this point. The third cue gives him another chance at an association. Again he seems only to think of one <u>in gambling</u> but this is added to the previous association sending uncertainty up to 2. It is probably this build up of associations which is the cause of the rise in uncertainty on cue 3. If we gave another cue he would probably add another association.

Note also that we do not need associations in last place in the sequence for this to happen. If they come initially they would act as cues to the core. Once the core is in place whatever cue comes at position 3 would probably generate some associations

I'll illustrate expanding uncertainty on unknowns with an example at 18.

18. Dale, seated on the edge of her <u>plyochair</u> pointed in the direction of the control panels. "How serious is it Flash?"

The genus is clearly <u>chair</u> so uncertainty is 1. As a differentia, I thought <u>plastic</u> or <u>flexible</u>. Realised I'd made a mistake on the morphology with <u>plastic</u> so rejected this and took <u>flexible</u>. Uncertainty is 1 again. I didn't want to add the genus to the differentia to give an uncertainty of 2. Then I saw <u>control panels</u> and started adding associations like: <u>flexible in order to reach controls, high tech, made of</u>

advanced plastic etc. What we seem to see is a fairly static uncertainty as the lexical component of the complex hypothesis is built up and then an expansion as the encyclopaedic component is turned to. Perhaps the expansion is part of a need to tie the new hypothesis in with other relevant schematic representations of knowledge.

Finally, with respect to order. No significant results emerged on the order variable. Given the low power of the experiment we can't draw conclusions either way

General Conclusion

In these experiments I think that we have been able to produce a fairly reasonable picture of what might happen when guessing known meanings in terms of both confidence and uncertainty. As to unknown meanings, two points do, I think, stand out. Uncertainty does appear to remain static then starts to rise across information. It seems to be associations ie. the encyclopaedic part of the complex hypothesis which involves this rise. Confidence also appears to rise but seems to do so more slowly for unknown meanings as opposed to known meanings. So there is difficulty in constructing new meanings even in this situation which is favourable. Also, even in a situation on unknowns which is favourable, perhaps artificially so, to the guessing of complex hypotheses through the use of the instruction to add hypotheses to a cue, subjects seem to some extent to form single word hypotheses. That is to say, they use the process for guessing known meanings when in fact

they are in the unknown meaning position. Probably, the problem of incompleteness followed by the problem of suspicion ie. one problem after another in complex hypothesis formation proves too much and they go for a single word.

With respect to the order variable, the experiments were really not powerful enough to show anything of interest.

Chapter 5

Using the Ruler Part 1

In terms of contents, this chapter deals with the setting up and results of Experiment 3. Chapter 6 discusses these results and Chapter 7 pursues a correlational analysis of the same data.

Experiment 3

Introduction

Purpose of the experiment: In this experiment, I intend to look at the effect of the independent variables meaning (known and unknown), amount of information (3 cues), order (6), form (cloze space and pseudoword) and part of speech (noun and verb) on the dependent variables of confidence, accuracy and uncertainty.

In the last two experiments, we saw that there are some grounds for suggesting that the guessing of known and unknown meanings differ. However, a somewhat artificial and "clumsy" instruction format was used for the unknowns where subjects were told to add hypotheses together. Here I want to abandon this instruction and put both known and unknown meanings on the same footing by telling subjects to simply to "guess" in both conditions. Since in Experiment 1, subjects still lexicalised unknown meaning targets and gave single word hypotheses to a degree despite this "adding" instruction, I would expect the

removal of this instruction to make single word hypotheses the dominant response type on unknown meanings. We must take this into account when making predictions. Also we shouldn' have such a severe problem with variety of responses.

Also, when subjects used single word hypotheses on unknown meanings in Experiment 1, two points emerged. First, subjects forced cues together. The strategy of abandoning information was not present. Secondly, confidence seemed to rise despite this forcing. The first result might be caused by the "adding" instruction in the sense that it encourages subjects to think that a hypothesis is possible and keeps them using information. The second result might also be a consequence of this instruction since it might distract subjects from the sense of inconsistency which should be the consequence of building up single word hypotheses in the unknown condition. They interpret this instruction as "add cues together as best you can". My opinion is that we will noe see more in the way of abandoning information and where both this strategy and forcing cues together are used to form single word hypotheses on the unknown meanings, confidence will suffer.

One final point worth making here is that the experiment was in four parts and involved subjects returning once a week for four weeks to sit each part. I'll give details of this later.

Predictions: Bearing in mind the above points concerning

lexicalisation of unknown meanings, I would make the following predictions based on the model.

1.   Confidence

a. There will be a significant interaction between known and unknown meanings across information. Confidence will increase for known meanings but it will remain static for unknown meanings.

b. There will not be a significant difference overall between cloze gap and pseudoword. Subjects will simply substitute a known word for the pseudoword rather than see the hypothesis as incomplete. This factor of form should also not play a role in any interactions.

c. Noun targets should generate more confidence than verb targets due to the verb association cues enforcing selection restrictions on noun targets. This difference should occur equally well in both meaning conditions and across information so no interactions are expected.

d. There will be no significant effects for order. This prediction is made for convenience as I have decided to await the results of experiments.

2.   Accuracy

Predictions for accuracy are identical to those for confidence so predictions 1 a, b, c and d should be seen as repeated here as 2 a, b, c and d.

3.   Uncertainty
                (Measured in terms of changing guesses)

a. There should be a significant interaction between known and unknown meanings across information. In the model, I predicted uncertainty would fall across information for known meanings. For unknown meanings there will be a mixture of holding and fairly large scale changes as a response to difficulty and this should leave uncertainty fairly static.

b. There will not be a significant difference overall between cloze gap and pseudoword. This factor of form should also not play a role in any interactions.

c. Noun targets should produce less uncertainty than verb targets. This is simply the reverse of prediction 1c.

d. There should be no significant effects for order.

Method

Cases: Forty six subjects sat the experiment. Approximately thirty were undergraduates from the Linguistics Department at the University. The remainder were post graduates attending either MA courses in the same department or the PGCE course at the College of Education. There is an age disparity in that whilst most subjects were between twenty to thirty years of age, two were in their forties and one in his fifties. Still, we have a fairly homogeneous sample in that we can say all are native speaker adults who have been successful in terms of the educational system.

I recruited subjects by going to the various lectures and

asking for volunteers. When a subject volunteered, we arranged a time on which he would attend each week to sit the four parts of the experiment. I also asked for a name to avoid confusion in terms of timetabling. An assurance was given that no names would be retained.

Of the forty six subjects who started the experiment forty one completed it. Given that subjects had to return once every week for four weeks this, I would suggest, is quite a low drop out rate. Also it shows a high level of commitment. One subject who dropped out did not seem to be terribly happy doing the experiment so I immediately let this subject go after he had expressed a wish not to continue. The others were caught by timetable changes since this experiment took place at the beginning of the first term. All turned up and asked to be rescheduled. Unfortunately, since the room I was using had other commitments and since I'd had to reschedule about six other subjects for the same reason it became impossible to fit these in and they had to be let go. All these subjects completed at least one section of the experiment, but the data was unuseable since the ANOVA programme ignores incomplete results.

Independent variables: The independent variable of meaning was dealt with in exactly the same way as in previous experiments. A known meaning was a familiar combination of genus, differentia and association and an unknown meaning was an unfamiliar combination of these elements. By now I'd

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developed an item bank of such targets and had been trying them out on friends fairly persistently. I chose the targets for this experiment on the basis of these trials. The factors influencing the choice of known meanings was that the meaning components were reasonably clear to subjects and that factors like polysemy or ambiguity didn't create problems. I doubt if it's possible to remove potential polysemy completely. What I was looking for was whether it would confuse subjects or send them in the wrong direction. In other words, the targets I selected were those which seemed to lead fairly consistently to the guess I hypothesised they should make. With the unknowns, I was likewise concerned with polysemy. I also asked whether these meaning components could be represented by a single word. Any target where there was a tendency for this to happen was rejected. Phil Scholfield kindly also reviewed targets with this respect to this point. Twenty four such targets were selected in all, twelve knowns and twelve unknowns. They were, somewhat subjectively, the "best" twenty four.

The independent variable of amount of information was also dealt with in the same way as Experiment 1. The genus, differentia and association were given as cues and in seeing one of these cues a subject got one amount of information, two gave two amounts and three, three amounts. These cues were given directly and no attempt to camouflage or give them indirectly was made. Also, all cues point consistently to a know meaning or in the case of unknown meanings, to a new meaning.

A criticism is that subjects would quickly understand that they will get no more nor less than three cues. In real life one could not make this assumption that there would always be a fixed number of cues. It is possible that a subject's guess on cue 1 might be coloured by this knowledge that more cues are to come and he might be conservative perhaps in his confidence.

The independent variable order consisted of six orders based on all the possible combinations of the three cue types: genus, differentia and association.

A criticism is that we are forcing subjects to operate in all six orders. In real life, a subject might select only one order or perhaps not all the cue types will be present.

Another criticism is the way that we present information is reminiscent of how teachers used to set mathematical problems. Every item of information we give will be seen as relevant by subjects. Whilst this clearly distances the experiment from real reading, it is essential if we are to retain control over the number of cues used by subjects and their order of exploitation.

The independent variable of form involves either a cloze gap or pseudoword. Each time a subject saw a cue then above this cue there either appeared a cloze gap or pseudoword.

The independent variable of part of speech involved a noun/verb distinction. For nouns, the pseudoword or cloze was preceded be an indefinite article except where it was uncountable, for verbs by an infinitive. The noun genus was

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marked by the phrase This is a kind of. The verb genus by This is to. The association for the nouns was verbal and so tended to carry a selection restriction (intra selectional collocation) and for the verbs was nominal and so didn't carry a selection restriction (extra selectional collocation).

In order to make this more concrete for the reader, I've given some examples at 4.

4. A) Known meaning   B)   Unknown meaning

   To _____   A flen

   a) This is to walk   This is a kind of holiday
   b) This is done in a   This follows a divorce
      measured or regular
      fashion
   c) Soldiers usually do this   This is usually looked
                                 forward to

Also, it was necessary to take precautions to control for unwanted order and item specific effects and ensure subjects worked on any given target only once. There were twenty four targets in all (see Appendix 2). The known and unknown meaning combinations the reader is now familiar with. Twelve of the targets were knowns, twelve unknowns. Six of the knowns were nouns and cues were presented in the form shown at 4 A). Six were verbs and cues were presented in the form shown at 4 B). Unknowns were treated in exactly the same way. This gave a total of twelve verbs, six knowns six unknowns and the same

held for nouns. The twelve verbs were written down in the sequence they were taken from the data bank, the first known target being written first and the first unknown target following it. The knowns and unknowns were then further jumbled by using a table of random numbers to order them. This removed the problem of subjects knowing that targets were knowns or unknowns. All subjects saw the verb targets in this sequence. Exactly the same thing was then done for the nouns. So we have two groups of targets, one of twelve verbs and one of twelve nouns. Each group contained six knowns and six unknowns. Targets, in the sequence subjects saw them, are given in Appendix 2. Each group of targets was seen by subjects in the pseudoword condition (see 4B). Here a pseudoword appeared each time a subject saw a cue or combination of cues. Each group of targets was seen in the cloze condition (see 4A) with a cloze gap appearing above the cues. I'll elaborate on this in the procedure section.

As to the independent variable of order. Each subject saw each of the six known verb targets in one of the orders. Each subject saw each of six unknown verb targets in one of the orders. So each subject saw all the orders twice, once for known verbs and once for unknown verbs. Exactly the same thing happened for the nouns. Also, whilst the first subject to sit the experiment saw one known and one unknown target under each order the second saw these targets under different orders. This variation was repeated for the first six subjects so that each known and each unknown target had been seen under each

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order. The same set of variations was repeated every block of six subjects until I ran out of subjects. The sequence in which subjects saw these orders is given in a grid in Appendix 2. Note also that each subject saw each order twice in the verb condition. This was repeated twice more in the noun condition and twice more in the cloze/pseudoword condition. So each subject saw each order eight times. Given that there are forty one subjects we now have 328 responses for each order. This should give us enough power to distinguish between the six orders if a difference does in fact exist. Also if we multiply this figure by six for the six orders and by three for the amounts of information we get a total of 5904 responses which makes this a reasonably powerful experiment. The responses are in Appendix 2.

Cues were presented to subjects on cards which were 5" by 3". (The computer used in Experiments 1 and 2 was abandoned as a way of presenting information due to the difficulties mentioned). These cards were constructed by typing out cues on sheets of paper. These cues were then cut out and stuck on cards. Cues were then covered with a strip of clear sticking tape to protect them. Holes were punched in the edge of the cards so that they could be placed in a file. When subjects sat the experiment they were given a file containing a sequence of cues and could turn over one card at a time. On the first card they saw one cue. On the next, a second cue combined with the first and on the third, a third cue combined with the first

two. This removed the problem of subjects seeing the cues singly at two and three amounts of information.

Procedure: The experiment was conducted in the same sound proof room in the phonetics laboratory as the first two experiments. The room could accommodate four subjects at a time although the usual number to attend one sitting was three. Occasionally, subjects came singly or in pairs especially where they'd been rescheduled. When a group of subjects entered the experiment room they were asked to sit at one of four desks. On the desk they found a file, an answer sheet consisting of four pages stapled together and a set of instructions. They were first asked verbally to do the experiment individually and not help each other. Since subjects seemed well motivated I felt this was reasonably safe. Next they were asked to read the instructions. The instructions are too long to give here so they have been included with the answer sheet in Appendix 2. There were two sets of instructions, one for the cloze condition and one for the pseudoword, and both asked subjects to guess the meaning of the unknown word and write their guess, either as a word or a phrase on the answer sheet together with an estimate of their confidence on a scale from 0 to 6 as used previously. The cloze set of instructions drew attention to the cloze gap and the pseudoword set to the word form.

A criticism here is that in the pseudoword condition the opening to the instructions read: "Guess the unknown word. You will see a word followed by by an item of information. Look

first at the word and then use the item of information to try and guess it." My worry here is that was that I was telling subjects to guess words and not meanings of words and that this might push them towards single word responses on unkowns. Later in the instructions the option of giving an answer as a phrase was made explicit and, looking forwards to the experiment, this option was used to some extent so it was not being ignored. Two subjects did pick up on this problem in the instructions and point out that I'd asked them to guess a word when there was a word form present in the pseudoword condition. I asked them to finish reading the instructions and try the examples. This seemed to remove the difficulty.

It's worth stopping for a moment to consider the task required by these instructions. The option of being able to use a phrase is most important. Where there is a known combination of genus, differentia and association covered by a cloze gap I would expect subjects to guess words as in Experiment 1. Where a pseudoword intervenes a subject can reject the single word option if he so chooses and simple write down the genus, differentia and association to form a complex hypothesis. This could occur in either meaning condition. If the pseudoword fails to have an influence and subjects begin by guessing words, they might realise in the unknown condition that the target can not be lexicalised and resort again to noting down the genus, differentia and association as a complex hypothesis. To try an clarify this point an example of a possible phrasal answer was given using the format of genus and

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differentia (see instructions).

Again, a criticism here is that writing down in the sense of simply repeating the information subjects are given to produce a phrasal answer might be seen by subjects as vacuous and the need to actually do something with the information might push them into guessing single word hypotheses in the unknown meaning condition. In trials, some subjects were prepared to repeat information. What tended to emerge, however, was that subjects were still able to form complex hypotheses by operating at a more specific level. If they saw the cues <u>This is to worship,</u> <u>This is done in a frenzy</u> they were able to say something like: <u>A religious dance with subjects in a trance state due to drugs</u>. It is important to note that complex hypothesis formation is still quite possible.

Subjects were now asked to write their names on the answer sheets. They were told that this was necessary since they would need to have the same sheet back on the next occasion. An assurance was given that no names would be kept. Subjects then opened their files and found a set of cards. To understand what each subject saw look at 5. The first subject saw twelve targets, six known and six unknowns, in the Verb/Pseudoword condition. The other three subjects saw their respective conditions at Part 1. There were two examples for each part of speech condition. The first was a known meaning and the second an unknown meaning. This was the same for all subjects on all occasions. The first three cards subject 1 saw are given at 6. Examples were always given in the order:

genus, differentia, association. After subjects had completed the two examples I left the room and subjects were left to work at their own pace. Each time they turned a card they noted their guess and confidence. The average time taken was about thirty five minutes.

5. Key: Run = The set of orders a subject saw the targets under. See the grid in Appendix 2.

S = Subject   ps = pseudoword
V = Verb   cl = cloze
N = Noun   P = Part. Subjects returned each
                         week to do a part.

		P1	P2	P3	P4
S1	Run 1	Vps	Nps	Vcl	Ncl
S2	Run 2	Nps	Vps	Ncl	Vcl
S3	Run 3	Vcl	Ncl	Vps	Nps
S4	Run 4	Ncl	Vcl	Nps	Vps
S5	Run 5	Vps	Nps	Vcl	Ncl
S6	Run 6	Nps	Vps	Ncl	Vcl
S7	Run 1	Vcl	Ncl	Vps	Nps
S8	Run 2	Ncl	Vcl	Nps	Vps

and so on until all subjects have sat the experiment. Note that each subject sees a different run until each target has been seen in all orders. This happens at subject seven which comes back to run 1.

Incidentally, the first cue was always marked a) whether it was genus, differentia or association. b) was always used for the second cue and c) for the third. Subjects sat the experiment in the cycle shown at 5 and it took one week to

process all forty six through Part 1. Subjects returned the next week to do Part 2 and so on. When subjects returned for Parts 3 and 4 they were seeing the same targets but in a cloze format if they had seen the targets previously in a pseudoword

6. <u>Example 1</u> (card 1)

To rimp:
   a) This is to make a copy

<u>Example 1</u> (card 2)

To rimp:
   a) This is to make a copy
   b) This is done to ensure permanence

<u>Example 1</u> (card 3)

To rimp:
   a) This is to make a copy
   b) This is done to ensure permanence
   c) This is done to music sometimes

format and visa versa. A criticism here is that they might have recalled some of the cues before they saw them so boosting confidence. However,since this factor applies across all conditions, one will not stand out as biased. If a subject could not carry on with the experiment this left a gap in the cycle. No attempt was made to fill this gap as things were already complex. It resulted in slightly unequal amounts of data in some of the conditions, but this was not a problem as

all conditions had sufficient data. Note also that the cycle at 3 counterbalances the noun/verb and the cloze/pseudoword conditions both within and between subjects.

No attempt was made to disguise the fact that subjects were guessing the meaning of words. I don't think this would have worked. I relied on the fact that subjects just wouldn't see that I was after movement in the dependent variables in terms of amount of information and variations due to order. Subjects were told after the experiments what I had been looking for and I also took this opportunity to "pump" them for their reactions to the experiment for later use in analysis.

A final criticism is that this experiment is large and complex with plenty of room for experimenter error. All moves were planned in detail on paper before the experiment began to avoid this problem. To the best of my knowledge, all went well. It might have been better to brake this experiment up into a series of smaller ones but there was difficulty in getting subjects and this determined me to get as much as possible out of this experiment once I had collected a reasonable number of volunteers.

Scoring: The dependent variable of confidence was scored in exactly the same way as in previous experiments.

Accuracy was dealt with by grading subjects' responses on a scale from 0 to 2. If the exact target word, a reasonable synonym or a reasonable paraphrase was given, the response got 2. If any of the above responses got reasonably close to the target, the rule of thumb I used here was family relationships

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based on the idea of hyponomy, I gave 1. For example, if the target was _march_ but a subject put _stride_ or _stroll_ etc. he scored 1. Anything else was graded 0.

Uncertainty, scores were not obtained directly from subjects but like accuracy the subjects' responses were graded to give some indication of how this variable might be behaving. If a second response repeated the same word or phrase as the first response then this was given 0. The same held for the relationship between the second and third responses. If the second response was held to be roughly in the same family as the first then a 1 was given. The same held for the second and third response. With the unknown meanings, there is a problem here in that subjects can add hypotheses. If an initial response was _instrument_ and a subject then added _an eastern instrument_, this was seen as still in the same family and scored 1. Anything else was given 2. This included instances where subjects gave up and made no response on the assumption that they felt the answer could have been anything. Also, if a second response received a 2 and the third response, although it was outside the family of the second response, returned to the same word or family as the first response, it was given 1 and not 2 since it seemed that uncertainty might be increasing but not as rapidly as to warrant a score of 2. It was necessary to redefine uncertainty from the original idea of the number of alternative hypotheses a subject could think of to this idea of changeability since we would have had to run the experiment a second time to measure the original notion of

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uncertainty. Given the scale and complexity of the experiment, this was clearly not possible.

As to the reliability of these schemes, there were too many responses to ask another marker to check. We therefore have no intra-judge reliability here. To compensate for this I went through the responses four times to try and iron out any inconsistencies within my own marking. Whilst this idea of family relationship might look nice on paper there is undoubtedly a subjective element in deciding what is close enough to be within a family and also as to what constitutes a reasonable paraphrase. I therefore found myself quite frequently quarrelling with myself over grades that I'd given perhaps in the same way that different judges might disagree. By doing this it was possible to get reliability/consistency in the marking of responses. Phil Scholfield also kindly checked over a small sample of five subjects and found that he could accept the grades.

As to validity, whether this notion of being inside a family leads to increasing accuracy and decreasing uncertainty would require a research project in it's own right. They seemed reasonable ideas to adopt. As far as uncertainty is concerned, I would have preferred to tap subjects' intuitions directly since, however rough the measure, it's better than trying to second guess the subject. This would have required running the experiment twice which was not feasible.

To give the reader a more concrete idea of how this system worked I'll give the responses and grades for Subject 9

on Item 7 (Unknown- This is to worship, It's done in a frenzy, Primitive tribes do this sometimes) at 7. Chanting and dancing can be forms of worship so it seemed right to give these an accuracy of 1. On the third response there seems to be a reasonable paraphrase in that ritual with prayer suggests worship and dance suggests frenzy, so I've given 2. With uncertainty, the second response repeats the first exactly but adds dance so I've given 1. The third response repeats the

7. Response	Accuracy	Uncertainty
a) chant	1	
b) chant & dance	1	1
c) chant & dance a special ritual with prayer etc.	2	1

second but adds that bit about ritual so I've given 1 again rather than 0.

On both accuracy and uncertainty we have scales from 0 to 2 for individual items. Of course, in any specific condition, more than one item is involved. Each order, for example, is seen eight times so any one order, for one bit of information, is out of 16. These scales are always averaged back to the original scale of 0-2. (The same applies to confidence scores) These look like very narrow interval scales. As with confidence, however, we don't know whether the interval between 0 and 1 is the same as the interval between 1 and 2. Added to

this is that the intervals between 0 an 1 and 1 and 2 might differ for known and unknown meanings. What we have are really ordinal scales which show us whether accuracy and uncertainty are simply increasing or decreasing and for the sake of convenience we pretend that they are interval. The same holds for the confidence scale although it has the advantage of being wider than the others. One further point to remember is that we've only got values for two and three amounts of information for uncertainty and have lost one third of our responses.

Experiment design: The design is repeated measures. Each subject performed in all the conditions with the sequences in which subjects saw the conditions being counterbalanced or randomised, as described above, to remove any form of biassing. We can also term the experiment factorial since we have five crossed independent variables with different levels on each. What we have is: Form x 2 (cloze/pseudoword), Part of speech x 2 (noun/verb), Meaning x 2 (Known/Unknown), Information x 3 (1, 2, and 3 amounts), order x 6. The statistical test used was ANOVA and it was run using the SPSSX package on the university mainframe computer (MANOVA command).

Results and Discussion

The programs to do a five way repeated measures ANOVA on ordinal category dependent variables were not available. The experiment, therefore, had to be broken down into three

smaller ANOVAS with consequent loss of data. The three ANOVAs were:

ANOVA 1   Meaning x 2 (known/unknown), Form x 2 (pseudoword/cloze), Part of speech x 2 (noun/verb), Information x 3 (3 amounts).

ANOVA 2   Meaning x 2, Part of speech x 2, Order x 6.

ANOVA 3   Meaning x 2, Information x 3, Order x 6.

These covered what I thought would be the most relevant results. These ANOVA results are given below under the headings of: confidence, accuracy and uncertainty. All results marked A apply to confidence. Similarly, B applies to accuracy and C to uncertainty. Standard deviations will be given where they are of interest.

Results: CONFIDENCE

                             ANOVA 1

RESULT 1A: MEANING x 2
             F= 213.08   Sig of F= .000 **
             Means

             Unknowns   Knowns
             2.085   3.586

RESULT 2A: Form x 2
             F= 8.22   Sig of F= .007 **
             Means

             Pseudoword   Cloze
             2.678   2.994

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RESULT 3A: Part of speech x 2
            F= 4.77   Sig of F= .035 *
            Means

            Nouns   Verbs
            2.906   2.766

RESULT 4A: Information x 3
            Mauchly= .000 **
            Multivariate F= 67.290   Sig of F= .000 **
            Means

            1 amount   2 amounts   3 amounts
            2.075   2.903   3.529

RESULT 5A: Meaning by Information
            Mauchly= .000 **
            Multivariate   F= 97.054   Sig of F= .000 **
            Means

                      1 amount   2 amounts   3 amounts
Unknowns   1.918   2.152   2.186
Knowns   2.232   3.653   4.873
                      Standard Deviations

Unknowns   1.110   1.067   1.330
Knowns   1.111   .939   .780

RESULT 6A: Form by Information
            Mauchly= .007 **
            Multivariate   F= 1.286   Sig of F= .288

RESULT 7A: Part of speech by information
            Mauchly= .005 **
            Multivariate   F= 6.248   Sig of F= .004 **

Means

	1 amount	2 amounts	3 amounts
Nouns	2.056	2.975	3.687
Verbs	2.094	2.831	3.372

RESULT 8A: Meaning by Part of Speech
F= 1.64 Sig of F= .208

RESULT 9A: Meaning by Part of speech by Information
Mauchly= .178
Univariate F= 7.56 Sig of F= .001 **
Means

	1 amount	2 amounts	3 amounts
Unknown nouns	1.878	2.254	2.455
Unknown verbs	1.957	2.051	1.917
Known nouns	2.234	3.695	4.919
Known verbs	2.230	3.612	4.827

RESULT 10A: Meaning by Form
F= .00 Sig of F= .955

RESULT 11A: Meaning by Form by Information
Mauchly= .005 **
Multivariate F= .694 Sig of F= .505

RESULT 12A: Meaning by Part of speech by Form by Information
Mauchly= .056
Univariate F= .34 Sig of F= .710

ANOVA 2

RESULT 13A: Order x 6
Mauchly= .275
Univariate F= .28 Sig of F= .922

RESULT 14A: Meaning by Order

           Mauchly= .118

           Univariate   F= 3.02   Sig of F= .012 *

           Means

	abc	acb	bac	bca	cab	cba
Unknowns	2.083	2.146	1.900	2.167	2.118	2.098
Knowns	3.518	3.435	3.801	3.571	3.516	3.675

ANOVA 3

RESULT 15A: Information by Order

           Mauchly= .003 **

           Multivariate   F= 2.365   Sig of F= .033 *

           Means

	abc	acb	bac	bca	cab	cba
1 amount	2.116	2.055	2.107	2.055	2.019	2.098
2 amounts	2.857	2.938	2.897	2.878	2.976	2.860
3 amounts	3.430	3.366	3.549	3.674	3.458	3.702

RESULT 16A: Meaning by Information by Order

           Mauchly= .000 **

           Multivariate   F= 7.330   Sig of F= .000 **

           Means

	abc	acb	bac	bca	cab	cba
			1 amount			
Unknowns	2.146	2.176	1.768	1.787	1.811	1.817
Knowns	2.085	1.933	2.445	2.323	2.226	2.378

Unknowns	2.061	2.396	1.884	2.140	2.439	1.994
Knowns	3.653	3.506	3.909	3.616	3.512	3.726

3 amounts

Unknowns	2.043	1.866	2.049	2.573	2.104	2.482
Knowns	4.817	4.866	5.049	4.775	4.811	4.921

Accuracy

ANOVA 1

RESULT 1B: Meaning x 2
F= 547.62   Sig of F= .000 **
Means

Unknowns	Knowns
.474	1.356

RESULT 2B: Form x 2
F= 5.65   Sig of F= .022 *
Means

Pseudoword	Cloze
.894	.936

RESULT 3B: Part of speech x 2
F= 9.45   Sig of F= .044 *

Means

Nouns	Verbs
.953	.877

RESULT 4B: Information x 3
Mauchly= .001 **

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                    Multivariate   F= 207.689    Sig of F= .000 **
                    Means

                    1 amount    2 amounts    3 amounts
                    .632        .995         1.117

RESULT 5B:   Meaning by information
             Mauchly= .093
             Univariate   F= 175.12    Sig of F= .000 **
             Means

                    1 amount    2 amounts    3 amounts
Unknowns            .376        .494         .551
Knowns              .887        1.496        1.684

RESULT 6B:   Form by Information
             Mauchly= .000 **
             Multivariate   F= .744  Sig of F= .482

RESULT 7B:   Part of speech by Information
             Mauchly= .043 *
             Multivariate   F= 2.019  Sig of F= .146

RESULT 8B:   Meaning by Part of speech
             F= .03  Sig of F= .875

RESULT 9B:   Meaning by Part of speech by Information
             Mauchly= .004 **
             Multivariate   F= 2.170  Sig of F= .128

