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PSYCHOLOGICAL DETERMINANTS OF CHILDREN'S FOOD PREFERENCES

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SUMMARY

Five experiments were conducted to investigate psychological determinants of food preference in five to seven year-old children. The research was informed by: (i) the general literature on human food preference, and (ii) behaviour analytic theory and research, particularly that on rule-governance.

Experiment 1, using a between groups design, examined the impact of *in vivo* peer behaviour on novel food consumption. Children exposed to "positive" peers avidly consuming a target food tended to prefer that food. Conversely, children who observed "negative" peers, rejecting the food, consumed little: it was also shown that these negative effects could be largely overridden by subsequent exposure to positive peers.

Experiments 2 to 5 utilised multiple baseline designs to evaluate the effectiveness of a series of multi-component interventions designed to promote consumption of previously refused fruits and vegetables. To maximise ecological validity and long-term maintenance of behaviour change these experiments were conducted in subjects' homes in the context of the evening meal.

During Experiment 2 an intervention incorporating video modelling, contingent rewards, and instructions effectively promoted consumption of three named foods. However, little generalisation to the consumption of other foods was evident. In Experiment 3 a similar intervention targeted broader *food categories* (vegetables and fruit) and this was effective in promoting consumption of up to 12 foods. Maintenance interventions utilising token rewards were effective in promoting long term consumption.

During Experiment 4, written instructions and contingent rewards, without video modelling, were relatively effective in promoting fruit, but not vegetable consumption. During Experiment 5, instructions and video modelling, without contingent rewards had a negligible effect on the consumption of either food category.

The results demonstrated that, contrary to the widely held belief within the human food preference literature, interventions utilising contingent rewards can be *very* effective in modifying food preferences. In discussing the results consideration was given to: (i) the role of rule-governance in ensuring effective reward use; (ii) maintenance and generalisation of behaviour change; and (iii) the outcome measure most appropriate for food preference research.

CONTENTS

CHAPTER 1

CULTURE AND FOOD: INTRODUCTION AND LITERATURE REVIEW

1.1: General Introduction

> I could never thoroughly understand the intense disgust with which the appearance at the dinner-table of a well boiled caterpillar, accidentally served with cabbage is always greeted. The feeling is purely one of habit, and the outcome of unjust prejudice. These delicate, shuddering people, who now with appetites gone, push away their plates upon the appearance of a well-cooked vegetable fed caterpillar, have probably just swallowed a dozen live oysters; or they may have partaken of the foul feeding lobster, and are perhaps pleasantly anticipating the arrival of a dish of ungutted woodcock! (Holt, V. 1885/1988, pp. 67-68)

This quotation is taken from Holt's *Why Not Eat Insects?* first published in 1885. Since then little has changed, and today Holt would be as likely to observe the diners' "intense disgust" if a caterpillar was served (either accidentally or intentionally) with their meal. Why is this? Put simply, caterpillars are not food: not in 1885, and not today. Although at first glance obvious, the notion that caterpillars (and other insects) are unattractive as food is interesting for at least two reasons: (i) items such as caterpillars (and many insects) *can be safely ingested* by humans, and (ii) these items are rejected on the grounds of disgust, whilst others which could be argued to be "equally disgusting" are relished (live oysters, ungutted woodcock, and other "well hung" game, to mention but a few).

Taking a global perspective, humans satisfy their (quite narrow) nutritional requirements by consuming a diverse range of substances (Fieldhouse 1991). Items known to be consumed by humans include various meats (snake, cow, rat), insects, pebbles, and even rotted wood. (See Fieldhouse, 1991 *Preface,* for an expanded list.) Why is it that a South American Indian will readily consume grubs, bees, and headlice, items which few Western Europeans would intentionally consume? Conversely, why do millions of Western Europeans consume litres of coffee and alcohol every day, substances which appear to be innately distasteful to the human palate? (Fieldhouse 1991, Rozin, 1977, 1982; Zellner 1991). Commenting upon the diversity of human energy sources, Levins and Lewinton (1985) have argued:

> Every human being eats and drinks....Yet when we look at these biological functions, which we share with all other animals, we see how...they have become detached in human life from their animal significance. Eating is obviously related to nutrition, but in humans this physiological necessity is imbedded in a complex matrix: *within which* what is eaten, whom you eat with, how often you eat, who prepares the foods, which foods are necessary for a sense of well-being, who goes hungry and who overeats have all been torn loose from the requirements of nutrition or the availability of food. (p. 260)

What is this "complex matrix" to which Levins and Lewinton refer? One possible answer is culture.

1.1.2: Culture and Food

The central role of culture in human eating has been acknowledged by Skinner (1953):

> What a man eats and drinks and how he does so... depend in part upon the practices of the group to which he is a member. (p. 415)

Consistent with such a claim is the observation that any group of humans will utilise only a small proportion of the potential food stuffs available to them (Fieldhouse 1991; Rozin 1988). Rozin (1982) argues that although there is something fundamentally biological about eating, it is a behaviour which has, over the course of human evolution, become embedded in culture. This process has occurred to such an extent that:

> ...there is no doubt that the best predictor of the food preferences, habits and attitudes of any particular human would be information about his ethnic group...rather than any biological measure that one might imagine. (Rozin, 1982; p. 227)

Humans are omnivores and as such enter the world with few genetically pre-programmed tendencies in relation to food (Rozin, 1977; 1981). The few pre-programmed tendencies that have been recorded include a tendency to the consumption of sweet and avoidance of bitter; plus a necessity for water.

The "natural preference" for sweet tastes, noted by numerous authors (Beidler, 1982; Bernstein, 1991; Birch, 1992, 1995; Logue, 1991; Rosenstein & Oster, 1988, p.1556; Rozin, 1982, 1988, 1990a & 1990b; Skinner, 1969; Wright, 1991), is argued to be linked to survival value. For example, Skinner (1969) has suggested that during the history of our species it was necessary to identify nutritious foods and "eat as much as possible when food was available" (p 50). He continues:

> Those who were most powerfully reinforced by certain kinds of oral stimulation were most likely to do all this [i.e., remember sources of food, kill game] and survive - hence man's extraordinary susceptibility to reinforcement by sugar and other foodstuffs, a sensitivity which, under modern conditions of agriculture and food storage leads to dangerous over eating. (p. 50).

Conversely it appears that human infants find bitter substances unpalatable and appear to reject them (Bielder, 1982; Logue, 1991; Rosenstein & Oster, 1988; Rozin, 1981, 1982; Wright, 1991). This behaviour also has survival advantage as natural poisons tend to be bitter (Rozin & Fallon, 1980). Thus the ability to detect poison prior to ingestion (by taste) may decrease the likelihood that it is ingested, and consequently decreases the likelihood of harm being caused to the organism.

The Omnivores Paradox

When attempting to satisfy their nutritional requirements humans benefit from the practice of omnivory. Omnivores can safely ingest, and consequently utilise as an energy source, a vast array of foodstuffs. Hence, the range of *potential* energy sources open to humans is enormous. Such flexibility with respect to diet means that omnivores are better equipped to negotiate seasonal changes, natural disasters, and competition for foodstuffs (Rozin 1977). However, omnivory does have a disadvantage: in order to survive the organism must identify sources of nutrition, and this results in experimentation with, and ingestion of, various substances (some of which may be dangerous to ingest). Such "forced" experimentation with foods increases the likelihood of ingesting poisons. Rozin (1977, 1991) has labelled this "*the omnivores paradox*".

Rozin suggests that a benefit of culture is that it allows the human omnivore to resolve this paradox. The need for trial and error learning in identifying foodstuffs is eliminated because exposure to safe energy sources is more likely within culture. A culture is a set of practices characteristic of a group of individuals, and these practices are selected for based on the consequences of the survival of the group (Skinner, 1988a, 1989). A subset of these practices will relate to food, and a new member of a given culture will be exposed to these practices. Because a culture represents the accumulated experience of many individuals across time (Lowe et al, 1995), learning within a culture is the result of a use of contingencies which is "*exclusively* human" (Skinner, 1989, p.116, emphasis added; see also Skinner 1988b).

How does a verbal/cultural community teach its new members about food? A number of variables are important with respect to the present thesis, namely:

1. Exposure: An individual living within a particular culture will be exposed to the foods of that culture; items deemed not to be food will not be presented as foods (Rozin, 1981). For example, British children receive frequent exposure to chips and little or no exposure to Iguana meat; the reverse applies to many South American Indian children.

2. Modelling: Not only are certain foodstuffs more likely to be encountered, we frequently observe other members of our culture modelling the consumption of these foods, both *in vivo*, and on television.

3. Cultural use: Cultural practices result in certain foods being used in certain ways, for example, some "foods" are considered to be "delicacies". Sweets are frequently used as rewards, especially as a means of promoting the consumption of other foods (e.g., "Eat your vegetables, then you can have some ice cream.").

Research examining the impact of these cultural variables will be reviewed in the remainder of this chapter. However, prior to undertaking this task it is necessary to offer some definitions. A characteristic of the human food preference research literature is that different authors often use different dependent variables as a measure of food preference. For present purposes three basic categories of outcome variable can be identified. These are:

1. *Stated preferences*: The central characteristic of this type of measure is that a subject's hedonic response, or some other overt verbal response is recorded. The particular measures utilised in this category have included five and seven point Likert rating scales of hedonic response with end points of "strongly like" and "strongly dislike". Typically, subjects rate a target food before and after an experimental manipulation. In a slightly different procedure, subjects are sometimes required to rank order a number of foods along a like/dislike dimension - after tasting a number of foods subjects are asked to rank order the foods from most to least "preferred" or "liked". Finally, some outcome measures require subjects to identify the item they would choose if given the opportunity to consume these items in the future.

2. *Choice*: This type of measure requires the subject to select a particular item from a range of items offered. The choices can be offered in a relatively formal way, for example, subjects may be presented with two or more items, in a controlled setting, and asked to select from them. Likewise, subjects can be offered a range of foods in a series of pairings such that each food in the range will be presented with each of the other items in the range (see for example, Birch, McPhee, Shoba, Pirok, & Steinberg, 1987). Another procedure places subjects in a situation where they choose items to consume (e.g., at lunch); however consumption data is not reported.

3. *Consumption*: Interestingly this measure is used infrequently by many of the authors whose research is reviewed in subsequent sections of the present thesis. When consumption is recorded, authors typically report some quantifiable measure (e.g., grams, spoonfuls) of the amount of food ingested by subjects; however, some authors (e.g., Birch, 1979a) have used plate waste as a means of measuring consumption.

In general, the term *food preference* is used (by many authors) to refer to any or all of these measures. Hence, within the mainstream human food preference research literature a subject's statement of the kind "I like food X" (Category 1), observing a subject choose food X

(Category 2), and a subject consuming food X (Category 3), are often taken as being equally valid measures of food preference. A serious limitation of such an approach is that it appears to treat these different measures as being equivalent or interchangeable, which may not necessarily be the case (this issue is developed in greater detail later). In the present review, the term *food preference* will continue to be used to refer to the three categories of measurement. However, to avoid the "uniformity myth" and by way of qualification, where possible the particular measure used will be labelled using one of the three categories presented above. This will allow the reader to be aware of the kind of behaviour changed (or otherwise) as the result of an experimental manipulation.