RESULT 10B:  Meaning by Form
             F= .10  Sig of F= .754

RESULT 11B:  Meaning by Form by Information
             Mauchly= .000 **
             Multivariate   F= 2.549  Sig of F= .091
```

RESULT 12B: Meaning by Part of speech by Form by Information
Mauchly= .008 **
Multivariate F= .555 Sig of F= .578

ANOVA 2

RESULT 13B: Order x 6
Mauchly= .001 **
Multivariate F= 5.007 Sig of F= .001 **
Means

abc	acb	bac	bca	cab	cba
1.010	1.010	.929	.827	.828	.883

RESULT 14B: Meaning by Order
Mauchly= .007 **
Multivariate F= .6.687 Sig of F= .000 **
Means

	abc	acb	bac	bca	cab	cba
Unknowns	.648	.642	.398	.329	.429	.394
Knowns	1.372	1.378	1.459	1.325	1.228	1.372

ANOVA 3

RESULT 15B: Information by Order
Mauchly= .016 *
Multivariate F= 15.531 Sig of F= .000 **
Means

	abc	acb	bac	bca	cab	cba
1 amount	.885	.876	.563	.488	.412	.573
2 amounts	1.052	1.025	1.116	.857	1.022	.900
3 amounts	1.095	1.132	1.113	1.137	1.052	1.177

RESULT 16: Meaning by Information by Order
Mauchly= .000 **

Multivariate   F= 15.233   Sig of F= .000 **
Means

	abc	acb	bac	bca	cab	cba
			1 amount			
Unknowns	.848	.775	.113	.098	.171	.262
Knowns	.921	.976	1.012	.878	.653	.884
			2 amounts			
Unknowns	.555	.610	.604	.250	.659	.287
Knowns	1.549	1.439	1.628	1.464	1.384	1.512
			3 amounts			
Unknowns	.543	.543	.488	.640	.457	.634
Knowns	1.646	1.720	1.738	1.634	1.646	1.720

Uncertainty
ANOVA 1

RESULT 1C: Meaning x 2
             F= 261.24   Sig of F= .000 **
             Means

Unknown	Known
1.359	.712

RESULT 2C: Form x 2
             F= 5.59   Sig of F= .023 *
             Means

Pseudoword	Cloze
1.080	.991

RESULT 3C: Part of speech x 2
F= 6.11   Sig of F= .018 *
Means

Nouns   Verbs
.982   1.089

RESULT 4C: Information x 2
F= 166.22   Sig of F= .000 **
Means

2 amounts   3 amounts
1.220   .851

RESULT 5C: Meaning by Information
F= 52.04   Sig of F= .000 **
Means

              2 amounts   3 amounts
Unknowns   1.423   1.295
Knowns   1.017   .407

RESULT 6C: Form by Information
F= .76   Sig of F= .388

RESULT 7C: Part of speech by Information
F= 4.71   Sig of F= .048 *
Means

            2 amounts   3 amounts
Nouns   1.192   .771
Verbs   1.248   .930

RESULT 8C: Meaning by Part of speech
F= .77   Sig of F= .387

RESULT 9C: Meaning by Part of speech by Information
             F= 3.12   Sig of F= .085

RESULT 10C: Meaning by Form
             F= 2.26   Sig of F= .141

Result 11C: Meaning by Form by Information
             F= .00   Sig of F= .983

RESULT 12C: Meaning by Part of speech by Form by Information
             F= .03   Sig of F= .867

ANOVA 2

RESULT 13C: Order x 6
             Mauchly= .287
             Univariate F= 3.39   Sig of F= .006 **
             Means

abc	acb	bac	bca	cab	cba
.950	.951	1.017	1.075	1.131	1.088

RESULT 14C: Meaning by Order
             Mauchly= .067
             Univariate   F= 3.89   Sig of F= .002 **
             Means

	abc	acb	bac	bca	cab	cba
Unknowns	1.198	1.223	1.430	1.375	1.433	1.494
Knowns	.701	.680	.604	.774	.829	.683

ANOVA 3

RESULT 15C: Information by Order
              Mauchly= .133

Univariate   F= 6.39   Sig of F= .000 **
Means

	abc	acb	bac	bca	cab	cba
2 amounts	1.143	1.006	1.281	1.238	1.360	1.293
3 amounts	.756	.897	.753	.912	.903	.884

RESULT 16C: Meaning by Information by Order
          Mauchly= .091
          Univariate   F= 4.14   Sig of F= .001 **

Means

	abc	acb	bac	bca	cab	cba
			2 amounts			
Unknowns	1.329	1.061	1.622	1.366	1.555	1.604
Knowns	.957	.951	.939	1.110	1.165	.982
			3 amounts			
Unknowns	1.067	1.384	1.238	1.384	1.311	1.384
Knowns	.445	.409	.268	.439	.494	.384

Chapter 6

Using the Ruler Part 2

This chapter interprets and discusses the results of Experiment 3 and will do so for the three dependent variables under the following headings: Amount of information, Known and unknown meanings, Form, Order, Part of Speech.

Discussion

Information: We have three cues representing three amounts of information. How do confidence, accuracy and uncertainty behave across information? Result 4 (Information x 3) is significant for confidence, for accuracy and for uncertainty. So the dependent variables are showing significant differences with respect to increasing amounts of information. Means are given in table 1 as percentages to allow comparison between the dependent variables. These percentage means are plotted on graph 1.

Table 1
Main effect for information means

	1 amount	2 amounts	3 amounts
Confidence	34.583%	48.383%	58.817%
Accuracy	31.600%	49.750%	55.850%
Uncertainty		61.000%	42.550%

Using percentages here assumes that the three scales used

Graph 1

Conf, Acc, Unc x Info
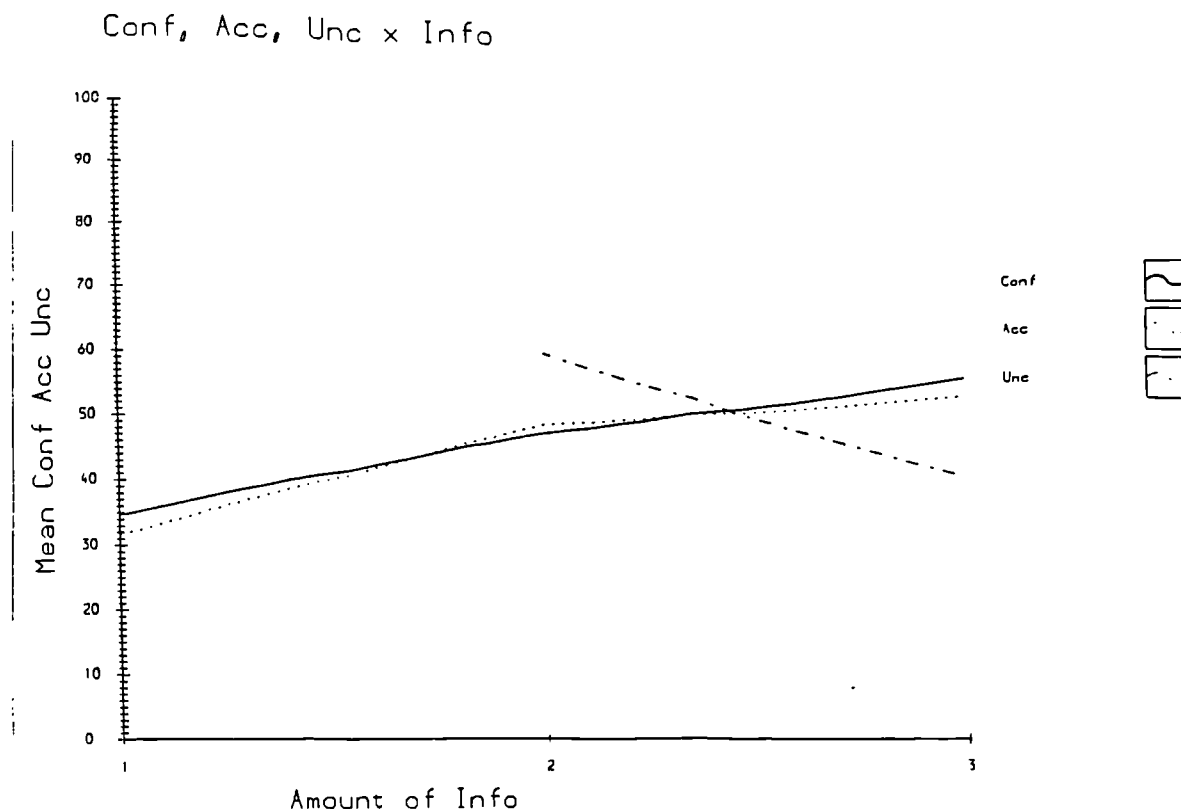
for the dependent variables have some absolute validity and run from zero to whatever. Hence the ends of the scales can be equated. This is a bold assumption so one can't read to much into the exact positioning of dependent variable lines vertically on graphs where this is done.

We see on graph 1 that confidence and accuracy rise and uncertainty falls as increasing amounts of information are given. One might speculate as to why accuracy criss crosses the confidence line, but as I've said we can't read too much into the exact positioning of these lines. The point, here, is that we have movement in the dependent variables across

information. Can we now use this factor to help point up differences between the other independent variables?

Meaning: There are two levels on the meaning variable: known meanings and unknown meanings. Is there a main effect here ie. are these two types of meaning significantly different? Remember that on the last two experiments this difference did not reach significance for confidence and uncertainty but there was a suggestion that it might become significant on a more powerful experiment. Result 1 shows that there are significant main effect differences between known and unknown meanings for confidence, accuracy and uncertainty. Looking at the means given in Result 1, we can see that unknown meanings generate less confidence and accuracy and more uncertainty than known meanings which is what we'd expect as a foundation for predictions 1a), 2a) and 3a).

The question now is whether meaning interacts with information as predictions 1a), 2a) and 3a) propose. If so we can look at how guessing develops as increasing amounts of information become available in each meaning condition.

Result 5a) gives the interaction of meaning by information for confidence. We have a significant interaction and powerfully so. The means at Result 5a are displayed on graph 2.

We can see on graph 2 that whilst confidence rises quite steeply for known meanings, for unknowns, after a small initial rise it remains static. Prediction 1a) seems to be met.

Result 5b) gives the interaction of meaning by

information for accuracy. Again we have a significant and
powerful interaction. The means are displayed on graph 3.

Graph 2

Conf: Meaning x Info
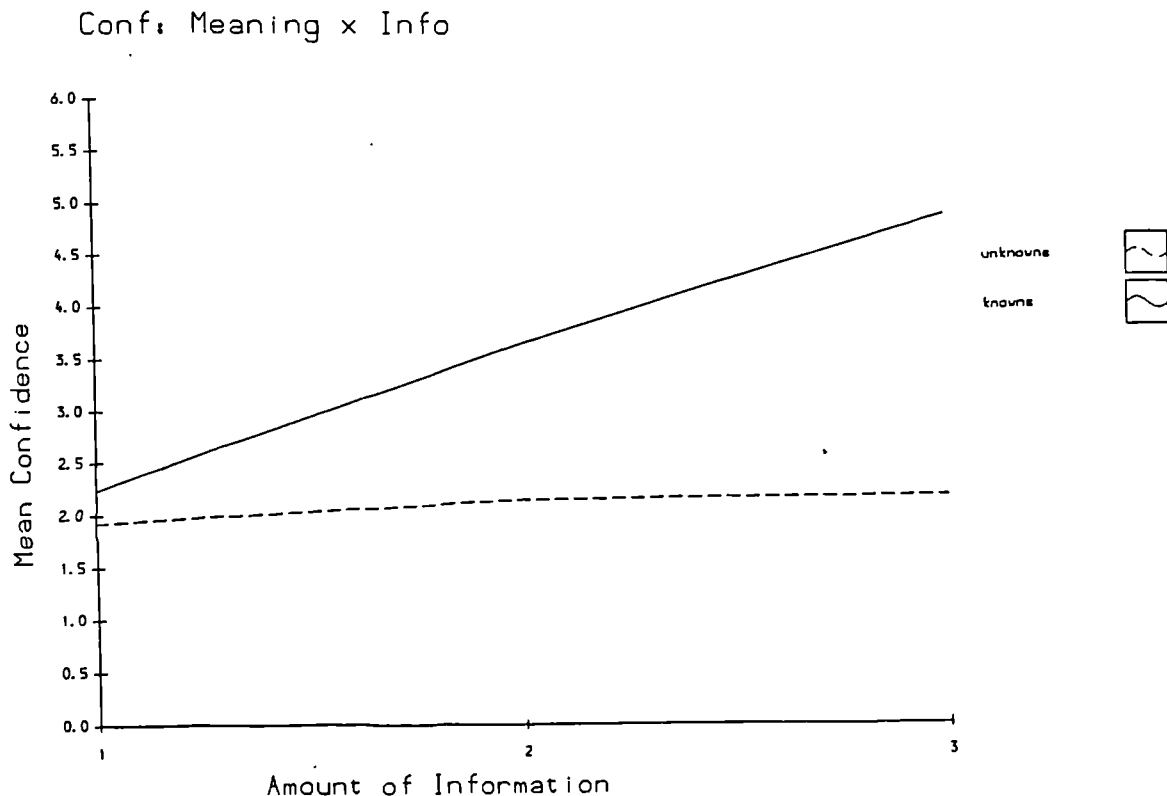
Looking at graph 3, we again see a very similar interaction on
accuracy as with confidence. There is a very slight rise for
unknown meanings but a much steeper one for known meanings so
prediction 2a is met.

It's worth plotting the means for confidence and accuracy
for this interaction of meaning by information on the same

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Graph 3

Accuracy: Meaning x Info
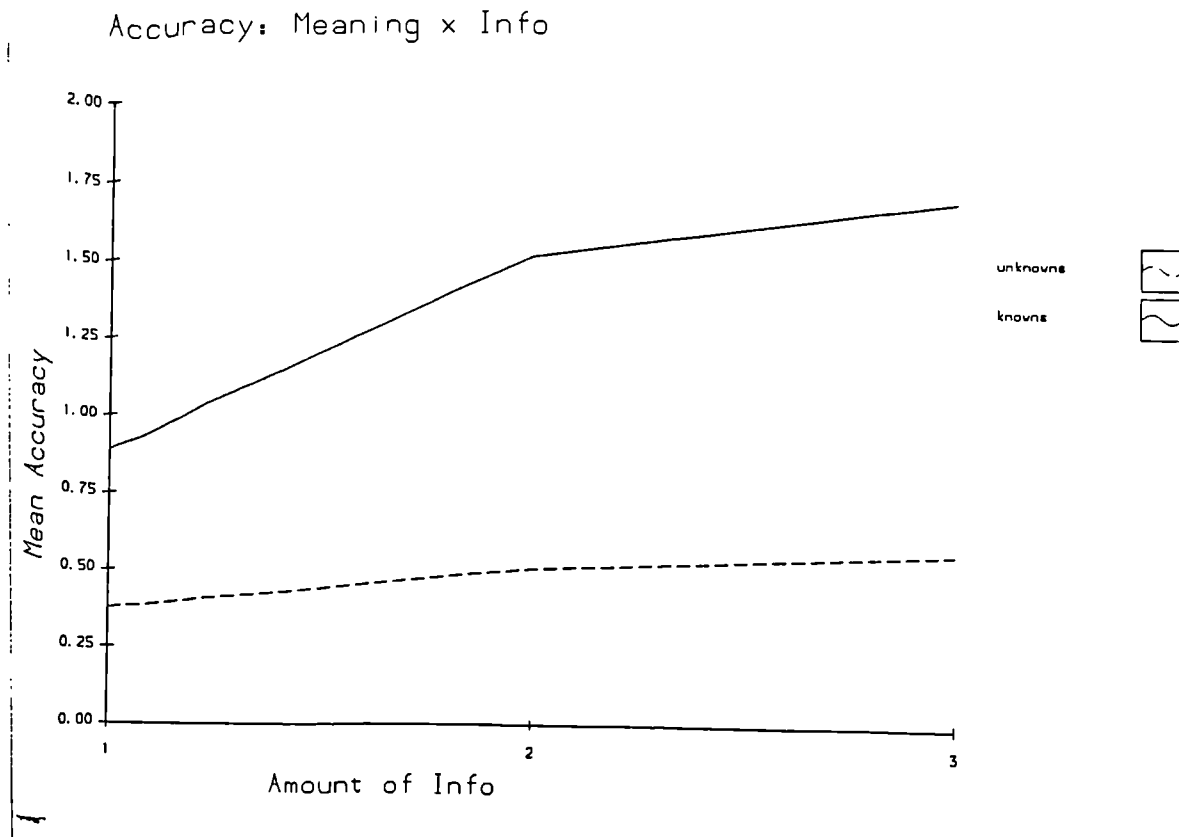
graph. Table 2 gives the means expressed as percentages.

Table 2

Confidence and accuracy means as % for the meaning by
information interaction

	1 amount	2 amounts	3 amounts
Confidence			
Unknown meanings	31.967	35.867	36.433
Known meanings	37.200	60.883	81.217
Accuracy			
Unknown meanings	18.800	24.700	27.550
Known meanings	44.350	74.800	84.200

These means are displayed on graph 4.

Let's look at graph 4. As to guessing the known targets .
there is, I think, little to add to what was said in Experiment
1. As subjects use more

Graph 4

Conf/Acc: Meaning x Information
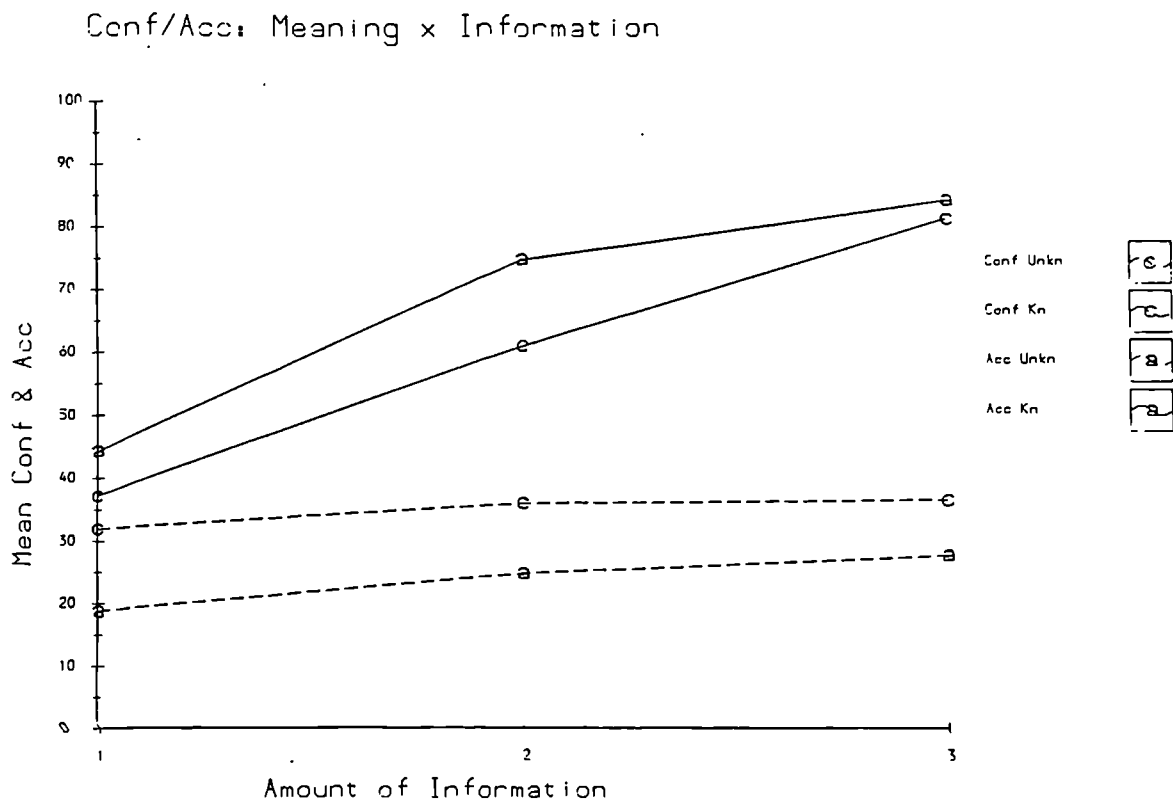
information to track down single word hypotheses their
confidence goes up. Even if they change a guess their new
hypothesis is a product of both old and new information with a
subsequent rise in confidence. We also see here that the
accuracy line tends to follow the confidence line. Subjects
have pretty good intuitions as to the correctness of their

guesses in the known meaning condition. (Remember, these are expert native speaker subjects). There is, however, one notable point of departure at two amounts of information. Here accuracy seems to rise quite some distance above confidence. What seems to be happening is that the first two cues do most of the work for accuracy, but subjects are a little cautious of committing themselves. Also, as the experiment progresses, they become aware that they will get a third cue so they become a little reluctant to commit themselves on confidence until they have seen it. The increase in accuracy does fall off at the third cue. Some subjects (a minority) have got confused even on the knowns, which is only to be expected. I suspect their confidence does mirror their difficulty. If we look at Subject 4 on target 4 nouns which is _effigy_ he gives the responses at 1.

1.	Cue	Response	Confidence
b)	This is made to represent a person	photograph	3
c)	This is hanged sometimes	painting	4
a)	This is a kind of stuffed figure	bust	1

Basically, the subject has gone off on the wrong tack on cue one, made a fine recovery ie. preserved a familiar relationship between cues, through use of polysemy on _hanged_, so confidence has gone up, but finally can't properly integrate cue 3, has a wild stab at the answer but as his confidence reflects, he

knows he's gone wrong. Essentially, his third guess suggests that he hasn't been able to use the third cue. Notice that the increase in confidence is also not quite so sharp between cues two and three compared to cues one and two. Possibly the realization in some subjects that they've gone wrong is making itself felt. The trouble is that confidence is still rising at cue three quite strongly despite this. Probably, the effect of subjects committing themselves fully is to some extent drowning out the lesser effect of subjects realizing they have gone wrong.

The lesson to be draw is that when information is used confidence goes up. Also, as the example at 1 shows, if a subject perceives a cue to be relevant but has trouble using it, confidence goes down. Any other information which the guesser fails to use because he perceives it as not relevant, would leave confidence static. This is not likely to happen in this experiment since the method of presentation tends to force subjects to see all cues as relevant.

If we come now to the confidence line on unknowns- I'll leave accuracy alone for the moment since this is fairly easily dealt with once confidence is explained- then there is a slight rise between cues one and two and the line is static between cues two and three. Does this mean that subjects are perceiving cues as not relevant? I think not. In the method of presentation we are forcing one cue after another on subjects. They will see them all as relevant just as students tend to see every item of information given in a mathematical

problem as relevant. What is keeping the unknown line pretty much static is that it is held in place by counteracting forces some of which try to push confidence up whilst others hold it back.

We can see what I mean by this idea of counteracting forces by looking at examples. If we look at target 7 verbs: <u>This is to worship, This is done in a frenzy, Primitive tribes do this sometimes</u>, then subject 7 who gets the cues in the order <u>acb</u> gives the responses at 2.

2.

Cue	Response	Confidence	Accuracy
a) This is to worship	idolize	3	1
c) Primitive tribes do this sometimes	idolize	3	1
b) This is done in a frenzy	___ (No response)	0	0

The genus cue has been used to get <u>idolize</u>. The association reinforces this though confidence stays static. Possibly the subject started a little too high and now corrects by keeping it the same. Then, when the differentia comes along the subject decides that although it is relevant he won't process it since he can't lexicalise it properly and confidence goes to 0. Abandoning information forces confidence down to 0. One might speculate here whether in real life a subject might end up being unable to give any form of guess in the situation

represented at 2 on the third cue. Personally, I don't think this is likely. Having gone to the trouble of getting some distance along the road to guessing the target, I don't think that a subject would throw a valuable hypothesis away. My feeling is that in real life, whilst the subject could perceive the third cue as relevant yet be forced to reject it he would still give idolize rather than nothing as his guess perhaps with a reduced confidence. (This leaves a problem in grading third guesses of this type in terms of accuracy. Since nothing is given, I think we must give 0 accuracy and maximum uncertainty, 2, since giving nothing suggests that anything could fit). Thus, whilst abandoning information he would retain his guess. There is of course the possibility that subjects might not perceive this third cue, the differentia in this case, as at all relevant in real life. We are forcing cues on subjects here. This is something I will check out later, but personally I do think that in real life all three cue types will be perceived as relevant. Here then we see abandoning information as one force which brings confidence down.

On the same item, Subject 13 gives the responses at 3. The order is again acb. Here, the subject has used the association to switch guesses and confidence has risen. But then, at guess three, the differentia is used; the same guess is kept but confidence falls. The differentia cue This is done in a frenzy does not fit sacrifice that well since it is not a

3. Response   Confidence Accuracy

     a) idolize   3   1
     c) sacrifice   6   1
     b) sacrifice   3   1

necessary feature in that not all sacrifices are frenzied. In
fact, _frenzy_ might be a perfectly good association of
sacrifice, but the way in which confidence declines suggests
that the subject has recognised this cue as part of the
target's core meaning but has forced it into a relationship
with the genus by treating it as an association (sometimes done
in a frenzy) to lexicalise the target. What we see is that
forcing information to fit into a hypothesis in order to try
and get a common denominator between all the cues can also
damage confidence.

What's really happening in these two examples? The
process used to obtain hypotheses at 2 and 3 above on unknown
meanings is essentially the same as that used for known
meanings. Subjects are after a single hypothesis, in this case
a word. They make such a guess off the first cue and try to
increase confidence by supporting or changing this hypothesis
off subsequent cues. However, either on the second or more
likely on the third cue they find that the unfamiliar
combination of cues can not be lexicalised to give a single
word hypothesis. The correct option now would be to abandon
the pursuit of a single hypothesis and go for a complex one
consisting of genus, differentia and association.   However,

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subjects do not switch to this alternative process probably because they are extremely suspicious of the unfamiliar combination. They stay within the process of guessing single hypotheses/known meanings and do this by treating the cues as inconsistent when they fail to lexicalise. The ways in which inconsistent information can be treated, as we have noted earlier, are by abandoning cues or by trying to force them into a familiar pattern. Example 2 shows the former and example 3 the latter. A feature of forcing worth pointing up is the deliberate distortion or downgrading of a cue. Usually the differentia is turned into an association. Thus it is the mistaken treatment of unknown meanings as combinations of inconsistent information which forces confidence down.

We should also note that when dealing with what appears to be inconsistent information the genus cue is almost invariably used. It seems to be the dominant cue type. The differentia is the most frequently abandoned though it can be forced into a relationship with the genus. This suggests that it is really the differentia which creates the inconsistent relationship and it seems to be next in strength to the genus. The association can be abandoned though it seems to be more easily assimilated into the genus guess than the differentia. The association thus seems to be third in terms of power. Unlike the Oskamp (1965) study subjects seem both to be able to recognise the different cue types- if differentias were simply mistaken as associations there would be no awareness of inconsistency- and to have fairly good knowledge about which

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cues to use and which to abandon in the face of inconsistency. Probably this is a consequence of the difference in knowledge/subject area. Remember that Oskamp dealt with clinical psychology.

Something, however, must be sending confidence up for the confidence line across information to be static. We do get responses like that given at 4 to noun target 12 (a. This is a kind of fear, b. This is caused by being robbed, c. People suffer from this sometimes) in the order bca for subject 16.

4.	Response	Confidence	Accuracy
	poverty	0	0
	fear	2	1
	paranoia	5	1

where the subject seems to have perceived what he thought to be a familiar pattern in the cues leading to the single, known word paranoia in which he has high confidence. The subject is still using the process for guessing known meanings on an unknown meaning but in this instance he has failed to spot any inconsistency in the cues— always a possible danger. The subject has, then, been deceived and his confidence does not reflect his accuracy. I don't think this means that the subject has failed to recognise the various cue categories. Rather, I suspect that the subject has perhaps decided that paranoia is a good enough guess under the circumstances and that "people will know what he means" if he used this word in

place of the target. Also, I suspect that whilst confidence rises quite well at example 4, on most guesses where subjects are deceived confidence does not rise so sharply as for the known targets and so there is some awareness of inconsistency which reflects a recognition of categories. This type of response together with the way in which subjects seem to retain some confidence on the third cue when forcing cues together as in example three helps keep the confidence line from falling.

We have, then, three types of single word response. The type at example 2 involves abandoning information, the type at example 3 involves forcing and the type at example 4 involves not spotting inconsistency. Counting on the final response given on cue three for unknown targets, these single word responses account for approximately 83% of the number of responses given. The type involving abandoning information is the most prevalent accounting for about 31% of the total responses. The remaining types involving forcing and not spotting inconsistency are roughly equal accounting for about 26% of the total responses each. In Experiment 1 it was the type which involved not spotting inconsistency which was most prevalent. Probably the difference in instructions between the two experiments has caused this different emphasis in response type. Since the instruction format in this experiment is the more neutral, it is the one I would tend to trust.

We can now see why the confidence line is fairy static. Subjects are invariably able to make a guess off cue one with a measure of confidence. Then on cue two and more certainly on

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cue three it becomes difficult to lexicalise information. The technique of abandoning information sends confidence down here whilst failing to spot inconsistency sends confidence back up. When cues are forced together, although confidence falls there can still be some confidence retained on the third guess as we see at example 3 and this would help keep confidence up.

There is an additional, though limited, force which prevents confidence falling by creating an upward trend, particularly on later cues. This is the use of the phrasal option to construct new meanings/complex hypotheses which accounts for about 17% of the responses. At the third cue, as as an alternative to treating information as inconsistent so sending confidence down, the phrasal option can come into use creating an upward trend for confidence. Subject 45's responses on the same target in the order cba are given at 5 as an example of the use of phrases. At 5 we've got the strange picture of the

5. <u>Response</u>   <u>Confidence</u> <u>Accuracy</u>.

c) to perform fertility rites   1   1
b) to perform tribal dances   3   1
a) to perform tribal dances/rites   4   2
   to the gods

differentia being built up first with <u>dance</u>. Then when the genus comes in, the idea of <u>tribal dancing is linked</u> to <u>worship</u> with <u>rites to gods</u>. It's interesting to note here that the

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genus, differentia and association are not held in the form in which they were given in the cues but guesses seem to have been made from them. So the various components of meaning are represented in the responses. This method of building new meanings was mentioned in the introduction and is used in preference to simply restating the cues which have been given.

I'll give one more example of a phrasal response. If we look at noun target 7: <u>This is a kind of musical instrument, This has one string, This is usually strummed</u>, we get responses like that of subject 6 recorded at 6.

6. <u>Response</u>   <u>Confidence</u> <u>Accuracy</u>

   c) lute   2   1
   a) lute   2   1
   b) an Eastern instrument 4   1

Here the subject has given single word guesses on the first two cues and then unlike the subject at 3 has not held on to this very specific single word but has realized that <u>instrument</u> is the genus and has restated the cue. He then uses the differentia to try and describe what kind of instrument. The subject has abandoned a single word hypothesis in favour of a complex one when he realises that he can't lexicalise the information. Interesting here is that the genus has been retained in the form in which it was given but guesses seem to be made from the other cues. More frequently, all components of meaning seem to be changed or guessed from in these complex

hypothesis responses as seen at 5. Confidence is rising at 6 but in terms of accuracy this does not guarantee a score of 2. I gave the third response at 6 an accuracy of 1 since I thought at the time the differentia was a little vague. I wasn't too sure about this accuracy score at the time, there is some kind of a differentia there, and I'm still not sure. It could be I've undervalued accuracy. What I think this shows is that the kind of uncertainty which can affect subjects when they try to guess a differentia can also affect the marker.

To sum up then, confidence is held fairly static on unknown meanings by a set of counterbalancing forces. However, it is single word hypothesis type of responses which predominate. This in turn explains the accuracy line on graph 4 for unknown meanings. Accuracy does rise slightly, but it can't get above a score of 1 (50% on the graph) because of these single word responses. Prediction 2a is borne out. Without a statement of genus and differentia, subjects can't score accuracy 2 on unknowns. Over cue 1 accuracy is lower than over cue three probably because there is more chance of making an error on low amounts of information. The rise at cue 3 is probably helped by the use of the phrasal option to build new meanings as well as subjects reairing errors made on cue 1, all be it with single word responses. On the whole the confidence and accuracy lines do correspond to each other suggesting that subjects do realise that they are in difficulty unlike with the Oskamp (1965) study. The main point of difficulty being caused by the attempt to treat unknown

meanings as combinations of inconsistent information so producing single word hypotheses.

A final point concerns the confidence standard deviations given at Result 5a for the meaning by information interaction. Standard deviations decrease across information for knowns. For unknowns, though there is a small decrease at cue 2, the contrast between cues 1 and 3 shows the standard deviations increasing. This is the same picture as on Experiment 1 and the cause is the same. On known meanings, there is probably a lot of fluctuation between subjects with some giving high and others low confidence scores on initial cues. Increasing amounts of information create a greater consensus and subjects who have given too high a confidence correct this (within an overall context of increasing confidence) and visa versa. For unknowns, on cue 1, the great majority of subjects think they are guessing a familiar single word. What variance there is reflects the use of this one strategy. Note that the standard deviation here is very similar to that of the known meaning on cue 1. As increasing amounts of information become available a variety of strategies: abandoning, forcing and the formation of complex hypotheses come into play. Each strategy generates a different finishing point on cue 3 in terms of confidence so increasing the standard deviation at this cue for unknowns.

Incidentally, we are also still faced with the problem of whether the guessing of unknown meanings, when successful, is more difficult in terms of confidence than the guessing of known meanings because of factors like suspicion. The best way

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to look at this problem would be to correlate confidence with accuracy for the two meaning conditions so that we can compare the confidence of those who score an accuracy of two on the unknowns, and so are considered to have formed some kind of new meaning, with those who score a similar accuracy on the knowns. There should be some form of drag effect on unknowns.

To finish this section we need to look at the interaction of meaning by information for uncertainty. The statistics are at Result 5c and we have a powerful interaction. The means at Result 5c are displayed on on graph 5.

Looking at graph 5, uncertainty for known meanings falls sharply. Cues are combining to knock out any options which cues in isolation might suggest as described in Experiment 2. For the unknown meanings I would have expected uncertainty to remain static (see prediction 3a) in that holding and changing would cancel each other out. Uncertainty on the unknowns is simply a much gentler fall than for the knowns. What we have is a mixture of abandoning and holding. In terms of the former subjects give up around cue three and get 2. That is, failing to give a guess is interpreted in terms of saying "anything is possible here" and is taken as expressing a wide uncertainty so it scores maximum. (I've argued that subjects might in fact hold on to these guesses in real life so it is possible to score 0 uncertainty here so this is an element of arbitrariness in my marking scheme). As to holding probably coupled with small scale changes, they are clearly strong enough to counteract abandoning on cue 3 and make initial uncertainty

fall somewhat. But remember that all these are responses to difficulty and reflect a degree of "confusion" so the main point is that uncertainty is higher for unknowns than knowns and this is borne out.

Graph 5

Unc: Meaning x Info
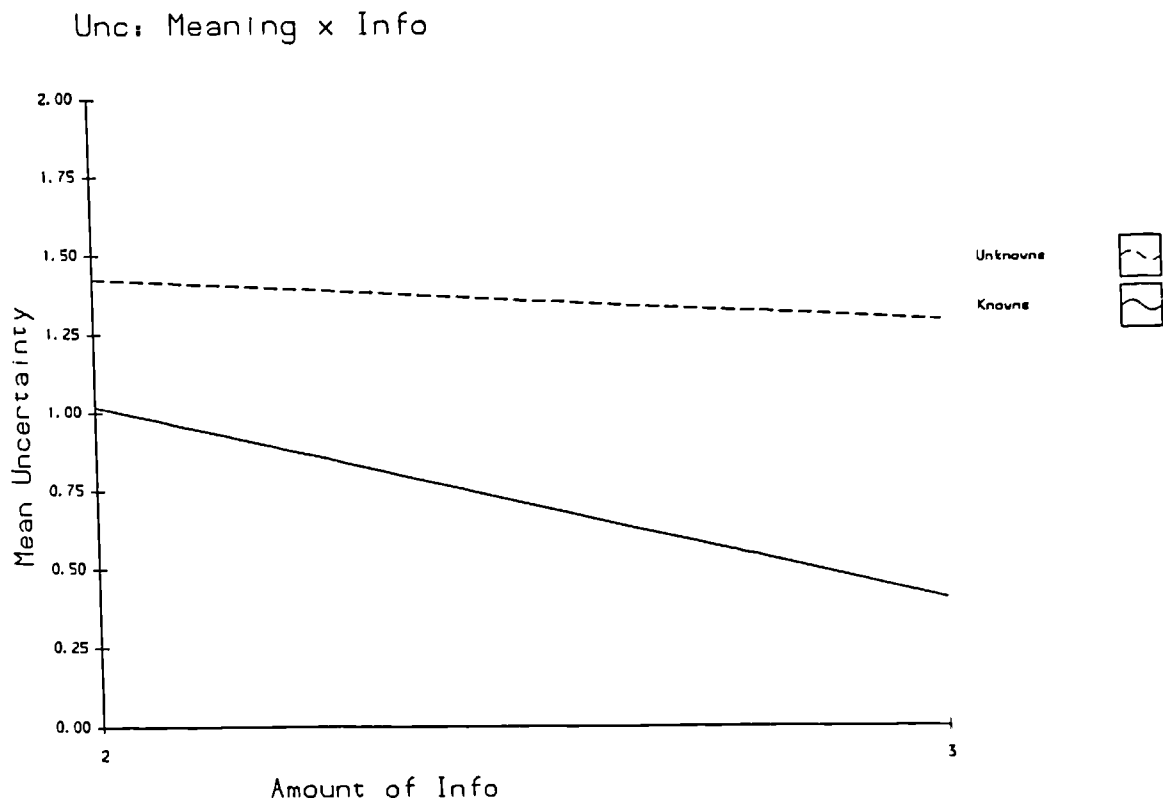
Where subjects are able to construct new meanings by building complex hypotheses we do seem to get static and possibly rising uncertainty as with Experiment 2. The response recorded for Subject 9 on cue three noted at 7 below seems to support this. The order is cba

7. c) Chant
   b) Chant & Dance
   a) Chant and dance. A specific ritual with prayer etc.

Note the high uncertainty on the response. Three ideas: <u>chant</u>, <u>dance</u> and <u>prayer</u> are added to <u>ritual</u> with the subject finishing with <u>etc</u>. Grated it is "small scale" uncertainty with the hypotheses falling within the general category of religion. At face value we can say cautiously that a lot more uncertainty surrounds the successful guessing of unknown meanings as opposed to guessing known meanings. This expansion of uncertainty suggests the adding of associations to the core meaning so as to build up a new schematic or encyclopaedic representation and reflects an increasing familiarity and confidence with the new meaning.

Form: We have two different forms: pseudowords and cloze gaps. Predictions 1b), 2b) and 3b) state that there will be no difference between these conditions on all three dependent variables.

If we look at Result 2 we see there is a significant difference on form for confidence, for accuracy and for uncertainty. All three predictions fail. The means are given at Result 2 and are expressed as percentages in table 3. These means, using the percentage figures, are displayed on graph 6. Looking at graph 6, cloze gaps generate more confidence and

accuracy and less uncertainty than pseudowords which is to say,
the cloze condition is easier than the pseudoword. Note that

Table 3
Means for pseudowords and cloze

	Pseudoword	Cloze
Confidence	45%	50%
Accuracy	45%	47%
Uncertainty	54%	50%

the differences are small, but they must be quite consistent or
they wouldn't have shown up. This was a surprising result.
I'd expected subjects to treat pseudowords in the same way as
cloze gaps ie. ignore the pseudowords. This is not the case.

Why do we get this effect? My first thought was that the
pseudoword acts as a signal, telling subjects that a target is
unknown and that they must be careful since an unknown meaning
might exist. This would mean that on cue 1 they are holding
cues like This is a kind of barrier and thinking in terms of
the hypothesis being incomplete rather than backing away from
this and using barrier or wall as single word responses. There
are two points here. First, there is very little evidence
amongst the actual responses that subjects are thinking in
terms of This is some kind of. Responses are in the main
single words both on cue 1 and subsequent cues. Second, if
subjects were regarding the pseudoword as a stimulus to build a
complex hypothesis we would expect a substantial difference in

confidence between the two forms on the basis of experiment 1, with pseudowords being the lower.

Graph 6

Pseudoword & Cloze

Pswd=1 Cloze=2
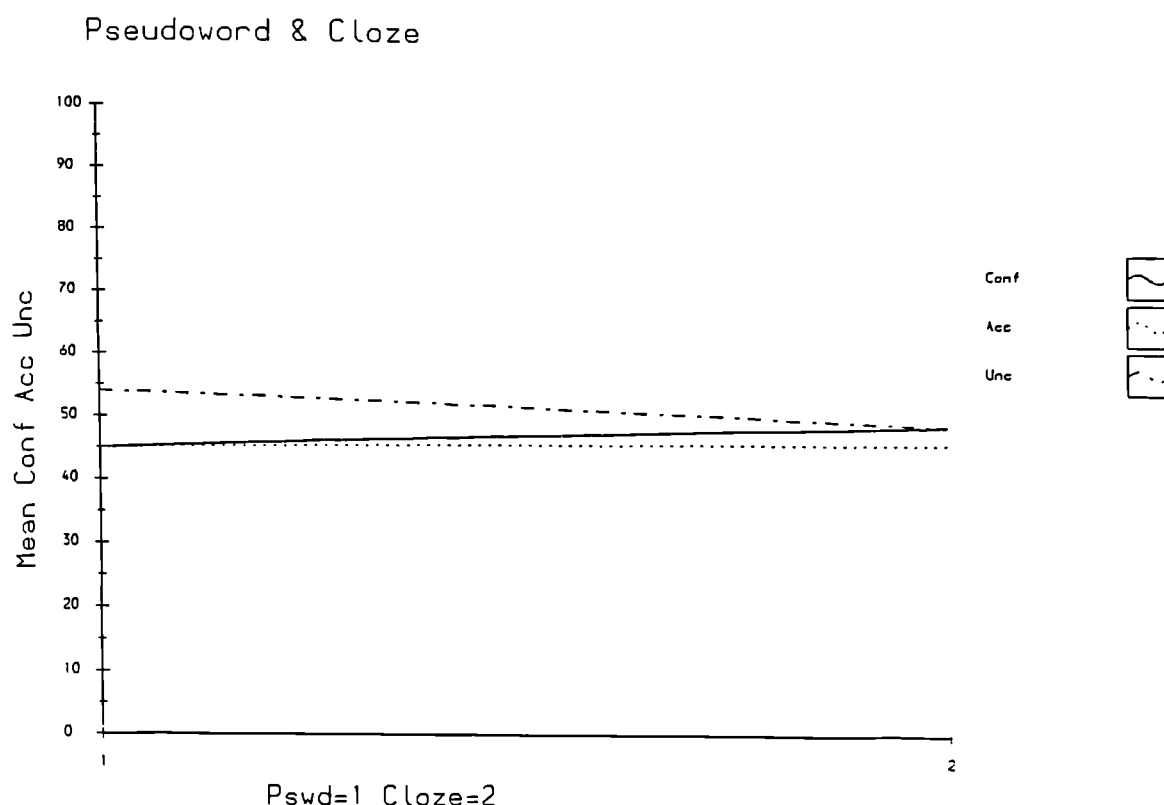
The difference here, whilst significant, is tiny.

Whilst subjects might initially try to build a new meaning on the basis of an unknown form they are quickly forced away from this option by incompletness and the sense that whatever they add must form an unfamiliar combination which can't be lexicalised and so will arouse suspicion. The result is single word hypotheses from cue 1 on and whatever we are dealing with in terms of the results in table 3 must be

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explained in terms of single word hypotheses.

Another possibility for this pseudoword/cloze distinction is that the pseudoword requires extra processing effort. Subjects have to stop and decode it, perhaps check pronunciation and maybe even check to see if there is some kind of morphological cue. This extra processing effort detracts from the guessing task and creates a drain on confidence since effort which should be going into guessing is now going into decoding. We might explain the confidence difference thus, but what about the accuracy difference. Dechert (1983) shows that high processing costs can be a source of error. But decoding a pseudoword is not going to impose any large scale processing effort. A small increase in effort might undermine confidence since it is the more sensitive of the variables but we would not expect it to encourage error unless it were more substantial. I can't see this problem manifesting itself in the data. Neither would I expect it to cause subjects to change guesses more frequently. The opposite would be more likely since it should be less of a drain to hang onto an old guess than think of a new one.

Another way that pseudowords may be influencing accuracy and uncertainty as well as confidence is through encouraging subjects to give up guessing by adding one more difficulty which simply overloads subjects. Where they give up they get 0 accuracy so this suppresses accuracy for pseudowords. The same applies to confidence. They also get 2 uncertainty and this increases uncertainty on the pseudowords. There is one

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problem. The tendency to give up exists on unknown targets rather than knowns and is caused by the tendency to treat the cues as inconsistent. Accuracy on the pseudoword unknowns would be forced lower than on the cloze unknowns whereas there won't be much difference between the pseudoword and cloze knowns. In other words we'd get an interaction on meaning by form. But Result 10 is not significant. Also, the tendency to give up on unknowns seems to be manifesting most at three amounts of information. This means we would get an interaction on form by information with pseudowords bending away from cloze at three amounts, but again this doesn't happen (see Result 6 on all dependent variables) More particularly perhaps we'd get an interaction on meaning by form by information, but (see Result 11 a b & c), we don't get this.

A point to remember here is that the cloze pseudoword distinction is slight. If it is caused by giving up then some of the above interactions could exist in embryo and simply not be strong enough to show up in the statistics. The place to look is on the possible interaction of meaning by form by information. There should not be much difference between pseudoword and cloze on the known meanings but we should see pseudowords fall away from cloze at three amounts of information on the unknowns. The dependent variable to look at is accuracy since this comes the closest to significance and so is the most likely to shed some light. The confidence result is not near significance and simply from a very pragmatic point of view won't give much help since the lines are fairly

parallel. The uncertainty result has no score at one amount of information so we lose one part of the interaction and the picture is not clear. The means for meaning by form by information on accuracy are given at table 4.

Table 4

Means for the meaning by form by information interaction on accuracy

	1 amount	2 amounts	3 amounts
Unknown pseudoword	.362	.480	.524
Unknown cloze	.390	.508	.577
Known pseudoword	.872	1.453	1.671
Known cloze	.902	1.539	1.697

It's difficult to display these means on a graph since they are so close. We can see that the differences are so slight that there is no difference between the two forms on knowns across information if means are given correct to one decimal place. The same happens on unknowns between one and two amounts of information but then on the third amount the pseudoword line dips just where we would expect it to. The cause is that pseudowords are encouraging subjects to give up on unknown meanings at cue 3 presumably because they create some extra difficulty and that this helps create an overall difference between cloze and pseudoword on all three dependent variables.

However, what kind of extra difficulty can pseudowords create? I don't think that extra processing effort in terms of decoding the form would really tip the balance.

Looking at table 4, there are differences between pseudoword and cloze on the known meanings and again on the unknown meanings at cues one and two which, though minute, might give us a clue as to why pseudowords encourage abandoning information and further explain the overall differences between cloze and pseudoword. Here, pseudowords are slightly lower than cloze. What might cause this? There is no morphological information in the pseudowords, but remember we noted how subjects could make a guess to a similar word in terms of sound or spelling to the target form: implication -> application. The point is that the surface form seems to be attractive even when it contains no hard information. There is no indication that my subjects are making errors of the type noted above. Remember that they seem to associate with low ability subjects. But they are being, I suspect, attracted to the pseudoform in the following way. A subject at noun target 4 might give doll or dummy in the cloze condition. But where a strange pseudoword appears they might go for a slightly more unorthodox answer like manikin. The former conventional responses gets them a 1 for accuracy, the latter a 0.

Subjects are trying to get something out of the pseudoword on cues 1 and 2. This leads them to slightly "offbeat" responses which they are not too sure about since the hypothesis is generated on the very flimsy basis that there must be something vaguely unusual about this target so overall confidence suffers. Overall accuracy also clearly suffers and overall uncertainty also rises since larger scale changes are

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needed to get out of this problem.

So on Unknowns, subjects are struggling to get something out of the pseudoword on cues one and two, but when the problem of inconsistent information makes itself felt on cue three subjects find it too much and give up. That is they now view the pseudoform as a cloze space and take their last guess as a rough synonym for the target. On the known meanings note that we have a small gap at table 4 between cloze and pseudoword at cue 1, it opens wider at cue two and then on cue 3 returns to the same value as the gap at cue 1. My suspicion is that the way in which the gap at cue three closes suggests that subjects finally start to regard the pseudoword as a fake. The way the third cue fits a known word convinces them to substitute this known form for the pseudoword. That is, they again eventually see the pseudoword as a cloze space.

Ultimately, I would suggest that predictions 1b, 2b and 3b on all dependent variables are correct in essence. Subjects do disregard pseudoforms. The word I should have included in the prediction is that they disregard them eventually and that a strange form containing no hard information does have an initial attraction before being disregarded.

It should be remembered here that the interaction of meaning by form by information given in table 4 is not significant. Also the differences at cues 1 and 2 for both types of meaning in the form contrast are minute. The above arguments should therefore be treated with great caution.

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Order: Here we are concerned with whether one or more orders stand out as more effective than others. I've made the prediction of no difference between orders at 1, 2 and 3d) as a matter of convenience. It may well be that we will see differences. If so we can use the cost/benefit principle to try and generalise from this experiment to the use of order in real life guessing.

Let's begin with the overall results for order. The relevant statistics are at Result 13. For confidence the Sig of F= .922. There is no difference between the orders. Prediction 1d works. For accuracy and uncertainty the Sig of F respectively are .001 and .006. There are significant differences between the orders. It looks like prediction 2d and 3d fail. But order, as pointed out, is complex, so let's try and go into this variable in some detail.

The means for the orders from result 13 for all the dependent variables are given at table 5 as percentages.

Table 5

Means for order on confidence, accuracy and uncertainty

	abc	acb	bac	bca	cab	cba
Confidence	46.6	46.5	47.5	47.8	46.9	48.1
Accuracy	50.5	50.5	46.4	41.3	41.4	44.1
Uncertainty	47.5	47.5	50.8	53.7	56.5	54.4

Let's put these means on graphs using the percentage figures. Graph 7 shows the means for the orders for confidence and

accuracy   and graph 8   shows the means for the orders on

confidence and uncertainty.

Graph 7

Order for Conf & Acc

Orders: 1=abc etc
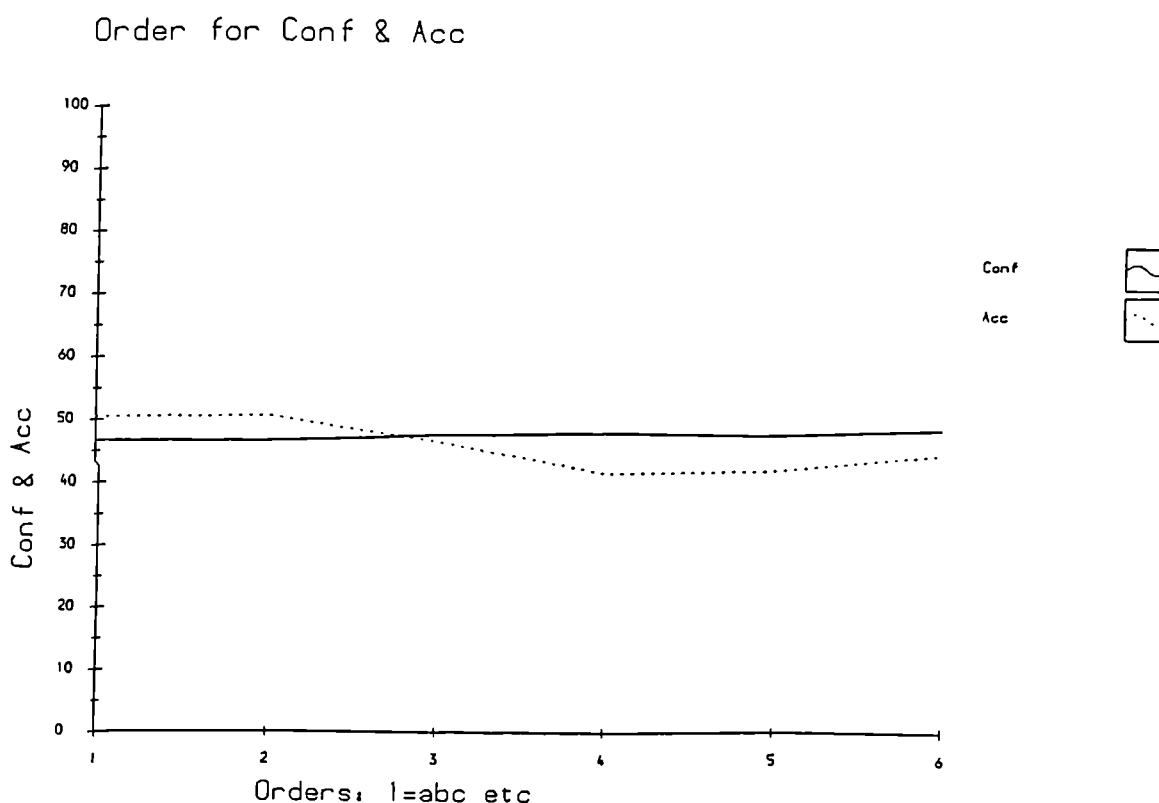
If we look at graph 7 then we see that the orders for

confidence are all very similar.   In fact the genus a first

orders are in fact amongst the weakest though not significantly

so.   If we turn now to accuracy then the genus first orders are

strongest and there is a gradual falling off with a slight

upturn for cba.   The point here, though is that the confidence

line doesn't in any way respond to the   movement in the

accuracy line. If some orders are better than others the subjects don't seem to be aware of that fact.

Graph 8

Orders for Conf & Unc
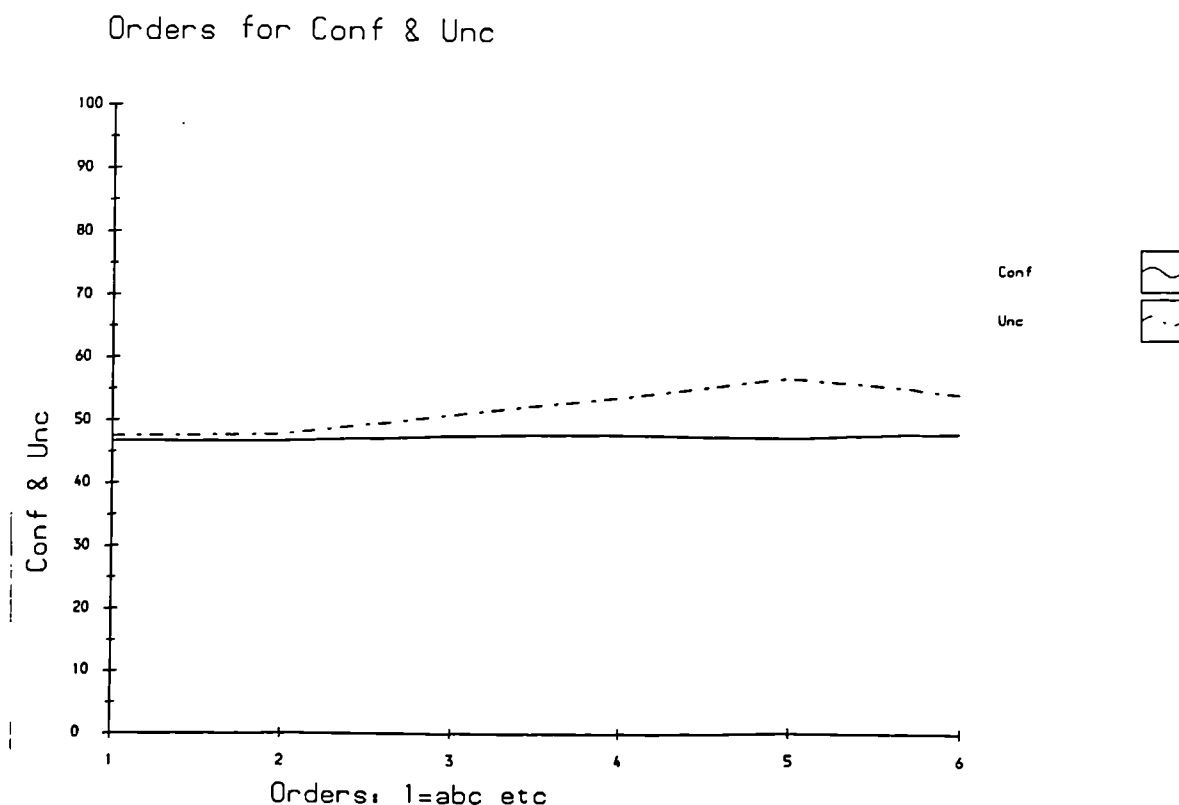
If we look now at graph 8 we can see that uncertainty for the orders is the mirror image of accuracy. The genus first orders generate less uncertainty and there is a gradual increase for the other orders with a down turn at cba. Although the two lines are close for the genus first orders the confidence line doesn't follow the rise in the uncertainty line and guessers again aren't aware of increasing uncertainty. Again subjects are not aware, this time that orders which do not have the genus in first place create higher uncertainty

than others.

If we turn now to the interaction of meaning by order, what we are in fact looking at is not so much a contrast between known and unknown meanings. Given what I have said earlier, then we really have a contrast between the processing of information which is consistent in known meanings and the processing of information which is thought to be inconsistent in unknown meanings though in the latter case subjects might be regarded as in error when viewing this information as inconsistent.

On the meaning by order interaction, Result 14, we get significant results on all dependent variables. Could it be that for confidence on the unknowns the genus first orders are the best, but that in the main effect their power has been obscured by something strange happening in the known orders. The means for confidence for the meaning by order interaction are displayed on graph 9. We do, in fact, see that something strange is happening. The main points of interaction is at <u>at</u> <u>bac</u> with this order being helpful on known meanings and <u>bac</u> being unhelpful on unknowns. In terms of known meanings we might have a cline in terms of the power of cue. The differentia, <u>b</u> might be the strongest and most helpful since not many potential words in a language share the same differentia. The genus, <u>a</u>, might be the next most powerful since more words share this feature and the association, <u>c</u> might be the weakest since it is non criterial. So the

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Graph 9

Confidence: Meaning X Order
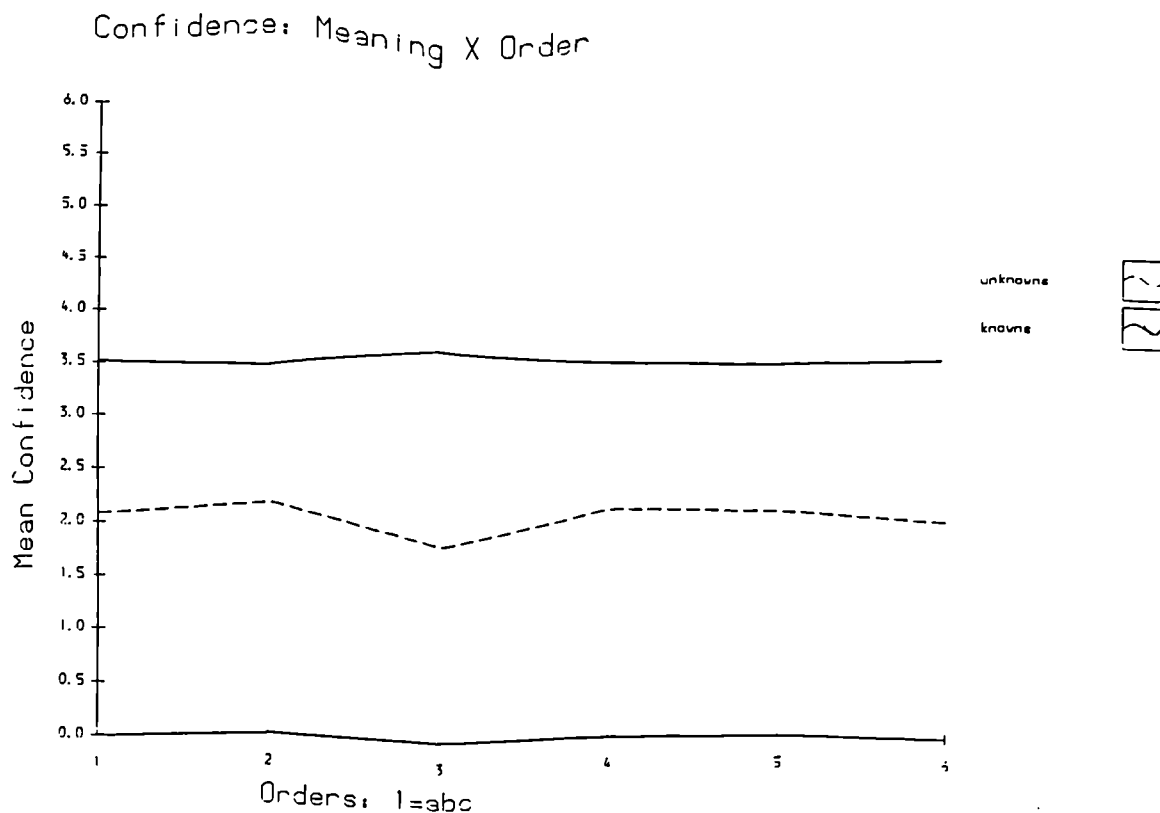
differentia in first place might fine down the number of possible hypotheses *quite a lot and the genus then clinches it.* Thus the combination of differentia followed by genus in first two places gives <u>bac</u> its superiority. On the unknowns, interestingly, the reverse has happened. I'll return to this later. On the whole, however, on the unknown meanings, there seems to be little difference between the orders in confidence apart from this one small feature. The order <u>bac</u> has a mean of 1.9 and the others have means of 2.1 or 2.2 so it doesn't stand out by much.

If we go on and look now at the same interaction of

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meaning by order for accuracy, the Result at 14 is significant.
The means are displayed on graph 10. If we look at graph 10 .

Graph 10

Acc: Meaning X Order
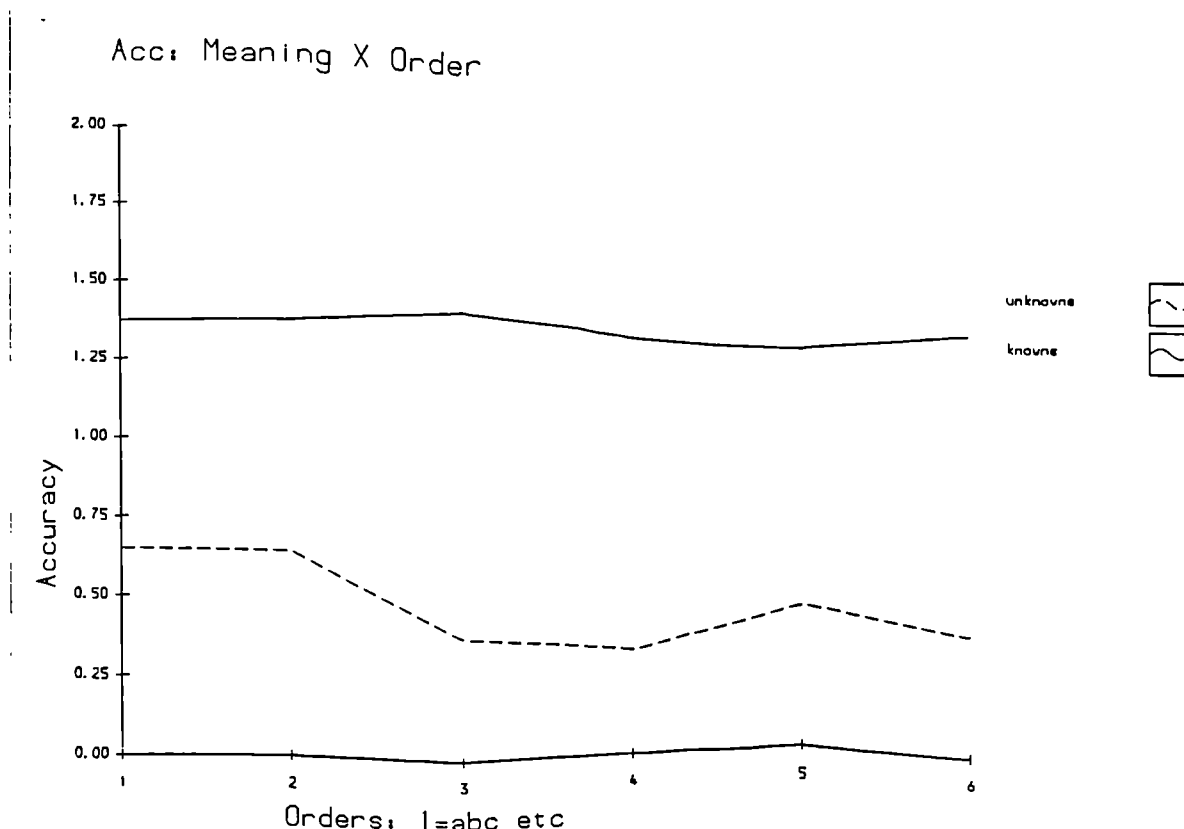
for the known orders then <u>bac</u> again is the most powerful order
for the reason given above. On the unknowns, however, the
genus first orders dominate the picture and stand out as
strongest with the other orders falling away from them. This
is a picture which we did not get on confidence where all
orders are pretty similar. The uncertainty results on the
meaning by order interaction duplicate this result for accuracy
surprisingly closely, but I won't draw graphs for them here as

I want to push on. The point to note is that on known meanings, <u>ba</u> initially is strong. On unknowns for confidence we don't get much difference between orders in terms of confidence but we do get a very coherent patterning for accuracy and uncertainty where genus first orders are strongest.

It is worth converting the means for confidence and accuracy to percentages just for unknowns. These are given at table 6 and displayed at graph 11. What we see on graph 11 is that whilst the confidence and accuracy lines are close for the genus first

Table 6
Unknown Order means as % for confidence and accuracy

	abc	acb	bac	bca	cab	cba
Confidence	34.7	35.7	31.6	36.1	35.3	34.9
Accuracy	32.4	32.1	19.9	16.4	21.4	19.7

orders the accuracy line then falls away from the confidence. In other words, subjects are not aware that the non genus first orders are causing difficulty (this seems to be purely an unknown meaning rather than known meaning problem). This is strange since at graph 4 we saw that across amount of information the accuracy line seemed to follow the confidence line suggesting subjects had rather decent intuitions about their accuracy. I don't think that what we will see in terms

of order will contradict this result. Rather, order should

help clarify it by showing where such intuitions come from and.

Graph 11

Conf & Acc: Unknown Orders
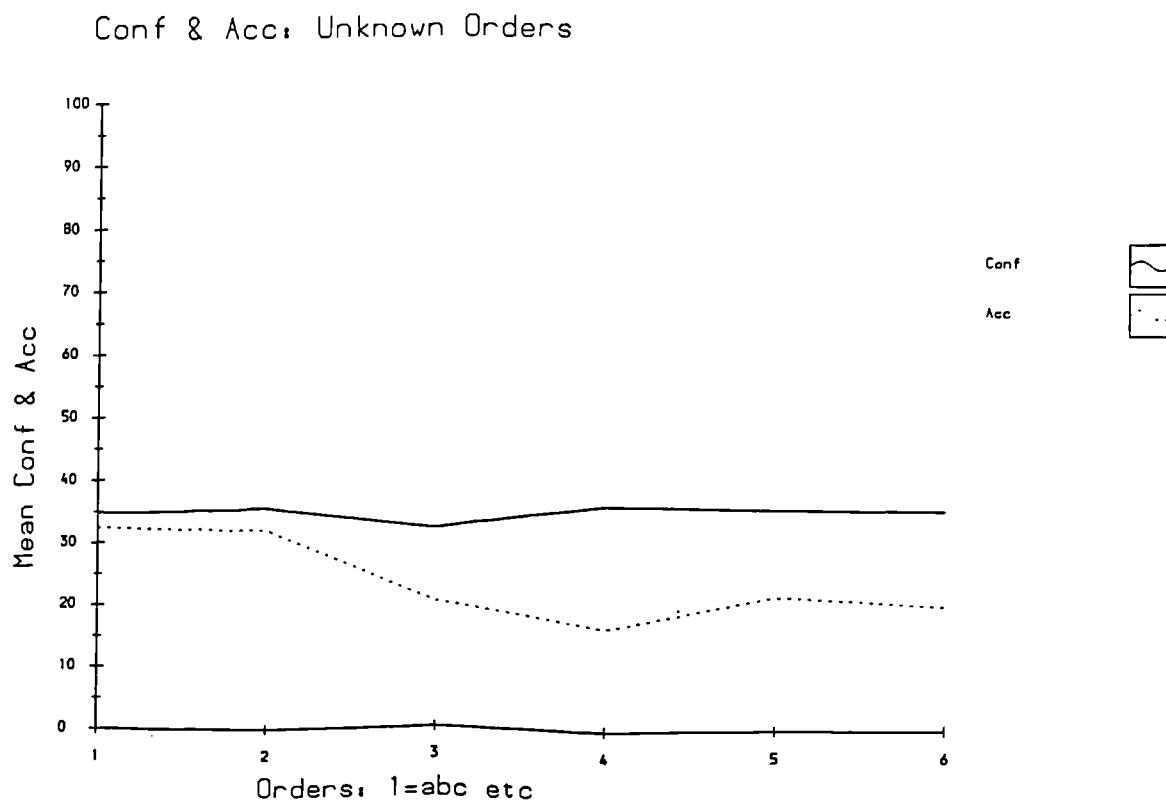
what problems frustrate, to a limited extent, such intuitions.

We can do exactly the same thing for the known orders.
The percentage means for confidence and accuracy are given at
table 7 and displayed on graph 12. On graph 12 we see
confidence respond to accuracy, rising over orders bac and cba
on knowns. We can now carry the discussion forward on two
fronts. First, we can check that the reason for bac's

superiority on knowns is borne out by meaning by order by information results. Also we can ask why subjects seem not to.

Table 7
Known order means as % for confidence and accuracy

	abc	acb	bac	bca	cab	cba
Confidence	58.6	57.2	63.3	59.5	58.6	61.2
Accuracy	68.6	68.9	72.9	66.2	61.4	68.6

Graph 12

Conf & Acc: Kn Orders
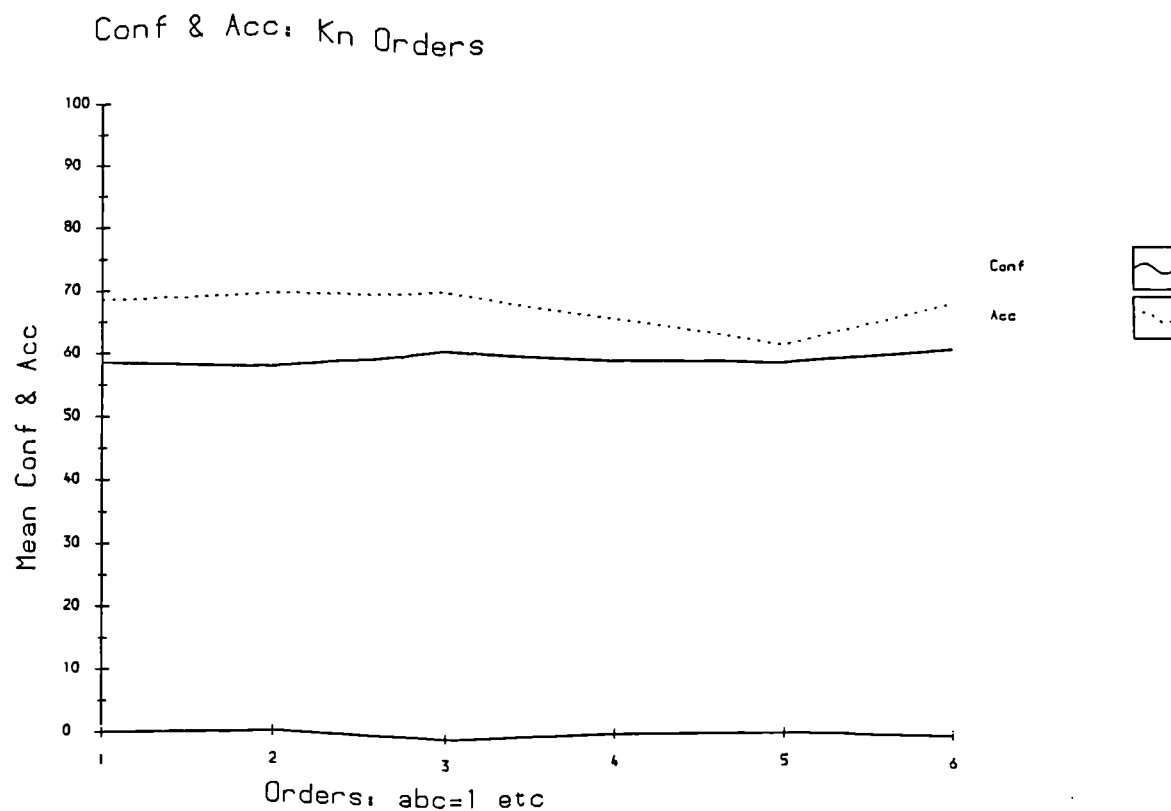
be aware that some orders are not as good as others on the unknowns. One could pursue this further by looking at uncertainty and bringing in the interaction of information by

order, but I'm going to go directly to the interactions of meaning by information by order.

If we look at the interaction of meaning by information by order for accuracy, Result 16b is significant. The interaction between known and unknown meanings is that the former rises whilst the latter is largely static. I'm going to ignore this aspect and look first at the interactions which occur within the known group of orders. The complete set of means is given at Result 16 and displayed on graph 13 for known meanings.

Looking at graph 13, for known orders, I had hoped to be able to look at 1 amount of information and say from the points noted above that b was the strongest cue, since not many words share the same differentia, a the next strongest since the genus is common to many words and c the weakest since the association is not criterial. Clearly we can't say this with any certainty since there is some confusion at cue 1 with the two b first orders not starting at the same point and other orders intervening and the same problem applying to the other orders. What we can see at graph 13 is that the orders bac and cab stand out across information, the first being strong and the second weak and lower than bac and almost parallel to it. It looks as though an initial ba combination is strong in that b restricts the number of options and a following it quickly leads to the right guess even if we can't get a clear picture of the respective power of each cue in the combination

individually at cue 1 and it seems that the b on bac might have

a fortunately high starting point.   Likewise, an initial ca .

Graph 13

Acc: KnMean x Infc x Ord
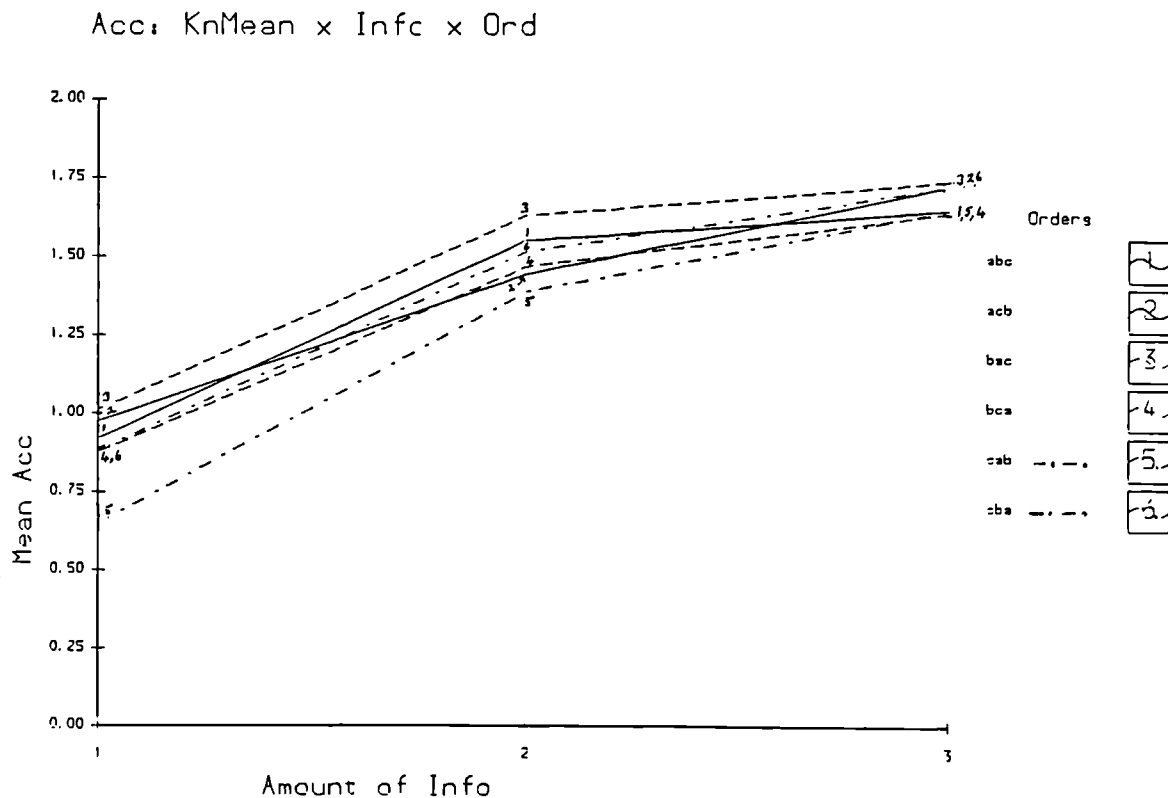
combination is misleading because c is not criterial and a is

common to many words although, again, the initial c on cab

might be unfortunately low. These initial combinations also

lead to differences in finishing points with bac maintaining

its superiority at cue 3.

Note also that at cue 3 on graph 13 cba and acb catch

up with bac. The first of these has a ba combination in last

place which probably helps it. (The initial c also has a lucky

high start). The reason why acb catches up, I'll return to. Also note that orders abc and bca finish lower at cue 3, in the same place as cab. The second of these has a ca combination last and this might confuse. Again, abc finishes lower. Let's look finally at the the two genus first orders: acb and abc. Perhaps here we can see the power of individual cues at work. The first order does have a high start and the second a low start at cue 1 which must be seen as accidents. On cue 2 they reverse showing the weakness of c and the strength of b and then they reverse again for the same reason.

Order is complex, but it does appear to be that order bac is the one to exploit when guessing and cab is the order to stay away from. Granted, two other orders do eventually catch up to bac and finish at the same point, but we do get accurate more quickly by exploiting this order. If we look at uncertainty for the known meanings at Result 16c) then bac again generates least uncertainty and decreases most sharply across information whilst the reverse is true of cab. For confidence, Result 16a) then bac gives the sharpest rise across information although cab is not clearly inferior here. There is a reasonable mirroring of the accuracy result.

An interesting question to ask is whether or not subjects would exploit the order bac in real life guessing because of its advantage. We'd need experiments here. However, remembering the principle of costs and benefits mentioned earlier, I would say it is unlikely even though the high confidence in bac betrays an awareness of its advantage. The

advantage to be gained in terms of accuracy and confidence and even uncertainty, if we compare the scores on cue 3, is not that great for <u>bac</u>. In return, processing costs are high in that subjects will have to collect all the cues, hold those they spot in memory while others are searched for and then put them in this order since these cues are likely to be scattered through a text in whole or even worse in part. In real life it makes more sense to process information as it comes unless perhaps some kind of problem or the need for speed makes itself felt. It would be interesting to check this out in more real life experiments, though. Unfortunately, this is beyond the scope of this study.

With the unknown orders subjects seem not to be aware that non genus first orders cause problems and confidence does not respond to accuracy on graph 11. It is because of this problem on unknowns that confidence fails to respond to accuracy on graph 7. On the knowns, subjects seem aware of their accuracy. Turning to the unknown side of the interaction, the accuracy means for these orders given at Result 16b) are displayed on graph 14 . What we see is the following. The genus <u>a</u> is the strong point of the interactions. Wherever it comes, accuracy is highest. Not surprising since the genus will almost always get us into the correct family. But at all points before the genus appears accuracy is low. In other words the differentia or association appearing either in isolation or combination before the genus comes in has sent subjects in the wrong direction. It is the

differentia which emerges clearly as causing the most serious

problem as we see at cue 1 on graph 14.

Graph 14

Acc: UnknMean x Info x Ord

Orders

1.00

0.75

0.50

Mean Acc

0.25

0.00

abc   1
acb   2
bac   3
bca   4
cab   5
cba   6

1   2   3

Amount of Info
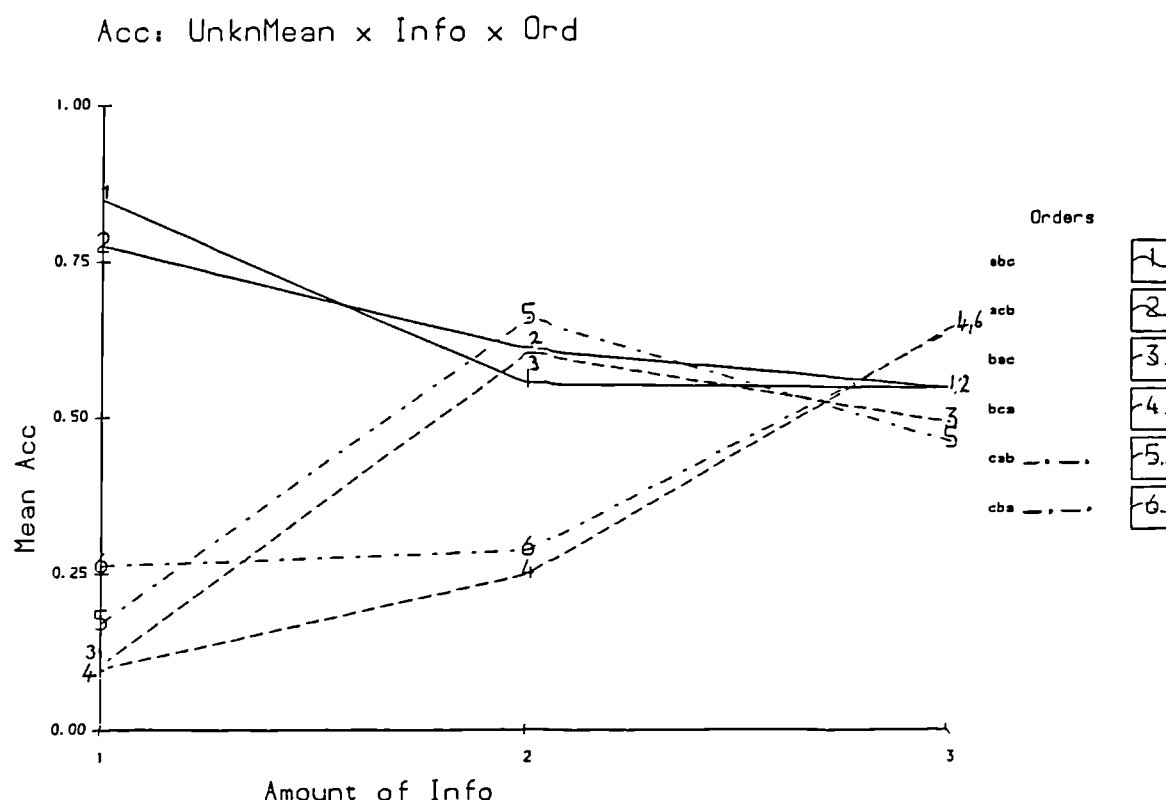
The association is not always as misleading. Why should there

be this contrast with known meaning cues? We have almost the

reverse of the known situation.

On the unknown orders where the combination of cues is

strange and a subject is trying to lexicalise a target as is

generally the case, the differentia, which is strong in a known

combination, might well send the subject in the wrong

direction. For example, if we take unknown target 7: <u>To relf</u>:

This is to worship, This is done in a frenzy, Primitive tribes do this sometimes, we can see that the differentia is likely to send the subject into single word options like kill, attack etc. which are not related to worship. Also, a similar but perhaps not so drastic effect is produced by the association. Any association has to be compatible with the differentia as well as the genus. It would be strange to suggest monks and nuns as associations of relf. As we see above, the idea of primitive tribes which is compatible with the differentia is more likely to suggest war dance or hunt than forms of worship and again the subject is misdirected. With some of the unknown targets, however, the association can be helpful. On unknown noun target 7 the association usually strummed can suggest single word guesses relevant to the genus musical instrument. So the association is less misleading than the differentia prior to the genus. The genus will now be the strongest cue since it gets subjects into the correct family. So on unknowns we have a cline of genus-> association-> differentia with the first cue being the most effective.

Let's now bring confidence into play. On the interaction of meaning by information by order for confidence, Result 16a) is significant. Let's focus on the unknown side of the interaction and compare the behaviour of the orders in terms of confidence and accuracy by turning their means into percentages. Means as percentages are given at table 8.

Let's put some of these orders on graphs. The unknown order abc is on graph 15. What we see at graph 15 is a gradual

decline in confidence and a sharper decline in accuracy, but we can say that the two dependent variables seem to be responding to each other roughly and do so from cue 1 which is the genus.

Table 8
The means as % for unknown orders across information

Order	1 amount	2 amounts	3 amounts
abc			
Accuracy	42.4	27.7	27.1
Confidence	35.7	34.3	34.0
acb			
Accuracy	38.8	30.5	27.2
Confidence	36.2	39.9	31.1
bac			
Accuracy	5.2	31.4	24.4
Confidence	29.5	31.4	34.2
bca			
Accuracy	4.9	12.5	32.0
Confidence	29.7	35.6	42.8
cab			
Accuracy	8.5	32.9	22.8
Confidence	30.1	40.6	35.0
cba			
Accuracy	13.1	14.4	31.7
Confidence	30.3	33.2	41.4

If we turn now to order bca the confidence/accuracy means are displayed on graph 16. What we see at graph 16 is that for the first two cues: the differentia and association, accuracy

is well below confidence and it is only when the genus appears

at cue 3 that the two lines really converge. So the

association and the differentia in particular has sent subjects

Graph 15

Conf/Acc: Unkn Ord abc x Info
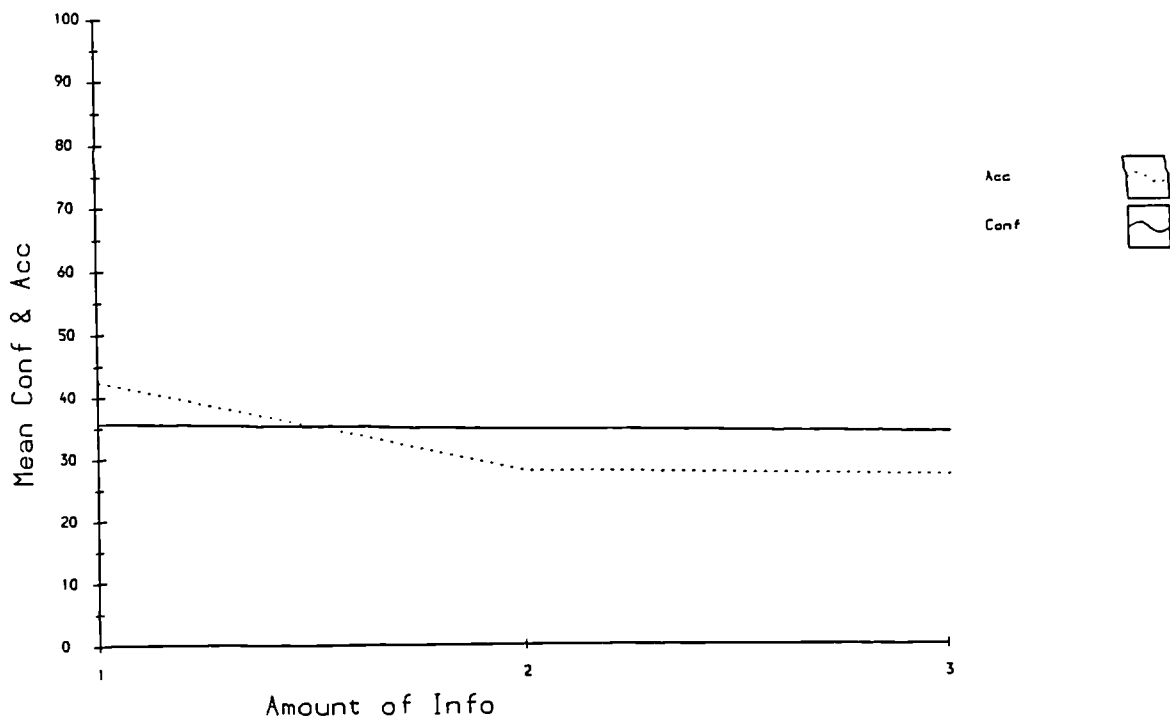
in the wrong direction but they don't realize this in terms of

confidence until the genus comes into play.

If we turn now to order _cab_ the means are displayed on

graph 17. Confidence seems to follow accuracy but note that

the gap at cue 1, the association is very wide. It's not until

the genus comes along at cue 2 that the lines really start to

follow each other. In other words the association has not

helped and again subjects don't become aware of this until the
genus comes in at cue 2.

In other words what we have is an explanation of why

Graph 16

Conf/Acc: Unkn Ord bca x Info
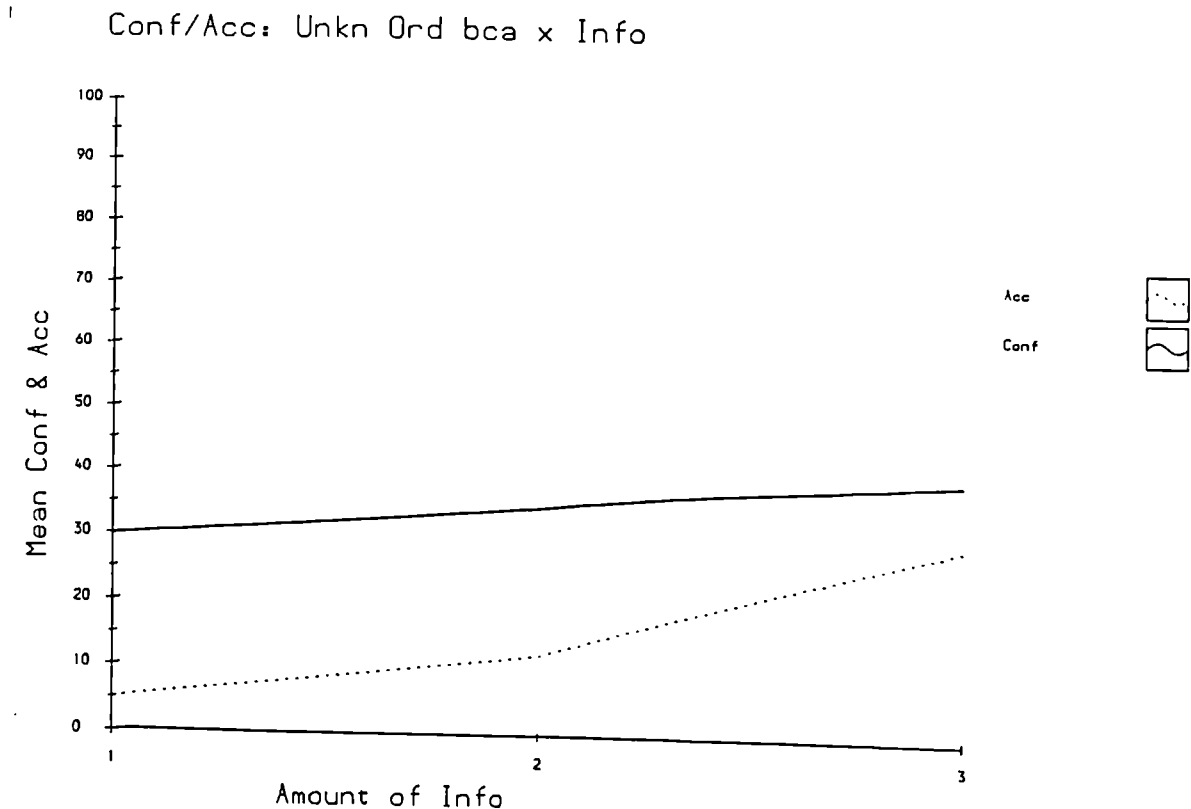
confidence doesn't respond to accuracy in the non genus first
orders for unknown meanings.   We saw at graph 11 that for
genus first orders accuracy and confidence were close but that
for the other orders accuracy falls off but confidence doesn't
follow.   The reason is that where the differentia or
association precede the genus subjects have been sent in the
wrong direction so accuracy suffers but they don't realize it

so confidence stays up. The same is true of all the unknown
orders if we look at table 8 and not just those shown on
graphs. This factor also creates the pattern on graph 7 where

Graph 17

Conf/Acc: Unkn Ord cab x info
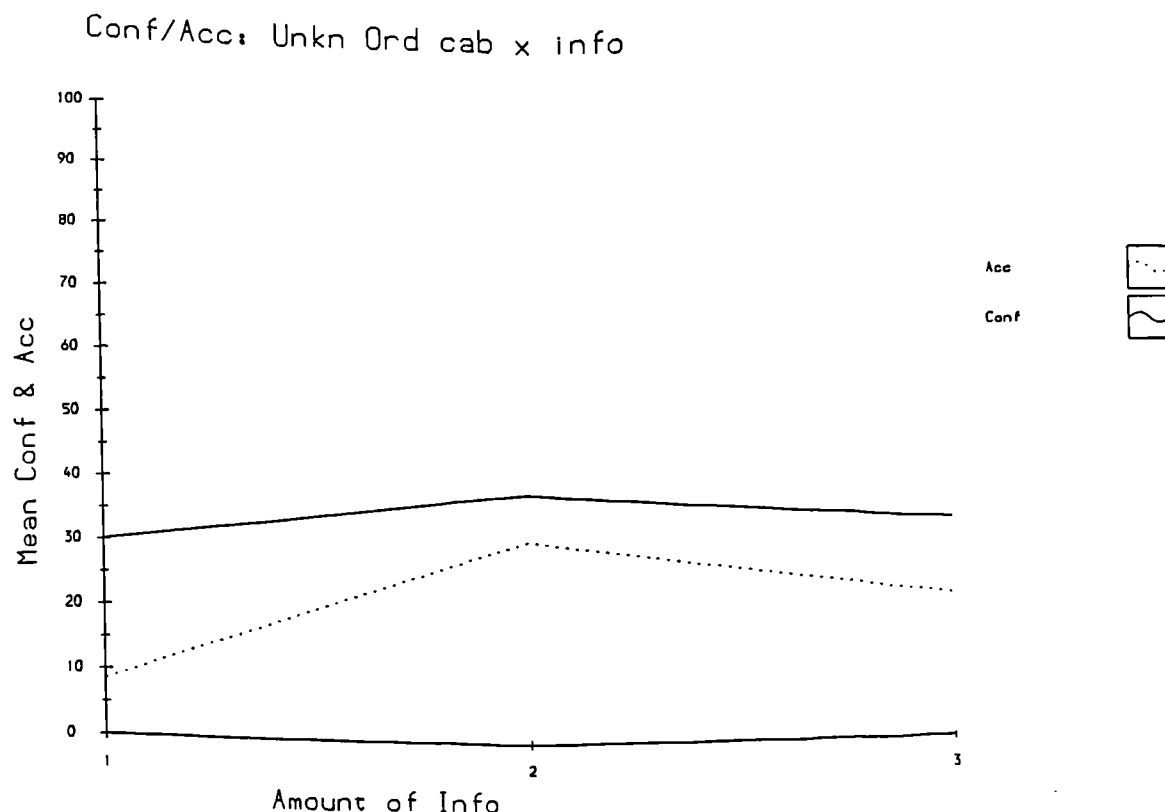
both meaning conditions are combined. (A similar argument can
be used to show why confidence does not follow uncertainty on
graph 8. Subjects have to change guess to correct their
initial error, but since at cue 1 they aren't aware of the
error, confidence doesn't suffer. I won't pursue this here).

The reason why bac on unknowns is a little lower than
other orders for confidence on graph 9 is due to the ba

combination. The differentia sends them in the wrong direction and powerfully so, the genus tries to send them in the right direction but it has to counteract the strength of the initial differentia and this creates a measure of confusion.

Incidentally, if we look at the confidence means at Result 16a we would expect the differentias in both unknown and known meanings to produce the same confidence score when they come in first position. Interestingly, the unknown differentias are lower than the knowns. The cause is likely to be that subjects saw the same targets a second time. Although there was a lapse of two weeks, it might be that subjects remembered those differentia cues in first place which seemed to be good cues but which then turned out to be not so helpful and this has lowered their confidence. Despite this artificial lowering of confidence on the differentia in first place, confidence is still out of proportion to accuracy where differentia precedes genus and I would therefore expect this problem to be more severe in real life.

What we can say, then, with respect to intuitions as to difficulty where unknown meanings or inconsistent information is involved is that as graph 4 shows subjects do have such intuitions. These intuitions seem to be founded on an understanding that the genus is the strongest cue. Where the genus comes first accuracy and confidence in this accuracy is quickly established and subsequent cues don't have the strength to disrupt this relationship. Where differentia and association come first, subjects are tricked. There is a

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problem of <u>overconfidence</u> in that confidence does not seem to reflect the probability of being correct. (See Peterson and Pitz (1986) for a more sophisticated definition of <u>overconfidence</u>). But when the genus comes into play and combines with these cues then subjects become aware of this and the genus dominates these other cues. The initial problem does decrease accuracy and and increase uncertainty scores for non genus first orders but the way in which this is repaired together with the way confidence does match accuracy and uncertainty overall when order is not an issue does support the conclusion as shown on graph 4 that when dealing with guessing unknowns by means of viewing such targets as combinations of inconsistent information, subjects are broadly aware of difficulty.

One point we might consider is that we could try to repair the damage done by differentia and association initially by teaching students to guess in genus first orders. We might see this as teaching a plan for guessing as say proposed by Faerch and Kasper (1983 & 1984). We would be making subjects aware or conscious of the potential of an order and giving them knowledge they seem to lack. It might even be worth trying to raise such a plan to the status of script as described by Widdowson (1983 p. 56) in terms of having a series of goal directed actions "conventionalized" and "established as a routine".

However, we need to be careful. This idea of not realizing one has been sent in the wrong direction on unknown

meanings affects the total accuracy scores on the orders, but does it affect the finishing points for each order on the third cue? In other words, do following different orders affect outcomes? I'll look just at unknown meanings here. The finishing points are given below at table 9 for confidence and accuracy.

Table 9
Means on cue 3 for the unknown orders

	abc	acb	bac	bca	cab	cba
Confidence	2.043	1.866	2.049	2.573	2.104	2.482
Accuracy	.543	.543	.488	.640	.457	.634

In fact, I think it is fair to say that there are no drastic differences in finishing points for confidence and accuracy as shown on table 9, but it is noticeable that orders bca and cba, the two orders which are perhaps at the greatest disadvantage initially since the genus comes last, actually finish higher than the other orders in terms of confidence and accuracy. We'd need another experiment to see if this difference is real, but I can't pursue this here. But we now have the odd paradox of the advantage in finishing point passing to genus last orders. Before coming to the consequences for planning let's try and think of an explanation for this.

How, then, might order effect final rather than total outcome in guessing unknown meanings bearing in mind that the genus last examples seem to be slightly more powerful in terms

of their finishing points on cue 3?

One possible explanation is as follows. Let's stay with verb target 7: This is to worship, this is done in a frenzy, primitive tribes do this sometimes. If we guess in the order acb we might go: pray off cue 1. Realise that it's wrong on cue 2 and go for sacrifice. Both answers give an accuracy of 1 and reasonable confidence. Then off cue 3 we get in a bit of a tangle. Sacrifice won't fit properly because not all sacrifices are frenzied. We then perhaps abandon guessing completely or stay with the sacrifice option as the best we can do. The end result is to abandon or distort information and give a single word answer bringing down confidence and possibly bringing down accuracy to 0 if we abandon guessing or keep them at 1 accuracy and low confidence if we retain sacrifice. If we went cba, however, we might get war dance off the first two cues which gives 0 accuracy but reasonable confidence. Then the third cue gives worship, we look at options like pray but they immediately get excluded by the preceding cues and so we realize that we simply can't make the guess more specific but must hang onto worship. We then see that the notion of dancing can be attached, to give worship by dancing. The genus in last place might act as a form of "buffer" which stops processing so that previous hypotheses get attached to it. Possibly processing effects like this migh help overcome to an extent suspicion in a new combibination. Also, this does not mean that we can't form complex hypotheses in non genus last orders, but it may be easier to form a complex hypothesis when

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the genus comes last as opposed to when it comes first.

Unfortunately, as we've seen, subjects do not use the phrasal option to build new meanings to any great extent. Whilst the points about ease of forming a complex hypothesis when the genus or strongest cue comes last is interesting and worth researching further, I do not think it explains the superiority we see in terms of finishing points for genus last orders we have in this experiment.

Let's bring back uncertainty on the significant interaction of meaning by information by order (Result 16c) and see if it will help. The interesting interactions are in the unknown meaning section. The means are given at table 10 to save referring back.

Table 10
Means for unknown orders across information for uncertainty

	abc	acb	bac	bca	cab	cba
2 amounts	1.329	1.061	1.622	1.366	1.555	1.604
3 amounts	1.067	1.384	1.238	1.384	1.311	1.384

One incidental point here. Earlier I mentioned that in terms of overall score for each order the genus first orders had an uncertainty which was more appropriate to confidence than other orders. This was because where the genus did not come in first place subjects were misled and had to change guess at cue 2. We can see that the pattern of results at 2 amounts on table 10 fits this explanation since the genus first orders have the lowest uncertainty.

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The interesting point here, however, is that the interactions fall into neat pairs across information: abc/acb, bac/bca, cab/cba. What we see is that abc falls and acb rises. Similarly, bac falls and bca rises, cutting across it. The final interaction is not so strong; cab falls but cba falls less strongly. It's really the last two pairs we're interested in since they contain the orders which place the genus last so let's look at these first.

It could be that within the last two pairs, those orders which rise or fall weakly ie. bca and cba, have subjects giving up more than on their counterparts. I suspect not. The two orders, bca and cba as noted above finish higher on confidence and accuracy. This superiority could not exist if subjects were giving up guessing more. The contrast within these pairs is due to the fact that getting a genus early is perhaps not such a great advantage as one might think since the only moves one can subsequently make are either to try to build a new meaning by use of a phrase or hang on to or make small changes to the previous single word guess. This latter course is the more frequent and is probably the cause of the falls in uncertainty on bac and cab where the genus comes early. Neither option is that satisfactory and confidence gets erroded as does accuracy by the small changes which are made in the genus guess. With orders which delay the genus: bca and cba, the guesser will have a single word guess which he can hold or exchange for another single word guess. Then the genus comes and because it is the strongest cue we get another change to a

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single word guess, rather than holding the same guess. This change is a much more substantial one than those noted in the other orders in the pairs since subjects now have to change away from cues which have misdirected them. So uncertainty is high at this point. So also accuracy gets a slight boost where the genus comes last since it over rules previous cues and gets subjects into the correct family. Confidence also gets a slight boost since subjects probably feel safe with a guess that clearly lies within a specific family.

Also, if we go back to the pair abc/acb then b is stronger than c and encourages more change in the original genus guess. So the first of these orders falls and the second rises. But again the initial genus guess is being erroded somewhat.

The trouble is that as far as planning an unknown meaning order goes we are now in a somewhat tangled situation. One set of arguments show that genus first is superior in terms of total scores whilst another set suggests that genus last is better in terms of finishing point. What I would suggest is that the genus cue stands out as powerful and subject have good intuitions about it. The other cues simply seem to interfere with the genus either by sending subjects in the wrong direction when they appear before the genus or by eroding the genus guess when they come later. My suggestion is that the best planning strategy to adopt is to gather the available cues, but not make a guess at this stage. This would limit the danger of being tricked by differentia or association in first

place. The genus cue should then be looked for and a guess made from it alone. The rest of the cues being abandoned. This to some extent in effect is what subjects seem to do naturally. Abandoning information, almost always the differentia and association cues, was seen as the most frequent single word response out of the three types of single word response. Even if we should decide to put forcing (a strategy which we might wish to discourage now) and not spotting inconsistency together as variants of one type of response then abandoning is still a very frequent response type. All we add to it is the refinement that they collect cues before making a guess and a little encouragement not to force cues together. We do, therefore, seem to have a plan which could be taught on unknown meanings but it does not involve order but rather is based on limiting amount of information by going for a specific type. This suits the principle of costs and benefits since it gives a decent return for not too much effort. Also it seems to accord with the findings of van Parreren and Schouten-van Parreren (1981) who found that subjects tended to limit amount of information rather than go for order based strategies.

Part of speech: We have two parts of speech: nouns and verbs. I proposed at predictions 1, 2 and 3c that nouns would be easier to guess than verbs since the association cue to nouns is a verbal collocations. Such collocations, I have suggested, might produce a set of closely related hypotheses because of the presence of selection restrictions. They are

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intra selectional.

There is a significant result on the main effect, see Result 3 where the means are given for all three dependent variables. Nouns produce more confidence, more accuracy and less uncertainty than verbs. It looks as though we might be on the right track.

We also have a result for the interaction for part of speech by information for confidence and uncertainty but not accuracy. See result 7 for means. For uncertainty, we would expect the noun means to be below the verb at each amount of information if the association is having an´ uniform effect. This we get, but remember we lack a result for 1 amount of information. For confidence, we would expect the noun means to be above the verb at each amount. This we get at two and three amounts but the position reverses at one amount.

We can see more clearly what's happened on the interaction of meaning by part of speech by information, Result 9. The only significant result is on confidence. The means are on graph 18. Although nouns seem superior to verbs at two and three amounts, both parts of speech start off equal at one amount on the known meanings and with verbs superior on unknown meanings. We would expect nouns to be superior at one amount as well as two and three amounts if association is having an effect.

From talking to subjects, it quickly became apparent that the problem lay in the use of the word This in the cues to the

verbs. It confused subjects as to whether they were guessing

verbs or nouns. Also, it seemed to confuse more in

Graph 18

Conf: PtSpch x Meaning x Info
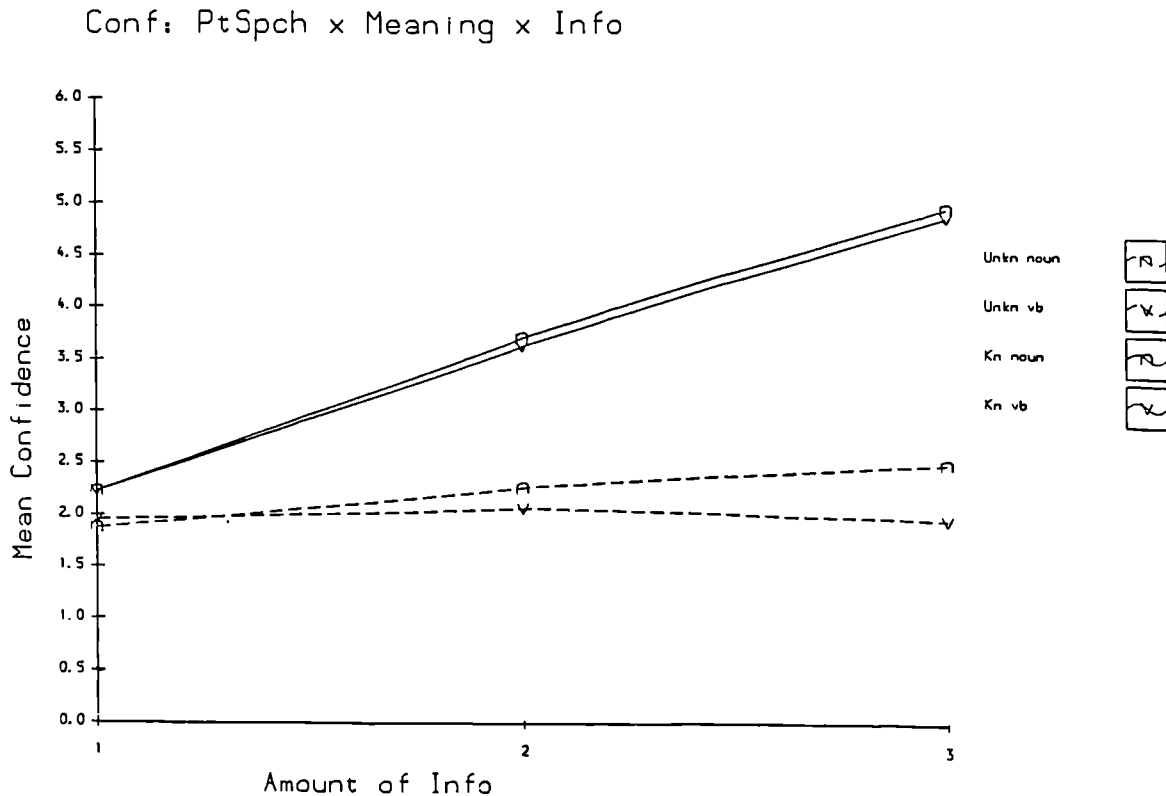
the genus cue than the others. There is the infinitive in the

cue This is to, but nevertheless subjects did seem to get

confused. Since the probability of getting a genus at one

amount is one in three the effect is not drastic; nouns and

verbs are almost at the same starting point and the slight

superiority of unknown verbs may just be accidental. As more

cues are given, the probability of getting this confusing genus

increases and the verb line on knowns and unknowns falls away

from the noun.   Subject's are having to think harder about the verb targets and put in more processing effort. The fact that we have a main effect on accuracy and confidence suggests that this extra effort is persuading subjects to give up. This giving up happens on the unknowns rather than the knowns and at three amounts of information. This is suggested by the way the separation between noun and verb lines is so much more pronounced on unknown meanings as opposed to known meanings. Although the confidence lines separate for known meanings, I suspect that for accuracy they would not.

The superiority of nouns over verbs that we see in the main effect is not a product of the association cues. Rather it's an experimental effect produced by the phrasing of the verb cues. This is unfortunate since we noted in the section on order that the association in the unknown condition was somewhat misdirective. So where the association is a verb, rather than helping us to guess noun targets it might hinder. The reverse being the case for known meanings.

Conclusions

In guessing known meanings we recognize the familiar relationships between cues and combine them to gradually narrow down the range of hypotheses until, if we are completely successful we arrive at only one possibility, this hypothesis being a word form. Confidence and accuracy rise together so subjects seem to have good intuitions about accuracy.

Uncertainty falls fairly steeply to complement this picture. As subjects feel they are on the right track they seem less willing to entertain alternative hypotheses .

In guessing unknown meanings the first question is: Do subjects lexicalise cues to form single word hypotheses or do they construct new meanings or complex hypotheses? The evidence suggests that they lexicalise cues. We must remember the problem that subjects might see the experiment task as vacuous if they do not use the cues. But as pointed out, this need not drive them to lexicalise cues as there is still the opportunity to use them to build new meanings, albeit at a more "specific" level than intended.

Subjects, when guessing unknown meanings, are still, then, in the main pursuing a single hypothesis or word form rather than a complex hypothesis or meaning. The guessing process on the unknown targets is similar to that on the knowns. Subjects use a cue to get a word hypothesis. They then try to use subsequent cues to reinforce or change to another single hypothesis. However, either at cue 2 or mainly cue 3 they hit a problem in that information can no longer be properly lexicalised by combining cues. At this point, rather than switch to building up a new meaning/complex hypothesis they stay within the framework of guessing known meanings and lexicalise the target by adopting one of two strategies. They can abandon information, most often the differentia though sometimes the association. Or they can force cues together. When forcing takes place the differentia appears to be

downgraded to an association and is no longer seen as a part of the core meaning. In doing this, subjects seem able to retain some kind of familiar or plausible relationship between the cues as though they are dealing with a known meaning. Forcing cues together though is dangerous since inconsistency might not be perceived with the result that subjects can get drawn into overconfidence. On the whole though subjects do seem to have good intuitions about their accuracy. Uncertainty also reveals the struggle to deal with perceived inconsistent information in that it falls less sharply for unknown meanings.

As to forms, the presence of a pseudoword seemed to attract some processing effort in that subjects seemed to some extent to be led into a slightly non typical response in the presence of a strange form at cues 1 and 2. At cue three on known targets, when the third cue comes in and it fits a known form then the pseudoword is seen as a trick and ignored. With unknown meaning, when inconsistency appears, the pseudoword is simply an added difficulty which pushes subjects towards abandoning information. This is most likely on the third cue. Again, if information is abandoned then the last guess made is most probably going to be taken as a fair synonym for the target so the pseudoword again gets ignored. In both known and unknown meaning conditions, it seems to me that the pseudoword is ultimately reduced to the status of cloze space.

As to the difference between intra and extra selectional collocations, which I hoped to show up in the noun verb contrast, this failed due to an experimental effect so there is

no conclusion to be drawn here.

As to order, if we look at known targets/consistent information first then we have an interesting result in that bac emerges as superior. It is debatable whether in real life such an order would be exploited. There is a difficulty involved in that cues have to be found and then placed in this order. Given that the advantage or benefit involved is not that great, it is debatable whether subjects will employ this order or whether it is worth teaching such an order. With unknown targets there are also points of interest bearing in mind that subjects are in the main lexicalising these targets. The combination of ba is damaging to confidence but on the whole this effect is small and there is not much difference between orders. With accuracy and uncertainty, genus first orders are clearly superior overall. Subjects seem unaware of this. However, genus last provides a stronger finishing point. What really emerges is that the genus cue is the strongest. The other cues coming before the genus mislead with subjects being unaware of this or coming after they erode the genus guess. The best strategy seems not to involve order but amount and type of information. It is better to find and use the genus cue and leave the others alone. So the best strategy is abandoning and not forcing information.

Finally, the consequences of the experiment, if it does duplicate reasonably what happens in real life are to some extent relevant for the idea that we learn words through guessing. Most of the guesses in the unknown condition are

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familiar single words. If we guess/learn words in this way the language would be full of fairly precise synonyms, something which doesn't seem to be the case. We'd have to go to the dictionary or ask a teacher to complete the process. So guessing can take us only part of the way down the road of learning.

Chapter 7

Using the Ruler Part 3

This chapter deals with the correlations of confidence
and accuracy, confidence and uncertainty and accuracy and
uncertainty. Apart from overall correlations between these
variables, there are a large number of possible correlations
based on factors like amounts of information, known and unknown
meanings etc. and possible interactions. Whilst a large number
of these correlations were looked at, I will confine the
discussion here by identifying a set of topics of relevance to
this study.

The chapter will be structured as follows. First, I will
identify a set of topics for discussion and make some
predictions. Second, I will look at the measures of
association which will be used. Third, I will discuss the
topics identified and see if the predictions are met.

Topics

Overall correlation of confidence and accuracy: In the
last chapter we saw that subjects do appear to have fairly good
intuitions about accuracy. There, however, we were using an
ANOVA and looking at this as an average group phenomenon. Here
we want to know if individuals are consistently more confident
when they are more accurate.

Prediction 1: Confidence and accuracy will correlate
positively. When a subject is more accurate he will be more

confident.

Complex hypotheses vs single word hypotheses: We noted
in the model that in the formation of complex hypotheses,
confidence will be damaged due to suspicion in the new
combination of ideas that form the new meaning. The model
predicts that this problem does not affect accuracy, however so
confidence in complex hypothesis formation should not be
proportionate to accuracy. We can illustrate this by a
comparison with known meanings. So when subjects score a
maximum accuracy of 2 on unknown meanings, (they can only get
this score by forming a complex hypothesis here) their
confidence should be lower than those subjects on known
meanings who also score maximum accuracy. The idea is that
known meaning guessing represents a balanced situation in terms
of costs/benefits and confidence will be appropriate to
accuracy.

Prediction 2: We should find that subjects who form
complex hypotheses on unknown meanings and score an accuracy of
2 should have a substantially lower confidence than those who
score an accuracy of 2 on the formation of single word
hypotheses in the known meaning condition.

The deception of differentias and associations on cue 1
where unknown meanings are lexicalised: In the last chapter we
noted that the differentia tends to be a strong cue on known
meanings since not many words share the same differentia. This
type of cue tends to lead quickly to the correct target. On
unknown meanings we have an unfamiliar combination of genus and

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differentia. If a subject tries to lexicalise a target, the differentia is now much more likely to send him in the wrong direction without him realising. The same is true of the association but to a lesser extent. For example, if we take unknown target 7: To relf: This is to worship, This is done in a frenzy, Primitive tribes do this sometimes, we can see that the differentia is likely to send the subject into single word options like kill, attack etc. which are not related to worship. Also, a similar but perhaps not so drastic effect is produced by the association. Any association has to be compatible with the differentia as well as the genus. It would be strange to suggest monks and nuns as associations of relf. As we see above, the idea of primitive tribes which is compatible with the differentia is more likely to suggest war dance or hunt than forms of worship and again the subject is misdirected. This led to overconfidence where differentia and association came before genus. We can again look at this problem by correlating confidence with accuracy.

Prediction 3: Differentia and association cues will misdirect subjects when they come in first position and when they try to lexicalise an unknown meaning. This leads to overconfidence.

Is changing a guess better policy than holding a guess in terms of accuracy? This is going to involve a correlation of uncertainty and accuracy and clearly, uncertainty is going to be the independent variable. As far as holding guesses goes, we have seen that this can be a response to difficulty but

reflects a somewhat negative attitude. The subject is not sure what guess to make so he holds his last one. In contrast, if one thinks that one has gone wrong, changing does offer the possibility of getting the correct answer.

Prediction 4: Changing guesses should be a better policy with respect to accuracy than holding the same guess.

<u>Does changing a guess generate the same amount of confidence as holding a guess?</u> This involves a correlation of uncertainty and confidence and clearly uncertainty will be the independent variable. Changing guesses should lead to the generation of confidence *just as holding a guess when* information is used. It is interesting to speculate what might have happened had I graded putting no guess as the same as holding the same guess on unknowns. I will leave this topic alone as it is not possible at this stage to regrade the *responses.* On the whole, I would expect both holding and changing to generate equal amounts of confidence.

Prediction 5: Changing a guess should produce the same amount of confidence as holding a guess.

The Correlation Coefficients Used

Before coming to the discussion of the above topics, a word about the correlation coefficients used. Also, to make this discussion more concrete, I am going to illustrate techniques by using the overall correlation of confidence and accuracy so we will also be looking at prediction 1 here.

The first type of coefficient used is Pearson r. Three

assumption lie behind this test. First, the association between the variables is linear. This is the main reason for choosing this test. I wanted to begin by looking at the possibility that the relationships between the variables was a straight line and this statistic is a good indicator of this. The second assumption is that the two variables are continuous. As I've mentioned, we can't say for sure that the variables are continuous since we can't say, for example, that the interval between 1 and 2 confidence is the same as the interval between 2 and 3. It is not uncommon, however, to find researchers make the assumption of continuity where it might not strictly apply and I'm going to do this here. The third assumption is that the scores for the two variables are independent of each other. We would make scores independent by adding together all the responses for each subject (144 responses and 41 subjects in this experiment). This assumption of independence is important if we want to do a significance test on Pearson r but is not so important where we want to use this test only descriptively

Two methods of using Pearson r commend themselves. The first is to take subjects as cases. A total score is given for each subject for confidence accuracy or uncertainty using which ever columns are of interest. For example, we might give a subject a total for verbs and another for nouns on two of the variables. If we take as an example the overall correlation for confidence and accuracy here, we get a coefficient of .084. Very poor in fact. The scattergram is given at graph 1 and we

can see that the line runs flat through the centre of the plots.

Graph 1 <u>Scattergram for Overall Confidence and Accuracy</u>
        c1= confidence
        c2= accuracy
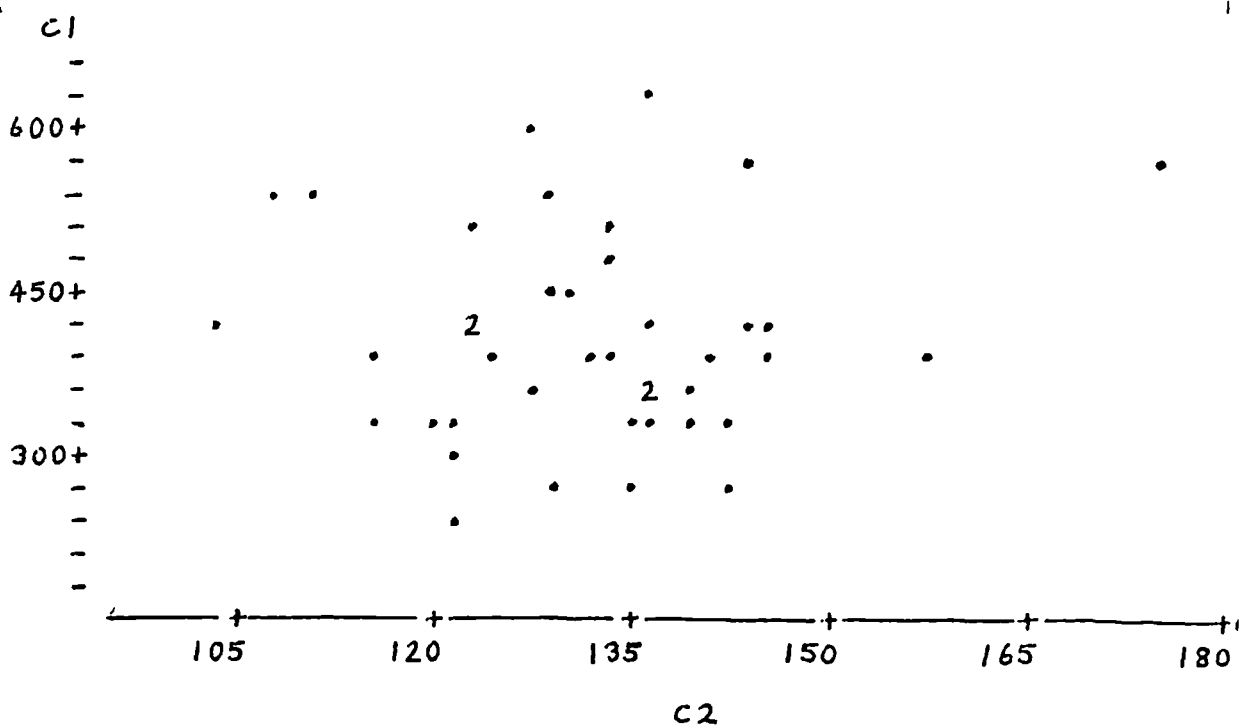
It looks as though prediction 1 has failed rather badly. However, I think it is fair to say that the reason for this failure lies in the method used to obtain the correlation coefficient. The real problem here is that we are rather crudely lumping together 144 different kinds of score for each person. The result is that we end up with 41 scores for the

individual subjects all reflecting a fairly average confidence over a fairly average accuracy which is essentially the picture displayed on the scattergram at graph 1. There is a lot of detail in terms of items such as amounts of information and known/unknown meanings and we need to look at items as well.

A second way, then, in which Pearson r could be used is to take subjects and items as cases. Using again the overall coefficient for confidence and accuracy as an example, the following method can be employed. Imagine the confidence file in the computer; forty one subjects down and one hundred and forty four responses across. In minitab the computer was asked to unstack the columns so that column 2 was placed beneath column 1 etc. The same was done for the accuracy file. The result is two columns 5,904 responses long with these columns containing not just between subjects data but now also within subjects data ie. the items. For example, the response for a subject on one amount of information is present and lower down the columns we get the same subject's responses on two and three amounts all in the same positions for confidence and accuracy. We can now correlate these two columns and the coefficient is now .587 instead of .084. The greater detail provided by the individual items improves the coefficient. If we table the two columns of data we get the distribution given at table 1.

We can't get a useful scattergram for this coefficient now since the accuracy scale in particular is too narrow. We can get an average for each column by multiplying each score by

it's confidence value, adding these scores for each column and dividing by the column total.   These scores/plots are given in table 2.

Table 1
The distribution of confidence and accuracy plots
ROWS= Confidence, COLUMNS= Accuracy

	2310	1788	1806	5904	Totals
6	87	122	642	851	
5	67	138	331	536	
4	151	265	349	765	
3	334	435	248	1017	
2	439	417	155	1011	
1	447	312	64	823	
0	785	99	17	901	
	0	1	2	Totals	

Table 2
Confidence and accuracy plots

Confidence	1.639	2.758	4.441
Accuracy	0	1	2

If we display the plots at table 2 on graph 2 we get a rising line representing the positive correlation coefficient rather than the flat line representing no correlation at graph 1. From now on only plots derived from averaging the columns in the tables will be given for the Pearson r (subjects and items)

coefficients. It will be too cumbersome to keep giving the tables themselves.

What we do see, then, is that when we introduce items we get a stronger correlation because of the greater detail provided by items. Another advantage is that in terms of

Graph 2

Confidence & Accuracy
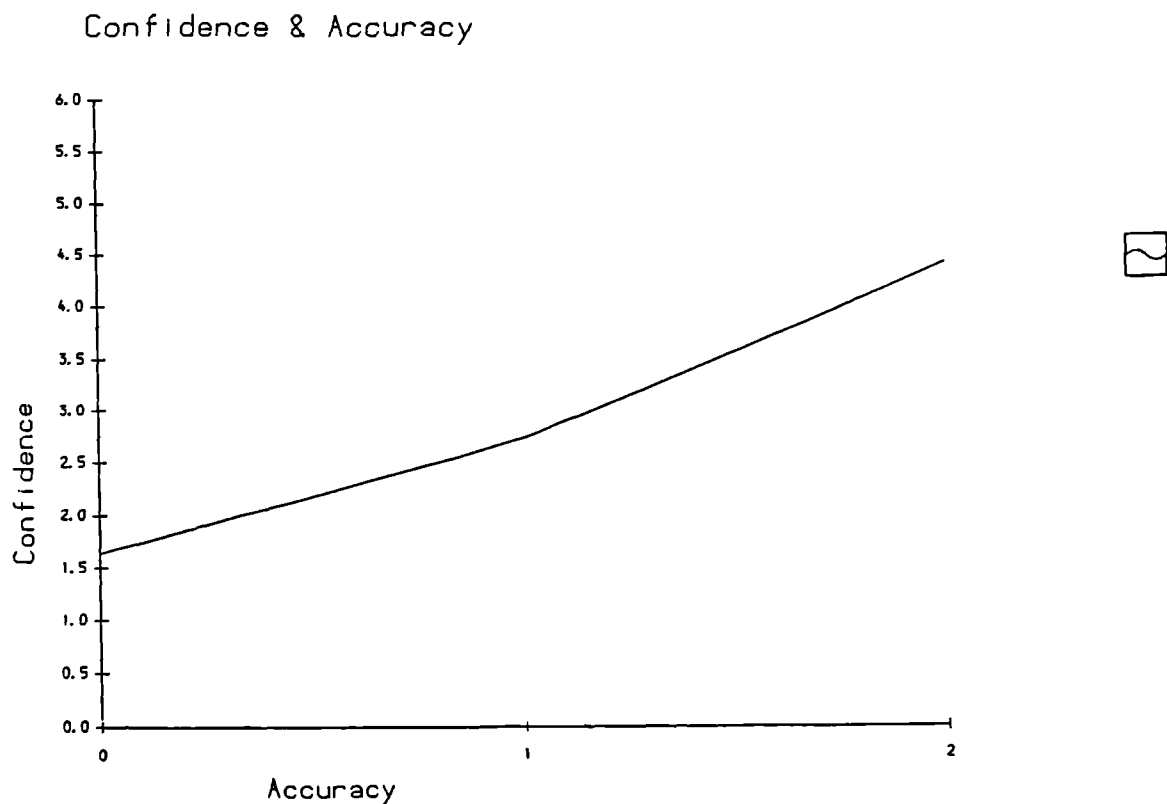
real life we would be interested in the confidence and accuracy of particular people on particular items, not how they perform on average over items. However, by using the subjects and items as cases approach on Pearson r we have the disadvantages of not being able to obtain clear scattergrams and also of not

being able to use a test of significance since scores are now no longer independent of each other.Despite these disadvantages, this approach is to be preferred because of its detail and realism and is the one I will adopt with respect to Pearson r from now on.

In terms of prediction 1, it does look as though we do get a positive correlation between confidence and accuracy. The coefficient is not particularly strong at .587 but we can say that when a subject is confident he also tends to be accurate. One factor which might be interfering with the correlation is different types of subject. Some people are "naturally" more confident than others and the effect of this variation might be to create to some extent lowish confidence scores over high accuracy and highish confidence scores over low accuracy thus spoiling to an extent the correlation.

We are, however, still exploring only the possibility of a linear relationship. Just in case, however, the relationship between the variables is not a straight line but a curve, I thought it desirable to cover Pearson r with a second measure of association more responsive to a curve. This measure being Goodman and Kruskal's gamma. This test is used on the same data of subjects and items as cases as Pearson r. Should this statistic give stronger results than Pearson r it might be taken as an indication that the relationship is curved rather than linear. Also, this statistic is slightly more generous than Pearson r. Therefore, a small increase of this result above Pearson r can not be taken as support for a curve rather

than a line.   Note that the overall measure of agreement for
gamma between confidence and accuracy is, .643, only marginally
above the Pearson r coefficient of .587 on the same data.
Probably not a sufficient increase to claim the presence of a
curve rather than a straight line.

Discussion

Complex hypotheses vs single word hypotheses:
The first question concerns those subjects on the unknown
meanings who were able to construct a reasonable meaning in the
form of a complex hypothesis for the targets.   Such subjects
score 2 accuracy.   But does the accuracy of these subjects
produce the same amount of confidence as it does for those who
score 2 on the known meanings.   Prediction 2 suggests not.   In
the known meaning condition the cues all support a single
hypothesis.   In the unknown condition, we have an unfamiliar
combination and there will be a sense of suspicion in the
complex hypothesis.   This will undermine confidence relative to
the known condition where maximum accuracy is achieved so that
we can say that subjects are somewhat underconfident where new
meanings are formed.

It is possible to use either accuracy or confidence as
the independent or explanatory variable.   I will choose
accuracy.   It is more reasonable to view high or low accuracy
as producing high or low confidence.   Also, it is variations
in confidence on the same level of accuracy that we are

interested in.

Are subjects who score high on accuracy in constructing unknown meanings at a disadvantage as far as confidence is concerned in contrast to similar subjects guessing known meanings? The first place to look at this topic is the overall contrast between known and unknown meanings. The coefficients are given in table 3.

Table 3
Known and unknown meaning coefficients

	Unknown meanings	Known meanings
r	.345	.591
g	.473	.681

We can see that on both measures of association, unknown meaning coefficients are weaker than the known so there is a contrast. People are simply not such good judges of their accuracy on unknowns. The distribution of plots for the Pearson r coefficient for known and unknown meanings is given in table 4. These means are displayed on graph 3.

What we see on graph 3 is that confidence falls off for the unknowns in contrast to known meanings at an accuracy of 2, so it looks as though those people who achieve a high level of accuracy on unknown meanings are suffering some kind of "confidence failure" in contrast to their known meaning

Table 4

The distribution of plots for known and unknown meanings

Unknown Meanings

Confidence	1.568	2.708	3.286
Accuracy	0	1	2

Known Meanings

Confidence	1.828	2.850	4.567
Accuracy	0	1	2

counterparts. The unknown meanings generate about 1.3 or 28%

Graph 3

Confidence and Accuracy x Meaning
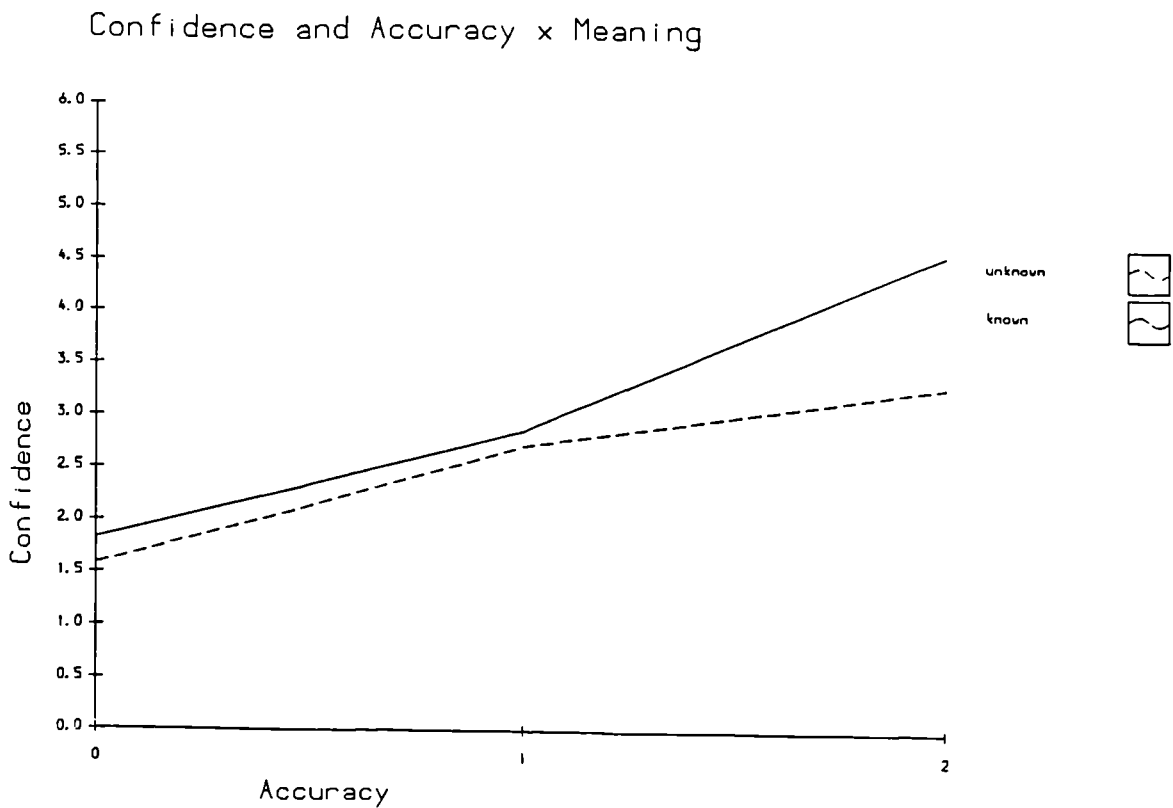
less confidence than the knowns. It is a substantial difference and does support prediction 2.

As to whether the lines for the coefficients are curved, it looks as though for known meanings we have an upward curve and for the unknowns a downward curve. Possibly, for the known meanings, subjects have strong intuitions about correctness at accuracy 0 and 2 but are less sure at 1. With unknown meanings the caution subjects feel in new meanings is bending the line downwards at accuracy 2 in contrast to the known meaning line at this point. The difference between gamma and Pearson r for known meanings is 0.09 and for unknown meanings is 0.128. This isn't a dramatic advantage for gamma and I don't think we should read too much into it. At best we can say that gamma shows a similar advantage on both types of meaning and that the known meaning coefficient might just be slightly concave and the unknown meaning, slightly convex.

The next place to look for support for this idea is meaning by amount of information. I'm going to focus on the third amount of information since it is here that we are going to find the highest accuracy scores. Table 5 gives the coefficients we need.

Table 5
Coefficients for known and unknown meanings on the third amount of information.

	Unknown meanings	Known meanings
r	.449	.632
g	.580	.760

We can see that for Pearson r and gamma that the unknown meaning correlation is weaker than the known. Subjects are again not such good judges of their accuracy on the unknowns. The plots for columns are given in table 6.

The means on table 6 are displayed on graph 4. We again see confidence on the unknown meanings fall quite substantially below confidence on the known meanings at an accuracy of 2 as at graph 3. Unknown meanings are about 1.8 or

Table 6
Confidence and accuracy plots for the 3rd amount of information

Confidence unknown meanings	1.295	3.143	3.534
Accuracy unknown meanings	0	1	2
Confidence known meanings	2.109	3.891	5.367
Accuracy known meanings	0	1	2

34% lower than knowns on an accuracy of 2. Again a substantial difference.

Suspicion in the components of a complex hypothesis is handicapping confidence on unknowns when subjects are actually accurate. Whereas on the known meanings we'd get a confidence progression of 2->4->6, on the unknowns we'd get 2->3->5. There being no difference on cue 1 since the pseudoword which would occur more naturally in the unknown condition rather than the known only has a small effect. There will, then, be a sense of underconfidence where new meanings are guessed. Probably subjects are reluctant to use such complex hypotheses

because of this. A good policy would be to follow guessing by checking in a dictionary.

Graph 4

Conf/Acc x meaning x 3rd am Info
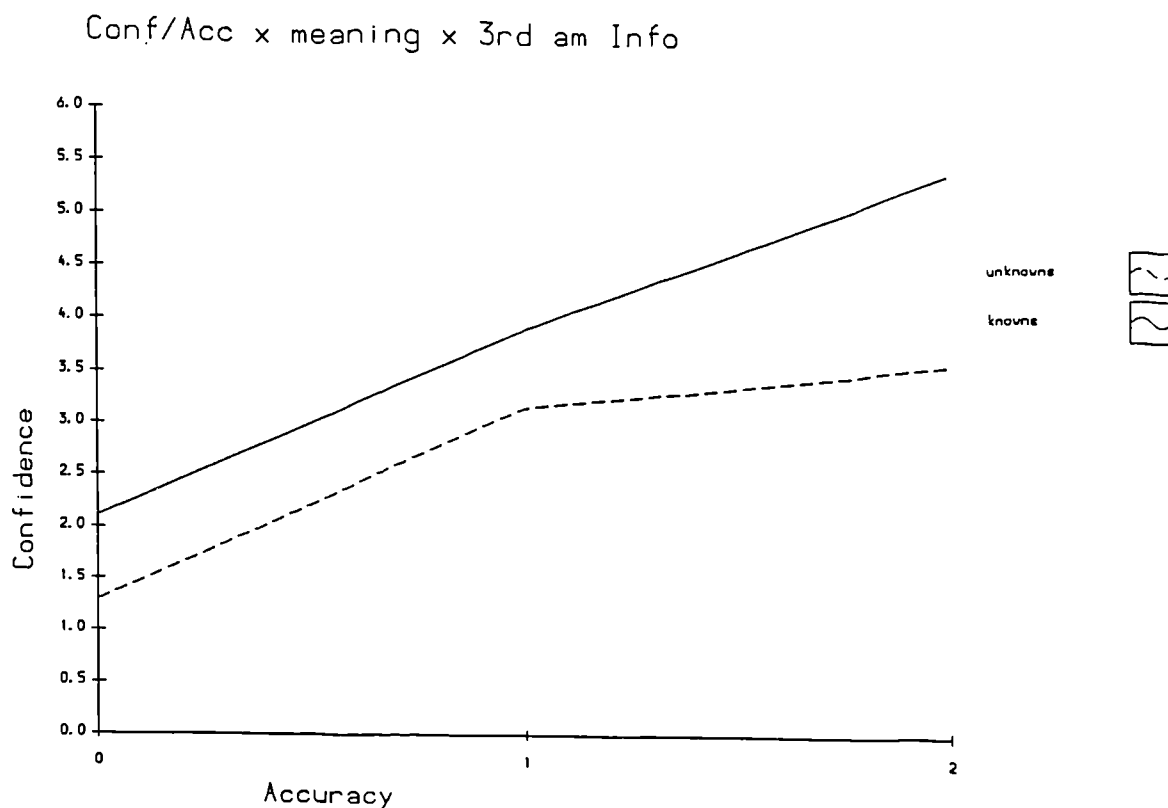
Finally, we could ask whether the line for the unknown meanings on graph 4 is more of a curve than that for known meanings. The differences between gamma and Pearson r for the unknown meanings is .131. Again, the difference is slight. Also note that the advantage for gamma on the known meanings is .128, almost the same as for unknown meanings, yet the known meanings are represented more clearly by a straight line. We don't really have any supporting evidence that the line for

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unknown meanings on graph 4 is truly curved.

The deception of differentia and association on cue 1
where unknown meanings are lexicalised: To move now to the
second question. Prediction 3 claims that subjects on unknown
meanings are being deceived by the differentia and association
in first position. This involves the correlation of confidence
and accuracy. I'll simply use Pearson r here.

The first thing we need to establish is how subjects
behave at low amounts of information normally. If we look at
known meanings by amount of information we get the coefficients
given at table 7.

Table 7
coefficients for known meanings by amount of information

	1 amount	2 amounts	3 amounts
r	.366	.495	.632

The correlations between confidence and accuracy get stronger
as information increases. But how? The average amounts of
confidence for the accuracy scores is given at table 8. These
means are displayed on graph 5. Essentially, the picture we
get is one of subjects exercising a degree of caution. Those
who get an accuracy of 1 are less confident on two amounts of
information than on three and again on one amount than two.
Yet even on 1 amount there is an awareness of accuracy. Those
who score an accuracy of 1 are a little more confident than

those who score 0 and again there is another increase at 2.
This then, I would suggest, is a fairly expected description of

Table 8
Confidence and accuracy plots for known meanings by information

	Accuracy		
	0	1	2
Confidence 1 amount	1.685	2.133	3.086
Confidence 2 amounts	2.049	3.207	4.165
Confidence 3 amounts	2.109	3.891	5.364

the relationship between confidence and accuracy. Subjects seem to have some awareness even at low amounts of information, they know that they've got a little muddled or have taken a wild guess. One interesting point is that over 0 accuracy confidence still rises very slightly with information. Possibly some subjects have gone wrong and don't realize it. This would not be frequent though as confidence would go a lot higher. Probably also subjects like to hold onto a vestige of confidence even when they suspect they have gone wrong and this has contributed.

If we move now to unknown meanings by amount of information and look at the various orders. The coefficients are in table 9.

Graph 5

Conf/Acc: KnMeaning x Info

	abc	acb	bac	bca	cab	cba
1 amount	.249	.221	.117	-.080	.239	.262
2 amounts	.309	.473	.351	.032	.358	.199
3 amounts	.459	.503	.491	.363	.438	.436
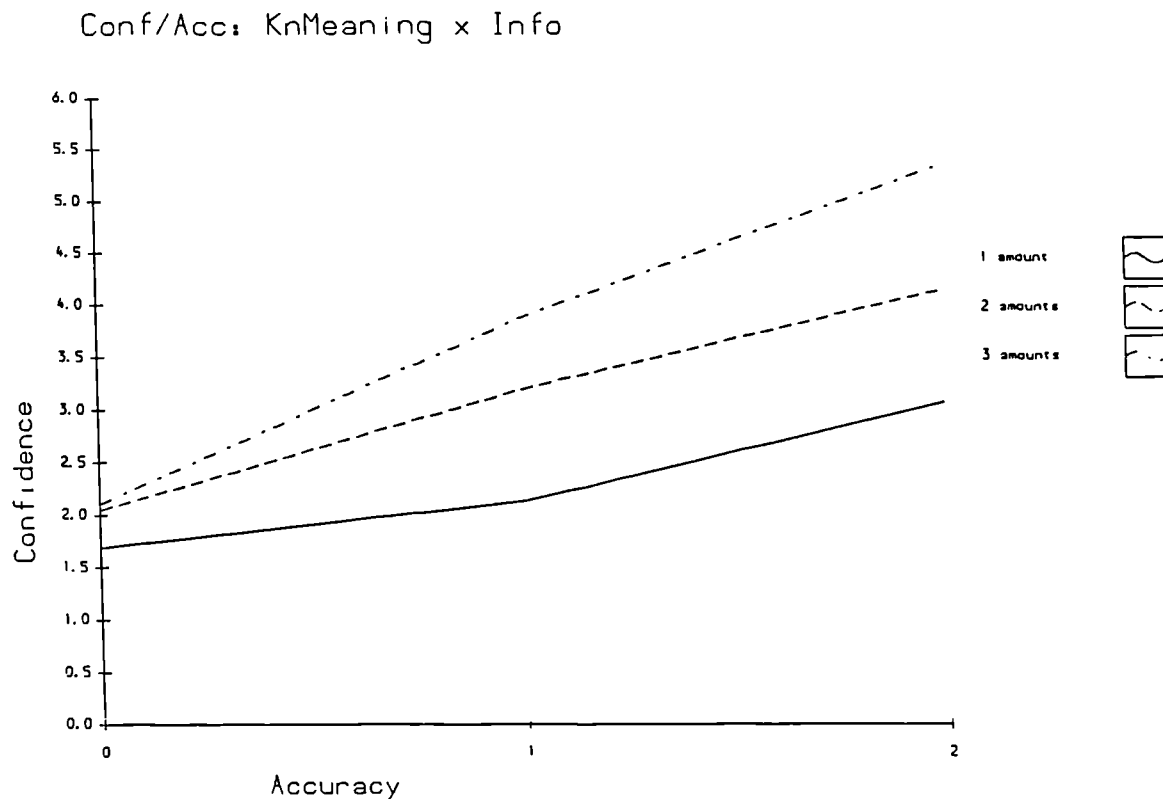
Table 9

Pearson r coefficients for order by unknown meaning by amounts of information.

The first thing to note is that at three amounts of information, all orders emerge pretty much the same. Given that we are dealing with descriptive correlations and fairly low power ones, if we rounded all scores correct to the first decimal place we get .4 to .5 for all and there is no clear

superiority for genus first orders since order bac is stronger than abc. Whatever happens at low amounts of information doesn't substantially interfere with the outcome of the various orders. Table 10 gives the average amounts of confidence for accuracy levels of 0 and 1 for all the unknown meaning orders on one amount of information together with the number of responses falling at each point.