In addition to the failure to recognise important differences between different outcome measures, many previous experiments investigating food preference have been carried out from theoretical perspectives other than behaviour analysis. Consequently, the findings are often interpreted within a mentalistic framework. This does, on occasion, lead to confusion concerning the meaning, and applied significance of much of this work.

In an attempt to provide a unified conceptual framework, and to highlight the implications of using different outcome measures, the latter section of this chapter will re-examine much of this research from a behaviour analytic perspective. During this latter section particular emphasis will be placed on rule-governed behaviour and the value of manipulating contingencies to produce beneficial outcomes in the applied arena. (In the final chapter of this thesis, an examination of the problems concerning the use of stated preference as an outcome measure will be discussed in detail.)

1.2: CULTURAL VARIABLES INFLUENCING PREFERENCE

1.2.1: Exposure

As noted above, children (and others), by virtue of living within a particular culture, will be exposed regularly to the foods of that culture. Rozin (1990c) has described such exposure as:

> ...a recurrent and necessary, if not sufficient cause of food preferences (e.g., Pliner, 1982; Zajonc, 1968). Exposure itself is largely a product of culture. People are exposed to that subset of all possible foods that their ecology and culture supports. For example, the lack of exposure of many white, rural, mid-western Americans to bean curd or pork kidneys is not because the sources of these foods are ecologically unavailable, but because locals regard such things as 'not food' (p. 257).

The present section will review a number of experiments which have examined the effects of repeated exposure (in controlled settings) on subjects' stated preferences (and choices) for foods. Much of this research has been carried out to examine the role of exposure in reducing *neophobia* (see Birch 1990, pp. 118-119).

It is generally accepted that, with respect to food, humans exhibit neophobia; a fear of new things (Birch & Marlin, 1982; Birch, McPhee, Shoba, Pirok, and Steinberg 1987; Logue, 1991; Pliner & Pelchat, 1991; Pliner & Hobden, 1992; Pliner, Pelchat & Grabski, 1993).

Although its existence is widely accepted, little research has examined the development of neophobia during infancy and early childhood (Birch, 1990). Further, anecdotal and empirical evidence may suggest that infants may exhibit few signs of neophobia, and are likely to put a range of objects and substances into their mouths (Rozin, Hammer, Oster, Horowitz, & Marmora, 1986). Consistent with such anecdotal accounts, Rozin et al (1986) provide empirical evidence suggesting that children aged between 16 and 29 months will frequently put items (many of which are novel) into their mouths which older children and adults reject. Hence, it is not entirely clear whether young infants are neophobic. Birch (1990), while acknowledging the paucity of research investigating the development of neophobia, suggests that children begin to exhibit a neophobic response around two years of age.

Most of the studies examining exposure and neophobia cite research carried out by Zajonc (1968) who examined "mere exposure". Zajonc defined this as "a condition which just makes the given stimulus accessible to the individual's perception" (p.1). A number of experiments reported by Zajonc demonstrate that adult subjects increase their stated preference for those stimuli presented more frequently than other stimuli. The stimuli used included nonsense words, Chinese letter characters, and male photos (but not food). Exposure frequency varied from zero to 20 presentations.

In attempting to investigate the issue further Pliner (1982) assessed the impact of taste exposure on stated preferences for unfamiliar fruit juices. Following pre-tests, 24 students tasted four different juices on 0, 5, 10 or 20 occasions (within one experimental session). Post-tests (administered at the end of the session) showed that stated preference (as measured on a seven point scale) rose as an increasing monotonic function of number of exposures.

Again working with students, Pliner, Pelchat, and Grabski (1993) examined whether subjects perceive novel food as being dangerous and expect to dislike its taste. In addition, Pliner et al examined the effects of forced exposure to a set of novel foods on subjects' choice of "other novel" and "familiar" foods. The results indicated that perceived danger (although generally low) was predictive of subjects' willingness to try novel, but not familiar foods, while perceived taste was correlated with willingness to try both novel and familiar foods. (Willingness to taste was rated on seven point scales.) Those subjects "forced" to taste a set of seven novel foods later chose more novel foods (relative to control subjects) when offered a series of choices consisting of one familiar and one novel food.

These findings suggest that subjects' perception of the consequences of ingestion (i.e., taste and danger) will determine the likelihood of a novel food being consumed. Further, if some novel foods are tasted, this may increase the likelihood that other novel foods will also be tasted.

In a recent study Pliner, Eng, and Krishnan (1995) examined the effects of hunger and fear (prior to presenting a public speech) on neophobia. The results indicated that subjects scoring lowest on both fear and hunger chose the greatest number of novel foods. Thus, willingness to try novel foods may vary depending upon the context (hunger/fear) in which the items are presented. When hungry, or fearful, subjects are more likely to opt for familiar foods.

Birch and her colleagues have carried out a number of studies examining (sight and taste) exposure and its impact on food choices and stated preferences of children. Supportive evidence of the importance of exposure (in general) has been provided by Birch (1979a, 1979b) who reports correlative data regarding familiarity and stated preferences with three and four year old children. For the purposes of these experiments Birch estimated familiarity of foods from food histories completed by parents, and by the subject's ability to accurately name the food. Stated preferences were obtained by the children rank ordering eight foods (fruits or open sandwiches with different spreads) in order of preference (i.e., the item ranked in the top position was the one the child indicated as the one they "liked the very best"). Subsequent statistical analysis revealed that familiarity and sweetness accounted for the greatest amount of variance in both studies. Further, familiarity accounted for a greater amount of variance with younger children (i.e., three year olds).

Continuing this theme, Birch & Marlin (1982) explored the effects of taste exposure on food choice in two and three year old children who tasted either: (i) 5 novel cheeses on 2, 5, 10, 15, or 20 occasions; or, (ii), in a separate study, 5 novel fruits on 2, 5, 10, 15, or 20 occasions. The results indicated that measures based on paired choice (cheeses) or Thurstone scaling solutions (fruits) indicated an increase in preference (i.e., choice) as a function of increasing number of exposures.

Birch, McPhee, Shoba, Pirok, and Steinberg (1987) examined the importance of the modality through which exposure to novel foods occurred. Over a period of 30 days, 51 subjects (aged 2 to 5 years) were exposed to seven novel fruits on either 0, 5, 10 or 15 occasions through either sight alone, or both taste and sight. Sight only exposure was defined as looking at the food for 10 seconds while taste exposure was defined as placing the food in the mouth but not necessarily swallowing it. Following this exposure subjects were presented with a series of food parings (using a paired comparison choice paradigm). Subjects were asked to chose one member of each pair basing judgements on: (i) visual preference, and (ii) taste preference.

Results showed that with respect to taste judgements, those foods tasted more frequently during the experiment were chosen more frequently by subjects than items presented on fewer occasions. (When presented with each pair of foods during the choice trials, subjects were instructed to "choose the one you like best". Although not formally reported, it appears that the subjects were not explicitly choosing to consume.) Visual ratings of the foods were similarly enhanced with the number of sight exposures. There was evidence that foods which received taste exposure in addition to sight exposure also attained enhanced visual preference ratings. However, no increase in taste rating was recorded in cases where foods were sight exposed only. From these results Birch et al concluded, "visual exposure enhanced visual preference, and taste exposure enhanced taste preference" (p. 176).

Commenting on the applied implications of these findings Birch et al (1987) note:

> These findings suggest a strategy for combating one of the major concerns reported by parents of young children: the lack of variety in their children's diets (Kram & Owen, 1972). If novel foods were presented for tasting for ten or 15 exposures, significant increases in liking could be obtained, corroborating the results of previous research (Birch & Marlin, 1982). Unfortunately, the number of exposures required to obtain changes in preference is greater than most parents are willing or able to provide. (p. 177)

Although this is consistent with the general findings regarding exposure and food preferences, in particular stated preferences, the applied significance of this strategy must be questioned.

Birch et al (1987) note, for exposure to be effective and enhance taste ratings, it is necessary for the subjects to *taste* the foods. However, if foods are presented for tasting there is no guarantee that they will be tasted, especially if one accepts that the child is "neophobic". In fact, neophobia will, by definition, make it unlikely that the food is tasted.

This begs the question, if children are neophobic, how do authors such as Birch (Birch et al, 1982, 1987) ensure that taste exposure occurs? How can one, through "mere exposure", increase taste exposure? Interestingly, Birch et al (1987) report little difficulty in ensuring the occurrence of taste exposure:

> In the taste exposures, the child had to place the food in the mouth, but did not have to swallow it. However, the vast majority of children did ingest the food in nearly all trials. Cases in which the food was tasted and spat out were rare. (p. 173).

Birch and Marlin (1982) in discussing this point, argue that neophobia was often displayed by a reluctance to ingest the food (e.g., it was spat out after tasting), and the foods were often tasted "with considerable hesitation and reluctance" (p 358). However, earlier in the same paper, and again somewhat contrary to a neophobia account, Birch and Marlin note:

> Tasting was scored if the child placed (or allowed the experimenter to place) the food sample on the tongue and/or in the mouth. In most cases, the entire food sample was ingested, although some children spat out some of the sample, particularly on their initial presentation. (p. 356)

In support of a neophobia account it is noted that in both experiments (i.e., Birch et al, 1982, 1987), any reluctance to taste the food was often displayed on the first presentation.

In conclusion, it can be said that increased exposure to the taste of a novel food will increase stated preference for, or choice of that food. However, the means by which this taste exposure is achieved is quite another matter. The apparent ease with which researchers ensure its occurrence surely leaves neophobia based accounts open to question. The provision of an operational definition of neophobia may help to resolve this argument. For example, neophobia could be defined as a refusal to taste a food on its initial presentation - on subsequent presentations the food is no longer novel (at least through the modality of sight). Similarly, based on the information presented in the present section, neophobia could be defined as a negative reaction to tasting the food, but which may not alter the probability of actually tasting the food (i.e., the subject will reliably taste the food, but will evidence both overt and covert negative collateral behaviour). At present it appears that researchers assume that children are "neophobic" to the extent that taste exposure of a novel food is less likely to occur. The available data does not necessarily support this view. The resolution of this contradiction, and the provision of an operational definition of neophobia, will allow researchers to determine whether neophobia is of significance to the applied arena.

Two further points are necessary to note. First, investigations of neophobia and the role of taste exposure have used novel foods. Many foods which children refuse to consume are not novel, and consequently there is likely to be a history of previous (albeit intermittent) taste exposure. Repeated "mere exposure" to such familiar foods may have few, if any, positive effects (Pliner, 1982).

Second, there is the context in which humans are usually exposed to foodstuffs. Eating is a social occasion (Rozin, 1990c), hence it is difficult, if not impossible, to quantify the extent to which exposure, independently of other social learning phenomena, impacts upon food preferences. This may lead one to question the validity of concepts such as "mere exposure" beyond the operational definition or descriptive level (e.g., attempting to promote consumption without utilising a complex programme of intervention, such as imposed reward contingencies). With the case of verbally able humans, is it valid to discuss a mechanism of exposure which is not inextricably tied to social variables?