What we get is essentially the same picture as on graph 5 at 1 amount of information. Subjects are slightly higher in confidence on 1 amount at accuracy 1 as opposed to accuracy 0, but it's not by a great deal. In other words, they have some intuition about accuracy but are exercising caution. On the surface, the unknown orders are not behaving much differently from the more general effect for known meanings. But look at the distribution of responses. On the genus first orders, confidence was generally rewarded by an accuracy of 1,

Table 10

Confidence and accuracy plots and numbers of responses for unknown orders at 1am .

KEY ( )= number of responses

Confidence for orders	Accuracy	
	0	1
abc	1.423 (26)	2.255 (137)
acb	1.684 (38)	2.320 (125)
bac	1.702 (148)	2.466 (15)
bca	1.825 (149)	1.428 (14)
cab	1.647 (136)	2.607 (28)
cba	1.603 (121)	2.418 (43)

and it is here we have the bulk of the responses, but on the other orders the great bulk of the responses, get an accuracy of 0. These responses which score an accuracy of 0 may be a little lower in confidence than those that score 1 within the appropriate order, but this degree of caution is not really appropriate to the numbers of subjects/responses which are getting accuracy 0. (Note also that where a pair of orders start with the same cue, confidence should be equal over the same accuracy. This is so where numbers of responses are high. Where numbers of responses are low, confidence scores fluctuate most noticeably on $\underline{b}$ at accuracy of 1. Note that with known meanings by information as given in table 8 the number of responses for each level of accuracy are much more evenly spread. These are given at table 11 for one amount of information.

Table 11
Confidence, accuracy and number of responses on 1 amount of information for known targets.

Accuracy	0	1	2
Confidence	1.685	2.133	3.086
Responses	401	293	290

We can see that there is a better than fifty fifty chance of getting an accuracy of 1 or higher off one amount of information and this warrants some confidence. In the situation on unknown meanings for non genus first orders the odds are probably nearer one in ten for some orders. We are in

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a situation where we are very nearly fooling all of the subjects at 1 amount of information for the non genus first orders and if they were to realize this their confidence would drop to the more appropriate level of near zero. It's probably mistaken belief by subjects that they have a reasonable chance of being correct on the first cue of non genus first orders which was causing the accuracy of these orders to drop below their respective confidence scores in the last chapter. One final point about tables 10 and 9. We can see on table 10 that b first orders attract a larger number of responses on accuracy 0 than c first orders. Also on table 9, it is the b first orders which have the poorest correlations at 1 amount with bca actually going negative. It looks as though the differentia is the main problem as noted in prediction 3. Not that many words share the same differentia. This makes it a strong cue on a known meaning but on an unknown or unfamiliar combination it will mislead strongly. The association, for reasons given in prediction 3 does not mislead so seriously.

However, we can' go on fooling most of the people all of the time and as more information comes in subjects realize their mistake and correct so that the non genus first orders catch up the genus first orders in terms of the strength of the coefficients. Just to show this I'll give the confidence and accuracy scores for the weakest order bca at table 12 and display them on graph 6.

Table 12
Confidence and accuracy plots for unknown order bca by information

	Accuracy		
	0	1	2
Confidence			
1 amount	1.825	1.428	
2 amounts	2.118	2.181	2.500
3 amounts	1.848	3.000	4.050

What we see is essentially a move to a rising line (positive correlation) over information very similar to graph 5 where confidence in an accuracy score of 1 or 2 increases as information increases though we have the interesting point of confidence rising at two amounts of information over an accuracy of 0 and then a correction being made at three amounts. Also, at three amounts of information the increases in confidence are not so dramatic as with known meanings because of the handicap guessing unknown meanings has at high levels of accuracy discussed earlier. Note also that the finishing point for <u>bca</u> on table 12 is 4.050 confidence on accuracy 2 on the third amount of information. This is higher than the average finishing point of 3.534 shown at table 6/graph 4. Despite the slightly weaker coefficient for this order on table 9, the order is effective and there is again the suggestion that genus last orders might be better when it comes to building new meanings as noted in the last chapter.

Essentially, however, the key cue on unknown meanings is the genus since these meanings are lexicalised. The best way

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to tackle the problem of the deception of differentia and association in first place is not to use genus first orders but to find the genus cue and abandon the others.

Graph 6

Conf/Acc: Unknown Ord bac × Info
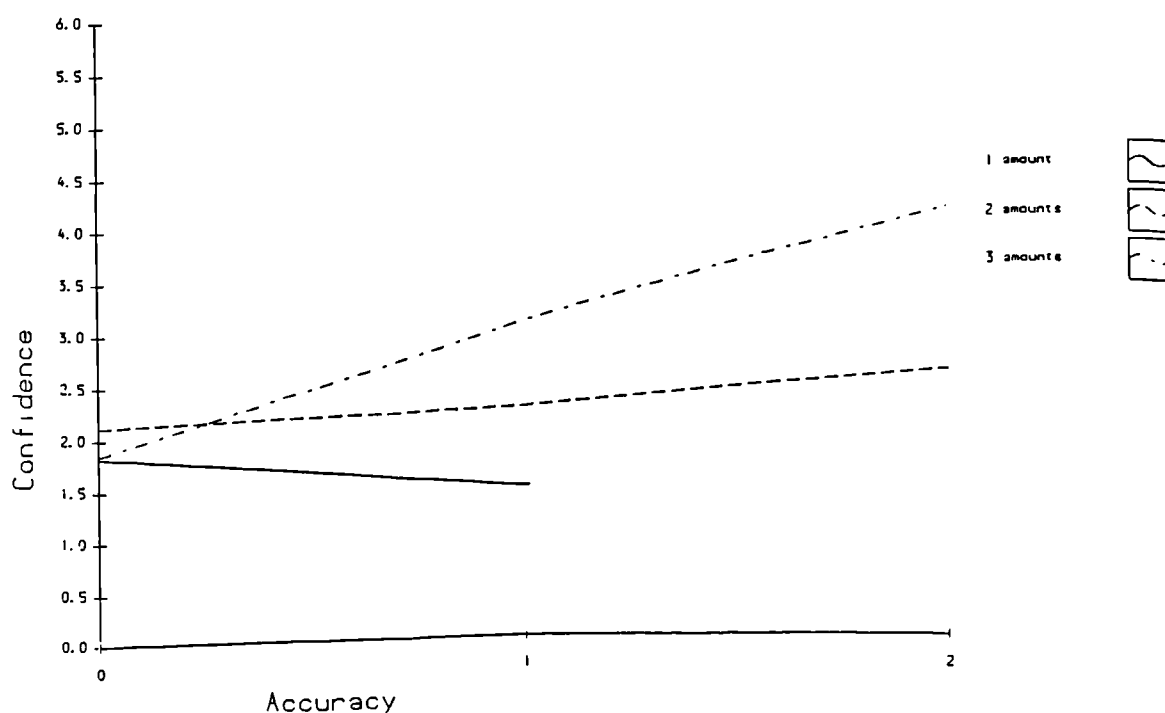
Is changing a guess better policy than holding a guess in terms of accuracy? The way in which uncertainty is measured in this experiment does raise questions of how valid our picture of uncertainty is. It does, however, give a good picture of whether subjects are keeping or changing guesses. If we now bring in the idea of accuracy we can see whether persisting

with an early guess is a "good" policy or not in terms of accuracy. If one sticks with one's first guess is one more likely to be right than if one shows flexibility and be prepared to change one's guess? I would expect the latter to be the case as given in prediction 4. This possibility was brought to my attention by Phil Scholfield who mentioned that he had come across an article on this subject quite some time previous to our conversation. Unfortunately, a search didn't find anything so there is an author I need to acknowledge, but unfortunately I can't pay the debt.

Here, then, we are concerned with the correlation of uncertainty with accuracy and it seems reasonable to take uncertainty as the independent or explanatory variable as this is the factor influencing degrees of accuracy.

The overall correlations for accuracy and uncertainty are give in table 13.

<div align="center">

Table 13
Overall coefficients for accuracy and uncertainty

$r = -.489$

$g = -.629$

</div>

Neither of the coefficients is strong. The stronger result for gamma suggests that the correlation might involve a curve. The most important point is that the correlation is negative. The plots for Pearson r for accuracy over the three values of uncertainty are given at table 14 and displayed at graph 7.

<u>Table 14</u>

<u>Accuracy and uncertainty plots for the overall coefficient</u>

Accuracy	1.490	1.236	0.567
Uncertainty	0	1	2

We can see that there is high accuracy over low uncertainty and low accuracy over high uncertainty. It seems

Graph 7

Accuracy & Uncertainty
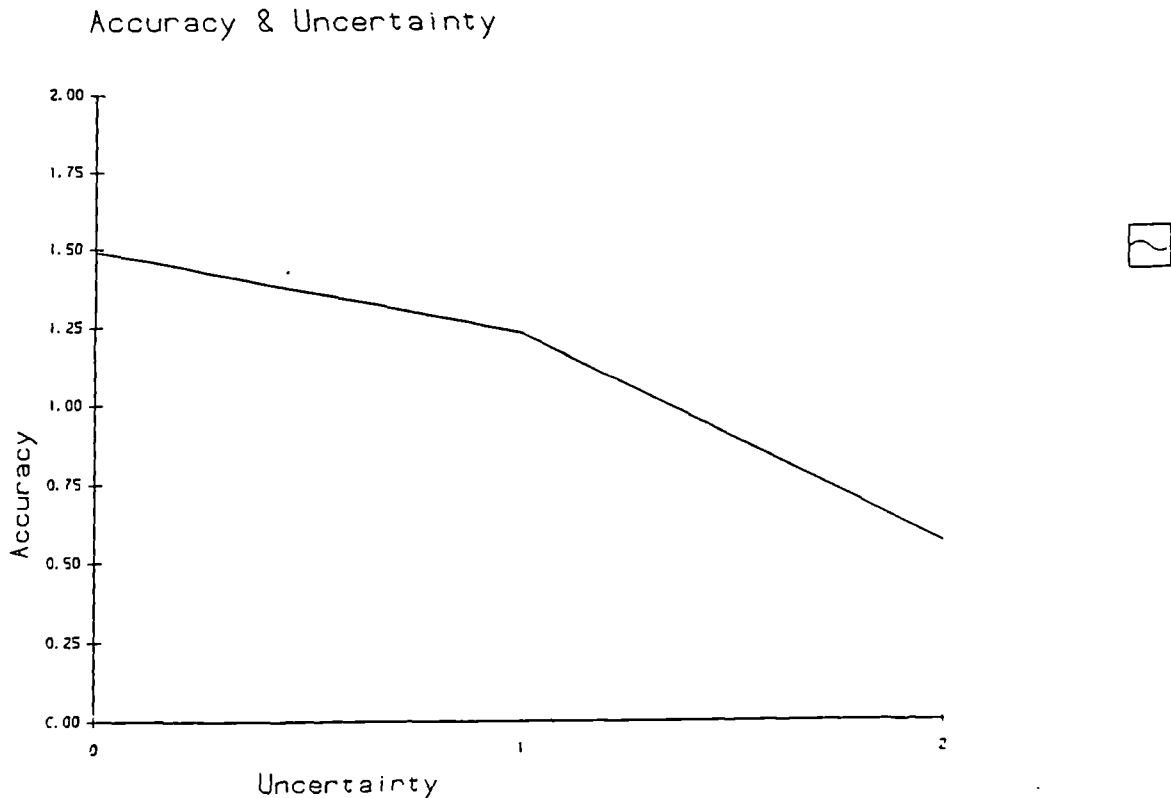
as though holding the same guess is good policy as far as accuracy is concerned at least in this experiment setup. Not something I would have expected. Prediction 4 seems to fail.

We also see on graph 7 that the line of the correlation might involve something of a curve, brought on by a steeper decline between 1 and 2 uncertainty as opposed to 0 and 1. The higher gamma value might lend some support to this.

It seems likely that the known/unknown meaning distinction is influencing this result, however. On the unknown meanings, subjects gave up and scored 0 accuracy and 2 uncertainty. This fact could be causing the more steeply falling section that creates the curve on graph 7 and creating low accuracy over high uncertainty. Also, with the known meanings, subjects got to the correct answer quite quickly as a rule so they wouldn't really see any point in changing guesses and this could be producing the high accuracy over low uncertainty with some subjects getting a little confused and producing low accuracy over high uncertainty. In other words the overall correlations could owe their negative values, to some extent, to a combined effect for known and unknown meanings.

Let's turn to the meaning distinction, then. The coefficients are in table 15.

Table 15
Coefficients for types of meaning

	Unknown meanings	Known meanings
r	-.321	-.391
g	-.539	-.572

Negative values are present throughout. The plots for accuracy and uncertainty for the coefficients are given at table 16. The means at table 16 are displayed on graph 8.

Table 16
Accuracy and uncertainty plots for types of meaning

Unknown meanings

Accuracy	.726	.861	.323
Uncertainty	0	1	2

Known meanings

Accuracy	1.802	1.586	1.134
Uncertainty	0	1	2

If we look at graph 8 for unknown meanings it looks like there's a curve there and the higher value of gamma in table 15 supports this. The low accuracy at low uncertainty tells us that subjects are in difficulty here. The curve shows us what they can do about it. If they hold a guess then clearly, they can't get out of trouble. If they switch guesses they get an increase in accuracy so that the line for unknown meanings starts to rise. This is probably caused by the differentia and association cues in first place sending subjects initially in the wrong direction. The subsequent fall producing low accuracy over high uncertainty is caused more by subjects giving up than by switching guesses although there may be an element of drastic changes in an attempt to get out of difficulty. What the uncertainty 1 plot with its higher

accuracy shows is that subjects seem quite able, <u>if the</u> <u>situation necessitates</u>, to change guesses to increase accuracy.

Graph 8

Acc & Unc: Meaning
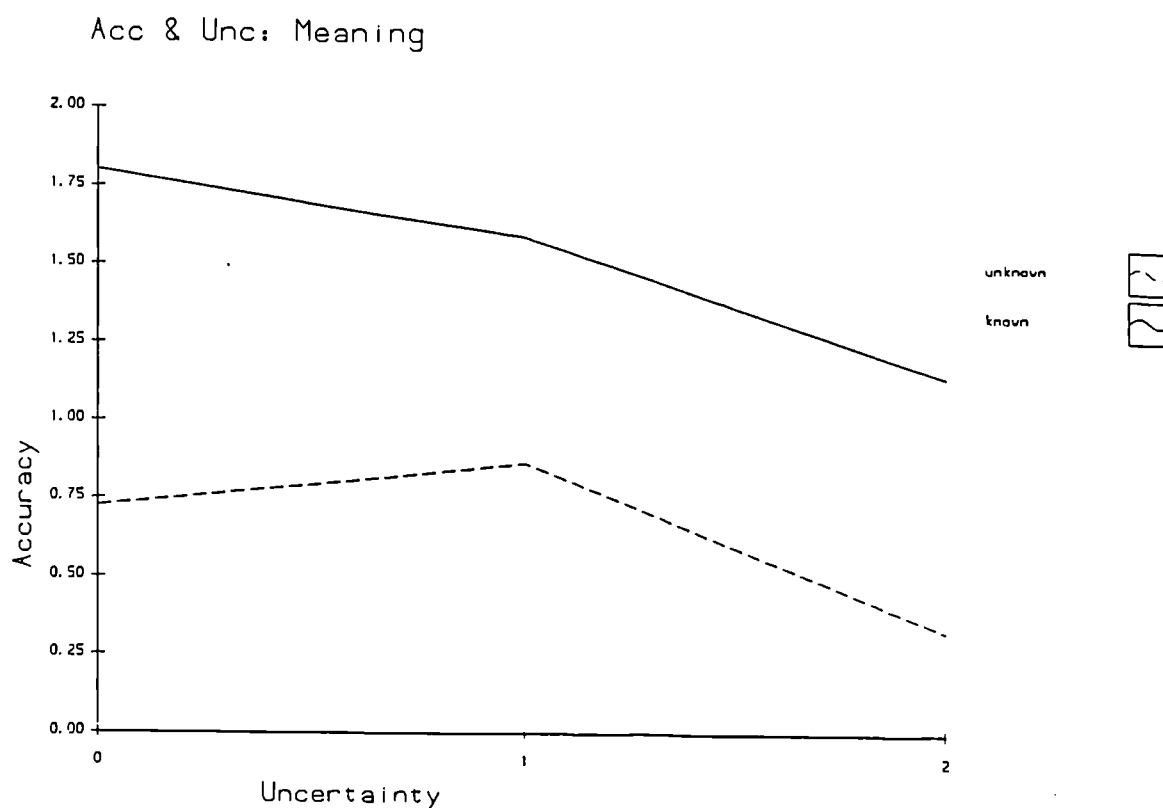
Holding, here, is perhaps a symptom of difficulty and is clearly not an effective way of dealing with it since it offers no chance of improving accuracy.

If we turn now to known meanings the coefficients are still negative (see table 15). But we see on the graph at 8 for the known meaning plots that the upper part of the accuracy scale is used. Although subjects are at their highest accuracy when keeping the same guess, they have not gone very low when

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changing it. Probably subjects are getting through to the correct answer quite quickly and see no need to change it. Holding a guess in this way is going to create high accuracy over low uncertainty. What pulls accuracy down, to some degree, as uncertainty increases, is that subjects have got a little confused on some of the targets (noun target 4 _effigy_ was not easy to guess) and have perhaps guessed wildly to try and rescue the situation.

That we have negative correlations suggests that holding guesses is a better policy than changing and so on the surface at least prediction 4 fails. We do need to point out, however, that changing guesses can be a way out of getting out of a difficulty as illustrated by unknown meanings when subjects have been sent the wrong way and is effective in generating accuracy. On known meanings there might not really be a pressing need to change since the items might be fairly easy to guess. So changing might well be a better policy than holding where there is difficulty. We really need to experiment further around this problem.

Finally, I'd just like to look briefly at order by unknown meanings by amounts of information. In the last chapter, I noted that the unknown orders across amounts of information fell into neat pairs as far as uncertainty was concerned. Order _abc_ fell and order _acb_ rose and crossed it. Similarly, order _bac_ fell and order _bca_ rose again crossing it. Order _cab_ fell sharply but order _cba_ not so sharply. I argued that on orders which fell or fell sharply, subjects might be in

more difficulty than where there were rises or slower falls and might be holding on to the same guess or making small changes as a way of dealing with the problem. Note also that for accuracy, although there was some variation, all orders finished at three amounts of information at pretty much the same place, either at .5 or .6 accuracy (the a last being slightly higher). If the finishing point for accuracy is roughly the same for all orders, they must get there in different ways. I doubt if subjects are giving up on some orders more than others as this would produce dramatic differences in finishing points. There may, then, be this tendency to hold guesses/make small changes on the order which falls or falls sharply in each pair and a tendency to change guesses more substantially on the others.

The tendency to hold/small change guesses should betray itself in that a strongish negative correlation should be produced. The point being that such accuracy as is produced is the result of holding the same guess. This factor, in it itself, would tend to give a zero correlation. However, the tendency to give up guessing would produce a negative correlation and the zero effect of holding guesses would not interfere too much with this. For the other order in each pair, that which rises or falls more slowly, the correlation should be weaker ie. not so strongly negative. That accuracy which is produced is the result of more positively changing guesses. Since this would produce highish accuracy at highish uncertainty the result should be a positive correlation. I

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doubt if this would happen since we again have subjects giving up guessing which would produce a negative correlation with low accuracy at high uncertainty. However, this time we have a positive rather than zero effect interfering and this should weaken the correlation. If this is correct, then when we come to look at the correlations we should see something like the following for those coefficients at the third amount of information. The coefficient for acb should be weaker than for abc. The coefficient for bca should be weaker than for bac. The correlation for cba should be weaker than for cab. This is just what we do get if we look at table 17 where the coefficients on Pearson r (I don't have gamma at this level) for order on unknown meanings are given.

What is causing this is the point mentioned in the last chapter. When the genus comes early in an order there is perhaps more of a tendency to hold on to the guess generated or make small changes and the reverse when the genus comes late. In the a first orders the differentia causes more change than the association so when it comes before this cue uncertainty falls and visa versa. It is worth noting that order, then, may play a role in changing and holding guesses on unknown meanings. Rather than teach one order than another to students, however, my inclination would be to remove any difficulty attached to order by using the strategy of going for the genus cue and abandoning the others.

Table 17

Pearson r coefficients for order by unknown meaning on the
third amount of information of information.

abc	acb	bac	bca	cab	cba
-.643	-.531	-.549	-.014	-.506	-.196

Does changing a guess generate the same amount of
confidence as holding a guess? When a subject changes guesses,
then if he is using information efficiently to make this
change, confidence should rise just as when a subject uses
information to confirm a previous guess. The question I want
to look at very briefly here is whether or not using
information to change guesses contributes as much confidence as
when information is used to confirm guesses. Prediction 5
suggests that changing a guess should generate as much
confidence as holding a guess.

The overall coefficient is at table 18.

Table 18

Overall coefficients for confidence and uncertainty

r	-.556
g	-.615

It is negative so we are getting high confidence where
subjects hold the same guess and visa versa. The plots for
confidence and uncertainty for the coefficient are given in
table 19.

Table 19
The overall plots

Confidence	4.468	3.539	1.907
Uncertainty	0	1	2

These plots are displayed on graph 9. It looks as though prediction 5 fails and that changing a guess produces some kind of loss of confidence. What could be pulling the confidence score down at uncertainty 2 on graph 9 is subjects giving up guessing on the unknown meanings.

We need to divide this result into known and unknown meanings. Table 20 gives the coefficients.

Table 20
Coefficients for unknown and known meanings

	Unknown meanings	Known meanings
r	-.450	-.476
g	-.549	-.554

The plots for confidence and uncertainty are given at table 21. These scores are displayed on graph 10. What we see is a downward trend on both types of meaning on graph 10. Holding a guess seems to contribute more confidence than changing to a new one. Giving up at uncertainty 2 on unknown meanings helps to exaggerate the drop here. There is a corresponding fall in the same position for known meanings and in all probability this is caused by subjects who know they are in difficulty and are having a wild stab so confidence is bound to suffer. The

interesting point is the contrast on 0 and 1 uncertainty.
There is a small advantage of .4 on unknowns and .9 for knowns

Table 21

The plots for known and unknown meanings

Unknown confidence	3.343	2.98	1.438
Unknown uncertainty	0	1	2
Known confidence	4.928	4.068	2.995
Known uncertainty	0	1	2

for holding as opposed to changing. Prediction 5 has failed.
Possibly the source of this is that it costs a little extra in
processing effort with a resulting undermining of the "normal"
confidence level to change a guess as opposed to holding one.
It might be that this drain on confidence involved in changing
might encourage holding of guesses to some extent.

One final point. The perspective depending which
variable we see as independent and which as dependent in these
correlations is important. Here, I've taken uncertainty as the
independent variable. We could turn this around though and
take confidence as the independent variable. The plots for the
correlation this way around are given at table 22. If we do
this, the picture we get is not one of uncertainty creating a
drain on confidence but of low confidence generating high
uncertainty. That is, when people are not sure about a guess
they want to process more by generating more hypotheses.
Unfortunately, this second picture is more in keeping with the

view of uncertainty described by Peterson and Pitz (1988) as the number of alternative hypotheses held. The idea of changeability, I would see as better suited to using uncertainty as the independent variable and where we do get

Table 22

Known and unknown meaning plots

Known confidence	0	1	2	3	4	5	6
Known uncertainty	1.7	1.2	1.3	1.1	0.8	0.8	0.3
Unknown confidence	0	1	2	3	4	5	6
Unknown uncertainty	1.9	1.3	1.3	1.2	1.0	0.8	0.8

this picture of change involving greater cost. Something in fact which the principle of costs and benefits as described by Payne (1982) might have suggested had I remembered this when making predictions.

Conclusions

In prediction 1 we are interested in the overall correlation of confidence with accuracy. As expected, this correlation is positive but it is not strong. This, it is suggested, is because we have different types of subjects in terms of confidence. In addition to "middle of the road" subjects, we get some people who are always very sure of themselves and others who lack confidence. In general though,

when subjects are accurate they are confident.

With prediction 2, we are interested in what happens when a subject builds a complex hypothesis or new meaning. Subjects

Graph 9

Confidence & Uncertainty

are capable of doing this and achieving an accuracy of 2. However, suspicion in the complex hypothesis undermines confidence which suffers in contrast to the comparable known meaning or single word hypothesis condition at accuracy 2. Where a subject is able to guess a new meaning accurately, he could well find himself less confident than he would expect in

his hypothesis. In addition to processing information to make a guess, one would

Graph 10

Conf & Unc: Meaning
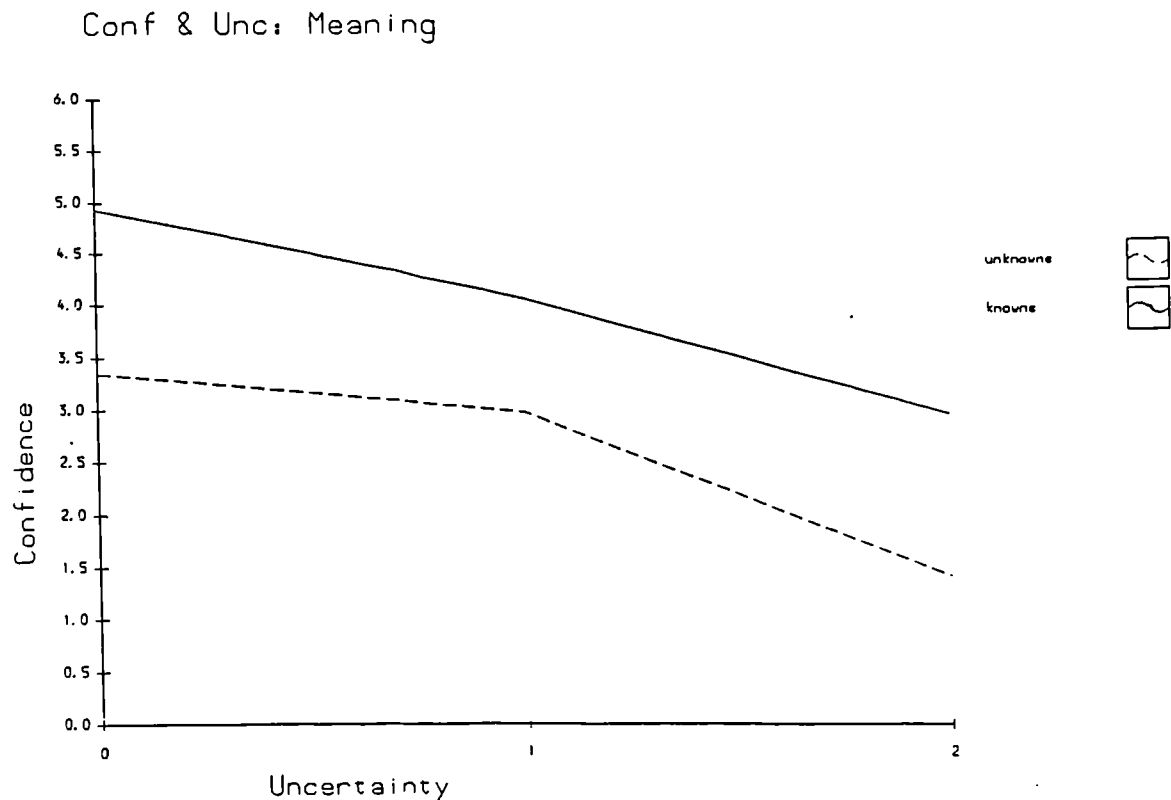
expect subjects in such a condition to follow their guess by an additional strategy of appeal to authority. They would check it in a dictionary or ask a teacher or a knowledgeable friend.

There is also support for prediction 3 and the idea that subjects are misled by the differentia and association cues in initial position on unknown meaning orders when they lexicalise such a target rather than build a knew meaning. The best policy for dealing with this deception seems not to be to use

genus first orders. This tends to lead to erosion of the initial genus guess if subsequent cues are used. Rather, the best policy is to find the genus and abandon the other cues.

In terms of accuracy, holding the same guess also seems to be generally a better policy than changing guesses. Prediction 4 seems to fail. We need to be cautious here, though, in that we did see successful changes of guess on unknown meanings. On known meanings, it might be that a high level of accuracy is being reached fairly quickly is making changes unnecessary and that where changes are taking place they might be accompanied by an element of confusion. We need more experimentation here.

With prediction 5, it appears that changing a guess does lead to a slight drain on confidence as opposed to holding a guess. In all probability, there is a little more processing effort involved in changing.

Chapter 8

Suggesting a New Meaning   Part 1

This chapter contains the introduction to, method and the results for Experiment 4. Chapter 9 contains the interpretation and discussion of these results.

Experiment 4

Introduction

Purpose of the experiment: The purpose of this experiment is to look at the guessing of known and unknown meanings across differing amounts of information and across orders of differing kinds of information in a more naturalistic or real life setting. The dependent variables are confidence, accuracy and uncertainty. A second purpose is that so far we've looked at confidence starting low and rising. It might be interesting to reverse this and look at a situation where confidence starts high and look at what impact known and unknown meanings have on such a confidence.

What do I mean by "naturalistic"? One aspect of the meaning of this word relates to the amounts and kinds of information one would find in everyday text which would provide cues to targets.

Schatz and Baldwin (1986) take up this problem. They state their view of language in the following quote. "When

novelists and journalists, for example, compose passages that contain low frequency words, they do so with a minimum of semantic redundancy." In a natural context, each word is seen as maximally informative and adds information which can not be predicted from other words in the environment. The conclusion is that natural contexts do not usually give cues to word meaning and so it is extremely difficult to guess.

These authors give some interesting illustrations of their idea. I'll give some examples at 1.

1a) Rasputin's <u>necromancy</u> allowed him to rule the kingdom.
 b) Merlin's <u>necromancy</u> allowed him to rule the kingdom.

The first they regard as fairly natural text. The second is a little more helpful in terms of cues.

The first point I would make is that the genus of <u>necromancy</u> can be partly or wholly guessed in both examples. In 1a we could get <u>some form of power</u> and in the second, <u>magic</u>. The real problem seems to be the differentia.

The second problem is that both examples at 1 are decidedly odd. To understand this oddness I would turn to Grice's idea of the Cooperative Principle, not in the original, but as set out by authors like Leech (1974) and Levinson (1983). Based on these ideas we would probably draw the implicatures at 2 from the statements at 1 if we understood <u>necromancy</u>.

2a) Rasputin's evil stemmed from magic involving the dead.
 b) Merlin was a very evil person.

Both implicatures fly in the face of what we know about
Rasputin and Merlin and are untrue.

Why should this be so? We need to be careful here since
Grice deals with the relationship between propositions and I'm
interested in the relationship between words, but I would say
that the problematic implicatures at 2 are the result of the
association of Rasputin/Merlin with necromancy violating
Grice's maxim of Relevance. As a tentative view of what makes
association relevant, I would say that they should come from
the same set as described by Berry (1977). Basically, this
idea is that when two words have a lot associations in common
then we can amalgamate these words into a set. If we look at
2b, then Merlin and necromancy do have the idea of magic in
common but little else. The associations on the former are all
to do with good magic and the latter evil magic. With Rasputin
the gulf is wider since he is a religious figure. So
Rasputin/Merlin on the one hand and necromancy on the other are
not in the same set.

The consequence of not being Relevant is that a reader
who understood necromancy would probably reject the
implicatures at 2, so reducing the target at 1a) simply to
power and at 1b) to magic. Conversely, if a subject had to
guess necromancy in a cloze situation at 1 then power or magic
must be perfectly adequate guesses and are in no way flawed.

A natural text should obey the Cooperative Principle, then, and one way of doing this is by making associations Relevant. We could make 1a and b) do this by restating them at 3.

3. The voodoo witch doctor's <u>necromancy</u> allowed him to rule the kingdom.

Notice now though that not only do we have a chance to guess the genus <u>magic</u>, we also have a chance to guess the differentia. The association is Relevant to both genus and differentia and there is a chance it could suggest the latter component in the sense that <u>voodoo</u> is concerned with <u>zombies</u> etc. So in a natural text, we might well get a reasonable genus cue and the differentia might be suggested by association cues. Of course, we will always have misdirective contexts or contexts which give little information but I think the context at 3 is a fairly likely possibility. Possibly, Schatz and Baldwin have more inclined to literary contexts where poetic licence does allow unusual collocation. On the whole though, language is more redundant than they suggest.

In this experiment, then, I intend to give one good cue to the genus and then to give association cues with the intention of suggesting a differentia. I'll give an example of an unknown target from the experiment to illustrate this. The target is <u>sprag: To brake by using a lever against the wheel.</u> The cues in the form subjects saw them are at 4.

4. a) He (   ) in order to slow the vehicle down.

   GUESS   CONFIDENCE

   b) <u>The cowboy</u> (   ) in order to slow <u>the wagon</u> down.

   GUESS   CONFIDENCE

   c) The cowboy (   ) in order to slow the wagon down.
      <u>He strained and perspired</u>.

   GUESS   CONFIDENCE

The cue to the genus at 4a is definitional in the sense that
what is given is really the differentia of the target's genus
<u>brake</u>. We might call it implicit definitional. The cue
underlined at 4b which suggests the differentia of <u>sprag</u> by
being Relevant occupies subject and object slots in relation to
the verb target and I'll call this <u>subject/object collocation</u>.
A third collocation at 4c which performs the same function,
does not occupy these slots and is more loosely syntactically
connected to the target and I'll refer to it as <u>non
subject/object collocation</u>. Cues 4b and 4c are implicit
associational. This gives three cues in terms of amount. For
order, I intend to keep the genus cue always in first position
and vary only the associations at 4b and c giving just two
orders. This is done for convenience as it is difficult to
keep testing six orders. The variation in associations has

been selected as there seems to be an interesting contrast here.

Note also that I've given two associations at 4 when there is only one at my exemplar of naturalistic language at 3. This does bring the total number of cues in the experiment to three so putting it on a par with previous experiments. It also gives us a reasonable number of cues to see guesses develop across. Two would have been limited. Also, one does find both types of association mentioned above in real life text and it is worth looking at them.

Also, with respect to naturalism, by making cues implicit definitional/associational we are now making subjects work to recover genus and differentia. This is more like what happens in real life where it is probably rare to receive these comonents explicitly.

I've given an unknown target. What of known targets? An example of a known target is <u>brake</u>. The genus cue is the same as 4a and the differentia cues are comparable to 4b and c and are given at 5 respectively, again being varied to give two orders.

5b. <u>The driver</u> (   ) in order to slow <u>the car</u> down.
 c. The driver (   ) in order to slow the car down.
    <u>As the speed reduced, he changed down a gear</u>.

Note that the target is the genus of <u>sprag</u>. Although these two items are different targets, I'll refer to <u>brake</u> and <u>sprag</u> as

know and unknown versions of the same target for convenience. Also note that on <u>brake</u> we do not have cues to genus and differentia but all cues point to the total meaning ie. to the word <u>brake</u>

A question now is why reduce the known meaning condition to guessing a word? Why have I not given cues to the genus and differentia of <u>brake</u> just as I have done with <u>sprag</u> so making the known and unknown conditions comparable?

The reason is that by reducing known meanings to guessing a word it is possible to turn known meaning guesses into a control situation which helps us illustrate the effect of unknown meaning information. By using this technique both known and unknown conditions on each target will begin with an identical cue because cue 1 will now be identical in both situations and confidence should begin at the same point for known and unknown meanings. Had I given cues to the genus and differentia on known meaning versions of the targets there would have been a problem. The genus of the known target <u>brake</u> is a lot more general than for the unknown target <u>sprag</u> and it might be that the genus cues would not be of the same strength or quality and we can't get a clear prediction of what will happen on cue 1. It's unlikely confidence for both meaning versions would be linked here. Using the method I have suggested the guesses at cue 1 on both meaning versions will be locked together in terms of confidence. Subsequent differences will be due to different ways of processing information.

A second factor in linking confidence on cue 1 for both meaning versions is that we need to select only one format for form. Here I've gone for the cloze gap rather than pseudoword. Whilst the last experiment gives an effect for pseudowords it is small and this format does not appear to trigger the guessing of new meanings. The selection of the cloze gap leaves us free to consider the more interesting phenomenon of known and unknown combinations of information.

An additional feature of this experiment mentioned in the purpose is that confidence will start high. Given what I've said about naturalistic contexts it could well be possible that a subject might pick up on a strong genus cue first. Given that subjects will not use the pseudoword as a signal that the hypothesis they hold is incomplete, subjects will have a high confidence initially and it is interesting to see what subsequent cues will do to such a confidence.

As to what will happen. Cue 1 in both meaning conditions will give a single word guess with high confidence. On the known version of the target cues 2 and 3 now come into play. These point <u>consistently</u> to the same hypothesis as cue 1 and reinforce it. Confidence should remain static or rise to some extent if cue 1 leaves some room for this to occur. This effect gives us a control line in terms of known meanings or consistency across amounts of information.

If we turn now to the unknown versions of the targets then subjects, whilst giving a single word hypothesis on cue 1, might try and build a complex hypothesis or new meaning on cues

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2 and 3 when the differentia is suggested. If this happens then they will examine the combination of components making up the new meaning and there will be a degree of suspicion in this new relationship. Given that confidence starts high, this suspicion is going now not going to hold back a rising confidence as in previous experiments, but cause a fall. If subjects do not try to construct a new meaning, they will have to cope with a set of strange collocations on a familiar single word hypothesis and this should again weaken confidence. In terms of predictions, I'm going to make two sets to cover both these possibilities.

Predictions: Complex Hypothesis on Unknowns

1. For confidence there should be an interaction between known and unknown meanings across information. Known meanings should produce a static or rising confidence. Unknown meanings, starting at the same point, should fall then rise. The fall should be caused by suspicion as the complex hypothesis is formed at cue 2 and the rise by an increasing familiarity with the new hypothesis on cue 3.

2. For accuracy, scores must be lower at cue 1 on unknown meanings, since only the genus part of the hypothesis is present, as opposed to known meanings where the whole, correct single word hypothesis will be present. Knowns will maintain a static accuracy across information with the same guess being repeated and unknowns will rise towards them as accuracy increases with the adding of the differentia so causing another

interaction.

3. For uncertainty, measured again in terms of changeability, we will have no value for cue 1. On knowns, subjects should be retaining the same guess so uncertainty should be static and low. On unknowns at cue 2, subjects should add a differentia to the genus gained on cue 1 so uncertainty should be higher here than for knowns. We effectively have a change but within the same family. On cue 3 they should retain the same guess so uncertainty should fall. Another interaction with knowns static and unknowns falling.

The first two predictions are particularly interesting as we will have a falling confidence and rising accuracy.

Predictions: Single Word Hypotheses on Unknowns

4. For confidence on the unknowns, there is no single word other than sprag which can absorb all the cues, but the subjects shouldn't be aware of this form. The result is that subjects will be forced into a position, we might say mistakenly, where they will have to regard the cues as items of inconsistent information and they will in all probability have to abandon some. Most likely, cues 2 and 3 will be abandoned in favour of cue 1. However, this abandoning is not likely to be as drastic as in Experiment 3 where we saw subjects give up completely, since in this case the differentia is not being given directly. Here, although cues 2 and 3 can't be lexicalised along with cue 1, they can be held on to and seen as somewhat unusual association of the guess off cue 1,

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brake. Cowboys can brake wagons and strain and perspire when doing so. This should allow subjects to continue lexicalising the target rather than giving up and they will continue to have a measure of confidence in their initial guess. But subjects will think "There must be a better word than brake here". Subjects should, then, be abandoning information which they see as potentially useful from the process of lexicalisation and this should undermine confidence.   So we would expect the unknown line across information to be lower than the known just as in prediction 1. However, the fall/rise pattern on unknowns caused by increasing familiarity at cue 3 should not be present. Rather, there should be a consistent parting of ways. Also, we can look at the responses to check what sort of hypothesis is present.

5. There is also the possibility that subjects will fail to notice any inconsistency and be deceived in this experiment as some were in the last.   In this case there should be no interaction between known meanings and unknown meanings across information for confidence.

6. For accuracy, clearly unknown meanings should be consistently below known across information.   Single word hypotheses can't get maximum accuracy in a situation where a complex hypothesis is needed.   There probably won't be an interaction.   There should be an overall difference.   An interesting question here is whether confidence will fall in proportion to this reduced accuracy.

7. For uncertainty, subjects will probably be holding on to

the same guess in both meaning condition so no effect anywhere.

8. There will be no effect for order whether responses are complex or single word hypotheses. This again is a convenience prediction.

Method

Cases: Three hundred and forty subjects took part in the experiment. All subjects were native speaker undergraduates at University of Wales, Bangor, from the faculties of Linguistics (approximately 40 subjects), Social Sciences (approximately 70 subjects), Biology (approximately 120 subjects), English Literature (approximately 20 subjects) and Economics (approximately 90 subjects).

Independent variables: Three targets were constructed, all verbs. The independent variable of meaning was dealt with by half the subjects seeing these targets in an unknown meaning condition and the other half in a known meaning condition. Unknown meanings were regarded as an unfamiliar combination of genus and differentia. Three unknown meanings were obtained by going through dictionaries and looking for very infrequent words which subjects would not be likely to know. The three selected were: To sprag, which means to brake by using a lever against the wheel, To flense, which means to cut the blubber out of an animal like a whale and to scabble, which means to shape a stone roughly. The three known meanings were the genuses of the unknown targets: To brake, to cut, to shape. So

within each target there are known and unknown counterparts. There are really 6 targets but for convenience it is simpler to see them as 3 with known and unknown variants on each. The order of presentation of targets was decided by using a table of random numbers and this order remained the same for all subjects in all conditions.

The independent variable of form was dealt with by using a cloze space throughout the experiment. So this isn't a factor in this experiment. *An added advantage of the cloze* space is that the unknown meaning targets are genuine and if some subjects did in fact happen to know them then they would betray this knowledge by using the appropriate word form rather than a phrase to describe the target's meaning. Subjects who gave such responses could be excluded from the experiment so preserving the integrity of the unknown meaning condition. In fact, no subject gave such a response.

The independent variable of amount of information was dealt with by giving three cues. For the unknown meanings, one cue was given to the genus. This was always an implicit definitional and "powerful" cue and was intended to make clear just what the genus was immediately it became available. Two cues were given to the differentia. For the known meanings (remember, these are the genuses of the unknown meanings), a "powerful" cue was given not to the genus or differentia of the target, but to the whole meaning or word itself. Then two implicit associational cues were given again to the word and not genus or differentia. Although this reduces the known

meaning condition really to guessing familiar words rather than familiar meanings, I'll continue to refer to it as a known meaning condition.

Some criticisms here are that subjects will quickly become aware that they are dealing with no more nor no less than three cues. Also, in being presented with one cue after another they will see all three as relevant or potentially useful even if they have to abandon some cues.

The independent variable of order was dealt with by giving an implicit definitional cue to the genus always in first place. This means that the order variable is restricted to the second and third cues only which are implicit associational. Where a subject/object association comes at cue 2 and a non subject/object association at cue 3, this will be termed Order 1. The reverse will be Order 2. So we have two orders rather than the potential six. This avoids the complexity of looking at 6 orders and we can focus on the interesting association distinction.

The cues were presented to subjects in a booklet approximately 3" by 8" with cue 2a) on page 1, 2b) on page 2 etc. in the form given at 4.

A full list of targets with their cues is given at Appendix 3.

The three targets were tried out on friends and it appeared that they were behaving differently in terms of response given. It appeared that this variety of response could be dealt with by anaysing each target individually.

Procedure: A prior arrangement was made with lecturers in the various departments named above for me to enter one of their lectures either at the beginning or towards the end for fifteen minutes. I asked those students attending whether they would like to help out by doing a brief linguistics experiment. Numbers of subjects attending a lecture varied from ten to eighty. The voluntary nature of the experiment was emphasised. Subjects were asked to work individually, read the instructions that came with the booklet before doing anything and not to attempt the experiment unless they were English native speakers. Occasionally someone pointed out that their first language was Welsh. Such subjects were asked not to sit the experiment.

Four versions of the experiment were used: known meanings in Order 1, unknown meanings in Order 1, known meanings in Order 2 and unknown meanings in Order 2 and a subject did only one version. The pile of booklets was organized so that version 1 was followed by version 2 which was followed by version 3 and then version 4 with this sequence repeating itself throughout the stack of booklets. Question booklets were always distributed from such a pile, usually directly into the hands of the subject though in some situations it was possible to place them on the desks before students entered. A reasonably even distribution of the four versions was obtained through stacking the booklets in this way.

The first thing the subjects saw was a page of

instructions which had been attached to the booklet (see Appendix 3 for the instructions). They read these instructions which basically asked them to fill in the cloze gap using a word or phrase and to note their confidence on a scale from 0-6. The phrase option is important and allows subjects to build a new meaning on unknowns. A clear example of a phrase type response was given. This is important since the size of the cloze gap might have persuaded subjects to go for word answers. Also note that subjects did not write responses in this cloze gap but in a space provided beneath the cue where there was ample room for a phrase. The instruction sheet also included an example for subjects to complete. When the subject turned over the instruction page, he saw the first cue to target 1 and noted his guess to this target and his confidence in the space provided beneath the words GUESS and CONFIDENCE (see the example at 1 above). He then turned the page and did the same thing for the second cue to target 1 and so on until all three cues to all three targets had been attempted. The second and third cues to each target were always underlined when they appeared (see 4) to make sure subjects didn't miss them by accident. Cue 3 also showed cues 1 and 2 and cue 2 also showed cue 1. The three cues to target 1 were all marked QUESTION 1 and the three to target 2, QUESTION 2 etc. and it was emphasised in the instructions that the target would change every three cues. No subjects seemed to get confused on this point. Subjects worked at their own pace. Although there was the constraint of fifteen minutes out of a lecturer's period,

subjects seemed to be able to complete the experiment in this time.

Because experiment versions were distributed evenly, the numbers of subjects in each version were reasonably uniform. There was a problem in that approximately twenty booklets had to be rejected because of bad language taken as a sign of non-cooperation. This happened in the two unknown versions chiefly and I'll leave it to the reader's imagination to decide just how the cowboy was supposed to have braked the wagon. This tended to create a disparity between known and unknown versions of the experiments. After screening the booklets the numbers in each version were balanced by using the smaller lecture groups which had been held back until last for this purpose. The result was eighty five subjects in each version. Responses are given in Appendix 3.

Scoring: Confidence was rated on a scale from 0 to 6 as in previous experiments. Accuracy and uncertainty were rated from 0 to 2 as in Experiment 2.

With confidence there is little to be said since subjects gave their intuitions directly.

With accuracy the following procedure was adopted. For known targets, if a subject gave the correct word or acceptable synonym then 2 was awarded. If a reasonably close answer was given then 1 was awarded. If the answer was not close a 0 was given. With the unknown targets a genus and a differentia had to be given to get a 2. The differentia didn't have to be the

exact answer I was looking for. If it was a reasonable guess based on the information given then this was seen as sufficient. A 1 was given if the genus category alone was stated without the differentia. Since this represents the situation on cue 1, the unknown meaning condition will always start lower than the known. A 0 was given if subjects seemed to have gone completely wrong.

With uncertainty the following procedure was adopted. If the same word or phrase was repeated then 0 was given. If a different word or phrase was given but I judged it to be reasonably closely related to the first then 1 was given. If a second answer did not seem to be closely related to the previous one then a 2 was given. If a third guess was unrelated to the second, but repeated the first guess or was closely related to it then a 1 was given. There is an added problem in the unknown condition which is the scoring of the differentia if it appears. Logically, a genus plus differentia guess following a genus guess is in the same family as the previous guess and should score 1. However, the differentia is a different quantity to the genus. What I decided to do in the end was that if a subject made a "weak" attempt at the differentia by, for example, adding an adverb: <u>brake hard</u>, I gave 1. If a more positive attempt was made: <u>brake using a lever</u>, I gave 2.

The notion of word family was again used to assess "closeness" with respect to accuracy and uncertainty. There is clearly a subjective element here.

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As to the scales of 0 to 6 and 0 to 2 used, whilst, for the sake of convenience, I'll regard them as interval, they are perhaps more properly ordinal showing increasing and decreasing amounts of the independent variables but probably without the intervals between these amounts being exactly the same each time.

Experiment Design: The experiment design is again factorial with three dependent variables. We have several independent variables with different levels on each as follows: information x 3, meaning x 3, target x 3, order x 2. This time we do nor have a repeated measures design, however. Different subjects see the different meaning types and the different order levels. For these variables the design is one of independent groups. All the subjects, however, see all three amounts of information and all three targets so for these variables we have repeated measures.

Results and Discussion

Results: The results are given for each dependent variable in the order: confidence, accuracy, uncertainty. Four ANOVAs were run for each dependent variable using the SPSSX package on the university mainframe computer: first,a general ANOVA for all three targets and then three more ANOVAs, one for each target. Result 4a shows my intuition about the targets was correct and provides a justification for doing ANOVAs for

each target separately. Where there are two levels on an
independent variable, the Mauchly Sphericity test does not
apply. Where there are three levels, as with target then one
Mauchly Sphericity test covers this main effect and all
relevant interactions.

Confidence
ANOVA 1 (All three targets)

RESULT 1a: Meaning x 2
             F= 23.01   Sig of F= .000 **
             Means

             Unknowns   Knowns
             3.592   4.191

RESULT 2a: Order x 2
             F= .07   Sig of F= .790

RESULT 3a: Meaning by order
             F= .88   Sig of F= .350

Tests involving target
             Mauchly= .002 ** The multivariate results apply.

RESULT 4a: Target x 3
             F= 41.993   Sig of F= .000 **
             Means

             Target 1   Target 2   Target 3
             4.100   4.036   3.539

RESULT 5a: Meaning by target
             F= 24.728   Sig of F= .000 **