Consistent with this latter point, Zellner (1991) acknowledges that exposure "may not itself cause liking" (p. 212) but that it is an important mechanism in that it allows the operation of other variables. Zellner continues, "...the more exposure one has to a food the more chance there is for liking to develop through other mechanisms" (Zellner, 1991, pp.

212-213). Birch et al (1987) propose a similar explanation when attempting to resolve the apparent contradiction discussed above (i.e., the apparent ease with which the neophobic child will eat novel foods); "'mere exposure" is seldom an accurate description of children's eating experiences" (p. 177). This is consistent with Rozin's (1981) suggestion that culture provides "forced" exposure to foods which may allow other processes and variables to impact upon consumption (e.g., alcohol and teenage peer pressure). The importance of some of these "other variables" will be examined below.

1.2.2: Modelling

Modelling (imitation, and observational learning, see below Section 1.3.3) are processes through which cultural practices can be transmitted from one generation to the next (Skinner 1988c, p 41). Modelling is a "naturally" and regularly occurring teaching method, which can be used as an efficient way of teaching new behaviours (Grant & Evans, 1994).

Anecdotal observation suggests modelling (and observational learning) appears to play a substantial role in the development of children's food related behaviour. For example, attempts by parents to induce their child's acceptance of a food often involve the explicit modelling of the consumption of that food, accompanied by comments of how "yummy" that food tastes. Further, most parents will probably have had direct experience of their child refusing a food (which is normally consumed) when an admired friend, who has been invited for dinner, is seen to refuse this food.

Rozin and Schiller (1980) and Rozin (1988) report (descriptive) work examining the development of chilli pepper consumption patterns in young Mexican children (chilli pepper appears to be innately distasteful to the human palate). Rozin (1988) describes how the child is offered, but never forced to eat the hot chilli (with non-chillied food available), and how a child's refusal of the hot chilli is accepted by adults. Children are offered the chilli in a positive social context where the child observes the "...family readily eating and obviously enjoying the piquant food" (p. 177).

The present section will review a number of studies examining the effects of modelling on children's food preferences. In a subsequent section the impact of television advertising, which often uses modelling in an attempt to influence the purchases of viewers, will also be examined.

A number of variables have been shown to alter the effectiveness of modelling and the resulting imitation and observational learning. For example, Bandura (1971) argues that perceived similarity of model and observer is important. Harper and Sanders (1975) highlight familiarity of the model as an important variable (see below). Brody and Stoneman (1981) provide data relating to the age differences between models and observers (described in detail below). Fehrenbach, Miller and Thelen (1979) suggest that observing multiple models is more effective than observing individuals, however the advantages of multiple models may be reduced if they behave inconsistently (see also, Garlington & Dericco, 1977).

Modelling and Food Preference

A number of experimental studies have demonstrated the importance of modelling in the development of food related behaviours. In an early paper Duncker (1938) reports a number of experiments examining the impact of peer behaviour on children's stated preferences and food choices. In the first experiment children (age range, 2.67 years to 5.17 years) were presented with an array of six foods: carrots, grapes, nuts, apples, bread and bananas. Each subject "was made to choose (and eat)" (p. 490) foods from this array, being instructed to chose the one he or she liked best. Following the first choice the instruction was repeated with respect to the remaining five foods, and so on. The subjects initially made these choices alone, and then in the presence of a peer who exhibited different choice behaviour. The results demonstrated that subjects' choices (and rankings) were consistent with those of peers on 81 percent of occasions, as compared to 25.6 percent during the control situations (i.e., when they chose in the absence of peers).

In a second study Duncker examined the impact of the model's age on the food choices of the observer. Two groups of children participated: one older (age range 3.92 to 5.08 years), and one younger (age range 2.67 to 3.5). During approximately half of the choice situations, a child from the older group acted as a model (i.e., made choices first), and a child from the younger group acted as an observer (i.e., made choices second). During the remaining half of the choice situations the reverse applied and the younger child modelled choice. The results indicated that when acting as observers, the younger children imitated the choices of an older child more often than was the case when the older child was the observer. Nevertheless, subjects from the older group exposed to younger models while less affected, did alter choices in the direction of the younger model, relative to control conditions.

In the final Experiment reported by Duncker, subjects (15 children, mean age 4.5 years) were read a story in which the hero ate one food and rejected another; the rejected food being the sweeter of the two. In a later role play situation based on the story, subjects tended to choose the target food (i.e., the one chosen by the character in the story) in preference to the sweeter alternative. However, given the context (i.e., role play, therefore not very natural), it is not clear how these choices correspond to a choice which is made in order to consume a food (e.g., during a lunch time presentation).

Duncker's work was later extended by Marinho (1942). Based on performance across a series of choice tests, subjects (aged four to six) were divided into two groups labelled "predominant and temporary preference" (*sic*). The predominant preference group comprised of children who tended to exhibit stable choices across time; the choices of children in the temporary preference group were more variable. Marinho reports that subjects from the latter group (i.e., unstable choices) were more inclined to alter choices in accordance with those of a peer, than subjects in the "stable preference" group.

More recently, Harper and Sanders (1975) examined the effect of adults' behaviour on the food choice of children aged between one and four years of age. The adults were either the mother of each subject or a stranger (an experimenter). Imitation of the adult model's choice of the target item was greater with the children who observed their mothers choose as compared to children who observed a stranger. Further, changes in the children's behaviour were greater when they observed a food being eaten (by mother or stranger) rather than simply having the food presented to them. Harper and Sanders report that most of the subjects who chose a food also consumed it. Based upon these results it would appear that modelling is most effective (in altering food choices) when the model is familiar and, in addition, is seen to consume the food.

Birch (1980a) studied the effects of *in vivo* peer modelling on the stated preferences, choice, and food consumption of pre-schoolers. Between one and eight weeks prior to a peer intervention, subjects' stated preferences for nine vegetables were obtained using a stated preference ranking procedure. The intervention took place across four consecutive lunch-times. Seating was arranged so that a child who, during the pre-experimental ranking tests, had ranked vegetable A high and vegetable B low was seated with three other children exhibiting opposite stated preferences (i.e.: vegetable A, low: vegetable B, high). On each of the four days, the four subjects seated at each table were offered a choice of vegetable A and B, in addition to the regular lunch. On the first day the target child was asked to choose either vegetable A or B, then he or she observed the three peers making their choices. On subsequent days the peers chose first, prior to the target child. (Subjects were never offered a choice of vegetables in the absence of peers.)

Three measures were used: (i) choice of vegetable A or B; (ii) how much of each was consumed; and (iii) stated preference for each (obtained from pre- and post-experimental preference ranking procedures). The data indicated that subjects' choice of the initially lower ranked vegetable tended to increase. Of the 17 subjects, 15 chose their preferred vegetable on the first day. On the fourth (and final) day of the intervention, 10 of these 15 subjects chose the food they had ranked lower during the pre-experimental test.

Although Birch reports that consumption data was consistent with the choice data, the impact of the intervention on the consumption of the initially less preferred food (i.e., the target food) is somewhat unclear. On the final day of the intervention the target children's consumption of their initially lower ranked food (the target food) was greater than the models' consumption of their initially lower ranked food. However, "...this result only approached significance" (p.493). Further, as a group, the target children's consumption of the target food was quite stable across the four days of the intervention, which may suggest little impact of peer behaviour. Across the same time span, the target children's consumption of the initially preferred vegetable *decreased.* Hence, because target food consumption accounted for a greater proportion of the overall consumption on the fourth day of the intervention, as compared to the first, Birch argues that the intervention had a significant positive impact upon consumption of the target food (in terms of total amount of additional vegetables consumed). However, it may also be argued that: (i) choice, but not consumption of the initially less preferred vegetable increased, or, (ii) the intervention decreased the subjects' consumption of the initially preferred vegetable.

Positive effects on stated preference were also recorded during the post intervention preference ranking procedures. Of the 17 subjects, 12 ranked the initially less preferred vegetable higher during this test, relative to the pre-experimental ranking position. The median increase was 2.5 positions. Interestingly, 14 of the 17 subjects showed a *decrease* in stated preference for the vegetable which was initially more preferred. The median decrease was 3 positions. Birch (1980a) argues that these recorded changes in preference, while not entirely ruling out conformity effects, suggest that "...the procedures produced relatively long-term social-learning effects on preference" (p. 495). However, the applied significance of these changes in stated preference depend upon whether consumption measures also followed the same pattern of change. From the data presented by Birch, it is unclear whether changes in consumption, which can be described as being of applied significance, actually occurred.

A further analysis of the ranking data was undertaken by Birch (1980a), to examine age differences in stated preferences. Subjects were divided into two groups: three and four year-olds and four and five year-olds. All eight of the younger subjects increased their ranking at post test (median 7 positions) for the initially non-preferred vegetable. Only four of the nine older children displayed a corresponding increase (median 1 position). With respect to the initially preferred vegetable, seven of the eight younger children decreased their preference (median 2 positions), and seven of the nine older children also showed a decrease in preference (median 3 positions). However, the age differences recorded for the decrease in preference of the initially preferred vegetable were not reported to be significant.

The experiment by Birch (1980a) is interesting for three reasons. First, it illustrates the need for researchers to be aware of the important differences in the measures encompassed by the label "food preference". The peer modelling appeared to be quite effective in altering subjects' stated preferences for the target food. On the other hand, changes in consumption of the target food were much less evident.

Second, there is the question of age effects. These may not be the result of age *per se*; the results of a later published study may suggest a different interpretation. Brody and Stoneman (1981) found that subjects were less likely to imitate a model (pointing to their "favourite food" of two alternatives presented on slides) when the model was younger than the subject (as compared to being of similar age or older). Brody and Stoneman extended this analysis to examine multiple peers. Children were exposed to two models simultaneously, in one of three experimental conditions: (i) a same aged and a younger model, (ii) an older and a younger model, or, (iii) a same age and an older model. Results indicated that subjects imitated either the same age, or older peer over the younger peer. Further, no differences in imitation were observed with those children exposed to a same age and an older peer. In Birch's (1980a) study children acted as both subjects (i.e., exposed to peer influence) and peers (providing peer influence). Hence, the 3 year old subjects were always exposed to peers of a similar age or older, while the four year olds were only ever exposed to peers of a similar age or *younger*. Thus the age differences in stated preference may be due at least in part to the younger subjects exposure to the older peers.

Third, there are the reciprocal effects on a model who is imitated (cf. the earlier reported experiments by Duncker, 1938, and Marinho, 1942). In these experiments (i.e., Birch, 1980a; Duncker, 1938; Marinho, 1942) many (or all) of the children both observed the peer models to whom they were exposed, as well as being observed when they themselves acted as peer models for other subjects. None of the authors provide data concerning the order in which children acted as models and subjects, or observers. It was noted earlier that if a person has been imitated, that person will be more likely to imitate a model (Thelen, Lada, Lasoski, Paul & Kirkland, 1980), that is, being imitated leads to reciprocal imitation. Hence, at least some of the apparent benefits of modelling as presented by Birch and Duncker may be the result of reciprocal imitation. Further research is needed to establish the validity of this claim.