```
        Means
        Target 1        Target 2        Target 3
Unknowns 3.586          3.960           3.230
Knowns   4.614          4.112           3.847
```

RESULT 6a: Order by target
            F= 1.234   Sig of F= .292

RESULT 7a: Meaning by order by target
            F= .630   Sig of F= .533

Tests involving amount of information
        Mauchly= .000 **   The multivariate results apply

RESULT 8a: Information x 3
            F= 15.876   Sig of F= .000 **
            Means

            1 amount   2 amounts   3 amounts
            3.792   3.829   4.054

RESULT 9a: Meaning by information
            F= 47.494   Sig of F= .000 **
            Means

            1 amount   2 amounts   3 amounts
Unknowns   3.792   3.422   3.562
Knowns   3.792   4.235   4.545

RESULT 10a: Order by information
             F= .032   Sig of F= .969

RESULT 11a: Meaning by order by information
             F= 10.348 Sig of F= .000
             Means

	1 amount	2 amounts	3 amounts
Unknowns order 1	3.580	3.376	3.595
Unknowns order 2	4.004	3.467	3.529
Knowns order 1	3.984	4.239	4.474
Knowns order 2	3.600	4.231	4.616

Tests involving target by information
Mauchly= .000 ** Multivariate results apply

RESULT 12a: Target by information
$F= 19.112$ Sig of $F= .000$ **

Means

	1 amount	2 amounts	3 amounts
Target 1	4.236	3.859	4.206
Target 2	3.900	4.015	4.194
Target 3	3.242	3.612	3.762

RESULT 13a: Meaning by target by information
$F= 11.830$ Sig of $F= .000$ **
Means

	1 amount	2 amounts	3 amounts
Unknown target 1	4.183	3.130	3.447
Unknown target 2	4.012	3.824	4.046
Unknown target 3	3.183	3.312	3.194
Known target 1	4.288	4.588	4.965
Known target 2	3.788	4.206	4.341
Known target 3	3.300	3.912	4.330

RESULT 14a: Order by target by information
$F= 2.049$ Sig of $F= .087$

RESULT 15a: Meaning by order by target by information
$F= .780$ Sig of $F= .538$

ANOVA 2 (Target 1)

RESULT 16a: Meaning x 2

               F= 53.19   Sig of F= .000 **

               Means

Unknowns	Knowns
3.586	4.614

RESULT 17a: Order x 2

               F= .410   Sig of F= .522

RESULT 18a: Meaning by order

               F= .700   Sig of F= .404

Tests involving information

       Mauchly= .000 **   Multivariate results apply

RESULT 19a: Information x 3

               F= 24.155   Sig of F= .000 **

               Means

1 amount	2 amounts	3 amounts
4.236	3.859	4.206

RESULT 20a: Meaning by information

               F= 49.907   Sig of F= .000 **

               Means

	1 amount	2 amounts	3 amounts
Unknowns	4.183	3.130	3.447
Knowns	4.288	4.588	4.965

RESULT 21a: Order by information

               F= .430   Sig of F= .650

RESULT 22a: Meaning by order by information
              F= 2.815   Sig of F= .061

                   ANOVA 3 (Target 2)

RESULT 23a: Meaning x 2
              F= 1.13   sig of F= .289

RESULT 24a: Order x 2
              F= .50   Sig of F= .479

RESULT 25a: Meaning by order
              F= 1.64   Sig of F= .201

Tests involving information
       Mauchly= .000 ** Multivariate results apply

RESULT 26a: Information x 3
              F= 7.222   Sig of F= .001 **
              Means

              1 amount   2 amounts   3 amounts
              3.900   4.015   4.194

RESULT 27a: Meaning by information
              F= 12.958   Sig of F= .000 **
              Means

                      1 amount   2 amounts   3 amounts
Unknowns   4.012   3.824   4.046
Knowns   3.788   4.206   4.341

RESULT 28a: Order by information
              F= .787   Sig of F= .456

RESULT 29a: Meaning by order by information
              F= 9.182   Sig of F= .000 **
              Means

                            1 amount   2 amounts   3 amounts
Unknown order 1   3.682   3.776   3.988
Unknown order 2   4.341   3.871   4.094
Known order 1   4.000   4.224   4.235
Known order 2   3.576   4.188   4.447

                    ANOVA 4 (Target 3)

RESULT 30a: Meaning x 2
              F= 16.40   Sig of F= .000 **
              Means

              Unknowns   Knowns
              3.230   3.847

RESULT 31a: Order x 2
              F= .33   Sig of F= .563

RESULT 32a: Meaning by order
              F= .10   Sig of F= .748

Tests involving information
        Mauchly= .000 ** Multivariate results apply

RESULT 33a: Information
              F= 21.942   Sig of F= .000 **
              Means

              1 amount   2 amounts   3 amounts
              3.242   3.612   3.762

RESULT 34a: Meaning by information
             F= 16.806   Sig of F= .000 **
             Means

                   1 amount   2 amounts   3 amounts
Unknowns   3.183   3.312   3.194
Knowns   3.300   3.912   4.330

RESULT 35a: Order by information
             F= 2.970   Sig of F= .053

Result 36a: Meaning by order by information
             F= 5.126   Sig of F= .006 **
             Means

                         1 amount   2 amounts   3 amounts
Unknown order 1   3.012   3.165   3.306
Unknown order 2   3.353   3.459   3.082
Known order 1   3.459   3.812   4.212
Known order 2   3.141   4.012   4.447

<u>Accuracy</u>

<u>ANOVA 1 (All three targets)</u>

RESULT 1b: Meaning x 2
            F= 1020.87   Sig of F= .000 **
            Means

            Unknowns   Knowns
             .900   1.766

RESULT 2b: Order x 2
            F= .98   Sig of F= .324

RESULT 3b: Meaning by order
              F= 6.91   Sig of F= .009 **
              Means

                    Order 1   Order 2
Unknowns   .949   .851
Knowns   1.744   1.788

Tests involving target
       Mauchly= .024 *   Multivariate results apply

RESULT 4b: Target x 3
              F= 56.615   Sig of F= .000 **
              Means

                    Target 1   Target 2   Target 3
                    1.520   1.323   1.157

RESULT 5b: Meaning by target
              F= 16.269   Sig of F= .000 **
              Means

                    Unknowns   Knowns
Target 1   1.192   1.847
Target 2   .841   1.804
Target 3   .667   1.647

RESULT 6b: Order by target
              F= 2.257   Sig of F= .106

RESULT 7b: Meaning by order by target
              F=2.416   Sig of F= .091

Tests involving information
       Mauchly= .000 **   Multivariate results apply

RESULT 8b: Information x 3
             F= 60.738   Sig of F= .000 **
             Means

             1 amount   2 amounts   3 amounts
             1.205   1.339   1.456

RESULT 9b: Meaning by information
             F= 3.305   Sig of F= .038 *

             Means

             1 amount   2 amounts   3 amounts
Unknowns   .755   .893   1.053
Knowns   1.655   1.784   1.859

RESULT 10b: Order by information
             F= 4.057   Sig of F= .018 *
             Means

             1 amount   2 amounts   3 amounts
Order 1   1.188   1.379   1.473
Order 2   1.222   1.298   1.439

RESULT 11b: Meaning by order by information
             F= 10.791   Sig of F= .000 **
             Means

                          1 amount   2 amounts   3 amounts
Unknown order 1   .745   1.016   1.086
Unknown order 2   .765   .769   1.020
Known order 1   1.631   1.741   1.859
Known order 2   1.678   1.827   1.859

Tests involving target by information

        Mauchly= .000 **   Multivariate results apply

RESULT 12b: Target by information
              F= 8.561   Sig of F= .000 **
              Means

                  1 amount   2 amounts   3 amounts
Target 1   1.350   1.512   1.697
Target 2   1.277   1.330   1.362
Target 3   .989   1.174   1.310

RESULT 13b: Meaning by target by information
              F= 19.753   Sig of F= .000 **
              Means

                        1 amount   2 amounts   3 amounts
Unknown target 1   .877   1.177   1.524
Unknown target 2   .824   .824   .877
Unknown target 3   .565   .677   .759
Known target 1   1.824   1.847   1.871
Known target 2   1.730   1.836   1.847
Known target 3   1.412   1.671   1.859

RESULT 14b: Order by target by information
              F= 8.870   Sig of F= .000 **
              Means

                        1 amount   2 amounts   3 amounts
Order 1, target 1   1.341   1.642   1.700
Order 2, target 1   1.359   1.382   1.694
Order 1, target 2   1.271   1.400   1.382
Order 2, target 2   1.283   1.259   1.342
Order 1, target 3   .953   1.094   1.336
Order 2, target 3   1.024   1.253   1.283

RESULT 15b: Meaning by order by target by information
              F= 5.368   Sig of F= .000 **
              Means

	1 amount	2 amounts	3 amounts
Unknown order 1, target 1	.847	1.471	1.563
Unknown order 2, target 1	.906	.882	1.482
Unknown order 1, target 2	.824	.894	.882
Unknown order 2, target 2	.824	.753	.871
Unknown order 1, target 3	.565	.682	.812
Unknown order 2, target 3	.565	.671	.706
Known order 1, target 1	1.835	1.812	1.835
Known order 2, target 1	1.812	1.882	1.906
Known order 1, target 2	1.718	1.906	1.882
Known order 2, target 2	1.741	1.765	1.812
Known order 1, target 3	1.341	1.506	1.859
Known order 2, target 3	1.482	1.835	1.859

ANOVA 2 (Target 1)

RESULT 16b: Meaning x 2
              F= 214.81   Sig of F= .000 **
              Means

              Unknowns   Knowns
              1.192   1.847

RESULT 17b: Order x 2
              F= 3.40   Sig of F= .066

RESULT 18b: Meaning by order
              F= 7.40   Sig of F= .007 **
              Means

	Order 1	Order 2
Unknowns	1.294	1.090
Knowns	1.827	1.867

Tests involving information

Mauchly= .011 * Multivariate results apply

RESULT 19b: Information x 3

F= 38.813   Sig of F= .000 **

Means

1 amount	2 amounts	3 amounts
1.350	1.512	1.697

RESULT 20b: Meaning by information

F= 28.981   Sig of F= .000 **

Means

	1 amount	2 amounts	3 amounts
Unknowns	.877	1.177	1.524
Knowns	1.824	1.847	1.871

RESULT 21b: Order by information

F= 10.029   Sig of F= .000 **

Means

	1 amount	2 amounts	3 amounts
Order 1	1.341	1.642	1.700
Order 2	1.359	1.382	1.694

RESULT 22b: Meaning by order by information

F= 15.553   Sig of F= .000 **

	1 amount	2 amounts	3 amounts
Unknown order 1	.847	1.471	1.565
Unknown order 2	.906	.882	1.482
Known order 1	1.835	1.812	1.835
Known order 2	1.812	1.882	1.906

ANOVA 3 (Target 2)

RESULT 23b: Meaning x 2

$F= 545.08$ Sig of $F= .000$ **

Means

Unknowns	Knowns
.841	1.804

RESULT 24b: Order x 2

$F= 1.90$ Sig of $F= .169$

RESULT 25b: Meaning by order

$F= .02$ Sig of $F= .887$

Tests involving information

Mauchly= .000 **   Multivariate results apply

RESULT 26b: Information x 3

$F= 3.242$ Sig of $F= .040$ *

Means

1 amount	2 amounts	3 amounts
1.277	1.330	1.362

RESULT 27b: Meaning by information

$F= 1.619$ Sig of $F= .200$

RESULT 28b: Order by information

$F= 4.123$ Sig of $F= .017$ *

Means

	1 amount	2 amounts	3 amounts
Order 1	1.271	1.400	1.382
Order 2	1.283	1.259	1.342

RESULT 29b: Meaning by order by information
               F= .236   Sig of F= .790

                    ANOVA 4 (Target 3)

RESULT 30b: Meaning x 2
               F= 334.13   Sig of F= .000 **
               Means

               Unknowns   Knowns
               .667   1.647

RESULT 31b: Order x 2
               F= 1.20   Sig of F= .274

RESULT 32b: Meaning by order
               F= 3.34   Sig of F= .068

Tests involving information
        Mauchly= .000 **   Multivariate results apply

RESULT 33b: Information x 3
               F= 32.535   Sig of F= .000 **
               Means

               1 amount   2 amounts   3 amounts
               .989   1.174   1.310

RESULT 34b: Meaning by information
               F= 5.053 b   Sig of F= .007 **
               Means

                    1 amount   2 amounts   3 amounts
        Unknowns   .565   .677   .759
        Knowns   1.412   1.671   1.859

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RESULT 35b: Order by information
F= 7.299   Sig of F= .001 **
Means

	1 amount	2 amounts	3 amounts
Order 1	.953	1.094	1.336
Order 2	1.024	1.253	1.283

RESULT 36b: Meaning by order by information
F= 2.603   Sig of F= .076

Uncertainty

ANOVA 1 (All three targets)

RESULT 1c: Meaning x 2
F= 93.29   Sig of F= .000 **
Means

Unknowns	Knowns
.844	.447

RESULT 2c: Order x 2
F= 3.92   Sig of F= .049 *
Means

Order 1	Order 2
.686	.605

RESULT 3c: Meaning by order
F= 3.73   Sig of F= .054

Tests involving target
Mauchly= .029 * Multivariate results apply

RESULT 4c: Target x 3
              F= 9.275   Sig of F= .000 **
              Means

              Target 1   Target 2   Target 3
              .706   .564   .668

RESULT 5c: Meaning by target
              F= 66.841   Sig of F= .000 **
              Means

              Target 1   Target 2   Target 3
Unknowns   1.156   .674   .703
Knowns   .256   .453   .632

RESULT 6c: Order by target
              F= .332   Sig of F= .717

RESULT 7c: Meaning by order by target
              F= .860   Sig of F= .424

Tests involving information
       Univariate results apply

RESULT 8c: Information x 3
              F= 11.20   Sig of F= .001 **
              Means

              2 amounts   3 amounts
              .697   .594

RESULT 9c: Meaning by information
              F= .98   Sig of F= .324

RESULT 10c: Order by information
F= 15.36   Sig of F= .000 **
Means

	2 amounts	3 amounts
Order 1	.798	.575
Order 2	.596	.614

RESULT 11c: Meaning by order by information
F= 20.77   Sig of F= .000 **

Means

	2 amounts	3 amounts
Unknown order 1	1.012	.679
Unknown order 2	.749	.937
Known order 1	.584	.471
Known order 2	.443	.290

Tests involving information by target

Mauchly= .630   Univariate results apply

RESULT 12c: Information by target
F= 3.390   Sig of F= .034 *
Means

	2 amounts	3 amounts
Target 1	.707	.706
Target 2	.627	.500
Target 3	.759	.577

RESULT 13c: Meaning by information by target
F= .320   Sig of F= .729

RESULT 14c: Order by information by target
F= 27.240   Sig of F= .000 **
Means

	2 amounts	3 amounts
Target 1, order 1	.930	.571
Target 1, order 2	.483	.841
Target 2, order 1	.736	.441
Target 2, order 2	.518	.559
Target 3, order 1	.730	.712
Target 3, order 2	.788	.441

RESULT 15c: Meaning by order by information by target
F= 16.620   Sig of F= .000 **
Means

	2 amounts	3 amounts
Target 1, unknown, order 1	1.553	.824
Target 1, unknown, order 2	.753	1.494
Target 1, known, order 1	.306	.318
Target 1, known, order 2	.212	.188
Target 2, unknown, order 1	.765	.541
Target 2, unknown, order 2	.647	.741
Target 2, known, order 1	.706	.341
Target 2, known, order 2	.388	.376
Target 3, unknown, order 1	.718	.671
Target 3, unknown, order 2	.847	.576
Target 3, known, order 1	.741	.753
Target 3, known, order 2	.729	.306

ANOVA 2 (Target 1)

RESULT 16c: Meaning x 2
F= 233.60   Sig of F= .000 **
Means