Another strategy for use in the applied arena is to combine modelling with other variables. Such a strategy was employed by Greer, Dorow, Williams, McCorkle, and Asnes (1991) who, working in an applied setting, combined peer modelling with contingent token reward and/or social praise in order to increase acceptability of foods. In a first study, the target child (18 months old) observed his older sister consume a portion of food and receive contingent reward. The target child was then given the opportunity to eat the food in order to obtain contingent reward and social praise. In their second study Greer et al extended their analysis of modelling-based procedures working with a subject at a pre-school. Two types of peer interventions were investigated: (i) when the model ate first, then the subject was given the opportunity to consume the food (this pattern was rotated between the model and subject), and (ii) when the model and the subject were presented the target food simultaneously. The authors report stronger effects with the former procedures, suggesting that observing the model before being given the opportunity to eat served as an establishing operation, thus altering the reinforcing potential of the praise or food.

Consistent with the descriptive and anecdotal example provided at the beginning of this section, the experimental evidence reviewed above suggests that modelling can impact positively on children's food preferences. The impact of modelling is likely to be enhanced if: (i) the model is familiar to the observer, and (ii) the model is observed consuming the target food (Harper & Sanders, 1975). Further, the extent to which reciprocal imitation is instrumental in producing the observed results is unclear. The experiment by Greer et al highlights the importance of modelling when used in an applied setting. However, given that modelling was used as a component of an intervention, the results provided by Greer et al cannot provide additional information concerning the importance, or otherwise, of reciprocal imitation, or of the importance of modelling *per se*.

Unfortunately, the research reviewed in the present section does not allow any firm conclusions to be drawn regarding the impact of modelling on consumption. Only two of the experiments reviewed report consumption data - Greer et al (1991) and Birch (1980a). Given that Greer et al combined modelling with other variables (i.e., rewards), little can be said regarding the impact of modelling per se. Furthermore, the consumption data reported by Birch (1980a) is equivocal: the *actual amount* of target food consumed by the subjects did not increase across the intervention. This observation highlights the need for researchers to be aware of the important differences in different outcome measures. An increase in stated preference, or choice, may not necessarily mean that an increase in actual consumption will also be recorded.

1.2.3: Television Advertising

Television is another medium through which children are regularly exposed to models, and, given the extent to which children view television, and consequently advertisements, it may well be that television plays an increasingly important role in the formation of children's food preferences. Research suggests that even pre-school children watch an average of 27 - 28 hours of television each week (Leung, Fagan, Cho, Lim, & Robson, 1994). Further, evidence suggests that infants as young as six months can imitate the behaviour of a televised adult model (Meltzoff, 1988); thus television is a potential influence from a very early age. Not surprisingly, the impact of television on children's food preferences has been the subject of experimental investigation.

Stoneman and Brody (1981) examined the effect of peers stated preferences for salty snacks and child oriented advertisements for these snacks. Fourth grade children (approx. 9 years old) were assigned to one of four experimental conditions. Subjects in the first condition were exposed to television advertisements. In the second condition subjects viewed the same advertisements and in addition were exposed to a peer whose stated preference was consistent with the advertisements (i.e., when asked to indicate their favourite of two pictorially represented snacks, the peer selected the item featured in the advertisement). Conditions for the third group were similar to those of the second, but peers' stated preferences were inconsistent with the televised messages. Finally, subjects in a control group watched television, but were not exposed to advertisements or peers. Following the experimental manipulation, each subject was shown a series of ten colour slides, each of which featured a salty snack and another common food. The subject was required to "point to their favourite" of the two alternatives on each slide. Children in the television advertisement condition chose more salty snacks than controls. Children who were exposed to the "consistent peer" chose more salty snacks than the children in the television advertisement only condition, while the children exposed to the "inconsistent peer" chose less than the subjects in the television advertisement condition, but more than controls. This finding is consistent with the findings of research examining the effects of multiple peers (e.g., Fehrenbach, Miller & Thelen, 1979). Contradictory messages (in this case, peers and television advertisements) are less effective than consistent, unidirectional messages from peers and television in combination, or presented independently of each other.

Goldberg, Gorn, and Gibson (1978) report two studies investigating the impact of different types of television advertisements. In the first study (5 & 6 year old) children viewed a (food neutral) cartoon with either "sugared snack and breakfast food" advertisements, or "Pro-nutrition Public Service Announcements (PSA) for more wholesome snack and breakfast foods" (p. 74), inserted at various points. Following this subjects were shown a series of large boards with six different foods mounted on each. There was two broad formats, either, (i) three nutritious snacks and three less nutritious snacks (two of which were featured in the advertisement); or, (ii) three high sugar breakfast foods, and three more nutritional alternatives (two of which had been featured in the advertisements). Subjects were also given pictorial representations of each board, and stated preferences were recorded by requiring subjects to put an "X" over the foods they preferred. The results indicated that children exposed to the advertisements chose more of both types of sugared foods (i.e., snack and breakfast foods) than control subjects who were not exposed to any television. Further, the subjects who viewed the PSA *did not* choose significantly more of the nutritious foods than the control subjects.

Furthermore, Goldberg et al (1987) report that longer exposure to advertisements resulted in subjects choosing a wider range of snacks high in sugar; these subjects tended to choose more foods not featured directly in the advertisements; however, the overall number of foods indicated as being preferred did not increase. Interestingly, when the children were asked to indicate which foods were healthy and which were not, very few errors were reported and no significant differences between the groups was observed. Hence, children were aware which foods were of greater nutritional value regardless of whether or not they had been exposed to PSAs.

In the second study reported by Goldberg, Gorn and Gibson (1978), children viewed a "pro nutritional cartoon" in which:

> The child viewer is led step-by-step to see that too much junk food can lead to unwanted visits to the dentist, feeling weak, losing the football game, and losing esteem in the eyes of one's friends. It is suggested that eating wholesome food can help one avoid these negative outcomes (Gorn & Goldberg, 1987, p 35).

The first group of children (aged 5 to 6 years) watched this 24 minute programme. A second group watched the same programme with a number of pro-nutritional public service announcements (employed in the previous study) inserted at various points throughout. Children in the third group also viewed the cartoon but advertisements for high sugared foods were inserted (the advertisements used were the same as those employed in the previous experiment).

The results indicated that all three groups chose less sugared foods on the outcome test (as employed in the previous study) relative to a control group who did not watch television. However, no significant differences were observed between the three groups exposed to the cartoon. This suggests that the PSAs did not have any additional impact, and conversely, the advertisements did not have any detrimental effects when viewed with the cartoon. The results were similar for both sugared snacks and the sugared breakfast cereals. The authors also report that the children exposed to the cartoon in the second study chose *significantly less* sugared food than the children exposed to the public service announcements in the first study.

Although positive effects were reported, Gorn and Goldberg (1987) argue that the studies reported above (i.e., Goldberg, Gorn & Gibson, 1978) focused on "hypothetical preferences". Prior to indicating their preference of snack the subjects were told to:

> ...pretend that your Mommy and Daddy were going away on a holiday, and they asked me to baby-sit for you while they were gone. Now I don't know the kinds of foods you want while they were gone. (Gorn & Goldberg, 1987, p. 35).

To examine the effects of television on children's actual choice (as opposed to stated preferences), Gorn and Goldberg (1982) conducted a study with five to eight year old children attending a summer camp. Each day, for a two week period, the children viewed a 30 minute recording of a (food neutral) cartoon which incorporated one of the following: (i) fruit advertisements, (ii) public service announcements, or, (iii) candy advertisements. A control group were exposed to the cartoons only. Each day, following exposure to the cartoon, the children were presented with a choice of drink and snack. Two drinks were offered, orange juice or high sugar drink, and subjects were instructed to select one. In addition, four snacks were presented, two fruits and two candy bars, and subjects were instructed to choose any two. The subjects were then allowed to consume the items chosen. However, Gorn and Goldberg do not report any of the subsequent consumption data. Finally, advertisements were scheduled so that on the day a particular snack was offered, and the three preceding days, the children were exposed to an advertisement featuring it.

Results indicated that the children exposed to the candy advertisements chose *significantly less* fruit than the children in the other three conditions. No significant differences in snack choice were observed across these other three groups (i.e., controls, fruit advertisements, and PSA). With respect to drink choice, children exposed to fruit advertisements (including orange juice) chose significantly more orange juice than children in the other three groups. No significant differences were observed across the latter three groups, but children exposed to the candy advertisements chose the least orange juice. These results are consistent with the earlier reported stated preference data (Goldberg, Gorn & Gibson, 1987).

Peterson, Jeffery, Bridgewater, and Dawson (1984) also examined the impact of pro-nutritional television programmes, advertisements, and public service announcements on different measures of food preference with five and six year old children. Pre- and post-experimental measures included: (i) The Behavioural Eating Test - subjects were presented with six foods (three nutritious and three less nutritious foods) and allowed to eat freely for ten minutes; (ii) The Pretend Eating Test, a rank ordering of nine nutritious and nine less nutritious foods, and; (iii) two questionnaires to assess general nutritional knowledge and each child's understanding of the televised messages. Interestingly, following the experimental manipulation, little difference in any of the measures was recorded between the experimental and control subjects. The only significant difference concerned the experimental subjects' nutritional knowledge of the foods featured in the televised intervention. It is important to note that this nutritional knowledge did not appear to be reflected in changes in any of the other measures.

Taken together these studies suggest that televised information (advertisements, pro nutritional cartoons) impacts upon children's food preferences (in particular stated preferences). The results of Goldberg, Gorn, and Gibson (1978) and Stoneman and Brody (1981) suggest that advertising will increase children's stated preferences of sugary and salty foods. However, the extent to which pro-nutritional televised information will promote the consumption of "nutritional snacks" is not so clear - in the Gorn and Goldberg (1982) study, children exposed to the fruit advertisements chose more orange juice than other subjects, no other increases in "nutritional snack" choice were reported.

As with much of the research reviewed previously in the present chapter, few experiments examining the impact of television report any consumption data. Furthermore, the experiment which did (Peterson et al, 1984) reported no increases in actual consumption. The paucity of consumption data is very significant given that some of the experiments reported in the present section demonstrated that children were aware of the apparent nutritional value of "healthy snacks". This information may be effectively transmitted via television, but it remains to be demonstrated that provision of this information will result in increases in consumption of the corresponding foods. Such information may result only in increases in stated preferences.

Studies have also indicated that television advertisements may have an impact upon food purchase requests. Galst and White (1976) found significant positive correlations between the frequency with which three to five year old children pressed a button to keep advertisements on a television screen, and the amount of "purchasing - influencing attempts" (PIAs) they made when visiting a supermarket with their mother. PIAs were defined as independent requests for an item by a child. PIAs were also significantly correlated with parental reports of the amount of time the children spent watching commercial television, and the most frequently requested food items (cereals and candy) were those items most frequently advertised during children's viewing times. Similar findings have been reported by Taras, Stallis, Patterson, Nader, and Nelson (1989) and Donkin, Neale, and Tilston (1993). Interestingly, the frequency of PIAs was not related to the degree of success in influencing parents purchases, as reported by the parents' (Galst & White, 1976). This may reflect televisions ability to effectively alter stated preferences.

1.2.4: Cultural use of Food

In addition to laying down rules concerning what is and is not acceptable as food, a culture also lays down rules about which combinations of foods are acceptable (e.g., not chocolate with chips), and appropriate times for the consumption of certain items (pizza for lunch not breakfast). Combinations and preparation rules are specified in a cuisine (Rozin, 1982). Often, the function of food related practices is not necessarily apparent. For example, it has been suggested that the Jewish pork taboo is economic and political in origin, even though the rationale for pork abstinence is religious in nature (Harris, 1978; also see Malott 1988 for similar discussion of the Hindu sacred cow phenomenon). Likewise, Rozin (1982) notes that when making tortillas, it is a common Mexican practice to boil the corn in lime prior to grinding it. Residents of a traditional Mexican village claim that such practices facilitate the rolling and handling of the tortillas. However, the addition of lime at the boiling stage also makes the corn a much better staple food for human consumption by: (i) increasing calcium, (ii) improving amino acid balance, and (iii) increasing the availability of bound niacin. Hence, a practice promoting health benefits is justified in terms of manual or practical benefits (see also, Skinner, 1953, p.417). A common practice in Western European cultures (and others) is the presentation of sweet foods as rewards, which is probably linked to their natural taste properties. For example, Skinner (1969) notes:

> Over anxious parents offer especially delicious foods to encourage children to eat. Powerful reinforcers (called "candy") are used to obtain favours, to allay emotional disturbances, and to strengthen personal relations. (p. 55)

The practice of presenting food as a reward has received some experimental investigation, this research is described next.

Food as Reward

Birch, Zimmerman, and Hind (1980) presented 64 children (3-5 years-old) a target food of "neutral stated preference" (i.e., it was ranked in the middle position of a verbal ranking test) in one of four contexts: (i) as a reward contingent upon any of a number of specified behaviours; or, (ii) simply paired with adult attention; or, (iii) in a non-social context (the snack was left in the child's locker); or, (iv) at snack time. The children who were presented the target food as a reward or paired with attention, showed enhanced stated preference for that food. This was the case irrespective of whether the target food presented was sweet (vanilla wafers or animal crackers) or non sweet (peanuts or goldfish crackers).

In the first of three experiments, Mikula (1989) presented children with one food as a consequence of consuming another (i.e., "if you eat food X, then you can have food Y"). Stated preferences (i.e., ranking procedure) were obtained on three occasions: (i) prior to the experiment; (ii) immediately following the intervention (presenting foods in the contingency); and (iii) six weeks after the intervention. Choice was also measured on the latter two occasions; subjects were presented both foods and asked to indicate the item they would like to eat (no consumption data was reported). In the pre-experimental ranking both foods presented to each subject fell in the middle of the ranking (and were thus deemed by Mikula to be neutrally preferred). At both post experimental ranking tests, the experimental subjects ranked the reward food as more preferred, relative to ratings in the pre-experimental test and those by control subjects. A slight, but not significant decrease, in preference for the food consumed to gain reward was recorded during the first post-experimental preference test, but no such decrease in ranking was evident during the later ranking test. Choice data was consistent with the changes in stated preference. Subjects in the experimental group chose the food consumed to gain reward less frequently, but significant differences were only observed during the final choice test (completed six weeks after the intervention).

In the second study, Mikula examined the consequence of presenting a "disliked" food as a reward. The food selected for the "if" position was placed in the middle of the ranking while the food in the "then" position (i.e., the food presented as a reward) was placed near the bottom. Children were assigned to one of three groups: (i) an "if - then" group (food presented contingently); (ii) a control group where the foods were presented in the same order but no contingency was imposed; and, (iii) a second control group where the foods were presented simultaneously. A significant increase in stated preference for the initially "disliked" (i.e., low ranked) food was recorded; however, this enhanced ranking was recorded with all three groups and so could not be attributed to the effects of the contingency. The choice data indicated a *trend* for the experimental subjects to choose the reward food (i.e., the food initially ranked low), but this was not significant. (Mikula's final study is described later in Section 1.3.4.)

Although these results suggest that presenting a food as a reward will enhance stated preference for that food, Birch, Zimmerman, and Hind (1980) have noted that such beneficial effects are frequently confounded by cultural practices. Sweet foods tend to be presented as rewards and these are foods which children are more likely to eat. Support for this claim comes from a study by Lepper, Sagotsky, Dafoe, and Greene (1982). Four year old children were read a story in which the character (a child) was offered two new foods, either: (i) contingently, one food had to be consumed in order to gain the other, or, (ii) sequentially with no imposed contingency. Approximately 17 percent of the children told the latter story said the character would prefer the second snack while 75 percent of subjects in the contingent presentation condition indicated this to be the case. When providing a rationale for their decisions these latter subjects said that the food offered as a reward would be "sweeter" or "nicer".

Taken together, these results suggest that presenting target foods as rewards is a strategy which may prove beneficial in applied settings (i.e., increase preference for the target food). This hypothesis was tested by Epstein, Wing, Valoski, and Penner (1987) who examined obese children's stated preferences for low calorie, nutrient dense snacks. These snacks were presented as consequences for the performance of activities performed as part of a weight loss programme. The children (aged 8 to 12 years), were presented with novel food (such as kiwi, pineapple, and some novel vegetables) contingent upon engaging in certain weight control procedures (e.g., exercise, self monitoring of weight). Stated preferences for the foods were obtained on four occasions: (i) twice prior to the experiment, (ii) eight weeks after the experiment, and, (iii) 6 months after the experiment.

No increases in stated preferences for the foods was recorded (when comparing pre- and post- experimental stated preferences). In addition, no increase in stated preferences were observed with the control children (who were also obese and engaged in the programme, but who were simply presented the foods non-contingently). Interestingly, although no increases in stated preferences were recorded, Epstein et al, report that the programme was successful in promoting weight loss with both the experimental and control groups (an average loss of 16.5% over six months), and that the novel foods appeared to be effective in promoting engagement in the weight loss tasks. In discussing the lack of replication of the effects reported by Birch, Zimmerman, and Hind (1980), Epstein et al (1987) cite the possibility of developmental differences (i.e., the children were older), and the fact that Birch et al's findings were obtained in well controlled experimental settings.

So far it would appear that experimental evidence supports the hypothesis that presenting a food as a reward will enhance preference for that food. The extent to which this is the case in the applied field, and the use of this finding in the applied arena is another matter. As with much of the research already reviewed, outcome measures have typically utilised stated preferences: the impact that presenting a food as a reward has on the consumption of that food remains to be demonstrated. Additionally, Western cultural practice dictates that sweet foods are most frequently offered as rewards, and these are foods which humans are more likely to consume anyway (see Birch 1980b; Rozin, 1982, pp. 228-229). While Birch, Zimmerman and Hind (1980) provided evidence that a preference for a food increases when presented as a reward (regardless of whether it was sweet or savoury), Mikula (1989) was unable to replicate this finding.

Foods can enter into contingencies in at least one other way - the consumption of a food can be the task upon which consequence is dependant, the consumption of a particular food can be rewarded. This will be the focus of the next section.

Rewarding Food Consumption

When considering the development of food choice and consumption patterns, a mass of anecdotal evidence can be cited to illustrate the importance of numerous cultural variables. Recall the earlier example of the child who refuses to consume a food because an admired friend refuses that food. A role for the use of rewards in the development of food related behaviour is also highlighted by anecdotal evidence. The practice of withholding ice cream, or access to television, unless at least some vegetables are eaten is a common ploy often used by parents to promote their child's vegetable consumption. What is interesting about this anecdotal evidence, which sets it apart from the other instances cited earlier, is that it runs contrary to (at least some of) the experimental evidence. Although casual observation suggests that such practices of reward use are very common, and one assumes at least partially effective, the experimental evidence relating to this topic suggests that offering rewards for the consumption of a food has an overall detrimental effect upon a child's preference for that food. Further, such a view is now widely accepted in the literature (Horne, Lowe, Fleming, & Dowey, 1995). A number of quotations from introductory text books and review articles illustrate this:

> ...making participation in a pleasurable activity contingent on consuming a particular food results in a *decrease* in preference for that food....parents may want to keep ...[such findings] in mind when setting guidelines for their children's eating. (Logue, 1991, pp. 110-111)

> The results on the use of foods in contingencies suggest that these child feeding practices have effects on preference quite opposite to those intended by parents who use them. In the case of instrumental eating [i.e., rewarding food consumption], parents employ this strategy to increase the child's consumption of a nutritionally desirable food. Our data indicate that instrumental eating results in declines in preference, making it less likely that the food will be consumed when the contingency is removed. (Birch, 1987, p. 201)

> Birch et al added a fascinating twist to this story. If children are given a reward for eating a particular food, their preference for the food increases. However, when the reward is discontinued, their preference drops to below its initial level. (Rozin, 1990a, p. 111).

Similar quotations may also be found in the following: Birch (1987b, pp. 124-126; 1990, p. 517; 1992, p. 253), Birch, Johnson and Fisher (1995, p. 74), Rogers and Blundell (1990, p. 38), Booth (1994, p. 78), Epstein, Wing, Valoski, and Penner (1987, p. 88), Koivisto, Fellenius, and Sjoden (1994), and Koivisto and Sjoden (in press), Rozin (1988, pp. 180-181; 1991, p. 559), Wright (1991, p. 111).

Although this view is widely held, it is based on a relatively small number of experiments. These experiments will be reviewed below, followed by a discussion of the theoretical explanations which have been proposed to account for such an effect.

Experimental Evidence

To examine the effects of rewarding food consumption Birch, Birch, Marlin and Kramer (1982) assessed 12 pre-school children's (mean age 3 years 11 months) stated preferences for seven fruit juices and seven play activities (using a verbal ranking procedure). A target drink and play activity, the middle ranked item in each case, was selected for each child. The middle ranking items were selected to allow a preference ranking change in either direction as a result of the manipulation of the independent variable.

Over a period of three weeks subjects were exposed to six "contingency sessions" during which they were required to drink an increasing amount of their target juice in order to gain two minutes access to their target activity. Subjects were instructed to "drink this juice and then you can (ride the tricycle)" (p.129). A comparison of pre and post experimental preference rankings yielded a statistically significant *decrease* in stated preference (average 1.4 ranks) for the target juice (i.e., consumed to gain reward) following the experimental manipulation. (Interestingly, 3 of the 12 children did not alter preference ranking across the two tests.) Birch et al (1982) conclude:

> The results of the present study demonstrate that the instrumental consumption of a food can adversely affect the preference for that food. Negative shifts in preference were noted for the juices consumed instrumentally, while juices receiving approximately equivalent exposure, and consumed in similar amounts at snacktime during the same period, showed a slight positive shift in preference. (p. 133)

To investigate the effects of different types of rewards on consumption Birch, Marlin, & Rotter, (1984) assigned 45 pre-school children (mean age 4 years 2 months) to one of six groups: four experimental and two control groups. Children in the first experimental group consumed as much of a (middle ranked) milk drink as they wished (referred to as *baseline*), and received contingent verbal praise. Conditions in the second experimental group were similar except that the children were encouraged to consume more of the drink when they indicated they had finished (referred to as *baseline plus*), and received contingent verbal praise. In the remaining two experimental groups conditions were similar to those mentioned, except that verbal praise was replaced with a contingent tangible reward: viewing a movie. In one of the control groups, children were merely exposed to the drink, then the movie, the reverse applied in the second control group.