```
              Unknown        Known
              1.156          .256
```

RESULT 17c: Order x 2
              F= 2.25   Sig of F= .135

RESULT 18c: Meaning by order
              F= .16   Sig of F= .690

RESULT 19c: Information x 2
              F= .00   Sig of F= 1.000

RESULT 20c: Meaning by information
              F= .01   Sig of F= .914

RESULT 21c: Order by information
              F= 43.26   Sig of F= .000 **
              Means

```
              2 amounts    3 amounts
Order 1         .930         .571
Order 2         .483         .841
```

RESULT 22c: Meaning by order by information
              F= 47.62   Sig of F= .000 **
              Means

```
                          2 amounts    3 amounts
Unknown order 1             1.553         .824
Unknown order 2              .753        1.494
Known order 1                .306         .318
Known order 2                .212         .188
```

ANOVA 3 (Target 2)

RESULT 23c: Meaning x 2

                $F = 15.22$ Sig of $F = .000$ **

                Means

Unknown	Known
.674	.453

RESULT 24c: Order x 2

                $F = .78$ Sig of $F = .377$

RESULT 25c: Meaning by order

                $F = 2.60$ Sig of $F = .108$

RESULT 26c: Information

                $F = 7.23$ Sig of $F = .008$ **

                Means

2 amounts	3 amounts
.627	.500

RESULT 27c: Meaning by information

                $F = 1.72$ Sig of $F = .190$

RESULT 28c: Order by information

                $F = 12.71$ Sig of $F = .000$ **

                Means

	2 amounts	3 amounts
Order 1	.736	.441
Order 2	.518	.559

RESULT 29c: Meaning by order by information

                  $F = .04$ Sig of $F = .851$

ANOVA 4 (Target 3)

RESULT 30c: Meaning x 2

               F= 1.29   Sig of F= .257

RESULT 31c: Order x 2

               F= 2.90   Sig of F= .089

RESULT 32c: Meaning by order

               F= 3.95   Sig of F= .048 *

               Means

	Order 1	Order 2
Unknowns	.695	.712
Knowns	.747	.518

RESULT 33c: Information x 2

               F= 11.86   Sig of F= .001 **

               Means

2 amounts	3 amounts
.759	.577

RESULT 34c: Meaning by information

               F= .20   Sig of F= .657

RESULT 35c: Order by information

               F= 9.67   Sig of F= .002 **

               Means

	2 amounts	3 amounts
Order 1	.730	.712
Order 2	.788	.441

RESULT 36c: Meaning by order by information

               F= 1.00   Sig of F= .318

Chapter 9

Suggesting a New Meaning   Part 2

This chapter contains the discussion of the results for Experiment 4. There are a large number of results and to stop the discussion wandering I will adopt four headings. First, I'll make some general points about the results. Second, I'll look at the idea of building a new meaning. This section will cover predictions 1-3. Third, I'll look at the idea of familiar, single word guesses as an alternative to building new meanings. This will cover predictions 4-7. Fourth, I'll look at the idea of order, prediction 8.

Some General Points

The first point to note is that values of F on the independent variable of amount of information reaches significance for all three dependent variables (see Result 8). Confidence and accuracy rise with increasing amounts of information, uncertainty falls. The value for F on the independent variable of meaning also reaches significance for all three dependent variables and unknown meanings generate less confidence, less accuracy and more uncertainty than known meanings (see Result 1). There seems to be a foundation for predictions 1-3.

We come now to the interaction of meaning by information. This result, particularly with reference to the dependent variable of confidence, is really the key to the whole

experiment.

We see at Result 9a that there is a significant interaction for meaning by information for confidence. The confidence means are displayed on graph 1. What we see on graph 1 is that confidences rises as information increases for the known meanings. Although the first cue should make the answer clear immediately, rendering the other cues redundant, subjects have been a little conservative in their confidence and the subsequent cues have been able to generate more confidence by consistently reinforcing the original guess. This was expected. The line for unknown meanings is "peculiar". It falls at cue 2, then tries to rise again. This is roughly the kind of interaction we are looking at prediction 1 so we may be getting complex hypothesis formation.

To move on, there is a significant interaction on meaning by information at 9b for accuracy. The accuracy means are displayed on graph 2. We can see that known meaning line rises slightly. Something I did not predict but not too unexpected as it would not perhaps be unexpected for there to be a degree of error on low amounts of information which would be corrected later. Most important, the unknown line rises towards the known and it looks like prediction 2 is being met not 6 which again suggests complex hypotheses.

With uncertainty, there is no interaction of meaning by information at 9c. Prediction 3 fails but note that unknown uncertainty overall is higher than known, Result 1c, which is

broadly what we expected. It's just that uncertainty on unknowns doesn't start to fall on cue 3.

Graph 1

Conf: Meaning x Info
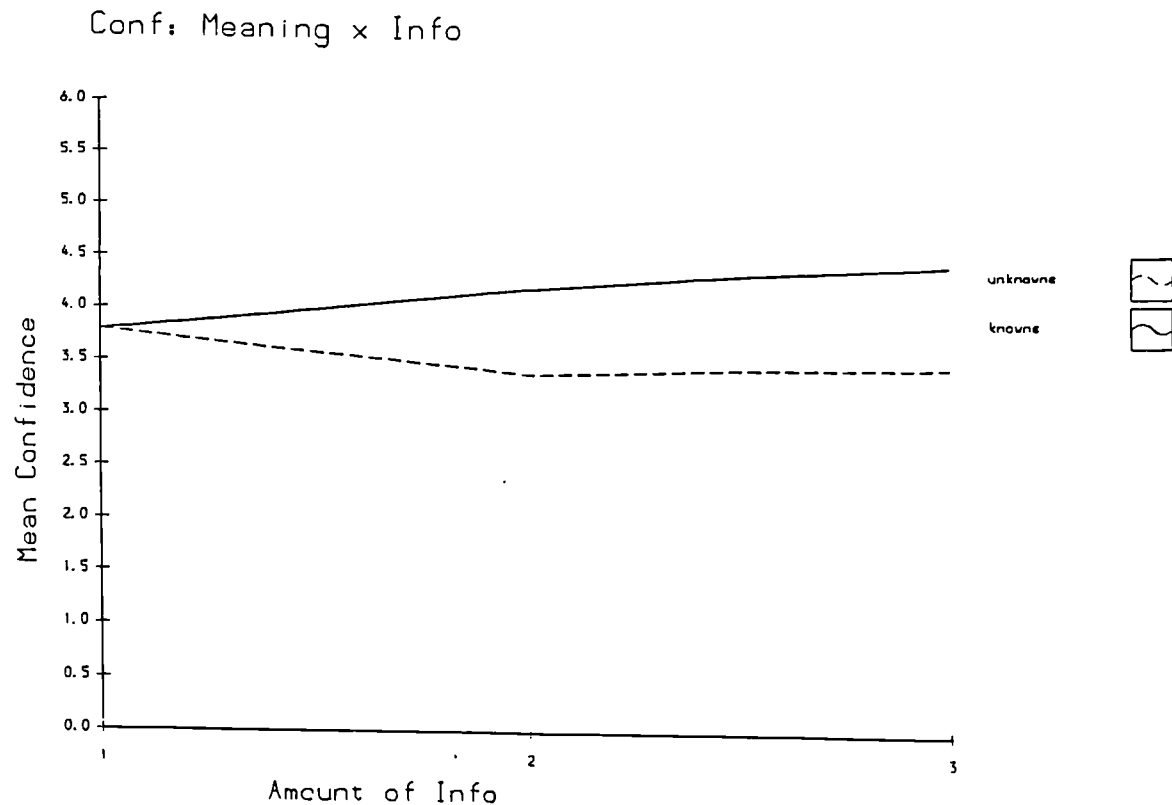
A large part of predictions 1-3, involving the construction of unknown meanings/complex hypotheses, seem to be working. However, a major factor is the difference between the targets given at Result 4 on all dependent variables. We can't take the generalised picture given so far for granted.

The best place to look at this contrast between targets is on the target by meaning interaction at Result 5 which gives

us more detail. All three dependent variables produce significant interactions. I won't look in detail here, but .

Graph 2

Acc: Meaning x Info
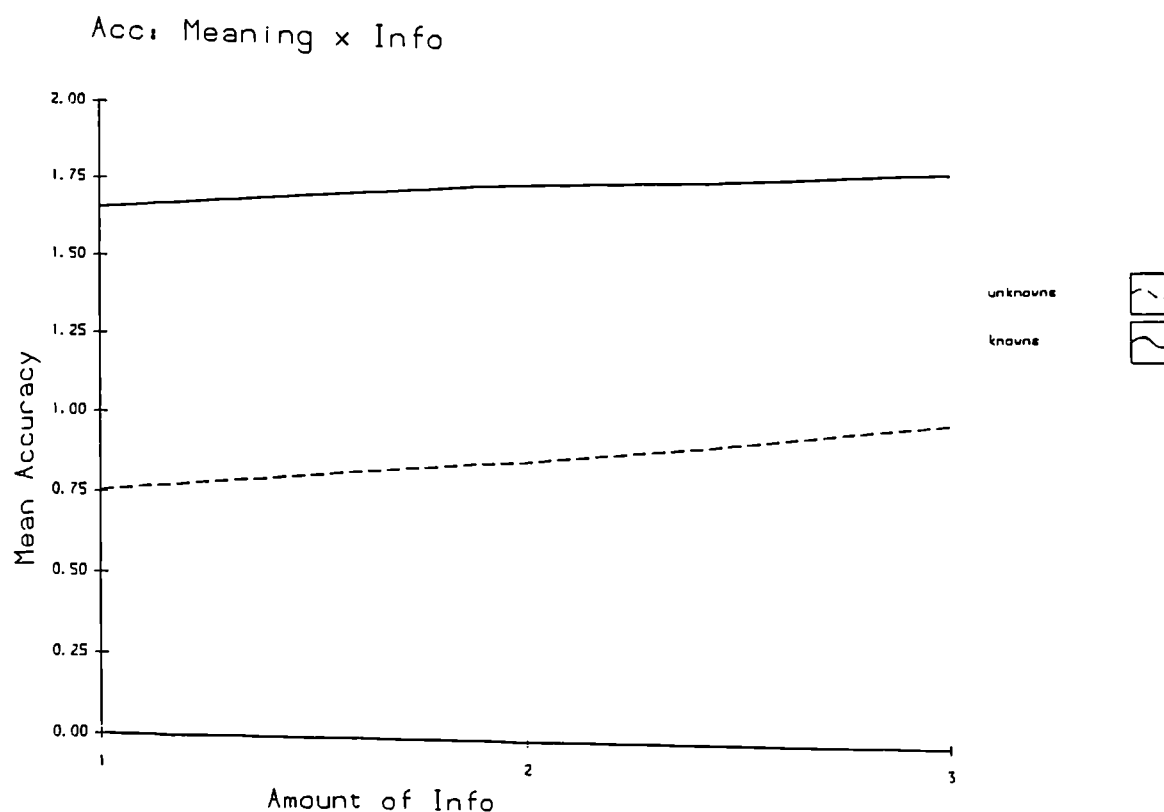
will just make some general points.

On the known side of this interaction, target 1 generates more confidence and accuracy than target 2 which in turn generates more of these dependent variables than target 3. The exact reverse is the case for uncertainty. So we can say on the knowns that target 1 is easier than target 2 which is easier than target 3. The reason for this cline lies in the uncertainty scores. On target 1, the hypothesis <u>brake</u> is given

very clearly and we get high confidence and accuracy. On targets 2 and 3, there is more opportunity to change guess and this allows room for error so reducing accuracy and also the range of alternatives would undermine confidence to a degree.

The unknown side of this interaction is interesting. For accuracy, target 1 is highest, followed by target 2 followed by target 3. The same order is preserved as for knowns. For the generation of confidence, however, the order of targets runs: 2, 1, 3. Target 1, unknown, is no longer generating the highest confidence which we would expect from the accuracy result which gives targets in the same order as the knowns so something is draining this confidence. Also, the fact that, target 1, unknown, is generating the highest accuracy suggests that information is being used despite this drain on confidence. Note also that with uncertainty, the order of targets is: 2, 3, 1, with target 1 generating the most uncertainty.

All in all, it looks like target 1, unknown, is our candidate for the construction of a new meaning or complex hypothesis. The highish accuracy relative to other unknown targets at 1.192 suggests that information has been used to construct complex hypotheses (Accuracy could not exceed 1 or 50% if a single word is used) but the relatively lower confidence is being caused by suspicion in the new combination. The highish uncertainty which attaches to this target at 1.156 would again fit this picture. The adding of one hypothesis to another effectively produces a change within the family and

should get 1 and I did mention that if a positive attempt was made to add a differentia, I would give uncertainty of 2 (see the scoring section in the last chapter).

Targets 2 and 3 on unknowns look to be generating single word hypotheses. Accuracy does not reach a mean of 1 on either target which supports this. Confidence also appears to be slightly lower on unknown versions of these targets as opposed to known but we'd expect this from prediction 4 since the cues can't be used properly.

A Possible New Meaning (Target 1)

In it's known version, target 1 is brake. In it's unknown version, it is sprag or brake by using a lever. I'll focus on the dependent variable of confidence to begin with.

There is a significant difference for meaning (see Result 16a). The unknown mean is 3.586 and the known 4.614. We see that the unknown meaning version of target 1 is generating less confidence than the known. There is also a significant difference for amount of information. I'll gloss over this, but if the reader looks at the means at Result 19a a drop in confidence can be seen on the second amount of information.

The result we really need to look at is 20a, the interaction of meaning by information. Here, the significance of F= .000. The means are displayed on graph 3. What we see for the known version of this target is a rising confidence. It is not dramatic and is caused, I would suggest by cues 2 and 3 consistently reinforcing the guess on cue 1. The first cue:

He (   ) in order to slow the vehicle down gives <u>brake</u> and the guesser is a little conservative and confidence is slightly .

Graph 3

Conf: Target 1, Meaning x Info
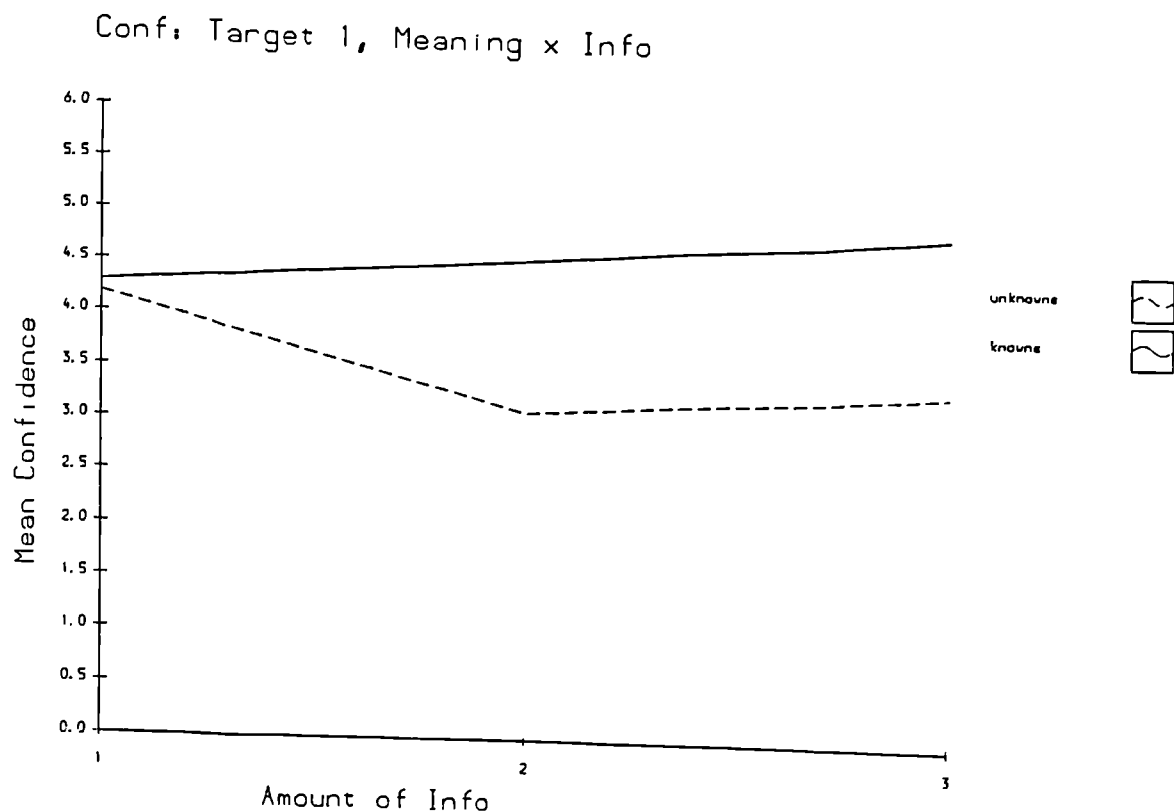
over 4. The next two cue add the ideas of <u>driver, car</u> and <u>changing gear</u>. All these are factors involved in braking and confirm the first hypothesis. Since subjects have been a little conservative to begin with, this leaves room for confidence to rise.

With the unknown version <u>brake</u> is obtained from the first cue just as in the known version. The cues that then come in are: <u>cowboy, wagon</u> and <u>He strained and perspired</u>. Well,

cowboys can brake wagons and they can strain and perspire when doing so. In other words, these cues could possibly have allowed subjects to retain the initial guess brake possibly with a falling confidence. However, what we see on graph 3 is not a consistent drop. Rather, confidence falls quite noticeably on cue 2 and then rises slightly on cue 3. If we look at the responses then the typical hypothesis for this target off cues 2 and 3 is pull on the reins. It looks as though information is being transferred from cues 2 and 3 which add ideas of cowboy, wagon and He strained and perspired to create this response. So information is being used yet we are in the "strange" position of seeing confidence fall causing the interaction with the known version across information. A factor which might explain this fall is that the response pull on the reins is a new meaning/complex hypothesis. At cue 1, subjects think they are guessing a single word hypothesis. At cue 2, they realise they have a complex hypothesis so suspicion causes a fall and at cue 3 they are becoming more familiar with the new meaning. Prediction 1 may be at work.

The question now is whether we can justifiably view this response pull on the reins as a new meaning/complex hypothesis. Clearly it is not the one I wanted to suggest which was brake using a lever, but it does seem to fit the information and if we could consider it as a complex hypothesis it would help explain the confidence pattern for the unknown meaning on graph 3. The major problem is that pull on the reins seems to be a paraphrase of the familiar single word rein in. That is, it is

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really a description of a known not a new meaning. But why then didn't subjects give the response _rein in_ and why add _pull_? We seem to have a genus _pull_ which perhaps continues the idea of _braking_ and a differentia _on the reins_. Cautiously, I would suggest we have the meaning _to brake by means of using the reins_ and that rather than being an expresion of the word _rein in_, subjects are regarding it as a new unlexicalised meaning and are suspicious of it. (Also, I'd regard the adding of _reins_ to _brake_ as quite a positive attempt to form a new meaning). If this response were a single word hypothesis there is no way of explaining the drop in confidence at cue 2 unknown version. Such a single word guess uses the information in cues 2 and 3 and so should force confidence to rise as with known meanings.

However, I don't really want to leave this discussion of the unknown version of target 1 here. There are quite a variety of responses on this target in addition to _pull on the reins_ at cues 2 and 3 that we should take note of. Also, order adds an interesting dimension and influences this variety of response.

The first thing to note about order and confidence is that if we look at Result 22a, meaning by order by information, the significance of F= .061. There is no interaction. The means for the interaction are given at table 1. Both known orders rise in terms of confidence and both unknown orders fall at cue 2 . However, there is no difference within the two known orders and within the two unknown orders. It is really

the unknown version orders that I'm interested in.

Table 1
Confidence means for unknown meaning by order by information
for target 1

	1 amount	2 amounts	3 amounts
Unknown Order 1	4.047	3.188	3.482
Unknown Order 2	4.318	3.071	3.412
Known Order 1	4.494	4.682	4.976
Known Order 2	4.082	4.494	4.953

Just to make the picture clear, I'll display the unknown version means on graph 4. We can see that the orders are very similar. The real point of difference is that Order 2 is slightly higher than Order 1 on cue 1. This is accidental since the same cues were present here in both orders. So there is really no difference between the unknown orders in terms of confidence, yet as I've mentioned order does seem to influence the responses given. Let's now look at these responses.

Let's begin with Unknown Order 1. On cue 1 we get the response brake and on cue 2 this changes. Forty four out of eighty five responses are now pulled on the reins. Another ten are either pulled or reined and these could be seen as "abbreviations" of this complex hypothesis response with the differentia missing in the first instance and the genus in the second. If we put these responses together, then they make up 64% of the responses on cue 2. Another 21% of the responses on cue 2 are represented by the single word brake. Another 15% of

the responses are slightly "eccentric", for example, <u>shouted</u> <u>"Woah"</u>.

Graph 4

Conf: Unkn Meaning x Info x Ord
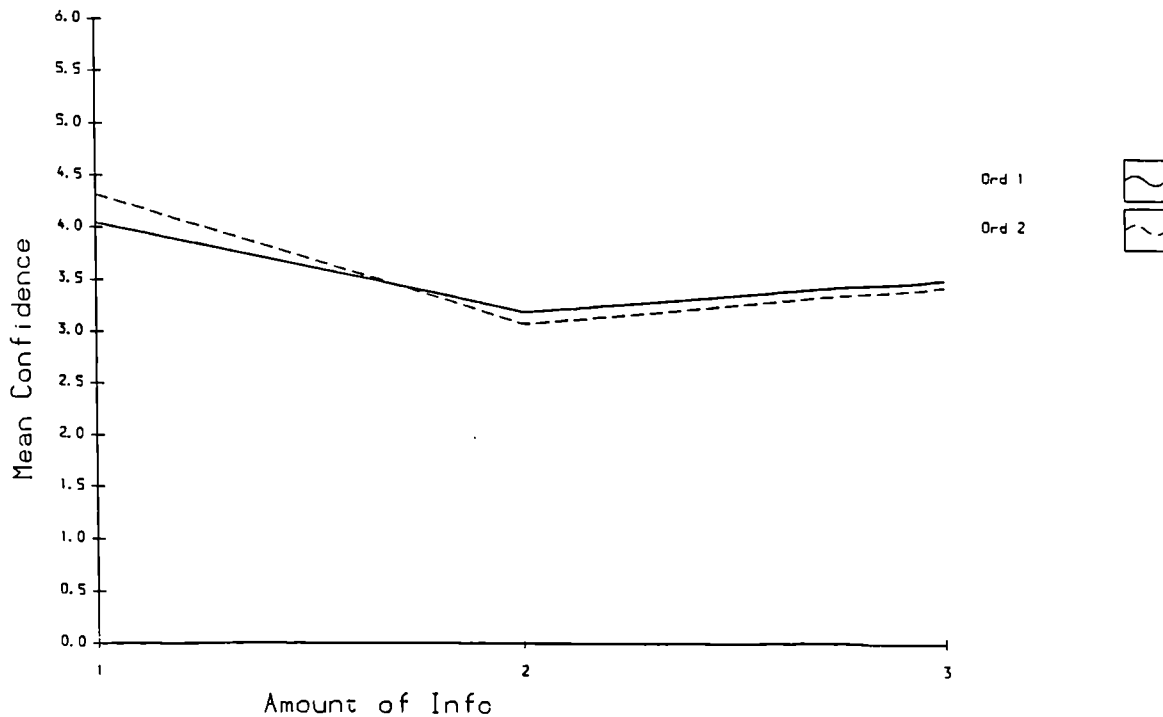
If we move to Unknown Order 2 on cue 2, then twenty two responses are represented by <u>brake hard</u>. A further fourteen could be seen as abbreviations of this so this response comes about 42% of the time. The single word <u>brake</u> is used about 48% of the time and about 10% of the responses are slightly eccentric.

Leaving aside the eccentric responses which are not too numerous and probably don't influence things too much, what can

we conclude from this? On Order 1, cue 2, the majority response is _pull on the reins_. This is a complex hypothesis which, if we look at the actual responses, does tend to reduce confidence on the second cue with respect to the first. Given the prevalence of this hypothesis we would not see the drop in confidence at cue 2 for Order 1 on graph 4 if this response type did not contribute to that drop. On Order 2 we get a similar drop in confidence at cue 2, but this response is not present. Here we get _brake hard_ which again can be seen as a complex hypothesis consisting of genus and differentia. Again in terms of plausibility, nothing dramatic has been attempted here. The adding of _hard_ to _brake_ is hardly dramatic. Yet again, looking at the responses, confidence tends to fall on cue 2 for this response despite the fact that information is being used.

We have, then, two different responses, depending on order, which can both be seen as complex hypotheses and which both seem to support the idea that the formation of complex hypotheses results in a weakening of confidence compared with the formation of single hypotheses in the known meaning condition. The key point is that these hypotheses use the information given at cue 2 quite effectively. We would therefore expect confidence on the unknown version at this point to match that for knowns. The fact that it does not can be explained in terms of suspicion in a new combination.

However, the picture is not so completely straightforward as suggested above since we have the single word response _brake_

to consider at cue 2. On Order 2 this is the dominant response coming 48% of the time. Confidence would not have fallen at cue 2 had not this response type been contributing to the fall. Looking at the confidence patterns of this response we find that in approximately 50% of its instances confidence remains the same or rises with respect to cue 1 and in the other 50% it falls. However, the falls in confidence are a little more dramatic than the rises and I've also counted static confidence instances in with rising confidence instances. This response type, then, pushes down confidence on cue 2 in Order 2 just as does the complex hypothesis. It's effect is almost identical on Order 1 where we again see a 50% split between falls as opposed to a static or rising confidence though here it is much less frequent and the complex hypothesis dominates.

This effect where single word hypotheses force confidence down on the unknown version in no way negates the idea that the creation of complex hypotheses causes a fall in confidence. Here, information is rejected as not useful and this factor not the use of information causes the fall. Where <u>brake</u> occurs and confidence falls on cue 2, I suspect subjects are thinking something like "Well, cowboys can brake wagons but there must be a better word than this". The problem seems to be that subjects feel these cues to be potentially useful in that they could produce a more precise single word response but that they can't use them to do so. They escape this inconsistency by abandoning cue 2 from the process of lexicalisation and hold it as an unusual association of the form <u>brake</u>. Since useful

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information is rejected, confidence suffers. Essentially, we are looking at prediction 4 here where the effect of abandoning information was predicted.

Where brake occurs and confidence rises or remains static subjects have probably been deceived in that they see brake as a perfectly good common denominator between the first two cues. So the effect noted at prediction 5 is present.

However, the overall effect of the single word hypothesis brake at cue 2 as pointed out in the above paragraph is to create a fall in confidence which helps that created by the complex hypotheses.

We should also look at cue 3 here as well as cue 2. At cue 3 pull on the reins now becomes very dominant in both orders. Confidence rises slightly and perhaps where this guess is repeated the new cue is reinforcing it. Perhaps where a change say from brake hard is involved then it may be that the drain on confidence caused by suspicion only comes at the point where a complex hypothesis is created and that changes can lead to increasing confidence just as with known meanings.

The most interesting point here is that we still get some instances of the single word hypothesis brake at cue 3. There are 9 in Order 1 and within this confidence remains the same or rises for 8 and falls for just 1. In Order 2 there are 15. For 10 confidence remains the same or rises and for 5 it falls. The overall effect of this hypothesis now is not to reduce confidence as we saw on cue 2 but to raise it. It seems odd that on cue 2 subjects tend to see the cues as inconsistent but

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suddenly on cue 3 they fail to do so. To some extent it is only those who did not notice the inconsistency on cue 2 who use this guess on cue 3.

Perhaps this failure to notice the inconsistency on cues 2 and 3 is not innocent or unsuspecting. Subjects might be seeing the new information as in a sense "fraudulent". Sometimes we come across new words that we consider simply to be jargon. In my experience, when someone mentions contact hours I immediately translate it to teaching hours. The more people tell me that there is a difference the more stubborn I tend to get about it and point out the distinct possibility of arrest should contact hours have some special meaning. In the same way subjects could be rejecting information on the basis that it is over complex and gaining confidence in their more straightforward guess as they do so. This might well be the same effect we noted in Experiment 3 with pseudowords. They were again rejected in both meaning conditions at cue 3 but there was a small fall in confidence. This fall is tied in with abandoning guessing though and it would be interesting to see what might happen to pseudowords where the hypothesis could be repeated.

If we turn now to accuracy on target 1, there is again a significant difference between known and unknown meanings with known meanings generating more accuracy than unknowns (see Result 16b). Also, Result 19b shows accuracy to be increasing significantly with information. The key interaction of meaning

by information is also significant (see Result 20b). The means
are displayed on graph 5.

Graph 5

Acc: Meaning x Info
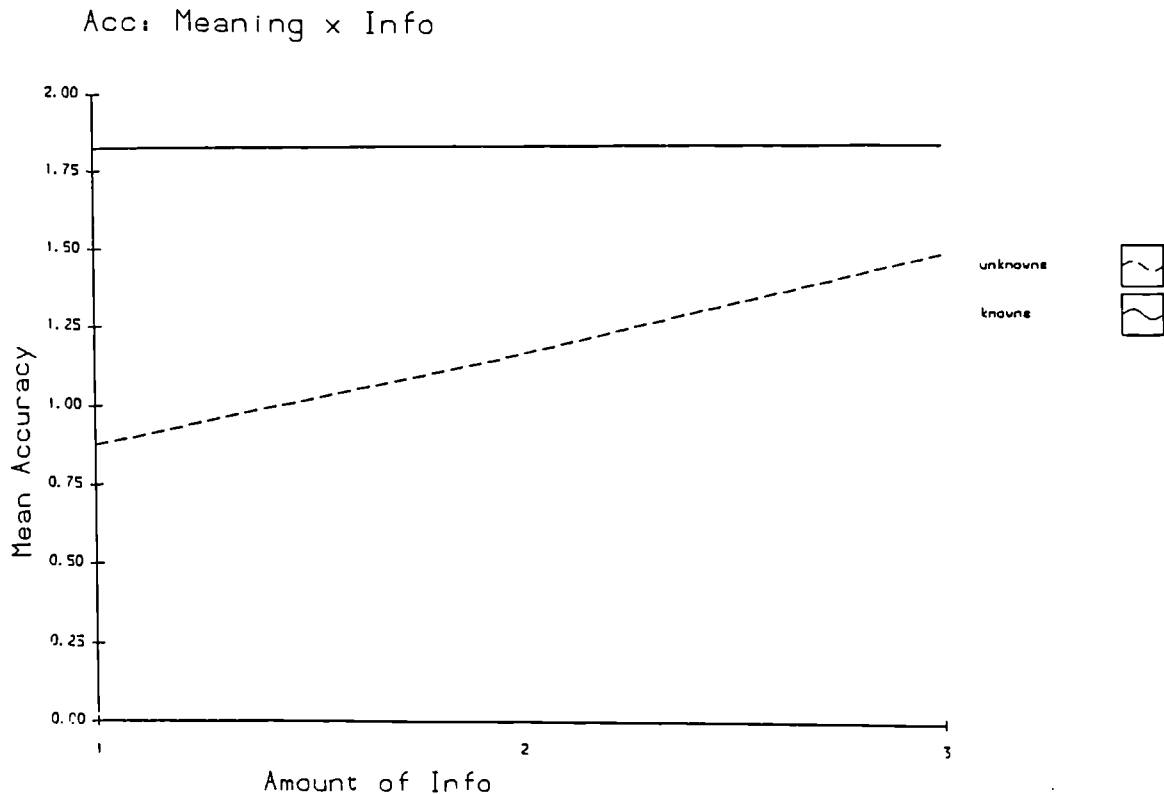
We see accuracy stay high on the knowns because <u>brake</u> is
obtained on cue 1 and is awarded an accuracy of 2. This guess
is maintained across the other cues with a few subjects who
went wrong to start with coming to the correct answer on cue 3.
On the unknowns, <u>brake</u> is obtained on cue 1, but now it is only
worth 1. The response <u>pull on the reins</u> which seems
appropriate to all the the information and so is worth 2 even
if it was not the expected hypothesis comes in progressively at
cues 2 and 3. To understand the gradual rise of this unknown

line, we need to look at the interaction of meaning by order by information which is significant (see Result 22b). I'm only interested in the unknown meaning side of the interaction here. I'll give the means at table 2 to save referring back. We see that accuracy on cue 2 is much higher on Order 1 than on Order 2. This is because <u>pull on the reins</u> became available as a hypothesis on Order 1 at cue 2. On Order 2, the hypothesis

Table 2

Means for the interaction between unknown meaning orders across information for target 1 on accuracy.

	1 amount	2 amounts	3 amounts
Order 1	.847	1.471	1.565
Order 2	.906	.882	1.482

<u>brake hard</u> was available at this point but scored 1 since it was not really appropriate to all three cues and does not cover the information about <u>cowboy</u> and <u>wagon</u>. It was not until cue 3 that <u>pull on the reins</u> became available. Hence accuracy is only half as good in total on cue 2 as opposed to cue 3 and so we get the gradual climb in the unknown line as information increases.

Essentially, prediction 2 is intact. Accuracy does rise on the unknown to meat the known. The order factor just slows down the rise a little.

If we turn now to uncertainty on target 1 Result 16c shows a significant difference for meaning with unknown meanings generating significantly less uncertainty than knowns.

There is no movement in the uncertainty line across information (see Result 19c) and there is no interaction at the key point of meaning by information (see Result 20c). This does not mean that the two lines are in the same place, but that the unknown line parallels the known at a higher level. The reason for these parallel lines is to be found at Result 22c, the significant interaction for meaning by order by information. The means are given at table 3.

Table 3

Means for the interaction of meaning by order by information for uncertainty on target 1.

	2 amounts	3 amounts
Unknown order 1	1.553	.824
Unknown order 2	.753	1.494
Unknown averages	1.153	1.159
Known order 1	.306	.318
Known order 2	.212	.188
Known averages	.259	.253

What we see is that on the known orders, Order 1 is consistently about 0.1 higher than Order 2 so that the averaged results for 2 and 3 amounts of information are almost identical. (This difference in orders is strange and I can't explain it. Since subjects seem to be keeping the same guess they should be identical).

On the unknown orders the hypothesis pull on the reins is available on cue 2 and since this is seen as a strong attempt to add a differentia to the previous guess brake (see the

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scoring section in the last chapter) it scores 2 giving high uncertainty on two amounts. It gets repeated on three amounts so uncertainty comes down. On Order 2, brake hard comes at cue 2. Since this is seen as a weak attempt to form a differentia, it's just an adverb added to the first guess brake, it scores 1 and so uncertainty stays low at two amounts. On cue 3, pull on the reins comes and scores 2 so uncertainty rises. The result is an interaction of order on the unknown meanings with the lines crossing, but the two sides of of the interaction cancel each other out when an average is taken and are equal. The result is two static parallel lines with the unknown meaning line well above the known.

So uncertainty on the unknown version is higher than on the known as expected at prediction 3, but uncertainty does not fall on the unknown version because of the effect of order 2. Prediction 3 does come close to what actually happens. But we do need to ask whether this picture of high uncertainty is valid. We are looking at uncertainty in terms of changeability and adding new information effectively changes a guess. A strong attempt to add a differentia gets 2. But this might well not reflect the number of alternative hypotheses a subject might hold. Here I prefer the result of Experiment 2 which shows uncertainty low and static then starting to rise as associations are added. We are asking subjects directly for their intuitions and there is some justification for this initially low picture of uncertainty since there might be an element of difficulty in retrieving information from the

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encyclopaedia relative to the lexicon. If we in fact convert uncertainty scores to percentages (see table 4) here they come out at just over 50%. Since in Experiment 2 the uncertainty went from 0-10, this experiment suggests subjects think of 5 ideas when they get a cue which is too high with respect to Experiment 2's results.

Interestingly, we do see an attempt to enlarge on hypotheses in the unknown condition as more information is given as mentioned in Experiment 2. If we look through the responses in the appendix to this chapter there are instances at cue 3 of <u>yanked on the horses reins</u> where the idea of <u>extra effort</u> has been added to <u>pull on the reins</u>. We also see responses like <u>pull hard on the reins</u> where an extra word is added to express this idea.

We can draw a graph to represent the unknown meaning side of the interaction with amount of information for all three dependent variables. The means as percentages are given at table 4.

<u>Table 4</u>
<u>The means for unknown meanings across amount of information for all dependent variables</u>

	1 amount	2 amounts	3 amounts
Confidence	69.7%	52.1%	57.4%
Accuracy	43.8%	58.8%	76.2%
Uncertainty		57.6%	57.9%

These means are displayed on graph 6.

Graph 6

Unknown Target 1
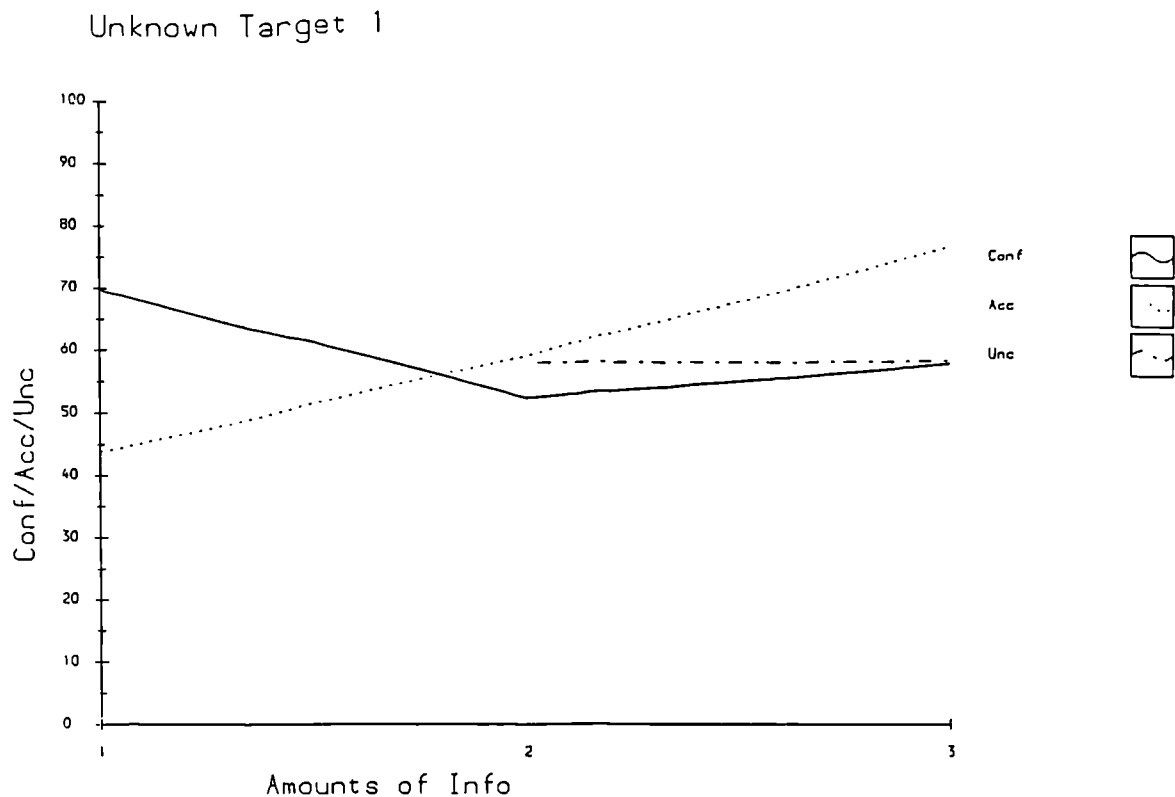
There is a problem with the position of uncertainty on this
graph in that it may be too high. However, when a new meaning
comes into existence from the perspective of high initial
confidence, which might happen in real life, in the more
naturalistic situation I have used here we see confidence fall
as accuracy rises. The fall in confidence might be taken as
evidence that the formation of complex hypotheses weakens
confidence though suspicion. The fall in confidence here does
not mean that confidence will always fall. If confidence
started low because of weak information perhaps, then
confidence would rise in the formation of a complex word

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hypothesis but not so fast as for a single word hypothesis as in Experiment 3. The conclusion is that complex hypotheses weaken confidence.

Accuracy, however, is not affected and here we see it rise. Where a subject builds a new meaning his confidence will be undermined even when correct and guessing is probably followed by some form of appeal to authority.

Correlations on the unknown version of target 1:

A large number of correlations were looked at. In the main, there is nothing of great interest to add to what was said in the correlations to Experiment 3 except where the unknown version of target 1 is concerned. Here we can use correlations to help sort out the variety of responses.

The measure of association used is Pearson r. Since we will be operating at the level of target by order by amount of information in order to give the greatest possible detail, there is only one item for each of the 85 subjects involved at this level. The decision we had to make in Experiment 3 as to whether we use subjects or subjects by items as cases is irrelevant. Here we can only use subjects as cases so scores are independent. Also, since the scales used to measure confidence, accuracy and uncertainty are narrow, it proved difficult to obtain clear scattergrams of the plots. So the same tabling method used for Experiment 3 correlations is repeated here.

The purpose of using correlations on the unknown version

of target 1 is as follows. We predicted a drop in confidence at cue 2 when a complex hypothesis is formed. Unfortunately, whilst we get this drop, we have a mixture of complex and single word hypotheses at this point. Using correlations, we should be able to distinguish between these responses and illustrate more clearly than in the last section that the formation of complex hypotheses does indeed cause a fall in confidence. Secondly, we saw that retention of the single word hypothesis brake on cue 2 and the abandoning of information led to a fall in confidence, but a similar retention on cue 3 led to a rise. It was as though subjects were rejecting information on the assumption that it was "fraudulent". We can again illustrate this with correlations.

Let's begin with a correlation of confidence and accuracy for Order 1. Remember here that the complex hypothesis formed at cue 2 was pulled on the reins and the single word hypothesis was brake. The former scored an accuracy of 2 and the latter an accuracy of 1 so we can distinguish between these responses in terms of accuracy and and display what degree of confidence goes with each response type.

Coefficients are given at table 5 for both orders.

Table 5
Confidence/accuracy coefficients for unknown target 1 across amounts of information for Order 1

1 amount	2 amounts	3 amounts
	Order 1	
.190	.111	.284

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The coefficients are all low but the main point of interest are the plots. These are given at table 6. The plots for Order 1 are displayed on graph 7.

Table 6

Confidence/accuracy plots across information for the unknown version of target 1, Order 1

Accuracy	0	1	2
Confidence 1 amount	3.4	3.6	
Confidence 2 amounts	2.6	3.4	3.3
Confidence 3 amounts	2.1	3.8	3.7

If we look at graph 7 at 1 amount of information at an accuracy of 1 we see a confidence of 3.6. These subjects have given the single word response brake. If we look at 2 amounts of information at accuracy 2, these subjects have given the complex hypothesis pull on the reins and confidence has dropped to 3.3. This is hardly a major drop but it is interesting since there should be no decrease at all in confidence here. Information is being used and confidence should be rising. What we see in this lowering of confidence is the effect of suspicion in a new combination of meaning components. Interestingly, the formation of the complex hypothesis at accuracy 2 on two amounts of information decreases confidence slightly further than the use of a single word hypothesis at accuracy 1. Here brake is repeated. So the formation of the

complex hypothesis actually decreases confidence further than the use of the single word hypothesis

Graph 7

Conf/Acc: Unkn T1 on Ord 1 x Info
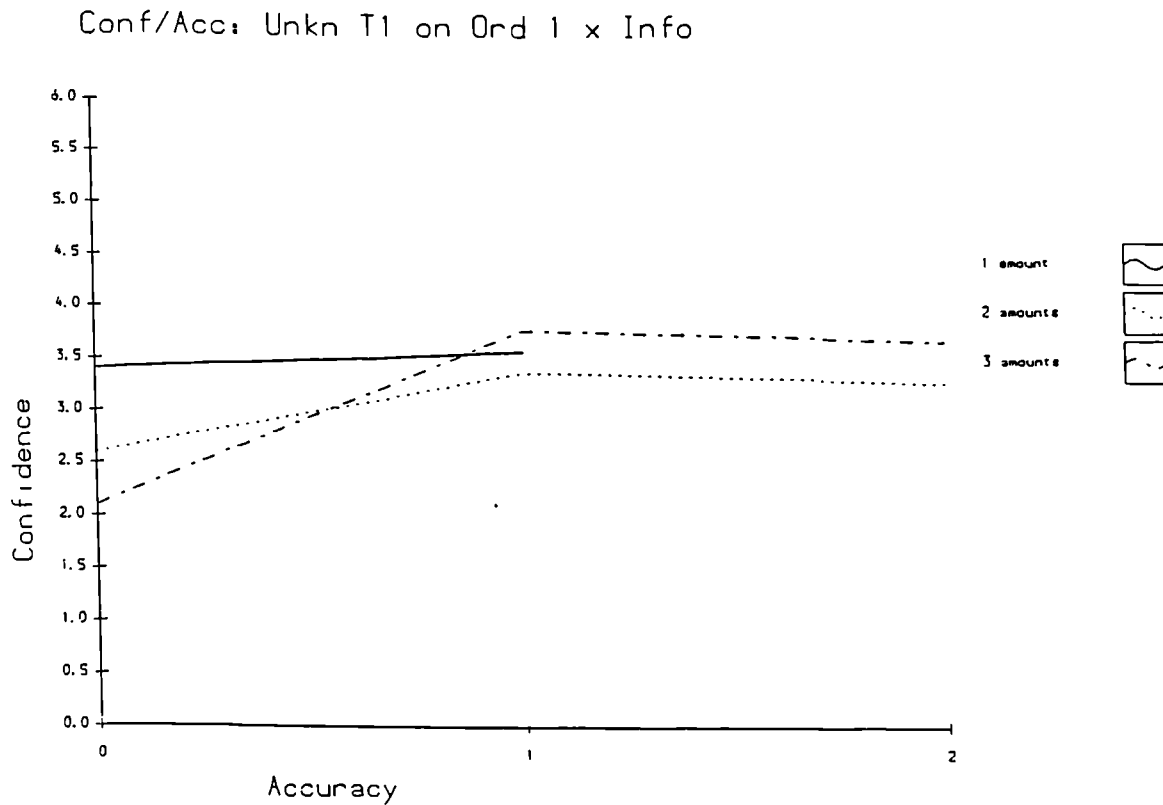
even though the former uses information and the latter abandons it.

On the third amount of information, confidence in the complex hypothesis rises. The third cue is now confirming this guess.

Turning to the retention of the single word hypothesis brake. When this happens on cue 2, marked by an accuracy of 1,

confidence falls slightly in relation to accuracy 1 cue 1. Accuracy, however, is down by 50% since <u>brake</u> without a differentia is only half correct. So confidence does not fall in proportion to accuracy and does not reveal any great awareness of difficulty. At at the third amount of information again at an accuracy of 1 we see that confidence here is 3.8. It has risen with respect to accuracy 1 on two amounts of information which also marks <u>brake</u>. Subjects do boost their confidence through the rejection of information, in all probability because they see it as "fraudulent. We can't tell if these are the same subjects on cue 2. This dosn't really matter. The point is that information can be seen as fraudulent at some point along the information sequence.

Unfortunately, we can't repeat the above illustration of the unknown version of target 1 on Order 2 since the single word response <u>brake</u> and the complex hypothesis <u>brake hard</u> both score an accuracy of 1 and we can't distinguish between them on cue 2.

Single Word Responses.

Target 2

Here we are dealing with the formation of single word hypotheses on both meaning versions of the target.

First, let's look at the independent variable of meaning for target 2. Result 23 shows that the unknown meaning version differs significantly from the known meaning version for accuracy and uncertainty, but not for confidence.

For accuracy the difference between the two means is significant and substantial. The known version mean is 1.804 and the known, .841, so prediction 6 is correct. The target in it's known form is <u>cut</u> and the first cue is: <u>He (   ) the carcass with a sharp knife</u>. The second cue in Order 1 adds <u>butcher</u> and <u>pig</u> and the third adds: <u>He wore an apron to stop his clothes getting messy</u>. The unknown version of the target is <u>flense</u>. Cue 1 remains the same. Cue 2 adds <u>sailor</u> and <u>whale</u> and cue 3, <u>They were soon covered with a smelly, white mess</u>. The responses on both versions of the target are very similar. Single word answers like: <u>cut, carve, chop, open, gut, slit, hack</u>. On the known version these score 2, on the unknown version only 1 since only a complex hypothesis can score 2 here, hence an inevitable difference. Since there is no significant difference in confidence between the two versions of this target, the known mean is 4.112 and the unknown 3.960, we might say that on the unknown version of target 2, subjects are not aware of their lack of accuracy.

The interesting feature on target 2 is in the confidence and uncertainty results. For uncertainty, there is a significant difference with the known producing less uncertainty than the unknown. The known mean is .453 and the unknown .674. Prediction 7 fails and there is more uncertainty, particularly on the unknown, than I bargained for. On the other hand there is no significant difference between the two versions for confidence. We would think that increased uncertainty would decrease confidence. Here, almost the

opposite has occurred. The unknown version with the high uncertainty (that is, high within the context of changing to fairly closely related guesses since the mean is below 1) has a confidence score which is close to and not significantly different from the known version.

I suspect the high uncertainty on the unknown version is linked to the closeness in confidence. The reason is to be found in the nature of the responses given above. We get cut which is neutral, and we get something like gut which is more biassed in it's associations towards the idea of fish and then we get hack which is biassed towards the idea of violence. In the known version of the target, the tendency is to choose a fairly neutral option and to retain it fairly frequently. Hence a lowish uncertainty. In the unknown version there is an increasing tendency to start with a neutral response but to change more to responses like gut or hack when whale and the idea of getting covered in a smelly white mess come in as cues. I would suggest that such changes are useful in that they allow subjects to extract some of the information from these cues. In this way, the unknown version of target 2 gains a confidence advantage over the strategy of simply abandoning the whole cue and so generates a confidence total close to that of the known version which is probably operating close to it's confidence "ceiling" right from cue 1 and can't gain much from cues 2 and 3.

Let's look at this notion of "extracting" some of the information from cues on the unknown version. Given that

subjects have obtained the hypothesis cut on cue 1 and know also that they are dealing with some kind of dead creature, then when the second cue whale comes in they might see it as made up most prominently of the items sea creature and very large size. If the subject changes his guess from cut to gut he has been able to use the idea of sea creature and with the use of information, confidence rises. If the subject changes from cut to hack then he has used the idea large size (needing a violent effort to cut up). With the third cue getting covered in a smelly white mess then white mess could lead to gut (we know there is a carcass and white suggests fish/sea creature) and covered to hack (it suggests a large carcass needing some effort). Or the subject having got gut from cue 2, might ignore this third cue.

What we have is a partial use of information and we might identify this as a strategy type. It involves taking some of the information in a single cue or taking one cue in preference to another where information is relevant to one of the meaning components. In this case the differentia information is treated in this fashion. This *strategy of partial use is* similar to the strategy of forcing noted in experiment 3 in that there is distortion of information. It is different in that with forcing we noted that there was a downgrading of differentia to association. Since we are dealing with associations suggesting a differentia here there can be no such downgrading. We might say that forcing applies to core meaning components and partial use to associations.

There are some important points to note here. Partial use need not only apply to situations where subjects have the opportunity to change guess. A subject could retain a guess and do the same thing. It is likely, however, that the opportunity to change guesses allows subjects to see new information as useful and attracts them to it. Where they hold the same guess, new information might not seem so useful and they would abandon. Also, this high uncertainty will only generate a confidence on unknowns. On a known target where information is consistent then changing or holding should generate confidence pretty much equally with the proviso noted in the correlations on Experiment 3 that an extra degree of processing effort might be involved in changing with a small reduction in confidence.

But if some information is used then what about the remainder? <u>Gut</u> uses the idea of <u>sea creature</u> with respect to <u>whale</u> but does not use <u>large size</u> for example. Now <u>gut</u> does not necessarily preclude <u>large size</u> so what happens here is not strictly logical. It simply doesn't use this item of information in an active sense in the lexicalisation process to achieve the change of guess. There is no single word form that can absorb <u>cut, sea creature</u> and <u>large size</u> as part of its meaning. Rather, <u>large size</u> is abandoned from the lexicalisation process and held as a strange association to <u>gut</u>. The <u>hack</u> response uses <u>large size</u> and takes <u>sea creature</u> as a strange association. We again see information abandoned from the lexicalisation process as inconsistency becomes a

problem in the same way as with the <u>brake</u> response on cue 2 target 1, but involving part of a cue this time rather than the whole thing. We would expect this to have some kind of negative effect on confidence since the abandoned information is probably seen as potentially useful. Subjects are probably thinking that there is a slightly better single word answers than <u>gut</u> or <u>hack</u>.

So partial use of information will in part send confidence up by allowing use of some information. But any such rise is going to be held back or limited by abandoning some information from the lexicalisation process. Where this is applied we would expect an unknown target to generate less confidence than a know.

The lack of a significant difference between the meaning versions of this target on confidence does not reveal this limiting effect on confidence for partial use, but we do need to follow through to the meaning by information interaction. If subjects are "troubled" by cues 2 and 3 on the unknown version the known and unknown confidence lines should diverge across information most likely with the unknown line falling. The rational is that they should start very close together since the first cue is common to both. Any differing approach to information subsequently must produce an interaction.

I'll look at the possible interactions on meaning by information for confidence and uncertainty together. The relevant statistics are at Result 27a and c) and we can see that there is indeed a significant interaction for confidence,

but not for uncertainty. I'll give the means at table 7 to save referring back.

Table 7
Means for the meaning by information interaction for target 2 for confidence and uncertainty

	1 amount	2 amounts	3 amounts
Unknowns confidence	4.012	3.824	4.046
Knowns confidence	3.788	4.206	4.341
Unknown uncertainty		.706	.641
Knowns uncertainty		.547	.359

For uncertainty, the unknown means are higher across information than the knowns as we would expect. Both versions show a tendency for uncertainty to decrease with information so the lines remain parallel

The means for confidence are displayed on graph 8. This interaction on graph 8 is not easy to interpret since the two confidence lines don't start in quite the same place (even though both points are responses to the same cue in isolation) and cross to cause the interaction. What we are looking at in this crossing of lines might be no more than an accident on cue 1. On the other hand, if we could imagine squeezing the two confidence lines together at cue 1, then the line for the unknown version of the target would drop slightly as the line for the known version rises, the strong point of the interaction being over cue 2 with the lines parallel after that. Note that though the lines are parallel after cue 2, the

unknown line stays below the known.

What I suspect is happening is that on the known version of the target across information, subjects see cues 2 and 3 as consistent and able to reinforce a previous guess completely. Sometimes guesses are changed, but again these cues

Graph 8

Conf: Meaning x Info
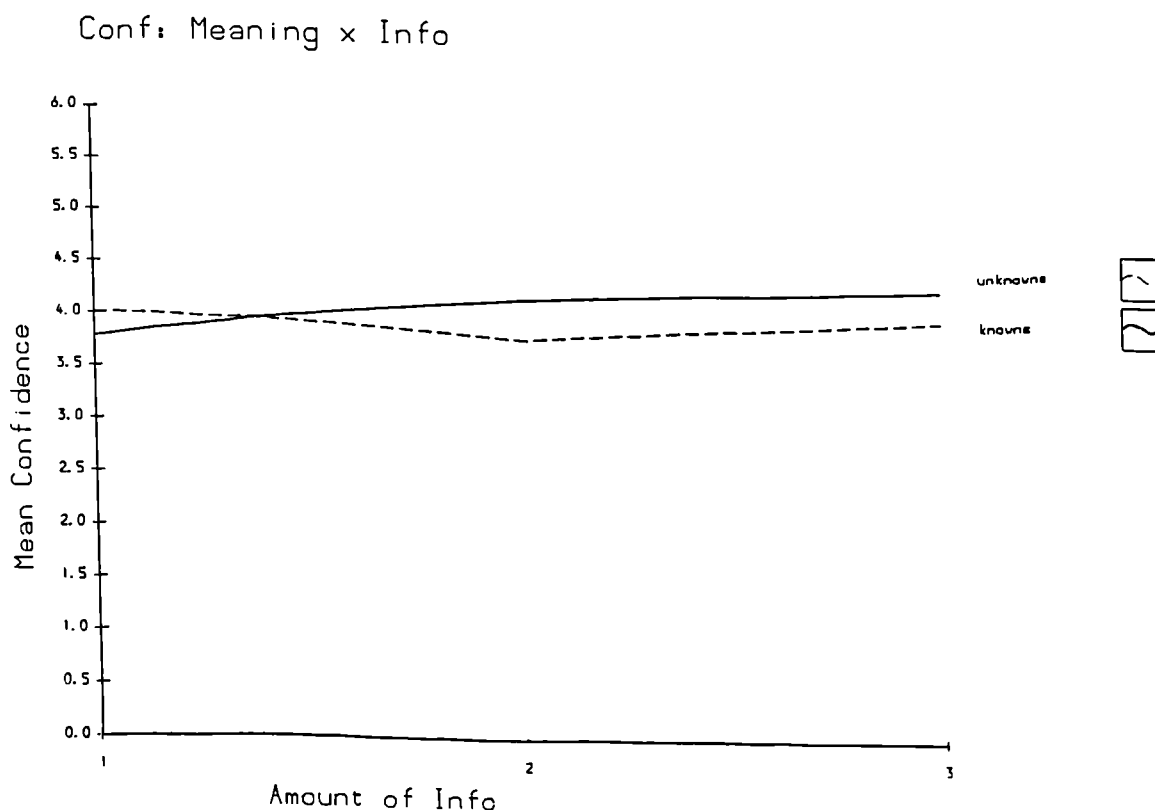
consistently support the new hypothesis. Confidence, however, is close to its maximum ceiling from cue 1 and there isn't much scope for increase. On the unknown version of the target, some of the information in cues 2 and 3 is seen as useful probably because it can lead to a change of guess and this sends

confidence up to a degree. However, some relevant information can not be used and this holds confidence back and prevents it from reaching the same levels as seen on the known version. If we go back to the overall difference in confidence between known and unknown versions of this target, it could be that we find no significant difference for two reasons. First, the confidence gap between the two versions of this target has partly been closed by the accidentally high start on cue 1 unknown as shown on graph 8. Also, however, because the information which has been taken up by partial use on the unknown version of the target has had an effect sufficient to close the gap.

Also if we look at confidence and accuracy scores given as percentages in table 8

Table 8

Confidence & Accuracy as % on target 2

Overall Accuracy

	Known	Unknown
	90.2	42.05

Confidence cues 2 and 3

	Known	Unknown
cue 2	70.1	63.7
cue 3	72.4	67.4

we see a substantial difference on accuracy with unknown meanings lower (meaning by information is not significant for

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accuracy) but confidence differences between the two meanings are small. Subjects have some intuitions about their lack of accuracy on unknowns but these intuitions are limited because partial use has given confidence a boost.

One final point about the strategy of partial use. Why do subjects use it rather than build complex hypotheses? It may be that the differentia has been formed then dropped because of suspicion. I doubt this. There are two reasons I would suggest. First, the way in which any information which is not taken up by the strategy can be held simply as strange collocations on the single word hypothesis formed allows information to be fairly easily processed. Second, even though there is a difficulty in processing here in that we have to cope with this strangeness, the information taken up is used to do something-change guess. This opens up the possibility of increased accuracy and so increased benefits.

It is not likely that a differentia is formed then and subjects do not come near the possibility of constructing a complex hypothesis but get sidetracked into choices between single word guesses.

In a way the situation is not very different from where a single word guess is retained in the unknown condition as on target 1. Again the differentia is not formed partly because information which is rejected can be held as unfamiliar associations. However, the attractive option of changing is no longer open and new information is not drawn in but must simply be held as associations to the word guess so the strategy is

more properly termed abandoning. However, a factor which off sets the lack of options to change to and encourages the use of this strategy is the possibility of seeing information as fraudulent which helps. Again, intuitions about accuracy are limited.

If in fact we move to target 3 where again single word hypotheses are formed, the picture is almost identical to target 2. The exception is that there is an overall confidence difference between both meaning versions of the target (see Result 30a), the unknown being the lower, but this time both versions start at almost the same point on cue 1 (see Result 34 a). So possibly it was the accidental high start of the unknown version of target 2 on cue 1 that closed the overall gap in confidence between known and unknown version so there does appear to be a drag on confidence where partial use occurs. I won't proceed any further with target 3 here because of the similarity with target 2.

To sum up then. In previous experiments, we have noted that subjects form single word hypotheses in the unknown meaning condition by abandoning or forcing information. We can now add a third strategy which was not predicted, that of partial use. This method of using information can provide a limited boost to confidence. Also, the way in which confidence is held back by the non use of some of the information in cues does suggest that subjects do have some intuitions about their lack of accuracy. However, whereas confidence is only marginally lower on unknown versions of targets 2 and 3 as

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compared with known it is substantially lower for accuracy. Although one might argue that we should refine our accuracy grading scheme since a variety of single word guesses are given and some are probably a little more accurate than others, broadly, we can say that subjects have a limited awareness of accuracy where partial use occurs. We also need to remember the high uncertainty (changes of guess) which associates with partial use. We might go further and say these intuitions about accuracy are limited in that subjects are prevented by high uncertainty from reaching the point where they might consider a new meaning/complex hypothesis. The high uncertainty makes sure that they are focussing on choices between single words and never really get close to considering that a complex hypothesis or new meaning might be present.

Order

Here we are concerned with the possibility that one of the orders used is superior to the other. Remember that we are dealing now with order only in a limited sense. The cue to the genus always comes in first place and is the same for both known and unknown versions of the target. Only the last two cues vary their position so that we have Order 1: subject/object collocation-> non subject/order collocation, and Order 2: non subject/object collocation-> subject/object collocation. Is one of these orders stronger? I have suggested at prediction 8 that there will be no effect for order. This is due to the fact that order is complex and I

decided to await results.

Having looked at the dependent variables of confidence and accuracy, there seems to be little of interest here. I intend to proceed straight to the dependent variable of uncertainty where I think we can see some interesting effects for order.

With uncertainty, we do get an overall effect for order (see Result 2c). The mean for Order 1 is .686 and for Order 2 .605. Order 2 generates less uncertainty than Order 1 and this difference is significant.

There is a significant interaction for meaning by order by information (Result 11c). The means are given at table 9 to save referring back.

Table 9
Means for meaning by order by information for uncertainty

	2 amounts	3 amounts
Unknown order 1	1.012	.679
Unknown order 2	.749	.937
Known order 1	.584	.471
Known order 2	.443	.290

Whilst the interaction between unknown orders is the first thing to catch the eye since the lines appear to cross, the averages for unknown Orders 1 and 2 are respectively: .846 and .843. Although the interaction is interesting, it is not what gives Order 2 less uncertainty. On the known version of the orders there's really not much interaction. Both lines fall,

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but known Order 2 does so at a lower level than Known Order 1. The fall is also a little steeper on Order 2 than Order 1 in the known version. It seems that the overall reduction in uncertainty for Order 2 lies in the known version side of this variable. Note we almost get a significant difference for the meaning by order interaction (Result 3c: significance of F= .054) There is also a significant interaction at Result 14c, order by information by target, but in order to bring back the meaning variable I'll move to meaning by order by information by target (Result 15c) where we have a significant interaction with the significance of F= .000. Again, bringing target into this discussion tends to decrease the importance of the order variable in terms of constructing plans or order based strategies in that we'd need a different plan for each target. But the differences might be more on unknowns than knowns. The means, however, are given at table 10. There's really too much at table 10 to use graphs, but we can see by eye much of what happens.

First the unknown orders. The orders for each interaction on the unknown target versions cross each other. On target 1, Order 1 falls and Order 2 rises. The same thing happens on target 2. On target 3, however, Order 1 falls very slightly, it's almost static. Order 2 crosses it by falling even more steeply. There is no real consistency across targets. The pattern on target 3 is almost the reverse of targets 2 and 1. What I suspect we're looking at is an accidental effect due to strength of cues. On targets 1 and 2

the subject/object collocations are generally the strongest in the sense that they seem to force most of the change that takes place. On target 3, the non subject/object collocation seems to generate the most uncertainty.

Putting the best light on things, we might say that the balance of evidence suggests that the subject/object collocation seems to produce the most uncertainty and forces

Table 10

The means for meaning by order by information by target for uncertainty

	2 amounts	3 amounts
Target 1 unknown order 1	1.553	.824
Target 1 unknown order 2	.753	1.494
Target 1 known order 1	.306	.318
Target 1 known order 2	.212	.188
Target 2 unknown order 1	.765	.541
Target 2 unknown order 2	.647	.741
Target 2 known order 1	.706	.341
Target 2 known order 2	.388	.376
Target 3 unknown order 1	.718	.671
Target 3 unknown order 2	.847	.576
Target 3 known order 1	.741	.753
Target 3 known order 2	.729	.306

the most change. Overall, however, there isn't really much difference between the means for unknown Order 1 and unknown Order 2 because as we see above, the lines keep crossing within each target across information. This crossing of lines creates

a balancing effect and both unknown orders end up producing very close overall uncertainty means: Order 1= .846, Order2= .843. We might say tentatively that the subject/object collocation seems the stronger and generates more uncertainty but that order does not really seem to exert much influence on it's power.

With the known orders, Order 2 seems to have less uncertainty consistently than Order 1. We need to know if the cause is the same on each target. Remember, Order 1 puts the subject/object collocation in second place, Order 2 puts the non subject/object collocation in second place. We might try to say that for each target, on cue 2 the subject/object collocation generates more uncertainty than the non subject/object collocation also on cue 2. This difference is consistent on all three targets but is very slight on target 3 though and we're on dangerous ground. This shouldn't create the overall superiority for Order 1 since we would expect the subject/object collocation to generate a lot of uncertainty on Order 2, cue 3.

Going on and looking at the third amount of information for the knowns we can note something interesting. Look at target 1, known Order 1 at cue 2. This is the subject/object collocation. The mean is .306. Now look diagonally downwards to the subject/object collocation on known Order 2 at cue 3. The mean is .188. The subject/object collocation seems not to maintain but to lose its power to generate uncertainty on cue 3. The same is true for all the other targets. So, the

subject/object collocation, whilst strong on cue 2, seems to lose this power on cue 3 ie. it is strong early but weak late. Reverse this process and look at the non subject/object collocations and the same can not be said. They seem to maintain their power. We have here the reason why Order 1 generates more uncertainty overall. On known Order 2 the subject/object collocation is losing it's influence to generate uncertainty when it comes after non subject/object collocations.

A possible explanation is as follows. If we take known target 2 in Order 2 as an example. The subject sees at He (   ) the carcass using a sharp knife. He wore an apron to stop his clothes getting messy. Say he has the genus cue and non subject/object collocation. Possibly the subject on the basis of this information which forms a familiar schematic representation is able to guess that the pronoun He is in fact butcher. That is, he has instantiated the pronoun on the basis of a familiar schema. See Whitney (1986) and (1987) for a fuller discussion of this phenomenon. So the effect of cue 3, the subject/object collocation is transferred to cue 2, the non subject/object collocation. But the subject might be cautious of this instantiation since information is not given explicitly and might not use it to generate uncertainty. When, however, on cue 3, he is told that the pronoun does represent butcher he will decide "Well I knew that all along" and ignore it again. All told the result is a weakening of subject/object collocations when they come after non subject/object

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collocations. Possibly also why we don't get the same thing happening on unknowns is because subjects are building up new schematic representations here and so can't instantiate so well.

To sum up, then, is it worth incorporating some of the above ideas into an order strategy which could be taught? I doubt if subjects would be aware of this difference between associations so we should probably think in terms of teaching them this. Also note that in this study, subject/object collocations are distant from the target only in terms of time, but we might argue that any effect due to time might translate into physical distance since these associations can occur away from their close position to the target

On known meanings, what changes of guess that do take place are important since changes might be needed to increase accuracy. We did see on the correlations for Experiment 3 with early cues on unknown targets how change was necessary and beneficial since subjects had been sent in the wrong direction. This could also happen on known targets in real life where information may be inconsistent. Also if information is simply vague close to the target we might need to change guess. It might be worth pointing out, then, that the order subject/object collocation-> non subject/object collocation is a better generator of uncertainty than the reverse. More simply, perhaps, it might be better to warn subjects not to ignore subject/object collocations when they occur some distance from the target rather than telling them to find these

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cues, hold them and then use them in a set order. This strategy of not ignoring subject/object collocations when they are distant does seem to address the problem of this type of cue losing it's power to generate uncertainty across distance. It does, however, remove order from the strategy and we are processing cues as we find them. But this does have the benefit of simpilcity and low processing cost over an order based strategy for probably the same gains.

One more point is that in this experiment there is no marked difficulty on the knowns. If there were it is possible that this order effect might vanish.

On unknown versions, order is not really an issue. The subject/object collocation doesn't seem to lose it's power to generate uncertainty as it becomes more distant from the target. We do need to remember that on the unknown versions, however, the "value" of uncertainty is questionable. It could lead to the formation of new meanings/complex hypotheses. On the other hand, it could lead to a search for alternative synonyms for the target which really do not improve accuracy, but which can give confidence a boost through partial use of information. This latter scenario is clearly dangerous and could involve overconfidence. Given that the construction of new meanings/complex hypotheses seems to be rare (on one target out of three) it might be best to teach a plan involving the reduction of amount of information used. Find the genus cue and ignore anything else.

High and Low Confidence Subjects

One subject mentioned earlier is that we can get different types of subject in terms of confidence. In addition to a middle of the road group some are very confident, others are conservative but all obtain roughly the same accuracy. This is of interest to future experimenters since it might be useful to issolate different subject types. So let's see if there is any evidence for this subject distinction.

Since there were 85 subjects in each version of the experiment this seemed sufficient so correlations of confidence and accuracy were done for known and unknown meaning conditions in each order so we have four correlations. All the scores for each subject were added together so we are doing a subject version and not subject by item. This is appropriate since it is simply a subject effect we are after. The coefficient used was Pearson r. Also, I'll use only correlations for order 1 here only since those for order 2 were much the same.

The coefficient for known order 1 was .040 and for unknown order 1 it was .157. They are very weak . The plots for confidence and accuracy, using the same system as for Experiment 3 correlations are given at table 11. These plots are displayed on graph 9.

Looking at graph 9 we can make two points.

First, , we see that the known version of Order 1 occupies the top half of the accuracy scale and the unknown version the bottom half. This is because on the known version, the first

cue gave subjects a clearly correct answer and so accuracy immediately reaches a ceiling and stays there. Much the same

Table 11
The confidence/accuracy plots

Accuracy

0.4	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.6	1.8	2.0
				Confidence	Unknown	Order	1				
2.7	3.6	3.6	3.1	3.6	3.6	3.5	3.8	3.8			
				Confidence	Known	Order	1				
	4.2								4.0	4.6	3.8 4.3

happens on the unknown version. Targets 2 and 3 immediately reach their ceiling, but this time, since subjects are giving single word answers, this ceiling is 1 rather than 2. Only on target 1 is there a tendency to get through to an accuracy of 2 and here only on later cues. The result is that accuracy is again consistent, but at a lower level than for the known version of Order 1.

Second, the confidence lines for both known and unknown Order 1 are pretty much horizontal. In all probability what is causing this is the problem of high and low confidence subjects. Looking in particular at the known version of Order 1, then I would suggest that subjects who are conservative and think that 4 is a high level of confidence have given the scores of 3.8 confidence, 1.8 accuracy. Subjects who are

very confident and think 4 is a low level of confidence have created the plot at 4.2 confidence, 0.9 accuracy. We can see .

Graph 9

Conf/Acc: Meanings on Ord 1
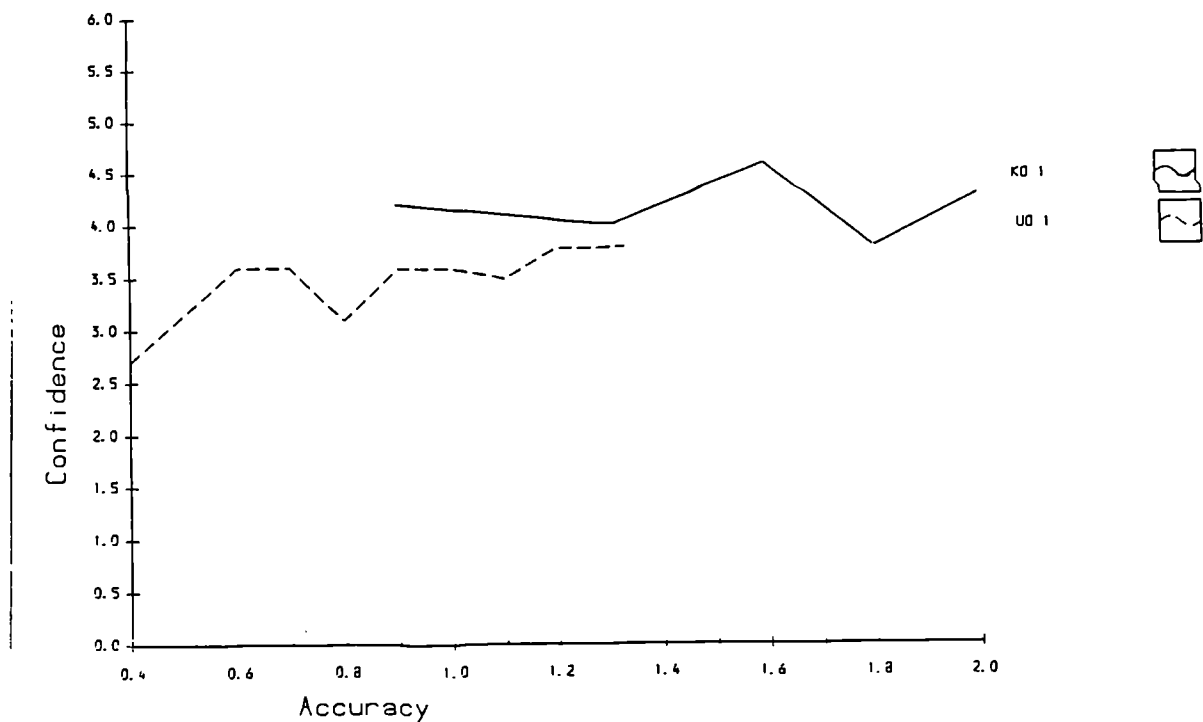
the same factors at work on the unknown line with a large number of 3.6 confidence scores across a wide range of accuracy.

There is some evidence then for different confidence type subjects.

Conclusions

I have suggested that in the formation of complex

hypotheses there is a drain on confidence caused by suspicion of a new combination. In this experiment, because confidence begins at a high level, I predicted that confidence would fall on cue 2 as a result of this effect and interact with known meanings across information. On target 1 we see the formation of two complex hypotheses which offer some support for this idea by the way in which they tend to produce the predicted interaction with known meanings across information.

With these complex hypotheses we are in the position of seeing confidence decrease in the environment of a possible increase in accuracy. Even if a subject guesses correctly he might still be unsure about such a hypothesis. For guessing as a learning strategy this is fairly serious. Subjects might well remember such a hypothesis due to depth of processing but if their confidence in it has been shaken to a degree they would be reluctant to use it. In a sense, it has not properly been learnt if it can't be used. One would expect there to be a follow up to guessing a complex hypothesis in terms of an appeal to authority. Subjects might well check their guess in a dictionary or ask a teacher before making it part of their productive vocabulary.

We also see the formation of single word hypotheses in the unknown condition most noticeably on targets 2 and 3 but also to some extent on target 1. This response type seems again to dominate. This supports the results of Experiment 3 which suggested that single word hypotheses would be guessed in an unknown meaning situation. A more naturalistic text as used

in this experiment does not seem to mitigate the problem. Subjects seem to apply the process for guessing known meanings to the guessing of unknown meanings and try to lexicalise information. Any lack of accuracy produced here is the result of this misapplication and not as Schatz and Baldwin (1986) suggest due to lack of information in more natural texts. This use of the known meaning process on unknown meanings gets them into a problem since they now have to deal with perceived inconsistency between cues. This problem appears to be dealt with by abandoning information from the process of lexicalisation or by partial use of information which replaces the strategy of forcing cues where the meaning component is more explicit.

With respect to abandoning information. When, as in this experiment, we suggest meaning in contrast to the last experiment where the meaning cues were given explicitly, we do not see subjects abandon guessing when they abandon information. The target can continue to be lexicalised right up to cue 3. The unusual associations do appear to trouble the subjects so confidence falls at cue 2 on target 1. However, there is an indication that on cue 3 these associations are seen as "fraudulent" and ignored, this rejection of information being able to give confidence a boost. We can only say that subjects have limited intuitions about lack of accuracy.

With respect to partial use. The danger here is that this strategy associates with high uncertainty/changeability. The subject might get a boost to confidence through "bumping"

around between possible single word hypotheses without improving his accuracy. This might also deflect attention from the building of complex hypotheses Again intuitions about lack of accuracy are limited.

In fact, neither abandoning nor partial use leads to subjects constructing a differentia and then rejecting the genus differentia combination due to suspicion in this experiment unlike the last. We must therefore differentiate between stategies on the basis of cue types. Where meaning components are suggested by implicit associational cues we have abandoning and partial use where confidence is high and reflects only a limited awareness of accuracy. Where meaning components are given more explicitly as in Experiment 3 and probably also by implicit definitional cues, we have abandoning and forcing but with a severe limitation on confidence suggesting a much greater awareness of lack of accuracy.

As to a superior order, Order 1 produces more uncertainty than Order 2 . The advantage seems to be on the known versions of the target where subject/object collocation seems to lose its power to force change when it is delayed. Such change could be important on known versions, contributing to increasing accuracy if there were a problem with vaguenes or inconsistency of information. However, it is not worth teaching subjects to plan their guessing in Order 1. It would be better and simpler to tell them to process information as it comes and beware not to neglect subject/object collocations that occur away from the target.

As to unknown targets, order in the limited sense discussed in this experiment is not really an issue since subject/object collocations are strong in both orders and in fact tend to dominate and create the high uncertainty, at least on two targets. But this is double edged in that it could lead to the guessing of a new meaning on the one hand or it could encourage partial use and lead to subjects "bumping" around between a selection of possible alternatives with no real increase in accuracy but obtaining a boost for confidence. It may on balance, since single word guesses seem to dominate, be better to teach a strategy which ignores order and simply restricts amount and type. Process the genus cue and leave everything else. This makes abandoning the best strategy.

Chapter 10

Some Case Studies

Experiment 5   Part 1

Introduction

Purpose of the experiment: The preceding experiments have been
in a sense "artificial" due to the method of presenting cues.
Giving subjects one cue at a time in a gradual buildup of
information must suggest that each new cue as it appears is of
relevance to the target and must be used. The analogy has been
drawn with the way in which information is presented in
mathematical type questions.   The reason for adopting this
approach is that it allows us to treat variables like type of
cue, order etc. systematically.   Having looked at guessing
systematically it is now time to move to the more real life
situation of giving subjects a passage and asking them to guess
by picking whatever cues they choose to select.   Cues will be
mainly implicit associational.   The purpose is to provide a
followup and to check whether the more important results
obtained in the preceding experiments can be confirmed in a
more real life setting.   I intend to focus only on unknown
meanings. The independent variables of part of speech and form
will be held constant by choosing verb targets marked by an
unknown form.   Order will also be held constant.   This
followup is small in scale and is more in the nature of "case
studies" than an actual experiment.   The structure of this

chapter will be to present the protocol for each subject followed by a brief analysis and finally to present a set of conclusions.

Predictions: The results from previous experiments which I intend to try and confirm in this more are as follows.

The tendency to lexicalise cues to form single word hypotheses emerges as stronger than the tendency to form new meanings/complex hypotheses in the unknown meaning condition. Will this also be the case in a more normal reading as opposed to the more controlled experiments conducted so far

Prediction 1: Subjects will tend to lexicalise cues to form single word hypotheses rather than unknown meanings in a more normal reading situation.

We have also noted the following strategies where lexicalisation takes place: abandoning/forcing in a situation where cues are fairly explicit with a large reduction in confidence and abandoning/partial use where cues are implicit associational and where there is a more limited reduction in confidence. Since cues will not be explicit in this study and I will be relying heavily on implicit associational cues, the choice will be between abandoning where cues are implicit and partial use. Again, it is the genus cue which is held and associations suggesting the differentia which are abandoned or partially used. I have suggested that the best strategy to follow would be to abandon information (see Experiment 4). Since partial use does not really lead to much of an

improvement in accuracy over abandoning yet involves more processing, I would expect abandoning to be favoured.

Prediction 2: Abandoning information will be the most prevalent strategy.

A final point relates to the above introduction. I mentioned that in previous experiments, subjects were forced to see all cues as relevant because of the way in which they were presented. It is possible that in a more real life situation that subjects might not recognise some cues and simply be unaware that they are relevant. This is most likely to be the case with information related to the differentia which is most often partially used or abandoned. However, from what I have said in Chapter 3, I think it is probable that subjects will recognise cues to the differentia, even where they are associational, as relevant.

Prediction 4: Differentia information will be seen as relevant by subjects.

Method

Cases: Six subjects took part in the experiment. They were all post graduate students doing MAs in Teaching English as a Foreign Language or Applied Linguistics at University of Wales, Bangor. Two of the subjects were forced to drop out since they knew the word I had chosen for a target.

Independent variables: Amount of information is the only independent variable. One verb target marked by an unknown form was used. Order of cues is fixed in terms of the order

used in the passage is constant. There is a problem here in that subjects might not use the cues in the order in which they appear in the text. I'll only comment on this if it becomes significant.

The target was to sashay (to walk in a dance like fashion) and it was placed in a passage which I wrote myself so as to have better control of the cues. This clearly leaves me open to the criticism that I'm not using "authentic" materials. In defence, I would say that it is not too unusual to find a passage such as I've used here in real life. I'll give the passage which I constructed at 1.

1. The following is an extract from the memoirs of Lord Halifax, a well travelled gentleman of the last century. The word to guess is Sashay.

The first time I saw someone sashay down the street was in New Orleans. I was seated at the window of a rather pleasant cafe when the person in question came into view after turning a corner. He paused for a moment to exchange a greeting with someone he evidently knew and then proceeded onwards, raising his hat politely to a passing lady before disappearing from sight.

I have always believed that one can learn a great deal about a culture by observing the details of how people behave. Now in London a gentleman strolls, in New York he strides, in Paris he generally shuffles, but in New Orleans a gentleman sashays down the street. On seeing this in 1849, when I first visited the States, my inclination was to laugh. In truth, one could only see this in a culture grown rich at too great a pace. Yet, after consideration, I realised that this was but a

reflection of a colourful society, of a happiness and
outgoingness we sometimes lack in London.

CLUE   GUESS   CONFIDENCE

        If we look at the structure of a passage then all the