The subjects were exposed to the experimental manipulation on a total of eight occasions. The results demonstrated that preference for the target milk drink declined *in all four* experimental groups, but increased in both control conditions. No significant differences in decrease in ranking was observed across the four experimental groups; i.e., stated preference decreased regardless of reward schedule (*baseline* consumption versus *baseline plus* consumption), or type of contingent consequence imposed (verbal praise versus movie watching).

In a recent study, Newman and Taylor (1992) investigated the effects of rewarding the consumption of one snack with the presentation of a second snack (similar to Mikula, 1989, discussed earlier). Two snacks, both ranked in the middle of a preference ranking, were selected for each of 86 children (aged 4 to 6 years). Children were presented the snacks in one of three ways, namely: (i) contingently (i.e., they could "win" the second snack by consuming the first); (ii) sequentially, with no experimenter-imposed contingency; or (iii) simultaneously, again in the absence of an imposed contingency.

Subjects were presented the foods on one occasion, following which each was told they could choose one snack "to have more of". After making this choice each subject was asked, "which snack did you think was nicer?" and "why?" Post-experimental stated preferences were then obtained (via rank ordering).

The results showed that children in the contingent presentation condition ranked the first snack (i.e. the snack they were required to consume in order to win the second) significantly lower at the post-treatment test. The ranking position for this food increased in the other two groups. Stated preference for the reward snack tended to increase, however, this trend was observed with the other two groups also, and hence cannot be attributed to the effects of the contingency. Thus, Newman and Taylor appear to demonstrate a negative effect of reward on the stated preference for the target food.

Interestingly, the results of the choice task and the subjects' responses to the questions "which food is nicer?" and "Why [is it nicer]?" *were not* consistent with the observed changes in preference ranking. The authors report the following:

> ...answers to both of these questions were not related to treatment groups. Such inconsistency is puzzling, although frequently found (Quattrone, 1985). Perhaps the simple two category ordinal scales employed in the verbal measures were insufficiently powerful to detect changes revealed by the more differentiated ordinal scales. (p. 212).

Theoretical Explanations

At least two theoretical explanations, of relevance to the present thesis, have been discussed by the authors of these experiments to account for the apparent detrimental effects resulting from the use of rewards. The first explanation is conceptualised in terms of a decrease in "intrinsic motivation" and the "overjustification" of behaviour. The second account (Birch, 1987a) proposes that decreases in preference result from subject attributions concerning rewards, and classical conditioning processes.

Intrinsic motivation and overjustification: In accounting for their data Newman and Taylor (1992), Mikula (1989), and Lepper et al (1982) cite theoretical work by Deci (e.g., Deci 1971, 1975; Deci & Ryan 1985). According to Deci (1975), much human behaviour results from (or is "energised" by) "intrinsic motivation". Intrinsic motivation is innate (p. 65) and results from an organism's need to "...deal effectively with its environment" (p. 54) and "...feel competent and self-determining" (p. 57). Because of this, humans (and animals) will often engage in behaviours "...for which there is no apparent reward except for the activity itself" (p. 23). (see also, Deci & Ryan, 1985, pp 32-35.) Deci (1975) defines intrinsic motivation thus:

> Intrinsically motivated behaviours are behaviours which a person engages in to feel competent and self-determining. The primary effects, therefore, are in the tissues of the central nervous system rather than in non-nervous-system tissues. Intrinsically motivated behaviours will be of two general kinds. When there is no stimulation people will *seek* it. A person who gets no stimulation will not feel competent and self-determining; he will probably feel 'blah'. So he seeks out the opportunity to behave in ways which allow him to feel competent and self-determining. He will seek out challenge. The other kind of intrinsically motivated behaviour involves *conquering* challenges or reducing incongruity. Only when a person is able to reduce incongruity (or reduce dissonance, etc.) and only when a person is able to conquer challenges which he encounters or creates will he feel competent and self determining. (p. 61).

According to Deci (1975), although intrinsic motivation may cause many behaviours, if a person is rewarded for engaging in an intrinsically motivated task, intrinsic motivation for that task may decrease. This occurs when the individual (who is behaving) perceives the extrinsic reward as the variable controlling of their behaviour (Deci 1975, p.139). Thus people make choices regarding behaviour based upon their perception and attributions about the environment. If individuals perceive that their behaviour is controlled from outside themselves (e.g. by rewards) they will only engage in that behaviour when they perceive the rewards to be available. This reduction in intrinsic motivation occurs because rewards decrease a person's "feelings of competence and self-determination" (Deci, 1975, p.141).

Deci (1975) identifies rewards as serving two functions, namely: (i) rewards can be used to control behaviour; (ii) rewards provide information regarding performance, that is, people tend to get rewards when they behave appropriately or correctly. Deci argues that the latter aspect of rewards is positive and does not necessarily impact negatively upon intrinsic motivation. Thus, if the controlling aspect of a reward is minimised, and the informational aspect prominent, intrinsic motivation for the rewarded task may increase (p. 142). This, according to Deci, accounts for findings that verbal praise and feedback tends not to decrease intrinsic motivation, while tangible rewards do (see Deci, 1975, Ch 5; Deci & Ryan, 1975, Ch. 3; Lepper & Greene 1978; McGraw, 1978). In verbal feedback, informational aspects are to the fore, and controlling aspects are less salient. Consistent with this, Lepper and Greene (1978) have argued:

> ...the theoretical model [overjustification, see below]...is not specifically concerned with the effects of rewards but rather deals more generally with any sort of salient extrinsic control that may lead an individual to see his or her behaviour as extrinsically motivated. (p. 121)

Emphasising attribution processes, Lepper, Greene and colleagues (e.g., Lepper, Greene, & Nisbett, 1973; Lepper & Greene, 1978; Lepper, Sagotsky, Dafoe & Greene, 1982) have proposed an "overjustification hypothesis" as one process by which decreases in performance can result from the use of rewards. Lepper and Greene (1978) argue the overjustification hypothesis predicts that:

> ...other things being equal - a decrease in subsequent intrinsic motivation will be likely to occur when an individual is presented with an activity of intrinsic interest under conditions that make salient the instrumentality of his or her engagement in that activity as a means to some ulterior end. (p. 121)

Lepper and Greene (1978, pp.128-129) and Lepper et al (1982) argue that overjustification reflects a discounting principle (see Kassin & Ellis 1988, p 950). The discounting principle is conceptualised as an abstract script or schema which develops as a result of behaving in the world. With respect to receiving rewards for behaviour, individuals may develop the relatively abstract script *when someone uses powerful incentives or sanctions to induce me to do something, the chances are that it is boring or unpleasant.* Such an abstract script will develop through the abstraction of common features of more concrete scripts which result from behaving in concrete situations; situations where rewards or other tangible controlling consequences are used. According to Lepper et al (1982), one of the earliest situations in which young children will discount is at meal times; even young children will acquire the (relatively concrete) script "When mom tells me I can't have dessert until I clear my plate, what's left on my plate is usually yucky" (p.53). The result of discounting and overjustifying behaviour is that the individual comes to value the rewarded activity less; that is, they have less intrinsic motivation for engaging in the rewarded activity.

Newman and Taylor (1992) discuss overjustification at length, arguing that the studies by Lepper et al (1982) and Birch et al (1984) "...show that the role which something has in the contingency acquires value which becomes independent of the initial intrinsic value" (p. 202).

***Attribution and classical conditioning*:** In the previous section it was noted that decreases in intrinsic motivation are apparently less likely to result as a consequence of verbal praise. However, in the experiment by Birch, Marlin, and Rotter (1984) decreases in stated preference for a target drink were observed with those subjects presented contingent tangible rewards *or* contingent verbal praise; preference decreases in response to the latter consequence are not consistent with intrinsic motivation and overjustification accounts. In response to this Birch (e.g., Birch 1987a, 1992; Birch, Johnson & Fisher, 1995) has proposed a slightly different account of preference decreases, an account based on classical conditioning. Birch (1987a) argues:

> These changes in acceptability [decreases in preference] can be viewed as a result of associative conditioning in which food cues become associated with perceived social context cues present during eating. Depending on the affective tone of the social context, preference for the food can either increase or decline. There is evidence that children see this instrumental context in a negative light [cites Lepper et al (1982) and describes the work]. (p. 200)

Although Birch is not explicit, it appears that she is claiming that using rewards to promote consumption is very likely to (and possibly will inevitably) produce a negative context, and hence a decline in stated preference. Consider again the quotation cited at the beginning of this section examining rewards and food.

> The results on the use of foods in contingencies suggest that these child feeding practices have effects on preference quite opposite to those intended by parents who use them. In the case of instrumental eating [i.e., rewarding food consumption], parents employ this strategy to increase the child's consumption of a nutritionally desirable food. Our data indicate that instrumental eating results in declines in preference, making it less likely that the food will be consumed when the contingency is removed. (Birch, 1987a, p. 201)

Birch appears to be suggesting, in this quotation, that the manipulation of contingencies will inevitably result in a negative context.

1.2.5: Summary

The importance of cultural variables in the development of children's food preferences was reviewed in Section 1.2. Three areas of research were examined: (i) exposure, (ii) modelling, and (iii) cultural practices; regarding the latter, the effects of rewarding specific food consumption was discussed. The evidence suggested that increased exposure to foods will enhance a person's stated preference for those foods. However, it was also acknowledged that, in order to increase taste ratings for foods, it was necessary for subjects to be exposed to the taste of the foods (Birch et al, 1987). Interestingly, the authors of these experiments reported few if any problems in getting the subjects to consume novel foods. Given that children are apparently neophobic, and consequently reluctant to consume novel foods, how the range of a child's food consumption may be increased through "mere exposure" to novel foods is unclear.

The research on modelling effects suggested that presenting models, choosing, or consuming the target foods, would impact positively on subjects stated preferences and choice of foods. Unfortunately, few of these experiments report consumption data, and where such data is reported (Birch, 1980a), the results are equivocal. Television advertising, which often employs modelling, appears to impact upon food related behaviour. Advertisements for salty and sugary snacks appear to enhance subjects' stated preferences, and choices of those snacks. Conversely, exposure to a pro-nutritional cartoon (Goldberg, Gorn, & Gibson, 1978) appeared to decrease stated preferences for high calorie snacks. The extent to which pro-nutritional televised information will increase choice and consumption of nutrient dense, "healthy foods" is unclear.

The research examining the effects of rewards and food choice is interesting. Some evidence suggests that presenting a food as a reward will enhance stated preference for that food. However, the effects of rewarding consumption are very different. It is a widely held view that rewarding food consumption will result in overall detrimental effects, and many psychologists warn parents against using such a tactic to increase their children's consumption of foods. Theoretical accounts for this negative effect centre around attribution processes (e.g., overjustification); this results in decreases in intrinsic motivation, or the production of a negative context (which also leads to preference decreases).

A core problem running through much of the research discussed in Section 1.2 is the lack of focus on actual consumption as an outcome variable. Authors consistently report changes in stated preferences and choices, but whether these are reflected in changes in consumption is unclear. This issue will be expanded in the next section, the purpose of which is to introduce the field of behaviour analysis.

1.3: BEHAVIOUR ANALYSIS

The discussion up to this point has highlighted the role of culture as a major determinant of what is eaten by humans. Put simply, through the collective experiences of many individuals across time, a culture defines what is and is not food. Members of a given culture will consume some, or all, of the substances defined as food, and ignore or reject numerous other potential energy sources. Research (described in previous sections) has highlighted some variables (e.g., modelling, rewards) central to the transmission of this cultural information.

The purpose of the present section is to begin to examine human food preferences from the theoretical perspective of behaviour analysis, and its underlying philosophy Radical Behaviourism. In particular, this framework will be used to re-examine much of the research which has been reviewed so far. The emphasis which has been placed upon the importance of cultural variables in determining food preferences is entirely consistent with Radical Behaviourism, which views verbal behaviour as playing a key role in the development of a culture, and the maintenance of its practices (see Skinner 1988a). Given that Radical Behaviourism emphasises the importance of language in the development of human behaviour, this issue will be examined below.

1.3.1: Culture and Language

> Relatively late in its history, the human species underwent a remarkable change: its vocal musculature came under operant control... vocal operant behavior made a great difference because it extended the scope of the social environment. Language was born, and with it many of the important characteristics of human behavior. (Skinner, 1974, p. 98).

This quotation highlights the important role which language plays in human behaviour. It is verbal behaviour which allows the "exclusively human" (Skinner, 1989) usage of contingencies which allows humans to benefit from much cultural knowledge. This is because verbal behaviour "...is free of the spatial, temporal, and mechanical relations which prevail between operant behaviour and non-social consequences" (Skinner, 1974, p.99; see also Catania, 1985, p.144.). The special character of verbal behaviour is that it is reinforced by its effects on people (Skinner, 1957). For example, the reinforcing consequences of an opened door can be gained by an individual grasping the knob, turning it, and then pushing the door open. On the other hand, the same consequences can be achieved by saying "Please open the door" to a responsive listener (Skinner, 1974, p.99).

Verbal behaviour is maintained by the practices of the verbal community because both speaking and listening are differentially reinforced by others. A young child (in Western culture) will be praised (reinforced by others) for saying "food" in the presence of apples, but will be punished for saying "food" when referring to rotted wood (see Skinner, 1953, 1957, 1988d). The process of acquiring a language transforms subsequent learning because verbal behaviour can control one's own behaviour as well as that of others. Consider the following quotation from Lowe (1985):

> In the lifetime of the normal individual, the world exists prior to his being able to talk...The behaviour of the human infant is...directly affected by the environment in the same way as is animal behaviour....His particular social environment, a verbal community, establishes in the child the skill of being able to talk about the world and his relationship to it...Being able to speak about his interactions with the environment has a profound effect on the way he behaves. In terms of psychological functioning, he has now altered qualitatively with respect both to his earlier infant self and to animals. Only at this stage may it be true to say that he reacts not simply to external stimuli alone...but also to his own labelling of these events. (pp. 87-88).

One of the fundamental functions of verbal behaviour is instruction: simply by talking, one organism can change the behaviour of another (Catania, 1985). An important subset of behaviour controlled by verbal behaviour is now referred to as rule-governed behaviour (Catania, 1985). This behaviour has emerged over the course of our phylogenetic development and supplemented contingency-shaped behaviour (Catania, 1985; Skinner, 1989). This important distinction will be discussed:

Rule - Governed Behaviour

Skinner (1969; pp.133-171) discussed the distinction between *contingency shaped* and *rule-governed behaviour.* To illustrate, he provided two examples of human behaviour where the goal is similar, the catching of a falling object:

Take the behaviour of an outfield baseball player running to catch a baseball. The ball-catching behaviour, responding to the speed and trajectory of the falling object, maintaining balance while moving, and so forth, is controlled by the consequences of past ball catching behaviour: it is contingency shaped behaviour. Now consider the behaviour of a ship commander manoeuvring his vessel to "catch" a re-entering satellite. The ship commander's behaviour is controlled by, amongst other things, complex mathematical analysis of the proposed trajectory of the satellite. Such behaviour is *not directly controlled* by past satellite-catching behaviour (which may have never occurred with this particular individual) but is controlled by the complex analysis of the proposed trajectory: the behaviour is rule-governed.

> We refer to contingency-shaped behavior alone when we say that an organism behaves in a given way with a given probability because the behaviour has been followed by a given kind of consequence in the past. We refer to behavior under the control of prior contingency-specifying stimuli when we say that an organism behaves in a given way because it expects a similar consequence to follow in the future (Skinner 1969, p. 147).

Rule-governed behaviour is behaviour under the control of a rule, and Skinner (1969, 1974) defines a rule as a "contingency-specifying discriminative stimulus". It is important to note that contingencies of reinforcement and the rules describing them are not the same (Skinner 1969). And, while the topography of rule-governed and contingency shaped behaviour may be similar, or the same, the controlling variables are different: "Rule Governed behaviour is in any case never exactly like the behaviour shaped by contingencies" (Skinner, 1969, p.150).

Rules can be used to control behaviour when the natural contingencies cannot be trusted to do so, or when the natural contingencies are likely to maintain behaviour deemed as undesirable (Skinner, 1969, pp. 148-149). Cultural rules, laws, and maxims are often more easily identified than the contingencies they specify (Skinner, 1969, p. 147). For example, the maxim "an apple a day keeps the doctor away" refers to the health related properties of apple-eating. It is much more difficult for an individual to contact directly, at least initially, the natural health benefiting consequences of apple consumption. Likewise, most people who refrain from breaking speed limits and who wear seat belts do not do so because they have "actually avoided or escaped from serious accidents by doing so." (p. 168).

The ability to analyse contingencies (Skinner 1974) means that rules can be self-generated or provided by others (See Zettle, 1990). Either way, following rules has many advantages. In the example provided above, the person can benefit from the consequences of apple consumption by following the rule. Rules generated by one person can be easily followed by another and this means that teaching people new behaviours can be achieved by providing them with rules to guide their behaviour. People who follow (accurate) rules can respond appropriately without direct exposure to the contingencies themselves. For example:

> The point of science, however, is to analyse contingencies of reinforcement found in nature and formulate rules or laws which make it unnecessary to be exposed to them in order to behave appropriately (Skinner, 1969, p. 166)

Malott (1988, 1989; Braam & Malott, 1990) argues that there are two general classes of contingencies: direct-acting and not direct-acting. The former are those involving outcomes which are, "...sufficiently immediate, probable, and sizeable to punish or reinforce the causal response" (1990, p. 67). For example, touching a hot stove will lead to a burn; this will decrease the likelihood of touching hot stoves in the future (Malott 1989, p.270; Braam & Malott, 1990, p.67). Contingencies which are not direct-acting, on the other hand, involve outcomes "that do not function as effective behavioural consequences for the causal response...such outcomes are ineffective because they are too delayed, too improbable, or too small (though perhaps of cumulative significance)" (Malott, 1989, p.270). The example provided by Malott (1989) of a contingency which is not direct acting is the consequences arising from dental flossing: the consequence of improved dental health is too delayed, a single floss produces a negligible effect on dental health, and the benefits of flossing only arise from the cumulative effects of flossing over an extended period.

The behaviour of eating a healthy diet illustrates many of the issues raised by Malott, and discussed earlier in this section. No one food is either healthy or unhealthy, it is the combinations of foods (i.e. diet) which can be described as being more or less healthy. The physical consequences of a healthy diet (being fitter, healthier, and perhaps living longer) are outcomes which are delayed and to an extent improbable. Many people who consume a "healthy diet" suffer ill health (sometimes chronic), and others may die prematurely. Secondly, the health benefits obtained from consuming a single portion of fresh vegetables (or other "healthy food") are small and only beneficial cumulatively. On the other hand, the negative outcome of a diet high in fat and sugar is also delayed and may be improbable (an unhealthy diet does not *inevitably* lead to coronary heart disease). In addition, the immediate consequences arising from the consumption of "unhealthy foods" (e.g., taste of foods high in sugar) may function to directly reinforce the behaviour (see Malott 1989, pp 288-289). It was mentioned earlier that our phylogenic history may have resulted in a tendency to consume foods which, if consumed too frequently, may lead to health problems.

Humans sometimes act in ways which maximise delayed (or improbable) outcomes. Imagine the familiar scenario of the dieting individual who forgoes a chocolate bar in favour of a bowl of salad in an attempt to loose weight - such behaviour will, if it is to be successful, occur over an extended period. Likewise, the chocolate may be rejected in favour of salad because of the long term health benefits of salad consumption. According to Malott (1989), rule-governance is central to such behaviour:

> ...human beings optimise outcomes by following instructions or rules that specify the outcomes of their actions; in other words, it is not the delayed outcomes but rather the rules stating those delayed outcomes that more directly control the actions. (p. 283).

Baum (1994, 1995), discusses rule-governed behaviour in the context of evolution. Consistent with Malott, Baum suggests the existence of two types of contingencies: the long term ultimate contingency, and the short term proximate contingency (see also Skinner, 1969, p. 169). The consequences of the ultimate contingency may often be, as suggested by Malott, ineffective in controlling behaviour. Through following a rule, and thus being reinforced via the proximal contingency, individuals may contact the long term consequences of behaviour. Baum goes on to suggest that this process has been selected by evolution as it increases the fitness of individuals. To illustrate, Baum (1995) provides the following example, which is particularly appropriate in the context of the present thesis:

> ...the speaker (e.g., a parent) says something like, 'eat your vegetables,' which is equivalent to 'If you eat you vegetables, then you will develop properly and remain healthy.' If the listener (e.g., a child) eats vegetables, the speaker provides the proximate reinforcer, which may be approval or simply the withholding of disapproval. The effect of this social contingency is to strengthen the eating of vegetables.
>
> The ultimate S^R...is a result which usually enhances fitness (reproductive success) in the long run. In the example, avoidance of disease or preservation of health in the long run makes it more likely that the listener will survive long enough to reproduce successfully. Eating vegetables enhances the listener's fitness. If the speaker is a parent or relative of the listener, it also enhances the speaker's fitness. (p. 6)

According to Baum, control may pass from the proximal to the ultimate contingency. In the course of this transfer, the behaviour is likely to change from "deliberate performances to more co-ordinated, automatic performances" (Baum, 1995, p.7). Transfer of control is discussed in greater detail later in this section.

Skinner (1969) distinguishes between different types of rules. In specifying a contingency a rule may make reference to the consequences which would result from direct exposure to the contingency, for example, "Drink this, it will make you feel better". Skinner terms this "advice" and it is often given in the form of maxims or laws such as "go west young man" or "an apple day keeps the doctor away". Other rules, "commands", are effective because of "special reinforcement" made contingent upon them, often by governments and other social agencies.