cues in paragraph 1, are implicit associational and are
relevant to the genus of the target which is <u>walk</u>. The
prepositional phrase <u>down the street</u>, suggests <u>walk</u>. Also, by
suggesting that the <u>person in question exchanges a greeting</u> and
then <u>raises his hat</u> I sought to block off the possible
hypothesis <u>run</u>. I wanted to keep subjects on as straight a
track as possible since I wanted to try and see what might
happen in guessing a new meaning not in changing known words
because of a wrong start. Paragraph 2 begins with a contrast
cue which is implicit definitional and gives the genus <u>walk</u>.
My intention here also was to block as many familiar, single
word hypotheses as possible such as: <u>stroll</u> which could be used
as alternatives to <u>walk</u> and so try to give subjects a clear
genus to which they could next try to add a differentia.
Following this contrast are a set of implicit associational
cues to the differentia such as <u>my inclination was to laugh</u>.
So we have a block of genus cues followed by a block of
differentia cues.

        Again, subjects have to work to get the components of
meaning which as I argued in the introduction to Experiment 3
is the more natural situation.

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Procedure: Subjects were given a set of instructions
which basically asked them to guess the meaning of the target
and state each cue they used as they used it, together with the
hypothesis they formed and their confidence in that hypothesis.
These responses were to be written in the space provided at the
bottom of the passage. The instructions are given in Appendix
4. It was made clear that they could give responses as a
single word or a phrase. Subjects were asked to take the test
home and to complete and return it. All protocols were
returned within three days. I'll present each protocol below
followed by a brief discussion.

A criticism of the experiment is that we have a great
deal less control over what happens than in previous
experiments and we can't say this this is anything more than
exploratory in nature. We should be able to examine the
predictions made, however. Also, there is the possibility that
this method of allowing subjects a great deal of freedom might
throw up something unexpected that we have missed in previous
more controlled experiments.

Subject 1

Protocol

CLUE	GUESS	CONFIDENCE
a) someone... down the street (the first time)	walk (in some peculiar manner)	2

b) strolls, strides, shuffles   struts   4
    gentleman

c) to laugh   strut/swagger   4

Discussion

    We have a pattern of rising confidence, but the subject
is not trying to guess a new meaning. Rather, he is holding to
single word options. Most important to note, is that the cues
to the differentia have not been ignored. They are seen as
relevant, but just as in Experiment 3, they are used to guess
and change familiar, single word hypotheses. The strategy used
is partial use. The idea of strangeness has been extracted
from cue c) laugh but the idea of humour included in this cue
is not really covered by properly by the responses. Also we
see this strategy linked with a highish uncertainty and the
subject is not sure which of the two responses on c) to take.
Also, the first guess is interesting in that it is not just a
single word guess, but the words in a peculiar manner have been
added. The hypothesis walk in conjunction with an unknown form
has been sufficient to start the process of guessing a new
meaning, but the subject has retreated from this into guessing
familiar single words. This is something we have not really
seen before. The contrast has always been either between a
single word hypothesis or a combination of hypotheses to form a
new meaning.

Protocol

CLUE	GUESS	CONFIDENCE
a) down the street	walk	1
b) strolls, strides,	kind of walk or run	3
c) to laugh, rich at too great a speed	skip?	3

Discussion

Again cues to the differentia are not simply ignored in a more realistic setting. They are used, but again on single word guesses, producing change in these guesses. The strategy again is partial use and the the question mark after skip reveals that not only does this single word hypothesis not absorb the cues properly, the subject is aware that they don't. There is an awareness of limited accuracy. Note that skip is a poor response and would get an accuracy of 0 yet the subject does manage 50% confidence so we can only say there is a limited intuition about accuracy. With subject 1 confidence is slightly higher but the responses are better quality.

It seems to me that cues which can be used to build new meanings are seen as relevant and are not simply ignored. They are, however, distorted by partial use in the search for an ever more precise, single word guess.

Note also, that at guess b) the subject starts to try and build a new meaning, this time the contrast cue has pushed him into it in conjunction with the strange form. We get a kind of walk rather than the single word walk. However, like subject 1, he retreats to single word guesses.

Subject 3

Protocol

CLUE	GUESS	CONFIDENCE
a) down the street	a kind of walk	1
b) strolls	a kind of walk	3
c) strides	a kind of walk	4
d) shuffles	a kind of walk	5
e) but	a swagger, confident walk	5
f) laugh	rather comic, pompous exaggerated walk	5
g) colourful	the above & colourful, smiling, confident	5½

Discussion

Here we see a subject combining hypotheses to try and form a new meaning. The initial hypotheses are interesting in that the unknown form together with the hypothesis walk have

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been strong enough to start the subject looking for a new meaning hence the words a kind of. Unlike subjects 1 and 2, this subject has persisted. Confidence rises quite well. It looks as though the awareness that a new meaning is present has depressed confidence on the early guesses. This subject only has a confidence of 1 at the end of the first paragraph. Had he been guessing a single word, I would have expected it to be higher. It suggests that awareness that the hypothesis is incomplete surpresses confidence. What surprises me is that the subject does not retreat to a word guess here. Note that we also seem to be getting increasing uncertainty as well. Once a subject starts to guess a new meaning, each new cue seems to suggest a new hypothesis and the presence of & in response g) suggests that old hypotheses are not being thrown away.

Subject 4

Protocol

CLUE	GUESS	CONFIDENCE
a) London...strides	A kind of walk	6
b) New york...strides	A kind of walk	6
c) Paris...shuffles	A kind of walk	6
d) culture...behave	A specific walk peculiar to black people in New Orleans	6

e) colourful society...   To walk with abandonment   3
   ...happiness-   perhaps swaying from side
   outgoingness   to side

Discussion

Here we see confidence start at maximum yet the subject indicates the presence of a complex hypothesis by <u>a kind of</u>. This level of confidence should not be possible according to the model since the hypothesis is incomplete. But note that he has given no response for the cues in paragraph 1. I would suggest this subject has not initially been provoked into trying to guess a new meaning as have subjects 1 and 3. Rather, I would suggest, he has guessed the familiar word <u>walk</u> and is not thinking in terms of <u>kind of walk</u>. We can't see this since his first response relates to the start of paragraph 2. At the beginning of paragraph 2 he becomes aware of the possibility of a new meaning, tries to guess it at d), but throughout will not give up his high confidence, and then, as he, paradoxically, builds up the complex hypothesis very successfully his confidence in the combination of components drops. The reason? There is suspicion in the unfamiliar combination of components making up the complex hypothesis.

Note also that accuracy is increasing as confidence decreases and we would really have to give him 100% accuracy for his last guess.

We again see an expanding uncertainty off the last two responses although there is no overt evidence this time that

the hypotheses at d) are retained at e). My feeling is that the subject is keeping them in mind even if he has not noted them down.

This is a good illustration of the effect of initial high confidence predicted on Experiment 4 and shows that this can happen in real life.

Conclusions

As to prediction 1. Two out of four subjects lexicalise the targets and go for single word hypotheses. This is quite a significant percentage though I would have predicted it would be higher.

As to prediction 2. Partial use is the strategy used by both subjects who go for single word hypotheses rather than abandoning. Prediction 2 fails. Probably the temptation to process some information proves too tempting in that subjects believe they might be increasing benefits.

As to prediction 3, information relevant to the differentia is clearly not ignored and is drawn in either by partial use or the construction of new meanings. There is support for the idea that subjects would have seen differentia information as relevant in the previous experiments even had it not been made attractive by the method of presentation.

However, there is one strange facet to this experiment. The presence of a strange form over initial cues appears to have prompted subjects to try and build a genus marked usually by the phrase <u>a kind of</u> on early cues even if they later

retreat from this and go for single word hypotheses. We have not seen this before and the choice has always been to build a single word hypothesis or a complex hypothesis. I ruled out this type of response on the grounds that subjects would not want to perceive the hypothesis as incomplete. This needs further investigation. As a result, I have extended this experiment and a further follow up study is given in the next section.

Experiment 5   Part 2

The purpose of this small follow up investigation was to see if subjects would use a single word hypothesis to replace the target or think in terms of some kind of or do something in some kind of fashion. Part 2 of this experiment was identical to Part 1 except in the following details. Three subjects were used. They were again from the same background as those in Part 1. Two short passages were used. I'll give them at 2 below

2.   Passage 1

It had been a good year for the tribe. Their crops had been bountiful. It was fitting, therefore, that the people of the tribe should crell their gods. The women prepared food and brought out the large jugs of alcohol which had been stored, the men built a large bonfire in the middle of the village. As darkness fell, the fire was lit and the feasting and drinking began. Soon a procession was started, the people of the tribe chanting and clapping as they wound their way around the

flames. As the moon rose high in the night sky, the speed of
the procession increased with some of the men breaking off to
leap high in the air to the accompaniment of great shrieks and
whoops. Others of the tribe left the procession to stand
swaying unsteadily, the dancing flames reflecting in their
eyes.

Passage 2

Mario had a problem. He had too much money. The old
rackets of gambling and protection had been good sources of
income, but since the family had moved into drugs, things had
boomed. So Mario decided to mult some money in business. He'd
always fancied a hotel, the holiday business in Florida was
taking off. Something classy with a casino maybe. After all,
the other families had gone into Vagas in much the same way.
The trouble was, he'd have to be careful. Large sums of money
appearing from nowhere were bound to attract attention. He
needed a partner, a legitimate partner. But then no legitimate
businessman would come near him. Well, he'd just have to send
some of his boys down to Florida to have a friendly chat with
some of the hotel owners. If that didn't work, then one or two
of those nice law abiding folk might just accidentally fall
under a bus. That would be sure to make the others listen to
his partnership offer.

The two targets are to crell (to worship in a frenzy) and
to mult (to invest illegally obtained money). Both are made up
meanings taken from Experiment 3. The passages are similar to
that in the Part 1 of this experiment. As the reader can see,
it is reasonably easy to guess a word like worship in passage
1, and that there are plenty of cues to the differentia like

alcohol, leaping into the air etc. The main difference is that I did not use the contrast cue here. There didn't seem any point since it had not really worked in blocking off possible single word options. Also some cues which suggest the differentia come before the target. For example, drugs and protection rackets which fix the illegal nature of the investment come before mult. This should help push subjects towards thinking in terms of invest in some fashion so we are not relying entirely on the effect of the pseudoword.

Subject 1

Protocol Passage 1

CLUE	GUESS	CONFIDENCE
a) feasting	thank	3
b) merrymaking	adore	4
c) shrieks and whoops	worship	6

Protocol Passage 2

CLUE	GUESS	CONFIDENCE
a) too much money	invest	3
b) drugs	launder	4
c) no legitimate businessman	launder	5

Protocol Passage 1

CLUE	GUESS	CONFIDENCE
a) bountiful	give thanks to	6
b) fitting	give thanks to	6
c) crell	give thanks to	6

Protocol Passage 2

a) to much money	spend	3
b) hotel/holiday business	invest	4
c) careful	invest illegally gained money	6
c) large sums/attract attention	hide illegally gained money	6
d) accidentally fall under a bus	invest illegally earned money	6

Subject 3

Protocol Passage 1

a) Gods	Thank	4

"Thought about changing it to <u>worship</u> because of <u>procession</u> but decided to stick with <u>thank</u>."

Protocol Passage 2

a) business   invest   5

"Wanted to change invest to a more devious word suggesting under-hand activity but couldn't think of appropriate word."

Discussion

Subject 2 on passage 2 builds a new meaning so this kind of response is possible here. The other five cases involve using single word hypotheses. Of these five cases, 2 involve partial use of information: Subject 1 on passages 1 and 2 . Here differentia information is used to switch to alternative single word guesses. The final single word hypotheses don't fit the cues properly since, for example with subject 1, launder is not really a form of investment and shrieks and whoops suggest a very atypical form of worship. Confidence is quite high and subjects are deceived to an extent since their responses don't really fit the cues well enough to justify their confidence scores. Possibly we need a large experiment like Experiment 4 to really catch the effect of partial use on confidence. Subject 2, passage 1, abandons information with a high confidence. Subject 3 also abandons with a slightly more limited confidence though it is still over 50% so awareness of accuracy is limited. We can also see from his comments that he is aware of cues to the differentia so this information is relevant.

The main point is that we do not, even where subject 2, passage 2, builds a new meaning have a response of the type a

kind of investment on initial cues. There is nowhere an attempt to build a genus on the basis of an unknown form. Rather, on the one instance a new meaning occurs it is the fact that information can't be lexicalised which prompts this. In fact, if we look at the final response of subject 2, passage 2 he repeats the word crell at maximum confidence. What he's probably saying is "You can't catch me with this" and is dismissing the pseudoform as "fraudulent". This is what we would expect from Experiment 3 and I am reasonably sure that this dismissal of an unknown form is fairly typical.

Why then do we get the formation of genuses marked by a kind of rather than single words on the first part of this experiment. The subjects are not very different. Also the passages are fairly similar. This suggests that the target sashay in Part 1 is in some way "peculiar" or marked.

In what way might the target sashay be marked. Note that subjects tend to treat the target as a noun not a verb when in fact it has been presented to them as a verb. Only one gives the response walk in some peculiar fashion. All the others treat it as a noun giving a kind of walk. This happens despite the fact that the verb form is the more frequent and familiar part of the derivation. Perhaps, with a little stretch of the imagination one can lay the cause of what is happening at the door of a government ministry and a comedy show. Monty Python's Ministry of Silly Walks sketch has become something of an institution. Also American films showing the kind of Negro jiving walk that can more correctly be termed sashay are

popular. Monty Python in particular presents the noun side of the derivation and not the verb. There is a ready made connection in most people's minds between the hypotheses of walk and some silly or strange movement even if they can't specify the nature of the strangeness. This connection is probably so strong that in some cases it needs only the mention of an unknown form in the environment of walk to trigger the possibility of some kind of walk. The point I wish to make here is that there are ready made connections in the mind. We have the case of known or, perhaps more correctly, partly formed meanings for which either no word exists or for which the subject might not know the form because of it's infrequency.

We have here a possible extension of the explanation as to why subjects are sometimes able to form complex hypotheses given in the model. There I suggested that where a new meaning was formed subjects could somehow overcome suspicion in the combination. It is more than this. Where new meanings are formed there is an associative link between the genus and differentia combination which though not lexicalised is reasonably strong. I would suggest that in perhaps all cases where subjects have been able to guess a "new meaning" in previous experiments they have done so by exploiting these already existing familiar links between combinations. Note that I sometimes used such combinations inadvertently myself when constructing targets. We have all seen pictures on television of strange instruments played by Indian musicians

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and handicapped people manipulating things with their feet rather than with their hands which I used in Experiment 3. Also the link between braking and using reins is fairly espablished which is why a complex hypothesis could be formed on target 1 of Experiment 4. Where such a link is available, it can be exploited whether meaning is given fairly explicitly, perhaps by implicit definitional cues or where it is given by implicit associational cues. The combination of components forming the complex hypothesis is still somehat strange, however, since it is not lexicalised and there is still a measure of suspicion in the complex hypothesis which undermines confidence to a degree.

Where a familiar link between meaning components is not available to a subject the following happens. If genus and differentia are fairly explicit the subject has trouble "making sense" of the combination of hypotheses and reverts to treating them as inconsistent in order to lexicalise a familiar hypothesis. If cues are implicit associational then the subject simply does not try to form a complex hypothesis. Being able to change to alternative single word guesses and retaining items of information which are not lexicalised as strange associations on the word hypothesis make strategies like partial use attractive.

We can illustrate these ideas with some experiments conducted by Rumelhart et al. (1986 pp 7-58). If we give a subject the term bedroom and ask for associations we get a fairly typical schematic representatin of a bedroom. If we

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give bedroom and sofa together, the schematic representation

now incorporates associations like easy chair, and fireplace

even if there is no single word for a fancy bedroom. If we go

one stage further than these experimenters and put together

bedroom and cooker we would probably cause problems. Subjects

would not understand the combination and could only operate by

dropping one of the items, perhaps just giving a familiar

bedroom schema or by forcing them together to get bedsit and

giving associations like tiny or gloomy even though what we

want to suggest to the subject is a fairly pleasant room used

for sleeping and cooking.

In other words it comes back to the idea of costs

and benefits. We will go for a new meaning/complex hypothesis

where we have help in terms of existing patterns of knowledge

which not so much reduce processing costs as make processing

along these lines possible. The effect can can be summed up by

the word plausibility. Where a new meaning is plausible we may

well go for it. Where it is not we either reject it if it is

given by implicit definitional cues or never see it if it is

given by implicit associational cues. Another point is that

unlexicalised links between genus and differentia components

are probably rare. Also, when there is such a link it may not

be easy to spot since the association, whilst present, is not

strong enough to give rise to a new word. Hence, subjects tend

to guess words rather than new meanings.

We still have a problem. We are now saying that when

subjects guess unknown meaning, they are helped and probably

need, vaguely familiar combinations of hypotheses in addition to cues or they will go for familiar single word options. But why in the sashay example do they give the response a kind of walk really on the basis of the unknown form and initial cues. My prediction in the model and most of the evidence suggests that at this point they should really form a single word hypothesis and not be too concerned with a possible new meaning. Here, I would repeat the suggestion made above that the sashay target is exceptional. There is such a strong connection between walk and some strange kind of walk, due to the media, that it needs only an unknown form or a cue suggesting something out of the normal to generate the response a kind of walk.

Conclusion

Returning to the predictions. With respect to prediction 1, we can say that subjects do tend to lexicalise unknown meanings and form single word hypotheses. This is because they need the help of existing, unlexicalised patterns of genus and differentia knowledge to process cues in order to construct complex hypotheses. However, such existing combinations are in all probability not that frequent so they end up forming single word hypotheses as alternatives. Out of 10 cases in both parts of this experiment, single word hypotheses were formed on 7. 10 cases is a very small number but all the previous experimental evidence backs this up.

With respect to prediction 2, though partial use was the

only strategy used for lexicalisation in Part 1 we do see
examples of abandoning on Part 2. Both strategies are used.
Since abandoning is better since we don't go on processing for
no appreciable gain in accuracy we might think in terms of
teaching abandoning. Remember again, however, that this is a
small study. We do have evidence of abandoning and on a large
experiment this might be favoured.

With respect to prediction 3, subjects do indeed seem
sensitive to differentia related information and see it as
relevant even when they abandon it. So we can feel fairly
confident that the method of presenting cues in the first four
experiments has not forced subjects to perceive information
they would not normally do so as relevant.

Chapter 11

Winding Things Up

This chapter deals with the conclusions of this study. First, I want to summarise and contrast briefly the processes involved in the four guessing situations outlined in Chapter 1: cloze over a known meaning, cloze over an unknown meaning, pseudoword over a known meaning, pseudoword over an unknown meaning. Second, I want to look at the interesting area of cue classification. In studies concerned with cue classification, a pseudoword or cloze gap is often used to cover a known meaning rather than an unknown meaning. Given the differences in process between guessing known and unknown meanings which we will note in the first section, what are the consequences of this substitution for cue classification studies? Third, I want to evaluate the effectiveness of guessing as a strategy which might help further the process of communication. Finally, I'll look at some directions for future research

The four guessing situations

Cloze over a known meaning

This is an artificial testing or experimental situation. Some, probably the majority of targets blanked out by an experimenter will have meanings known to the subject.

What we see here is essentially a very efficient information processing system. Subjects recognize familiar

combinations of cues and are able to put them together effectively to guess single words so generating, as we see, an increase in confidence, matched by an increase in accuracy (suggesting subjects are aware of their accuracy) and a reduction in uncertainty. There is no necessity for uncertainty to fall as confidence rises. One could, theoretically, hold a lot of hypotheses and still be very confident in one. It's just not very efficient to do this. Hence there is a tendency to increasingly focus on one hypothesis as cues combine and to reject, or ignore, the more peripheral hypotheses which a cue in isolation might suggest. Another mark of the efficiency of the system is the way in which subjects appear to have good intuitions about their accuracy. Probably, what governs these intuitions is the perception of cues fitting together in a familiar and known pattern.

As to the independent variable of order, on Experiment 3 there are interactions between orders and differentia->genus->association emerges as superior. Again, on Experiment 4, subject/object collocations followed by non subject/object collocations generate more uncertainty than the reverse and this might be valuable if early information is vague. However, differences between orders are not great and all orders are quite effective. Given that order is a complicated variable and involves a high degree of processing effort, the principle of costs and benefits suggests that it might not be worth exploiting such differences as exist. If we gave subjects the

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freedom to choose between orders, a freedom they would have in real life guessing but one which they are not allowed in my experiments (remember, there would very likely be an unknown form present in real life but this doesn't appear to have any great effect as seen in Experiment 3), they would simply ignore the order variable and process information as it comes. It is also questionable whether we should try to teach a strategy based on order say when tackling a cloze test. Note, however, that I have generalised from my experiments to real life by using this costs/benefits principle. It would be worthwhile doing more realistic studies of order to see if these points hold true and that this variable is in fact ignored.

Cloze over an unknown meaning

This is generally an experimental type situation. In some ways it is the most unusual of the four. It is perfectly possible to get an unknown meaning on a cloze test but one would expect relatively few instances of this. This situation does give us a clear picture of how unknown combinations of cues are dealt with without the pseudoword being present.

Subjects, in this situation, tend to form single word hypotheses rather than complex hypotheses/new meanings if there is no plausible connection between the components of the complex hypothesis. They are looking for a familiar combinations of cues just as with known meanings. However, there is a price to pay for guessing single words in that subjects are forced into the position of regarding unfamiliar

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cue combinations as combinations of inconsistent information. They handle this problem of "inconsistency" by abandoning/ forcing where cues are fairly explicit and clearly give the meaning components and abandoning/partial use where cues are implicit associational. Accuracy is limited and static across information. Subjects are much more aware of their limited accuracy on the first pair of strategies than the second. Uncertainty tends to be higher on the unknowns as compared to the knowns.

Sometimes, however, a new meaning or complex hypothesis is formed if there is a plausible link between meaning components which can be exploited. Hence, accuracy can reach a high degree yet confidence is handicapped since there is still an element of suspicion in such a complex hypothesis since it has not been lexicalised. In the situation where initial genus cues are strong and a subject thinks at this point he is guessing a single word then we see accuracy rise as confidence falls. As to uncertainty, the best picture is probably given by Experiment 2. Here uncertainty is low and static on the first two amounts of information but rising on the third as associations accumulate.

As to order. In the unknown condition, single word hypotheses are most frequently formed. Although Experiment 3 shows interactions between the orders these interactions indicate that the genus is the strongest cue and that where it comes initially the genus guess gets eroded by the subsequent cues. Where the genus comes late it overrides earlier cues.

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The best policy as far as strategies are concerned is to identify the genus and ignore other cue types. Given that other strategies like forcing and partial use do compete with abandoning, it might well be desirable to teach abandoning as the best strategy. It would also be interesting to experiment in situations where subjects are given freedom to select orders to see whether subjects might try to use the different cues in some order since they do see the various types of information as relevant. They might perhaps try in the hope of getting around the difficulty caused by the apparent inconsistency of information but the cost/benefit principle predicts that although they might try they would abandon any such attempt as not worth the effort. (Remember that in teaching or more realistic experiments we would have a pseudoword present. Experiment 3 shows the form variable to have very little effect though).

Pseudowords over an known meanings

This can again be of interest as an experimental situation, but, perhaps, more so as a more realistic situation involving foreign learners. The fact that foreign learners have L1 equivalents (perhaps not completely so in all details) to many targets they encounter in the foreign language places them in this position.

Whilst the presence of a pseudoword in Experiment 3 causes a significant decrease in confidence and accuracy and a significant rise in uncertainty in comparison with the cloze

gap, these differences are small. What differences there were came on initial cues for the know meaning condition. Possibly, a strange form combined with an initial guess might push subjects into a slightly atypical guess so that instead of say doll they give voodoo doll. This tends to get corrected by the third amount of information so the end result is of little consequence provided there are cues available to dispel this. The pseudoword is eventually treated as a a cloze gap.

In terms of both communication and learning strategies, guessing should be very effective for the foreign language learner. One point should be remembered here though. My subjects were native speakers and so I'm arguing from analogy. There may be depths to this situation that we do not see from the experiments in this study. Meara (1982) points out that foreign learners tend to give different types of response to natives on word association tests, the tendency being to produce clang responses most often associated with quite young native children. They also seem to know the words they have responded to in this fashion. Whilst factors like mistaking the stimulus word may be at work, there is always the possibility that foreign learners do not know or understand words in the "same way" as natives and that simply guessing a translation equivalent and so getting the meaning is not the end of the matter. We really need to rerun some of these experiments on foreign learners directly.

Pseudowords over unknown meanings

This is the kind of situation in which native speakers are more likely to find themselves. There is no reason why the native speaker should use guessing in this situation as a communication strategy, but it is most interesting to researchers as the initial stage in a learning strategy.

Again, we have the same small but significant differences between pseudoword and cloze gap as noted in pseudowords over a known meaning with pseudowords slightly less powerful than cloze. However, the main point of difference is now on cue 3. The effect of the pseudoword in Experiment 3 tended to encourage subjects to give up guessing. Since subjects in this situation would probably use their last guess before giving up and this would be a single word, then the pseudoword condition is again really reduced to a cloze gap and the form ignored. Apart from the above difference we are really in the same condition as cloze over an unknown meaning and pseudowords do not tend to act as a trigger signalling the presence of a complex hypothesis. This is more likely done by the failure to lexicalise information though again this factor needs support in terms of existing but unlexicalised combinations of meaning components.

So subjects, for the most part form single word hypotheses.

I'll come to the consequences of the use of single word hypotheses as a communication strategy shortly. For learning strategies the consequences seem grave. If subjects learnt the

single word guesses they make on unknown meanings and this was a major source of learning, then the language would be full of fairly exact synonyms. Something which is clearly not the case. It is likely that strategies like use of the dictionary supplement guessing as a learning strategy. As a learning strategy, guessing, then, is deficient. Perhaps our biggest mistake here is that we expect guessing to do all the work. Subjects could guess and remember both form and part of the meaning from guessing. Certainly, the difficulty posed by seeing information as inconsistent would encourage depth of processing. Other strategies in the general context of appeal to authority probably supplement guessing, however.

One factor which we should, perhaps, pay attention to in future experiments is <u>time</u>. There might be an interesting parallel here with the learning of words by native speaker children. Snyder et al (1981), for example, point out that after initial phases of under and over extension children seem to start to collect associations. The word <u>kitty</u> is used when pointing to a <u>dish</u>. It is not that the child is calling <u>a dish kitty</u>. He is associating the two. With guessing it may be that where subjects make single word guesses they actually remember the cues they reject and that they work on these cues over fairly longish periods of time and eventually produce a complex hypothesis. This is speculative though and needs research.

Also, in the smaller number of instances where complex hypotheses are formed in the experiments we still have a problem. A subject might learn his guess but be reluctant to

use it due to the handicap confidence suffers. In a sense we can say that a subject has not properly learnt the target if he's afraid to use it. Probably the best strategy to follow if learning of a single word or complex hypothesis is intended in this condition is an appeal to authority such as consulting a dictionary

Two things are needed here now. The first would be to repeat these experiments with primary school native speaker children to see if the results can be replicated since it is mainly to such subjects that the topic of learning through guessing relates. My subjects are adult native speaker. If they do and something dramatically different is not happening, we need to look at to what extent reading lessons where children encounter unknown words are followed by attempts to use the dictionary, questions to teacher or parent and perhaps simply the use of targets in speech production to try and form more precise hypotheses about them.

Consequences for cue classification studies

In many studies involved with cue classification such as Ames (1966) the experimenter usually replaces words in a text with a blank space or pseudoword. We are really in the situation of pseudowords covering known meanings. The situation experimenters like Ames intend to be in is that of unknown meanings. Given that there are some striking contrasts in process between the two meaning conditions, should we regard existing cue classifications derived from known meaning targets

as suspect when we are interested in unknown meanings ?

On thing we've noted is that in Experiment 5, cues which could be used to form a new meaning tend to be used on single word hypotheses. In Experiment 5 we are in the kind of experimental situation often used by classifiers of cues where subjects are given a passage and asked to make guesses and indicate how they arrived at their guesses. (This is usually done verbally whilst I've asked subjects to write). Now in a sense, whilst subjects are in an unknown meaning condition here, they do in fact behave as though they were in a known meaning condition and try to get a word. This in turn suggests that regardless of type of meaning the same cues are perceived as relevant. A point of interest is that Experiment 4, known meanings, suggests that subject/object cues tend to lose their power to cause change in third position. This whole idea is speculative and needs to be experimented on. But it is reasonable to assume cautiously that this might be a symptom of a wider process of simply not looking for more cues when we are fairly confident in a hypothesis. It may be that unknown meanings will continue to attract cues for longer than known meanings. I don't see this as much of a problem though. It certainly does nothing to discredit work on cues. It simply means that unknown meaning targets will give us more data than knowns but not of different sorts. So if a classification study is fairly extensive then most types should be caught.

The consequences of guessing for communication

We've noted two types of motivation for guessing. It could stem from a desire to learn words as noted by Jenkins et al (1984) or it could stem from a desire maintain reading fluency ie. keep the process of communication going. I've noted some consequences of guessing for learning. What might be the consequences for communication?

To consider this problem we need to work in the context of a theory of communication. Arguably, the only comprehensive theory of communication available to us is that of Relevance Theory, Sperber and Wilson (1986). The title of this theory is not to be confused with relevance in the sense of factors which draw our attention to particular cues. Nor is it to be confused with Grice's Maxim of Relevance mentioned in Experiment 4. I'll give only the briefest of descriptions of Relevance Theory here.

The Principle of Relevance states that a listener/reader will try to obtain the greatest possible contextual effects for the least processing effort. What's a contextual effect? There are three types, but I'll confine myself to one; that of implications taking the following examples from Sperber and Wilson (1986 pp.194-199). If we look at the dialogue at 1

1. Peter: Would you drive a Mercedes?
   Mary :   I wouldn't drive ANY expensive car.

then Peter, knowing that a Mercedes is an expensive car, can draw the implication at 2.

2. Mary wouldn't drive a Mercedes.

But why didn't Mary simply reply "No" at 1. By giving this indirect reply she is increasing the amount of processing effort Peter has to put in and as a result Peter is going to want a return for his effort. In short, Peter is going to assume that there is more to Mary's utterance at 1 than the interpretation at 2 and he will try to derive more contextual effects. He might decide that people who refuse to drive expensive cars disapprove of displays of wealth so he might derive the implication at 3:

3. Mary disapproves of displays of wealth.

What the authors suggest is that there is a guarantee of Relevance that comes with every communication which to put it very simply is a statement that work must be rewarded since the writer/speaker would not otherwise have required that work of the receiver. Because Mary's reply at 1 involves increased effort then further contextual effects over and above that at 2 must be obtained for this guarantee to be optimal.

We can add to the above the idea proposed in Sperber and Wilson (1985/86) that the propositions expressed in sentences need not be literally true. Rather, it's the implications

which need to be true. To give an example. Mary is asked where she lives and gives the reply at 4.

4. I live in Paris.

But in fact she lives in a block outside the city limits. Her answer is not true. However, Peter derives the implications at 5.

5. a) She spends most of her time in Paris.
   b) She knows Paris.

If Mary had been literally true at 4 and said: <u>I live near Paris</u> then <u>near</u> demands some processing effort which in turn will produce implications like that at 6

6. She has to travel to Paris.

which are false. The expression at 4, whilst not literally true is effective in conveying what Mary intends.

Instead of "truth" we can talk of "accuracy". Production can be inexact but reception needs to be accurate. The point is that the writer/speaker needs to produce accurate implications. Accurate implications, that is, in the sense of producing the ones he intended to produce. Processing effort seems to be a significant factor in controlling this.

If we move now to guessing. In the unknown meaning

condition we have, in the main, single word hypotheses produced by two sets of strategies depending on types of cue. I'll look at abandoning/partial use where cues are implicit associations first and come back to abandoning/forcing in the more explicit situation where cues are perhaps implicit definitional.

Abandoning and partial use in the implicit associational situation lead to incomplete processing. To see the consequences of this incomplete processing let's take the example at 7.

7. The negro <u>sashayed</u> down the street listening to his ghetto blaster.

The subject might process <u>down the street</u> and so would give the hypothesis <u>walk</u> which in turn would generate the implication at 8

8. He moved on foot down the street at a regular pace.

However, he abandons cues like <u>negro</u> and <u>listening to the ghetto blaster</u> which are relevant and which he perceives as relevant. The subject will know that there is something wrong with the implicature he has derived since he can't process information completely. In fact the implicature at 8 is inacurate in the sense that it is inadequate. We'd also want to derive implicatures along the lines of "Having a good time". However, as we have seen in Experiment 3, confidence stays

reasonably high in this situatiuon. This suggests that a degree of error can be tolerated in reception where meaning is given implicitly and that the subject could continue reading on the basis of a guess like walk derived by abandoning.

Also, in Experiment 4, I spoke of limited intuitions of accuracy. I suspect this is not so much to do with a subject being ignorant that there is a problem. If he can't process information he will know that something is wrong. Rather, in this situation, where meaning is implicit associational, error can be tolerated to a degree. Possibly, this is because the association cues need not be discarded completely since, although they are excluded from lexicalisation, they can be held as strange associations on the single word guess.

Let's move to the strategy of partial use. Here the subject will process genus cues and so get the hypothesis walk but he will go further and take some of the differentia information but at the same time leave behind other aspects of the differentia cues. So he might take the cue listening to his ghetto blaster and abstract the idea listening to music. Well, listening to music is pleasant so the hypothesis could be stroll and the implication which is derived is given at 9.

9. He moved in a relaxed, leisurely fashion.

However, the subject is aware that he has left behind the idea that the music is very loud. Again there is a problem. The idea which the subject has not processed music is very loud is

not conducive to _strolling_ and the implicature derived at 9 is not so much inadequate as inexact. The _move_ part is right but _relaxed_ is not quite what we'd want to say. Again, however, we see a fairly high confidence with partial use and this kind of difficulty can be tolerated perhaps again because the information which is excluded from lexicalisation is not completely discarded but can be held as strange associations of _stroll_.

As a communication strategy, then, guessing seems to operate reasonably well. The Guarantee of Relevance may be strained somewhat but it won't be broken and reading can continue on the basis of guesses in the above situations

There is of course the possibility that a good synonym for the target exists. If the subject could guess _jive_ here then he would get the implication at 10

10. He walked in a swaying, dance like fashion.

and would know that the Guarantee of Relevance is preserved since all the information is being processed smoothly. But good synonyms are rare in English and this option will be very infrequent. So again, abandoning is a better strategy than persisting in the hope of getting such a synonym. Incidentally, foreign language learners would very much be in this situation of having a good substitute for the target so they have an advantage over native speakers though the native speaker could make use of guessing quite adequately as a

communication strategy.

So abandoning and partial use are reasonably useful strategies to follow when reading. I would suggest that the former is the better since it is better, or at least safer, to be inadequate rather than inexact. However, if we move to the situation where cues are now more explicit indicators of genus and differentia, lexicalisation damages confidence very severely. In this situation subjects will be so aware that they cannot process information properly (perhaps they must now explicitly acknowledge error in their guess since they can't hold on to abandoned differentia cues excluded from lexicalisation and must knowingly downgrade the differentia if it is forced) that they will see the implicatures derived as completely inadequate. The Guarantee of Relevance will be broken and reading fluency damaged in the following way. A strategy of interest which I have not looked at in this study is avoidance. Normally we think of this happening on the basis of not enough information. It could also be linked to explicitness of information. Given that a subject's confidence in the way that he is processing information is drastically weakened he might well be able to make a single word guess at the target but will be so dissatisfied with the implicatures derived that he will ignore or avoid them completely. This would be tantermount to actually ignoring the word itself. However, since fairly explicit presentation of cues is not frequent this is not a major problem. On the whole, guessing is a good communication strategy.

So finally, in terms of advice to teachers. The foreign language teacher should continue as before. Show subjects how to find relevant cues and encourage guessing. The native speaker teacher should be cautious of guessing. It is not, as we have seen, the powerful learning tool we might expect. It needs to be suplemented by appeal to authority. As far as the native speaker student goes, guessing is probably better taught as a communication strategy.

Future Research

It seems to me that a lot can be gained in future from applying Relevance Theory to guessing.

A very important area where Relevance Theory could provide some interesting ideas is in terms of what makes cues relevant to subjects in the sense of why should a subject be attracted to one cue and not another. We might research this through the analysis of guessing errors. Laufer and Sim (1985) give lots of examples of foreign learners errors when guessing. I'll give one at 11.

11. In a society where mobility is <u>enjoined</u> on every citizen.

Here, the target was guessed as <u>enjoyed</u> which seems to be a confusion with a similar looking/sounding word. There's more here than a slip to sound. The subject has gone for this because he can get the contextual effect given at 12.

12. We'd all be lost without our cars.

What we are saying here is that what makes cues relevant in the sense of subjects being attracted to them is the ability of a cue to produce a hypothesis which gives a good contextual effect. What should block the guess _enjoyed_ and the implication at 12 is the preposition <u>on</u> at 11. So relevance in the sense of subjects being attracted to an item as a cue is a combination of a desire for context effects limited by the language code. Error in this instance is a product of cues being attractive because of their ability to produce contextual effects coupled with an insufficient understanding of the code which should deflect the subject from the cues and the hypothesis he has chosen.

Again cohesion could be seen as an aspect of language code which constrains the need to find cues simply on the basis of generating context effects and helps point us to the correct cues and get the implications the author intended. To give an example. I remember when I first heard the Don McClean song

13. Bye, bye Miss America Pie
    Drove my Chevy to the levy
    But the levee was dry

I guessed <u>levee</u> as <u>bar</u> because of the polysemy on <u>dry</u> and didn't realise my mistake until several months later when after using this item in a conversation with an American friend I

found myself being closely interrogated as to which levee I supposed there might be alcohol in. I suspect it was the way in which _bar_ could generate some interesting contextual effects which led me to be deceived by the polysemy in _dry_. I don't take this as evidence that we constantly go around making this kind of error. Rather, since any cohesive code is manifestly absent from this song, I take this as evidence of just how important the code side of language is in blocking such error by indicating relevance. Had Don McClean given a clear reason for his trip to the levee then I would have not made this mistake. Mind you, the song would probably have lost something.

A major area, then, in which future research could move is to investigate what attracts subjects to cues. It could prove to be a balance between a desire for context effects and code constraints.

This appendix contains information relevant to Experiments 1 and 2.

Targets and cues used in Experiments 1 and 2

Known Targets

Example
   To record

   a) This is to make a copy
   b) This is done to ensure permanence
   c) This is done to music sometimes

1. To wonder

   a) This is to want to know
   b) This is done with curiosity
   c) Poets sometimes do this

2. To sweep

   a) This is to clean
   b) This is done with a broom
   c) Rooms sometimes have this done to them

3. To gulp

   a) This is to swallow
   b) This is done quickly
   c) Fish sometimes do this

4. To taste

   a) This is to discriminate
   b) This is done by taking something into the mouth
   c) Food sometimes has this done to it

5. To take over

   a) This is to assume control
   b) When this is done people are replaced
   c) Companies sometimes have this done to them

6. To balance

   a) This is to be stable
   b) This is to be very close to falling
   c) Acrobats sometimes do this

Unknown Targets

Example
    To losk

    a) This is to help to grow
    b) This is done by singing
    c) This is done to tulips sometimes

1. To mutle

    a) This is to use one's feet
    b) This is done because one can't use one's hands
    c) Handicapped people sometimes do this

2. To juplicate

    a) This is to impersonate
    b) This is caused by madness
    c) Napoleon sometimes has this done to him

3. To klarim

    a) This is to worship
    b) This is done in a frenzy
    c) Primitive tribes sometimes do this

4. To hersk

    a) This is to carry
    b) This is done on the head
    c) African women sometimes do this

5. To zilst

    a) This is to travel
    b) When you do this you remain with your home
    c) Gipsies sometimes do this

6. To pral

    a) This is to invest
    b) This is done against the law
    c) The Mafia sometimes do this.

Cue Presentation Orders for Experiments 1 & 2

The following grid shows which order of cues each subject saw on each item.

Key a = genus
b = differentia
c = association
S = Subject
T = Target

	T1	T2	T3	T4	T5	T6
S1	cba	cab	bac	bca	abc	acb
S2	acb	cba	cab	bac	bca	abc
S3	abc	acb	cba	cab	bac	bca
S4	bca	abc	acb	cba	cab	bac
S5	bac	bca	abc	acb	cba	cab
S6	cab	bac	bca	abc	acb	cba

GUESS   CONFIDENCE

EXAMPLE   a)_____   _____

           b)_____   _____

           c)_____   _____

WORD 1   a)_____   _____

           b)_____   _____

           c)_____   _____

WORD 2   a)_____   _____

           b)_____   _____

           c)_____   _____

WORD 3   a)_____   _____

           b)_____   _____

           c)_____   _____

WORD 4   a)_____   _____

           b)_____   _____

           c)_____   _____

WORD 5   a)_____   _____

           b)_____   _____

           c)_____   _____

WORD 6   a)_____   _____

           b)_____   _____

           c)_____   _____

ANSWER SHEET EXPERIMENT 2

EXAMPLE   a)_____

          b)_____

          c)_____

WORD 1   a)_____   WORD 4   a)_____

         b)_____   b)_____

         c)_____   c)_____

WORD 2   a)_____   WORD 5   a)_____

         b)_____   b)_____

         c)_____   c)_____

WORD 3   a)_____   WORD 6   a)_____

         b)_____   b)_____

         c)_____   c)_____

Subject responses   Experiment 1;   Known Meanings.

		Subject 1		Subject 2	
		Guess	Confidence	Guess	Confidence
Word 1	a)	rhyme	2	interest	2
	b)	ponder	3	research	3
	c)	ponder	3	research	4
Word 2	a)	decorate	2	decoration	2
	b)	dust	2	swept clean	4
	c)	sweep	6	sweep	5
Word 3	a)	run	0	breathe	0
	b)	gulp	3	gulp	1
	c)	gulp	6	gulp	2
Word 4	a)	chew	3	feed	3
	b)	chew	4	taste	3
	c)	taste	6	tasting	4

		Guess	Confidence	Guess	Confidence
Word 5	a)	take over	3	repopulate	1
	b)	take over	4	take over	3
	c)	take over	6	take over	5
Word 6	a)	calm	1	balanced	3
	b)	balance	4	balanced	4
	c)	balance	5	balanced	6

	Subject 3			Subject 4	

		Guess	Confidence	Guess	Confidence
Word 1	a)	enquire	0	ask	0
	b)	investigate	1	ponder	2
	c)	search	0	philosophise	4
Word 2	a)	scrub	1	wash	1
	b)	scrub	1	sweep	3
	c)	sweep	4	sweep	4
Word 3	a)	swim	1	gulp	1
	b)	jump	2	gulp	2
	c)	gulp	3	gulp	4
Word 4	a)	boiled	1	processed	1
	b)		0	chewed	3
	c)	eating	0	spit out	3
Word 5	a)	substitution	1	take over	1
	b)	take over	2	take over	3
	c)	take over	5	take over	5
Word 6	a)	stumble	1	trip over	2
	b)	tumble	1	land on feet	2
	c)	balance	3	balance	6

	Subject 5			Subject 6	

		Guess	Confidence	Guess	Confidence
Word 1	a)	enquire	6	orate	3
	b)	ask	6	question	4
	c)	wonder	6	pry	4
Word 2	a)	sweep	6	sweep	5
	b)	clean	6	brush	5
	c)	dust	5	sweep	6
Word 3	a)	imbibe	4	blink	5
	b)	ingest	3	jump	5
	c)	gobble up	5	gulp	6

Word 4 a) distinguish	5	side	3
b) select	5	taste	5
c) taste	5	taste	5
Word 5 a) take over	6	command	5
b) take over	5	amalgamate	3
c) take over	6	directorship	3
Word 6 a) tumble	5	fall	3
b) balance	6	totter	5
c) balance	6	balance	6

Subject responses Experiment 1, Unknown Meanings.

	Subject 1		Subject 2	
	Guess	Confidence	Guess	Confidence
Word 1 a)	drop	0	mumble	1
b)	tumble	2	hobble	2
c)	grasp	0	shuffle	4
Word 2 a)	honour	1	have fun	0
b)	mock	1	make fun	0
c)	delusion	5	imitate	2
Word 3 a)	scream	0	special dance	0
b)	fetish	1	sacrifice	1
c)	fetishise	2	trance	1
Word 4 a)	groom	0	hit	1
b)	plat	1	carry large pots	2
c)	balance	3	carry large pots of water	4
Word 5 a)	slowly	1	like a snail	2
b)	caravanning	3	caravan	3
c)	nomadic	5	tour in a mobile home	4
Word 6 a)	to grow	0	time & energy	2
b)	usury	2	in prostitution	4
c)	usury	3	gambling etc.	4

	Subject 3		Subject 4	
	Guess	Confidence	Guess	Confidence
Word 1 a)	dance	1	use feet	0
b)	improvise	0	use feet	0
c)	stumble	1	paint with feet	4

	Guess	Confidence	Guess	Confidence
Word 2 a)	duplicate	1	be impressionist	3
b)	imitate	1	schizophrenic	2
c)	_____	0	cloned in wax	4
Word 3 a)	fight	0	pray	2
b)	dance	1	sacrifice	2
c)	trance	0	religious dance	4
Word 4 a)	grind corn	1	transport using head	2
b)	drag	0	transport using head	5
c)	balance	1	transport using head	6
Word 5 a)	hibernate	0	tell fortune	3
b)	caravan	0	be nomadic	4
c)	camp	1	be nomadic	5
Word 6 a)	drink	0	sell stolen goods	0
b)	murder	1	fiddle tax	3
c)	extort	2	blackmail	5

	Subject 5		Subject 6	
	Guess	Confidence	Guess	Confidence
Word 1 a)	tear with one's teeth	0	to cover up	3
b)	squashing pulp (grapes)	3	to totter	3
c)	hold brush or pen in mouth	4	to manipulate with the feet	4
Word 2 a)	to have certain illusions about perceptions	1	split personality	4
b)	give false reports	1	to mimic	4
c)	to take on someone else's identity	6	applied shock treatment	3
Word 3 a)	to treat as a prophet	0	chatter quickly	4
b)	scream in adoration	0	chatter quickly	4
c)	whoop in	1	to chant	3
Word 4 a)	on the shoulders in a container	0	to hump around in a back pack	3
b)	babies in shawl round shoulders	2	as tribeswomen carry things	5
c)	carrying loads	6	as tribeswomen/ Africans	6

Word 5	a) cheat	0	to hop from one place to another	3
	b) give up roaming	2	to camp around	5
	c) roam with caravan	6	to camp around in caravans	6

Word 6	a) spread false rumours	0	extract protection money	4
	b) pay protection money	1	extract protection money	4
	c) bribe officials	3	illegal share dealings	4

Subject responses Experiment 2, Known Meanings.

Key: S= subject

Uncertainty

		S1	S2	S3	S4	S5	S6
Word 1	a)	c	a	c	c	d	c
	b)	c	c	d	b	c	d
	c)	b	c	b	b	c	e
Word 2	a)	d	c	e	d	b	b
	b)	c	c	c	b	d	c
	c)	b	b	b	b	b	d
Word 3	a)	b	b	d	c	c	e
	b)	b	a	a	c	b	c
	c)	b	b	b	b	b	c
Word 4	a)	c	d	g	e	c	c
	b)	b	b	c	d	f	b
	c)	b	b	c	b	b	c
Word 5	a)	b	c	b	c	d	b
	b)	b	c	b	b	c	c
	c)	b	b	b	b	a	c
Word 6	a)	d	d	d	b	d	c
	b)	d	c	b	b	b	b
	c)	d	d	a	b	b	a

Subject responses Experiment 2, Unknown Meanings

Uncertainty

		S1	S2	S3	S4	S5	S6
Word 1	a)	b	c	b	a	b	b
	b)	c	d	b	b	b	b
	c)	c	d	c	b	a	d

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Word 2 a)	c	d	d	b	a	a
b)	c	a	c	b	a	b
c)	c	d	c	c	b	b

Word 3 a)	b	c	e	b	c	a
b)	b	b	b	b	b	b
c)	b	c	d	b	b	b

Word 4 a)	b	a	c	a	b	a
b)	b	d	d	b	a	b
c)	c	d	c	c	b	b

Word 5 a)	c	c	a	b	c	a
b)	b	c	d	b	b	b
c)	b	f	c	c	a	b

Word 6 a)	c	c	d	c	e	b
b)	c	c	d	c	a	b
c)	c	d	c	a	d	b

Appendix 2

This appendix contains information relevant to Experiment 3.

Targets

Targets with known meanings may be identified in that the correct word form is given next to the pseudoword in brackets. The remaining targets are those with unknown meanings. Targets are presented in the sequence in which subjects saw them.

Verbs

Example 1

    To rimp (To record)
a) This is to make a copy.
b) This is done to ensure permanence.
c) This is done to music sometimes.

Example 2

    To frell
a) This is to carry.
b) This is done on the head.
c) African women do this sometimes.

1. To kurf (To march)
a) This is to walk.
b) This is done in a measured or regular fashion.
c) Soldiers usually do this.

2. To dren
a) This is to manipulate.
b) This is done using the feet.
c) Handicapped people do this sometimes.

3. To rult (To contaminate)
a) This is to cause to become impure or corrupt.
b) This is done through contact.
c) Radiation does this sometimes.

4. To cusp (To meditate)
a) This is to think.
b) This is done with concentration.
c) Mystics do this sometimes.

5. To trull (To sweep)
a) This is to clean.
b) This is done with a broom.
c) This is done to floors sometimes.

6. To plend
a) This is to impersonate.
b) This is caused by madness.
c) This is done to Napoleon sometimes.

7. To relf
a) This is to worship.
b) This is done in a frenzy.
c) Primitive tribes do this sometimes.

8. To pesh (To steal)
a) This is to take.
b) This is done without permission.
c) This is done to jewelry sometimes.

9. To mult
a) This is to put money into a business.
b) This is done against the law.
c) The Mafia do this sometimes.

10. To rilk (To boil or poach)
 a) This is to cook.
 b) This is done using water.
 c) This is done to eggs sometimes.

11. To hesk
 a) This is to throw away.
 b) This is done to something one has an emotional attachment to.
 c) This is done to photographs sometimes.

12. To losk
 a) This is to help to grow.
 b) This is done by singing.
 c) This is done to tulips sometimes.

Nouns

Example 1

    A resk
a) This is a kind of cutting instrument.
b) This has pointed teeth.
c) This is sharpened sometimes.

Example 2

    A lurb
a) This is a kind of meeting place.
b) Drugs are taken here.
c) People usually hang around this.

1. A veck (An encyclopaedia)
a) This is a kind of book.
b) This gives information on many subjects.
c) This is usually consulted.

2. A flen
a) This is a kind of holiday.
b) This follows a divorce.
c) This is usually looked forward to.

3. A belk (An income)
a) This consists of money.
b) This is received periodically.
c) This is usually earned.

4. A trug (An effigy)
a) This is a kind of stuffed figure.
b) This is made to represent a person.
c) This is hanged sometimes.

5. A wirp (a hedge)
a) This is a kind of barrier.
b) This is made up of bushes.
c) This is trimmed sometimes.

6. A pleck
a) This is a kind of glass jar.
b) Plants are grown in this.
c) This is usually looked at.

7. A reth
a) This is a kind of musical instrument.
b) This has one string.
c) This is usually strummed.

8. A lut (An antidote)
a) This is a kind of medicine.
b) This counteracts the effects of poison.
c) This is injected sometimes.

9. Crell
a) This is a kind of crime.
b) This results from not helping someone in danger.
c) This outrages people sometimes.

10. Bronts (Slippers)
 a) These are a kind of shoe.
 b) These are meant for use indoors.
 c) These are fetched sometimes.

11. A shilt
 a) This is a kind of garden.
 b) This is uncultivated.
 c) This is usually studied.

12. Crith
  a) This is a kind of fear.
  b) This is caused by being robbed.
  c) People suffer from this sometimes.

Orders in which cues were presented

<u>KEY</u>   a= genus
       b= differentia
       c= association
       T= Target
       U= Target with an unknown meaning.
       K= Target with a known meaning.
       R= Run. The sequence of orders seen by a subject on the various targets. Subject 1 saw the targets in Run 1, Subject 2 saw the in Run 2 and so on down to Subject 6 in Run 6. Subject 7 then returned to Run 1.

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
	K	U	K	K	K	U	U	K	U	K	U	U
R1	abc	bca	cba	bac	acb	cab	acb	cab	abc	bca	cba	bac
R2	bca	cab	abc	cba	bac	acb	bac	acb	bca	cab	abc	cba
R3	cab	acb	bca	abc	cba	bac	cba	bac	cab	acb	bca	abc
R4	acb	bac	cab	bca	abc	cba	abc	cba	acb	bac	cab	bca
R5	bac	cba	acb	cab	bca	abc	bca	abc	bac	cba	acb	cab
R6	cba	abc	bac	acb	cab	bca	cab	bca	cba	abc	bac	acb

Instructions

The following instructions were seen by subjects when in the cloze condition.

     Guess the unknown word. You will see a blank space followed by a piece of information. Use this piece of information to guess what goes in the space. Write your guess in the space provided on the answer sheet and also write down how confident you feel in your guess. You will now see the blank space again followed by two pieces of information. Again, try to guess what goes in this space using the information given. Again, write your guess and your confidence in it on the answer sheet. Finally, you will see the blank space a third time followed by three pieces of information. Again, try to guess what goes in the space using the information given and write your guess an your confidence on the answer sheet. Altogether there will be twelve words and you will be asked to guess and give your confidence three times for each word as described above.
     When you write your guess on the answer sheet, you can use a single word eg. "retreat", "mascot" or you can use a

phrase eg. "To move back when faced by an enemy", "An object which is thought to bring luck". If you can't think of an answer at all then put a dash - .
When you write your confidence, use a scale from 0 to 6

            0= no confidence
            6= maximum confidence

        You will now see two examples. Work your way through these recording your answers on the answer sheet. When you have done this, you may ask any questions you might have. Now go on an complete the experiment.

        The following instructions were seen by subjects when in the pseudoword condition.

        Guess the unknown word. You will see a word followed by a piece of information. Look first at the word then use the piece of information to try and guess it. Write your guess in the space provided on the answer sheet and also write down how confident you feel in your guess. You will now see the same word followed by two pieces of information. Again, look at the word and try to make a guess using the information given. Again, write your guess and your confidence in it on the answer sheet. Finally, you will see the same word a third time followed by three pieces of information. Again, look at the word, make a guess from the information given and write your guess and your confidence in it on the answer sheet. Altogether you will see twelve words and you will be asked to guess and give your confidence three times for each word as described above.
        When you write your guess on the answer sheet, you can use a single word eg. "retreat", "mascot" or you can use a phrase eg. "To move back when faced by an enemy", "An object which is thought to bring luck". If you can't think of an answer at all then put a dash - .
When you write your confidence, use a scale from 0 to 6.

            0= no confidence
            6= maximum confidence

        You will see two examples. Work your way through these recording your answers on the answer sheet. When you have done this, you may ask any questions you might have. Now go on and complete the experiment.

ANSWER SHEET

	GUESS	CONFIDENCE		GUESS	CONFIDENCE
Eg.1 i)	_____	____	6. i)	_____	____
ii)	_____	____	ii)	_____	____
iii)	_____	____	iii)	_____	____
Eg.2 i)	_____	____	7. i)	_____	____
ii)	_____	____	ii)	_____	____
iii)	_____	____	iii)	_____	____
1. i)	_____	____	8. i)	_____	____
ii)	_____	____	ii)	_____	____
iii)	_____	____	iii)	_____	____
2. i)	_____	____	9. i)	_____	____
ii)	_____	____	ii)	_____	____
iii)	_____	____	iii)	_____	____
3. i)	_____	____	10. i)	_____	____
ii)	_____	____	ii)	_____	____
iii)	_____	____	iii)	_____	____
4. i)	_____	____	11. i)	_____	____
ii)	_____	____	ii)	_____	____
iii)	_____	____	iii)	_____	____
5. i)	_____	____	12. i)	_____	____
ii)	_____	____	ii)	_____	____
iii)	_____	____	iii)	_____	____

The complete set of responses is too lengthy to include here. I have, therefore, given a sample consisting of the first set of responses for eight subjects. For a computer printout of all dependent variable scores, see Appendix 5.

Key C= confidence
      A= accuracy
      U= uncertainty

Subject 2 (Nouns/Pseudoword Condition)

Guess	C	A	U	Guess	C	A	U
1a) encyclopaedia	1	2		7a) bow	1	0	
b) book	2	1	1	b) violin bow	2	1	2
c) encyclopaedia	3	2	1	c) stringed instrument	3	1	1
2a) party	1	0					
b) treat	1	0	1	8a) lozenge	1	1	
c) fling	1	0	2	b) penicillin	1	1	1
				c) antidote	2	2	1
3a) belt	0	0					
b) wages	1	2	2	9a) guilt	1	0	
c) wages	3	2	0	b) selfishness	1	0	2
				c) neglect	1	1	2
4a) painting	1	0					
b) effigy	2	2	2	10a) sticks	1	0	
c) effigy	4	2	0	b) slippers	2	2	2
				c) slippers	4	2	0
5a) hedge	1	2					
b) hedge	2	2	0	11a) herb	1	1	
c) hedge	4	2	0	b) wild	1	1	1
				c) botanical	2	1	1
6a) storage	1	0					
b) crystal ball	1	0	2	12a) hayfever	1	0	
c) terrarium	3	1	2	b)loss of privacy	2	0	1
				c) paranoia	1	1	2

Subject 9 (Verb/Pseudoword Condition)

Guess	C	A	U	Guess	C	A	U
1a) march	4	2		9a) assassinate	3	0	
b) march	5	2	0	b) corrupt a business by takeover	4	2	1
c) march	6	2	0				

Guess	C	A	U		Guess	C	A	U
2a) flex	3	0						
b) ___	0	0	2	c) takeover by			
c) stamp	0	0	2	intimidation	4	2	1
3a) touch	3	0		10a) grill	3	0	
b) heat by friction	2	0	2	b) poach	3	2	1
c) to contaminate	5	2	2	c) poach	6	2	0
4a) ponder	4	1		11a) to promise	2	0	
b) wrack one's brains	3	1	1	b) to treasure	3	0	2
c) meditate	6	2	1	c) to rid oneself of something though the process is painful & poignant	5	2	2
5a) sweep	3	2					
b) sweep	5	2	0				
c) sweep	6	2	0				
6a) to be ridiculous	3	0		12a) nourish	3	1	
b) to be schizophrenic	4	1	2	b) to encourage growth esp of plants by human voice in song	4	2	1
c) to be schizophrenic	4	1	0	c) to encourage growth esp of plants by human voice in song	5	2	0
7a) chant	2	1					
b) chant & dance	4	1	1				
c) chant & dance a specific ritual with prayer etc	6	2	1				
8a) disobey	2	0					
b) steal/pilfer	4	2	2				
c) steal/rob	6	2	1				

Subject 14 (Noun/Pseudoword Condition)

Guess	C	A	U		Guess	C	A	U
1a) encyclopaedia	2	2		7a) bow	2	0	
b) encyclopaedia	3	2	0	b) ___	0	0	2
c) encyclopaedia	5	2	0	c) ___	0	0	2
2a) party	2	0		8a) ___	0	0	
b) weekend break	3	1	2	b) ___	0	0	2
c) short break	1	1	0	c) ___	0	0	2
3a) ___	0	0		9a) guilt	3	0	
b) bursary	2	1	2	b) death	2	0	2
c) wage	4	2	1	c) ___	0	0	2
4a) suit	0	0		10a) sticks	2	0	
b) voodoo doll	3	1	2	b) slippers	4	2	2
c) voodoo doll	5	1	0	c) slippers	6	2	0

	C	A	U			C	A	U
5a) thicket	2	0		11a) window box	2	1	
b) ___	0	0	2	b) ___	0	0	2
c) hedge	6	2	1	c) ___	0	0	2
6a) bottle	1	1		12a) flue	1	0	
b) ship in bottle	1	0	1	b) shock	3	0	2
c) miniature garden	4	2	2	c) shock	4	0	0

Subject 20 (Nouns/Cloze Condition)

Guess	C	A	U	Guess	C	A	U
1a) encyclopaedia	4	2		7a) bow	4	0	
b) encyclopaedia	5	2	0	b) ___	0	0	2
c) encyclopaedia	6	2	0	c) ___	0	0	2
2a) Christmas	3	0		8a) laughter	2	0	
b) Christmas	4	0	0	b) insulin	2	1	2
c) ___	0	0	2	c) antidote	2	2	1
3a) salary	2	2		9a) regret	2	0	
b) salary	4	2	0	b) irrespons- ibility	2	0	2
c) salary	6	2	0	c) neglect	4	1	2
4a) human	3	0		10a) children	2	0	
b) effigy	3	2	2	b) boot	2	1	2
c) effigy	6	2	0	c) slippers	6	2	1
5a) copse	4	0		11a) vegetable patch	3	1	
b) horse jump	4	1	2	b) herbaceous border	3	1	1
c) hedge	6	2	1	c) ___	0	0	2
6a) kilner jar	3	1		12a) amnesia	3	0	
b) test tube	3	0	2	b) loss	3	0	1
c) incubator	3	0	2	c) anxiety	3	1	2

Subject 24 (Nouns/Cloze Condition)

Guess	C	A	U	Guess	C	A	U
1a) encyclopaedia	3	2		7a) guitar	6	1	
b) encyclopaedia	4	2	0	b) guitar	4	1	0
c) encyclopaedia	5	2	0	c) ___	0	0	2
2a) Bank Holiday	3	1		8a) medicine	4	1	
b) a needful rest	1	1	1	b) a vaccine	3	1	1
c) beginning a new life	1	0	2	c) a vaccine	4	1	0

	Guess	C	A	U
3a)	a monthly magazine	4	0	
b)	a financial magazine	4	0	0
c)	wages	6	2	2
4a)	guy	5	1	
b)	an effigy	4	2	1
c)	an effigy	6	2	0
5a)	hair	4	0	
b)	lawn	5	0	2
c)	hedge	6	2	2
6a)	soil	6	0	
b)	soil	5	0	0
c)	jam jar	4	1	2
9a)	an insult	3	0	
b)	cowardice	4	0	2
c)	cowardice	2	0	0
10a)	wellingtons	4	1	
b)	slippers	5	2	1
c)	slippers	6	2	0
11a)	plastic	3	0	
b)	a forest	2	0	2
c)	wild life	5	0	2
12a)	claustrophobia	3	1	
b)	claustrophobia	4	1	0
c)	fear of the outside world	2	1	1

Subject 27 (Verbs/Cloze Condition)

	Guess	C	A	U
1a)	fight	3	0	
b)	march	5	2	2
c)	march	3	2	0
2a)	use	2	1	
b)	___	0	0	2
c)	soil	2	0	2
3a)	exchange	1	0	
b)	___	0	0	2
c)	subvert	2	0	2
4a)	contemplate	3	1	
b)	consider	3	1	1
c)	contemplate	3	1	1
5a)	polish	2	1	
b)	sweep	5	2	1
c)	sweep	6	2	0
6a)	rave	3	0	
b)	imitate	2	1	2
c)	mock	2	0	2
7a)	hunt	2	0	
b)	dance	2	1	2
c)	pray	1	1	1
8a)	___	0	0	
b)	steal	3	2	2
c)	steal	3	2	0
9a)	extort	3	0	
b)	fund	3	1	2
c)	fund with dirty money	2	2	1
10a)	heat food	2	1	
b)	fry	3	1	1
c)	poach	4	2	1
11a)	love	3	0	
b)	frame	3	0	2
c)	___	0	0	2
12a)	fertilize	3	1	
b)	increase	1	0	2
c)	___	0	0	2

Subject 31 (Verbs/Cloze Condition)

Guess	C	A	U
1a) move	6	0	
b) pace	4	1	2
c) march	5	2	1
2a) walk	6	0	
b) shuffle	3	0	1
c) get the better of	0	1	2
3a) burn	5	0	
b) touch	3	0	2
c) to influence badly	0	1	2
4a) thought	3	1	
b) contemplate	3	1	1
c) philosophize	3	1	1
5a) wash	5	1	
b) wash	5	1	0
c) brush or sweep	6	2	1
6a) honour	1	0	
b) imitate	3	1	2
c) ___	0	0	2

Guess	C	A	U
7a) praise	5	1	
b) sing	3	1	1
c) chant	1	1	1
8a) value	3	0	
b) ___	0	0	2
c) steal or remove	1	2	2
9a) invest	6	1	
b) illegally be involved	2	0	2
c) be involved in a black market	1	0	1
10a) warm	5	1	
b) boil	5	2	1
c) boil	6	2	0
11a) frame	4	0	
b) treasure & frame	3	0	2
c) it seems contradictory discard something one is attached to	0	0	2
12a) make a noise	3	0	
b) nurture	0	1	2
c) prune	0	0	2

Subject 45 (Verbs/Pseudoword Condition)

Guess	C	A	U
1a) kill	1	0	
b) march	4	2	2
c) march	6	2	0
2a) fiddle	0	0	
b) turn wheelchair's wheels	1	0	2
pedal	0	0	2
3a) catch something			

Guess	C	A	U
7a) to perform fertility rites	1	1	
b) to perform tribal dances	3	1	2
c) to perform tribal dances/ rites to the gods	4	2	1

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         eg. a cold      2  0           8a) play truant    2  0
    b) burn              4  0  2          b) to steal       5  2  2
    c) stain             0  0  2          c) to steal       6  2  0

4a) consider             3  1           9a) kill            3  0
 b) consider             4  1  0          b) invest         2  1  2
 c) meditate             6  2  1          c) invest in
                                             shady deals    2  2  1
5a) sweep                5  2
 b) sweep                6  2  0        10a) to fry          3  1
 c) sweep                6  2  0         b) to fry          3  1  0
                                         c) to boil         5  2  1


6a) to be hysterical 1   0             11a) to kiss         2  0
 b) to be                                b) to display      2  0  2
    schizophrenic        2  1  2         c) ___             0  0  2
 c) ___                  0  0  2
                                       12a) to nurture      2  1
                                         b) to nurture      1  1  0
                                         c) to nurture      0  1  0
```

Appendix 3

This appendix contains information relevant to Experiment 4.

Targets

Target 1 Known Version: To Brake
Target 1 Unknown Version: To Sprag (To brake by using a lever on the wheel)
Target 2 Known Version: To Cut or a reasonable synonym
Target 2 Unknown Version: To Flense (To cut the blubber from a creature like a whale)
Target 3 Known Version: To Shape or a reasonable synonym.
Target 3 Unknown Version: To Scabble (To shape roughly).

Cues

Cues for the targets. Cues for Order 1 are given first followed by those for Order 2. Since Order 2 involved only a reversal of cues b and c with cue a remaining unchanged in first position, only these last two cues will be given for Order 2.

Known Versions

Target 1, Order 1.

1a) He (   ) in order to slow the vehicle down.

1b) The driver (   ) in order to slow the car down.

1c) The driver (   ) in order to slow the car down.
    As the speed reduced, he changed down a gear.

Target 1, Order 2.

1b) He (   ) in order to slow the vehicle down.
    As the speed reduced he changed down a gear.

1c) The driver (   ) in order to slow the car down.
    As the speed reduced, he changed down a gear.

Target 2, Order 1.

2a) He (   ) the carcass using a sharp knife.

2b) The butcher (   ) the pig's carcass using a sharp knife.

2c) The butcher (   ) the pig's carcass using a sharp knife.
    He wore an apron to stop his clothes getting messy.

Target 2, Order 2.

2b) He (   ) the carcass using a sharp knife.
    He wore an apron to stop his clothes getting messy

2c) The butcher (   ) the pig's carcass using a sharp knife.
    He wore an apron to stop his clothes getting messy.

Target 3, Order 1.

3a) He (   ) the stone to get it to the correct size.

3b) The workman (   ) the stone to get it to the correct size.

3c) The workman (   ) the stone to get it to the correct size.
    He hammered away happily.

Target 3, Order 2.

3b) He (   ) the stone to get it to the correct size.
    He hammered away happily.

3c) The workman (   ) the stone to get it to the correct size.
    He hammered away happily.

Unknown Versions

Target 1, Order 1.

1a) He (   ) in order to slow the vehicle down.

1b) The cowboy (   ) in order to slow the wagon down.

1c) The cowboy (   ) in order to slow the wagon down.
    He strained and perspired.

Target 1, Order 2.

1b) He (   ) in order to slow the vehicle down.
    He strained and perspired.

1c) The cowboy (   ) in order to slow the wagon down.
    He strained and perspired.

Target 2, Order 1.

2a) They (   ) the carcass using sharp knives.

2b) The seamen (   ) the whale's carcass using sharp knives.

2c) The seamen (   ) the whale's carcass using sharp knives.
    They were soon covered with a smelly, white mess.

Target 2, Order 2

2b) They (   ) the carcass using sharp knives.
    They were soon covered in a smelly, white mess.

2c) The seamen (   ) the whale's carcass using sharp knives.
    They were soon covered with a smelly, white mess.

Target 3, Order 1.

3a) He (   ) the stone to get it to the correct size.

3b) The farmer (   ) the stone to get it to the correct size.

3c) The farmer (   ) the stone to get it to the correct size.
    He cut his hand and swore.

Target 3, Order 2.

3b) He (   ) the stone to get it to the correct size.
    He cut his hand and swore.

3c) The farmer (   ) the stone to get it to the correct size.
    He cut his hand and swore.

Experiment Instructions

What do you do? You will see a sentence with a space marked by brackets in it, for example, "John picked up his pen and began to (   )". Try to complete the sentence by putting a word or a phrase in the space. In order to complete this example, you could use the word "write" or the phrase "write in a slow, careful fashion". If you can't think of an answer, put a dash.

Also, each time you write an answer, put down how confident you feel in your answer. When you write your confidence, then

            0= no confidence
            6= maximum confidence

So you can use any number between 0 and 6. Perhaps your confidence for the above example may be 2.

You will then see a second sentence giving some extra information on what goes in the same space. This extra information will be underlined so you can see it clearly. For example, "John picked up his pen and began to (   ) a letter." Try to complete this space again- you can keep your first answer or change it to something different if you wish. Again, remember to put down your confidence in this second answer. You will then see a third sentence, again with some extra information eg. "My son John picked up a pen and began to (   ) a letter". Try to complete this sentence a third time and remember to give your confidence in your answer. You will then see a second question which you will answer three times and

finally a third question which you will answer three times just as above.

Try this example. Put your answers underneath the headings GUESS and CONFIDENCE. Try also to make your answers explicit. If you think a single word is sufficient then PLEASE use a single word. If you feel that you need to give more information then PLEASE use a phrase.

a) She (   ) the song.

GUESS   CONFIDENCE

wrote   2   (I've put an answer here for you)

b) The soprano (   ) the aria.

GUESS   CONFIDENCE

                    (Now you try an answer)

c) The soprano (   ) the aria and smashed all the windows in the hall.

GUESS   CONFIDENCE
                    (Now you try an answer)

Now do the experiment by turning one page of this booklet at a time. Don't look back and don't go forwards until you have answered a question.

Responses

Three hundred and forty subjects took part in Experiment 4 and it will be too lengthy to record the responses for all of them here. To give the reader an idea of the responses obtained then those for the first fourteen subjects on each of the four versions of the experiment will be recorded here. For a computer printout of all dependent variable scores, see Appendix 5.

Key   C= confidence, A= accuracy, U= uncertainty

Known Version, Order 1

C A U				C A U		
Subject 1				Subject 8		
1a) braked	3	2		1a) put his foot		

1b)	braked	5 2 0	
1c)	braked	6 2 0	
2a)	slashed & mutilated	1 0	
2b)	cut	4 2 2	
2c)	cut	5 2 0	
3a)	ground & measured	2 0	
3b)	ground	3 0 0	
3c)	chipped at	6 2 2	

Subject 2

1a)	braked	5 2
1b)	braked	5 2 0
1c)	braked	6 2 0
2a)	cut up	4 2
2b)	cut up	5 2 0
2c)	cut up	5 2 0
3a)	hammered at	3 2
3b)	hammered at	3 2 0
3c)	hammered at	5 2 0

Subject 3

1a)	put on his brakes	5 2
1b)	put on his brakes	5 2 0
1c)	put on his brakes	3 2 0
2a)	picked	6 0
2b)	cut	5 2 2
2c)	cut	5 2 0
3a)	filed	3 0
3b)	filed	5 0 0
3c)	chiselled	4 2 2

Subject 4

1a)	brakes	6 2
1b)	brakes	6 2 0
1c)	brakes	6 2 0
2a)	cuts	6 2
2b)	cuts	6 2 0
2c)	cut	2 2 0
3a)	smashed	2 2
3b)	smashed	2 2 0
3c)	smashed	2 2 0

Subject 5

1a)	braked	6 2
1b)	changed down	

	on the brake	3 2
1b)	pressed the brake	4 2 0
1c)	pressed the brake	5 2 0
2a)	cut	2 2
2b)	cut	3 2 0
2c)	cut	3 2 0
3a)	cut	2 2
3b)	cut	2 2 0
3c)	chiselled away at	3 2 1

Subject 9

1a)	braked	6 2
1b)	braked	6 2 0
1c)	braked	6 2 0
2a)	cut	6 2
2b)	cut	6 2 0
2c)	cut	6 2 0
3a)	broke	1 2
3b)	cut	3 2 1
3c)	hammered	6 2 1

Subject 10

1a)	braked	5 2
1b)	braked	4 2 0
1c)	braked	4 2 0
2a)	cut	5 2
2b)	cut	4 2 0
2c)	opened	3 2 1
3a)	polished	3 0
3b)	smashed	5 2 2
3c)	broke	6 2 1

Subject 11

1a)	braked	5 2
1b)	braked	6 2 0
1c)	braked	6 2 0
2a)	cut	5 2
2b)	cut	6 2 0
2c)	cut	6 2 0
3a)	sanded down	5 0
3b)	sanded down	6 0 0
3c)	chiselled	6 2 2

Subject 12

1a)	braked	5 2
1b)	braked	5 2 0
1c)	braked	6 2 0
2a)	carved	3 2
2b)	cut up	4 2 1
2c)	cut up	5 2 0
3a)	chiselled	4 2

		C	A	U
	a gear	6	0	2
1c)	braked	6	2	1
2a)	carved	6	2	
2b)	butchered	6	2	1
2c)	used continental butchering techniques on	6	2	1
3a)	measured	6	0	
3b)	worked/paired	6	2	2
3c)	paired	6	2	0

Subject 6

1a)	braked	2	2	
1b)	braked	4	2	0
1c)	braked	5	2	0
2a)	butchered	2	2	
2b)	cut up	3	2	1
2c)	cut up	5	2	0
3a)	broke	2	2	
3b)	broke	3	2	0
3c)	smashed	5	2	1

Subject 7

1a)	braked	5	2	
1b)	braked	4	2	0
1c)	braked	5	2	0
2a)	cut	3	2	
2b)	attacked	3	0	2
2c)	attacked	3	0	0
3a)	smashed	3	2	
3b)	ground	4	0	2
3c)	hit	4	2	1

3b)	chiselled	5	2	0
3c)	chiselled	6	2	0

Subject 13

1a)	braked	6	2	
1b)	braked	6	2	0
1c)	braked down	6	0	2
2a)	slashed at	6	2	
2b)	cut open	4	2	1
2c)	worked	4	0	2
3a)	broke	3	2	
3b)	broke	5	2	0
3c)	broke	2	2	0

Subject 14

1a)	braked	4	2	
1b)	braked	5	2	0
1c)	braked	6	2	0
2a)	skinned	4	0	
2b)	cut	4	2	2
2c)	cut	4	2	0
3a)	smashed	4	2	
3b)	smashed	4	2	0
3c)	chiselled	5	2	1

Unknown Version, Order 1

		C	A	U
	Subject 1			
1a)	braked	4	1	
1b)	shouted Whoa!	6	2	2
1c)	pulled on the reins	6	2	2
2a)	sliced	5	1	
2b)	butchered	5	1	1
2c)	slashed	3	1	1
3a)	broke	2	1	
3b)	cracked	4	1	1
3c)	chiselled at	4	1	1

		C	A	U
	Subject 8			
1a)	braked	5	1	
1b)	pulled on the reins	4	2	2
1c)	dragged his feet on the floor	1	0	2
2a)	dissect	5	0	
2b)	dissect	5	0	0
2c)	dissect	5	0	0
3a)	hit	3	1	
3b)	hit	4	1	0
3c)	hit	4	1	0

Subject 2
- 1a) braked — 6 1
- 1b) pulled the horses' reins — 4 2
- 1c) pulled hard on the reins to control the horses — 4 2 1
- 2a) dissected — 4 0
- 2b) butchered — 4 1 2
- 2c) butchered — 3 1 0
- 3a) chiselled — 4 1
- 3b) chiselled — 3 1 0
- 3c) chiselled — 3 1 0

Subject 3
- 1a) braked — 3 1
- 1b) pulled on the reins — 1 2 2
- 1c) pulled hard on the reins — 1 2 1
- 2a) mutilated — 1 0
- 2b) mutilated — 1 0 0
- 2c) mutilated — 1 0 0
- 3a) threw — 0 0
- 3b) filed down — 0 0 2
- 3c) filed down the stone — 1 0 0

Subject 4
- 1a) braked — 4 1
- 1b) took out his whip to the horses — 1 0 2
- 1c) pulled hard on the reins — 2 2 2
- 2a) cut up — 2 1
- 2b) sliced — 2 1 1
- 2c) cut open — 2 1 1
- 3a) filed — 1 0
- 3b) filed down — 1 0 1
- 3c) filed down — 2 0 0

Subject 5
- 1a) braked — 4 1
- 1b) braked — 2 1 0
- 1c) pulled the reins — 2 2 2
- 2a) cut up — 5 1
- 2b) cut up — 4 1 0
- 2c) slashed — 3 1 1
- 3a) filed — 3 0
- 3b) filed — 3 0 0

Subject 9
- 1a) braked — 6 1
- 1b) pulled on the reins — 4 2 2
- 1c) pulled on the reins — 6 2 0
- 2a) cut up — 6 1
- 2b) slit — 3 1 1
- 2c) slit — 5 1 0
- 3a) scraped — 5 0
- 3b) ground — 5 0 2
- 3c) ground — 3 0 0

Subject 10
- 1a) brake — 4 1
- 1b) brake — 2 1 0
- 1c) jumped out and slowed the vehicle down with his spurs — 0 0 2
- 2a) carved — 2 1
- 2b) speared — 3 0 2
- 2c) cut up — 4 1 1
- 3a) struck — 1 1
- 3b) smashed — 2 1 1
- 3c) cut up — 3 1 1

Subject 11
- 1a) braked — 4 1
- 1b) pulled in the reins — 4 2 2
- 1c) fought with the reins — 4 2 1
- 2a) opened — 3 1
- 2b) slashed — 3 1 1
- 2c) attacked — 3 0 2
- 3a) ground — 2 0
- 3b) smashed — 1 1 2
- 3c) split — 0 1 1

Subject 12
- 1a) brake — 4 1
- 1b) braked — 4 1 0
- 1c) pulled the reins — 5 2 2
- 2a) removed — 2 0
- 2b) removed — 4 0 0
- 2c) cut — 5 1 2
- 3a) chipped — 2 1
- 3b) smashed — 2 1 1
- 3c) hammered — 2 1 1

	C	A	U
3c) filed	3	0	0

Subject 6

	C	A	U
1a) waved	3	0	
1b) pulled on the reins	4	2	2
1c) pulled on the reins	5	2	0
2a) sliced	3	1	
2b) sliced	3	1	0
2c) sliced	3	1	0
3a) chipped pieces off	0	1	
3b) chipped pieces off	6	1	0
3c) chipped at	5	1	1

Subject 7

	C	A	U
1a) braked	3	1	
1b) braked	3	1	0
1c) pulled on the reins	5	2	2
2a) gutted	3	1	
2b) gutted	4	1	0
2c) gutted	5	1	0
3a) broke	2	1	
3b) broke	3	1	0
3c) cut	5	1	1

Subject 13

	C	A	U
1a) braked	6	1	
1b) pulled on the reins	6	2	2
1c) pulled on the brake lever	5	2	2
2a) carved	4	1	
2b) cut up	5	1	1
2c) cut up	3	1	0
3a) broke	3	1	
3b) hit	3	1	1
3c) hit	5	1	0

Subject 14

	C	A	U
1a) pressed the brake	3	1	
1b) pulled the reins	3	2	2
1c) pulled the reins	1	2	0
2a) cut	4	1	
2b) sliced	4	1	1
2c) sliced	4	1	0
3a) filed	2	0	
3b) filed	3	0	0
3c) filed	3	0	0

<u>Known Version, Order 2</u>

Subject 1

	C	A	U
1a) braked	6	2	
1b) braked	6	2	0
1c) braked	4	2	0
2a) dissected	3	0	
2b) dissected	3	0	0
2c) dissected	2	0	0
3a) chipped away at the stone	4	2	
3b) smashed away at	3	2	1
3c) hammered away at	2	2	1

Subject 2

	C	A	U
1a) braked	5	2	
1b) applied the brakes	6	2	0
1c) applied the brakes	6	2	0
2a) cut up	6	2	
2b) cut up	6	2	0

Subject 8

	C	A	U
1a) braked	6	2	
1b) braked	6	2	0
1c) braked	6	2	0
2a) cut	4	2	
2b) opened	5	2	1
2c) carved	5	2	1
3a) smashed	4	2	
3b) tapped	3	2	1
3c) tapped	5	2	0

Subject 9

	C	A	U
1a) braked	6	2	
1b) decelerated	5	0	2
1c) braked	5	2	1
2a) carved	6	2	
2b) carved	5	2	0
2c) dissected	2	0	2
3a) smoothed	2	0	
3b) honed	1	0	1
3c) smoothed	1	0	1

Subject 2 (continued)

2c)	cut up	6	2	0
3a)	ground down	4	0	
3b)	chipped at	5	2	2
3c)	chipped at	4	2	0

Subject 3

1a)	braked	6	2	
1b)	braked	6	2	0
1c)	braked	6	2	0
2a)	sliced	6	2	
2b)	carved	5	2	1
2c)	carved	6	2	0
3a)	chipped	6	2	
3b)	chiselled	5	2	1
3c)	chiselled	6	2	0

Subject 4

1a)	used the brake	6	2	
1b)	used the brake	6	2	0
1c)	used the brake	6	2	0
2a)	cut	6	2	
2b)	cut	6	2	0
2c)	cut	6	2	0
3a)	broke	6	2	
3b)	broke	6	2	0
3c)	broke	6	2	0

Subject 5

1a)	braked	6	2	
1b)	braked	6	2	0
1c)	braked	6	2	0
2a)	cut	6	2	
2b)	cut	6	2	0
2c)	cut	6	2	0
3a)	chiselled	6	2	
3b)	chiselled	6	2	0
3c)	chiselled	6	2	0

Subject 6

1a)	braked	3	2	
1b)	braked	5	2	0
1c)	braked	6	2	0
2a)	cut	2	2	
2b)	cut	4	2	0
2c)	cut	5	2	0
3a)	chipped	2	2	
3b)	chipped	5	2	0
3c)	chipped	5	2	0

Subject 7

1a)	waved his arms	3	0

Subject 10

1a)	braked	6	2	
1b)	braked	6	2	0
1c)	braked	6	2	0
2a)	cut	6	2	
2b)	cut	6	2	0
2c)	cut	6	2	0
3a)	ground	6	0	
3b)	chipped	6	2	2
3c)	chipped at	6	2	0

Subject 11

1a)	waved	2	0	
1b)	signalled	2	0	2
1c)	saluted	2	0	2
2a)	cut	2	2	
2b)	hacked	2	2	1
2c)	cut	1	2	1
3a)	paired	1	2	
3b)	hammered	2	2	1
3c)	carved	2	2	1

Subject 12

1a)	braked	4	2	
1b)	braked	6	2	0
1c)	braked	6	2	0
2a)	cut	3	2	
2b)	butchered	3	2	1
2c)	cut	4	2	1
3a)	weighed	3	0	
3b)	broke	4	2	2
3c)	broke	4	2	0

Subject 13

1a)	braked	5	2	
1b)	braked	3	2	0
1c)	braked	4	2	0
2a)	cut	3	2	
2b)	cut	4	2	0
2c)	cut	5	2	0
3a)	filed	5	0	
3b)	filed	4	0	0
3c)	filed	5	0	0

Subject 14

1a)	waved	3	0	
1b)	braked	5	2	2
1c)	braked	6	2	0
2a)	cut	3	2	
2b)	carved	5	2	1
2c)	carved	6	2	0
3a)	chipped	3	2	

	C	A	U		C	A	U
1b) braked	5	2	2	3b) chipped	5	2	0
1c) braked	5	2	0	3c) chipped	6	2	0
2a) opened	2	2					
2b) sliced open	4	2	1				
2c) opened	5	2	1				
3a) hammered	2	2					
3b) hit	5	2	1				
3c) hit	6	2	0				

Unknown Version, Order 2

	C	A	U		C	A	U
Subject 1				**Subject 8**			
1a) braked	4	1		1a) braked	6	1	
1b) braked	3	1	0	1b) pulled	3	2	2
1c) pulled the reins	4	2	2	1c) pulled	3	2	0
2a) stripped	4	1		2a) dismembered	4	1	
2b) skinned	4	0	2	2b) ___	0	0	2
2c) stripped	4	1	1	2c) cut up	5	1	1
3a) ground	3	0		3a) cut	6	1	
3b) ground	4	0	0	3b) cut	6	1	0
3c) ground	3	0	0	3c) cut	6	1	0
Subject 2				**Subject 9**			
1a) braked	6	1		1a) braked	6	1	
1b) braked	0	1	0	1b) braked	6	1	0
1c) reined	0	2	2	1c) pulled the reins	6	2	2
2a) carved	6	1		2a) attacked	6	0	
2b) carved	0	1	0	2b) attacked	6	0	0
2c) boned	0	1	1	2c) mutilated	6	0	2
3a) carved	0	1		3a) cut	3	1	
3b) carved	0	1	0	3b) shaped	6	1	1
3c) carved	0	1	0	3c) smashed	4	1	1
Subject 3				**Subject 10**			
1a) braked	3	1		1a) braked	3	1	
1b) braked	3	1	0	1b) braked	2	1	0
1c) pulled	3	2	2	1c) sweated	1	0	2
2a) cut	4	1		2a) cut up	6	1	
2b) hacked	4	1	1	2b) cut up	5	1	0
2c) sliced up	3	1	1	2c) cut up	6	1	0
3a) chipped at	4	1		3a) scraped at	3	0	
3b) chipped at	4	1	0	3b) scraped at	3	0	0
3c) used a pick axe to	3	1	1	3c) scraped at	3	0	0
Subject 4				**Subject 11**			
1a) braked	6	1		1a) braked	4	1	
1b) struggled	4	0	2	1b) braked	4	1	0
1c) heaved	5	2	2	1c) pulled the reins	3	2	2
2a) dissected	5	0		2a) carved	3	1	
2b) chopped	6	1	2	2b) carved	3	1	0
				2c) carved	3	1	0
				3a) ground	2	0	

2c) massacred	6	0	2	
3a) smashed	6	1		
3b) hammered	4	1	1	
3c) belted	0	1	1	

Subject 5

1a) braked	6	1	
1b) braked	6	1	0
1c) braked	6	1	0
2a) cut	6	1	
2b) cut	6	1	0
2c) chopped	6	1	1
3a) chipped	6	1	
3b) chipped	6	1	0
3c) chipped	6	1	0

Subject 6

1a) placed his foot on the brake	5	1	
1b) placed his foot on the brake	3	1	0
1c) pulled the reins of the horse	5	2	2
2a) cut	6	1	
2b) scraped	5	0	2
2c) gutted	4	1	1
3a) picked up	5	0	
3b) gripped	5	0	1
3c) ground	5	0	2

Subject 7

1a) braked	1	1	
1b) braked	0	1	0
1c) pulled	2	2	2
2a) cut	3	1	
2b) cut	3	1	0
2c) cut	4	1	0
3a) broke	2	1	
3b) smashed	1	1	1
3c) cut	2	1	1

3b) ground	3	0	0
3c) ground	2	0	0

Subject 12

1a) braked	4	1	
1b) braked	4	1	0
1c) braked	6	1	0
2a) dissected	3	0	
2b) dissected	4	0	0
2c) cut	4	1	2
3a) ground	3	0	
3b) ground	4	0	0
3c) ground	5	0	0

Subject 13

1a) braked	6	1	
1b) braked	6	1	0
1c) pulled the reins	5	2	2
2a) pulled apart	4	0	
2b) pulled apart	4	0	0
2c) opened	5	1	2
3a) filed	3	0	
3b) filed	6	0	0
3c) filed	6	0	0

Subject 14

1a) put his foot down on the brake	5	1	
1b) braked sharply	4	1	1
1c) put the brakes on	3	1	1
2a) cut up	4	1	
2b) carved up	4	1	1
2c) slaughtered	4	0	2
3a) filed	4	0	
3b) filed	4	0	0
3c) sharpened	3	0	2

Appendix 4

This appendix gives the instructions given to subjects for Experiment 5. These instructions were the same for both parts of the experiment with the exception that in the second part of Experiment 5, subjects were told that they would see three passages and would need to guess the meaning of three words.

Experiment Instructions

You will see a short passage in which there will be a word, TO SASHAY, which you probably won't know. If you have seen it before then please tell me now. What you need to do is guess the meaning of this word and tell me how confident you are in your guess. When you write your guess you can use a single word eg. "sing" or a phrase "sing in a high pitched voice". For confidence

        0= no confidence
        6= maximum confidence

Now when you guess the meaning of a an unknown word in real life everything happens very fast. Look at this example:

"Mike dropped the fug on the floor and it broke into pieces. Nobody would ever drink from that again. The only bit he could recognise was the handle."

Now you've probably zoomed through that and got the answer "cup". What I want you to do is slow the whole thing down and tell me how you get that answer. So find a clue, the one that you spot first. It may be "dropped". Note this down. Also note down your guess. Perhaps it is "wallet". Also note down how confident you are in this guess. Perhaps 2. Then find a second cue. This may be "broke". Note this down. Perhaps your guess this time is "glass". Note this down. Again note down how confident you feel in this guess. Perhaps 3. The next cue you find may be "drink". This may suggest the guess "glass" again. Note down again the clue and your guess together with your confidence. Go on and finish this passage by finding the clues, making a guess and giving your confidence.

What you need to do then is find a clue, make a guess and state your confidence in your guess then keep repeating this process until you feel you've finished. I know this is a bit clumsy and artificial but doing it like this will give me the information I want. Let's have one more practice. You can use a single word or phrase to give the meaning of the unknown word. Write the clues you spot, the guesses you make from those clues and your confidence in your guesses in the space provided.

"The rickshaw of China is pretty basic, the sedan chair of 18th century England was clumsy- more at home in a pantomime than on the street, but the howdah of India, swaying to the

motion of the great beast on whose back it is carried, is the very stuff romance is made from."

<u>CLUE</u>   <u>GUESS</u>   <u>CONFIDENCE</u>

Appendix 5

This appendix contains the data for Experiments 3 and 4.

For Experiment 3, the block of data shows 41 subjects down the side and 144 responses for each subject across the top. The data in each block is organised as follows: Meaning x 2 (unknown/known), Form x 2 (pseudoword/cloze), Part of speech x 2 (noun/verb, Information x 3 (1, 2, 3 amounts) and Order x 6 (abc acb bac bca cab cba).

For Experiment 4 each block of data is organised across the top as follows. For confidence and accuracy: Target 1, cue 1, cue 2, cue 3; Target 2, cue 1, cue 2, cue 3; Target 3, cue 1 cue 2, cue 3. For uncertainty: Target 1 cue 2, Target 2 cue 2, Target 3 cue 2, Target 1 cue 3, Target 2 cue 3, Target 3 cue 3. Down the side, the first 2 columns contain the figures 1 and 2. For column 1, the figure 1 corresponds to a known target and 2 to an unknown target. For the second column, 1 corresponds to Order 1 and 2 to Order 2.

Accuracy, Experiment 3

1001011001111011110000000100000000010000001011010110111101111111100000
2122222212222
1100101001101100000000000010100000001011010110011010111111100000001101
0102102212272
1100000110100001011000000011010000010110100100000000010111111111000000
1100011110110112100011100001111001011101101101100100000000110000000100001000001000012
1200202022022...

Confidence	Accuracy	Uncertainty
11356145335	11222022002	11020002
11556435335	11222222222	11000000
11553655354	11222022002	11020002
11666662222	11222222222	11000000
11550560566	11202222022	11212110
11245235235	11222222222	11010001
11545333344	11222200202	11022001
11345233223	11222222222	11000001
11666666136	11222222222	11001001
11544543356	11222222022	11002011
11566566566	11222222002	11000002
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