Expanding on this issue, Zettle and Hayes (1982) propose that what is crucial about rule-governed behaviour is that it involves two (distinct) sets of contingencies: one set relating directly to the particular task in question (e.g., the natural consequences of the activity); the second contingency is verbal/social in nature. To illustrate, Zettle and Hayes provide the example of a person told to fast for a day; avoidance of food may in itself be punishing, but the rule is followed to avoid possible negative social consequences.

> Rule-governed behaviour is behaviour in contact with two sets of contingencies, one of which includes a verbal antecedent. (p. 78)

Just as Skinner has acknowledged the presence of different types of rules, Zettle and Hayes (1982; also Hayes, Zettle & Rosenfarb 1989) have proposed a similar classification with respect to rule following. *Tracking* refers to rule-following controlled by "...the apparent correspondence between the rule and the way the world is arranged" (p 81). Taking the earlier example of a man who is told "drink this it will make you feel better", he will take the drink because he believes it will alleviate the symptoms of an illness. The speaker may be a doctor, a friend, or the rule may even be written on the packaging of medicine. The rule is *not* followed because of the consequences which the speaker will administer.

Pliance (from the word compliance) is rule following which is under the control of "...apparent speaker mediated consequences". In such cases, the rule is followed primarily because of the person providing the rule and the perceived consequences the speaker could deliver. Thus, unlike tracking, the person providing the rule is of particular importance. Taking the above example, the drink may be an alcoholic spirit and the speaker an admired peer. The listener may follow the rule (and drink the drink) solely to avoid negative social consequences administered by the peer (e.g., ridicule). The natural consequences of rule following, alcohol ingestion, may be aversive (e.g., alcohol may be innately distasteful to the human palate). Thus, in such a case, the social contingencies override the natural contingencies. If the speaker cannot administer the perceived consequences, the rule will not be followed by the listener. For example, in the present case the speaker may be "caught short" and rush to the lavatory, because he is no longer present to monitor the listener's behaviour, the listener may pour the drink into the nearest plant pot and pretend to have consumed the spirit (when the speaker returns).

Hayes and colleagues propose a third category of rule following: *Augmenting*. This is "...rule-governed behaviour under the control of apparent changes in the capacity of events to function as reinforcers or punishers" (Zettle & Hayes, 1982, p81). An augmental (a rule) will function as an establishing stimulus (Hayes, Zettle & Rosenfarb, 1989). This form of rule following occurs because exposure to the rule is likely to elicit conditioned emotional responses. For example, an anti-abortion campaign may begin with a song about death. Subsequent augmentals about abortion will repeatedly refer to the death of an unborn child. Augmenting does not usually occur in pure form, and is often combined with the other types of rule following discussed.

It was noted earlier that control may pass from a rule to the contingency it describes - for example, when an individual "discovers the truth of a rule" (Skinner, 1969, p 151). According to Skinner (1969) the usefulness of a rule depends upon the extent to which it corresponds to the contingencies responsible for it's creation. Hence, following the rule may allow the individual to contact the contingencies described by the rule. The behaviour may then become controlled by these consequences, and not by the rule - even though the behaviour in both cases looks similar. However, it has been argued that it may be very difficult to provide examples of adult human behaviour that are "unequivocally contingency-shaped" - possible exceptions concern areas of motor skills (Catania et al, 1989) and some social skills (see Cullen, 1991, p 54). This may be related to the observation that it is extremely difficult to stop people talking to themselves, and thus producing (self) rules which control behaviour (see Lowe, 1979).

Before continuing, it will be useful to work through a hypothetical example illustrating the different types of rule following discussed above. Consider a child who is reluctant to consume vegetables. When presented vegetables (e.g., broccoli) at the evening meal the child refuses to consume them. Because the parent is aware of the health benefits of vegetable consumption, he or she instructs the child to consume. This instruction may include some consequence (e.g., "eat your vegetables and you can have some ice cream", or "if you don't eat them you will be sent to bed early"). The child may follow the instruction as a *ply*, eating to avoid/contact speaker mediated consequences. As suggested above, if the parent is perceived as being unable to mediate consequences, the rule will not be followed.

Vegetable consumption may continue via pliance for an extended period. However, for whatever reason, the child may begin to perceive vegetable consumption as being worthwhile for health reasons. For example, the child may read the rule on a leaflet, or hear a doctor on television (who is unable to administer any consequences) describing the relationship between vegetable consumption and good health. The doctor may employ augmentals by discussing at length diet related illness, prior to instructing the viewer to "eat a balanced diet in order to avoid illness". The child may now begin tracking the rule, "eat vegetables because they are good for you" because of health benefiting consequences of vegetable consumption. Such tracking may lead to the child making self-statements such as: "Hey veggies are really good for you, I'm doing real well to eat them." This begins to blur the distinction between pliance and tracking.

> When the speaker and listener are in the same skin, the 'speaker' as well as the 'listener' is affected by the consequence. Thus, in addition to the consequences mediated by the environment for self-tracking, the person may add self-evaluative comments ('Boy, I really blew that; what a dope!' or 'Way to go; I've got this beat!'). Such statements may be congruent with the environmental consequences, or they may stand in contrast ('I don't care what they say; I think I was still right!'). Reinforcing oneself for adhering to a plan of action shades tracking into self-pliance. (Poppen, 1989, p. 340)

This prolonged tracking behaviour may allow the child to contact the long term natural consequences - i.e., contact with the ultimate contingency. Likewise, prolonged pliance may also facilitate this, thus circumventing tracking.

Depending on the particular behaviour, this process is likely to occur at different rates, and it may not continue right the way through. For example a young girl may be reluctant to eat a fruit she has never seen before because she is following the self-generated track that "any new and funny looking food, especially if it is a vegetable, will be so yukky that it is bound to kill you!". She may consume the food to avoid the speaker-mediated consequences (e.g., early bed-time). This will allow the child to contact the natural consequence of the sweet taste of the fruit - this may be sufficient to maintain future consumption. Conversely, maintaining consumption of less sweet vegetables may require regular employment of speaker mediated consequences, to the point that, as Baum noted, "eat your vegetables" means "eat your vegetables to avoid the consequences which I will deliver if you don't". Control may never pass to any natural ultimate reinforcer, or even to tracks, and the girl stops consuming vegetables when old enough to control her own diet (e.g., when she leaves home).

Experimental research.

A strategy for investigating rule-governed behaviour in the laboratory has been to examine human performance on schedules of reinforcement. Much of this research has demonstrated that in many cases human responding is very different to that recorded with most other animal species (for reviews see Lowe, 1979; Lowe, Horne & Higson, 1987; Weiner, 1983). In accounting for these differences, many authors claim that language, in the form of experimenter provided instructions and self instructions, is the critical variable (e.g., Barnes, 1989; Lowe, 1979, 1983; Poppen, 1982). For example, Horne and Lowe (1993) note:

> There have been numerous reports in the literature of marked differences between the performances of adult humans and other animal species on schedules of reinforcement. This is true on fixed-interval (FI) and fixed ratio (FR) schedules, and is evident both in response patterning and in sensivity to the schedule parameters. The evidence also suggests that the occurrence of rule-governed behavior in humans may also give rise to some of these differences. (p. 29)

Humans enter the experimental situation with a verbal repertoire which allows them to formulate rules concerning what is required of them. When responding on schedules, humans may formulate descriptions of the contingency, or they may be provided with these courtesy of the experimenter, in the form of instructions. Either way, it is often the case that these verbal antecedents appear to control the responding, as opposed to the actual contingency of reinforcement (imposed on the experimental task).

In an influential series of experiments, Lowe (1979) provided convincing evidence to support this view. Lowe argues that individuals, when performing on fixed interval schedules, will often use verbal strategies such as counting to measure intervals between reinforcers. It is these verbal strategies that control the subjects' responses, as opposed to the contingency directly. Attenuating such descriptions (e.g., by providing subjects with a device allowing them to measure the schedule interval) results in responding which is sensitive to schedule parameters, and similar to that of animal responses (i.e., contingency shaped behaviour). However, Lowe also makes the point that it is no easy task to prevent humans from talking to themselves.

A further demonstration of the importance of language in human schedule performance was carried out by Lowe and colleagues (Bentall, Lowe & Beasty, 1985; Bentall & Lowe, 1987; Lowe, Beasty & Bentall 1983) who examined the topic from a developmental perspective. Pre-verbal infants' response patterns were indistinguishable from those of animals, both in pattern and sensitivity to schedule parameter, when responding on fixed interval schedules (FI value ranged from 10 to 50 seconds). Children above five years, and who were linguistically capable, responded as adults - responding at either a high or a low rate. The responding of the children aged between three and four was varied and irregular, appearing "...to mark a transitional stage between animal and adult-like behaviour" (Bentall et al, 1985, p. 177). The authors also reported that with this latter group of children, continuous patterns of responding indistinguishable from that of adults could be obtained by providing the subjects with instructions (e.g., "press faster").

The results of experiments examining human schedule performance have led some authors to propose that rule-governed behaviour, in some cases at least, may be insensitive to its consequences (Catania, 1985; Catania, Matthews & Shimoff, 1990; Cullen, 1988a). For example, Catania (1985) argues:

> Verbal behaviour does not necessarily put humans in closer touch with contingencies. When people do what they are told, their behaviour is controlled by the instructions rather than by the natural consequences of their behaviour. Uninstructed human behaviour, not influenced by language, is most likely to be in close touch with environmental events, but instructional control ordinarily overrides the contingency-shaped behaviour. It is pervasive and often operates in subtle ways. It is a type of control from which it is difficult to escape. (p. 151)

Catania, Shimoff and Matthews (1990) argue that such insensivity is a major advantage of rule-governed behaviour, and it is what makes it so useful. As has been discussed above, rule control can be used when natural contingencies are too weak or delayed to control behaviour, or where the natural consequences may be undesirable.

The debate concerning the extent to which human rule-governed behaviour is sensitive to its consequences is still unresolved (Vaughan, 1989) and beyond the scope of the present chapter. Given that rules can establish control over behaviour very quickly, rule control in some cases will allow humans to respond very quickly to changes in contingencies, and hence may generate very sensitive responding (c.f., Grant & Evans, 1994). Other authors have suggested that insensivity will only persist in cases where the contingencies support it, and will be extinguished in cases where the insensitive responding leads to punishment (e.g., point loss: see Vaughan, 1989, p. 109). Finally, some authors have suggested that rule-governed behaviour is indeed sensitive to its consequences but this must be discussed in terms of the two contingencies with which it is in contact (c.f., Cerutti, 1994). Humans not only respond to the contingencies relating to an experimental task such as button pressing, they may also respond to the social contingencies operational during the experiment. Hence, a subject may press a button at a high rate on an interval schedule because he or she has been instructed to do so by the experimenter. Although not sensitive to the imposed contingency, this behaviour is dependant upon the complex history of instruction following in general.

However, one thing is clear from this body of literature: it is often the case that subjects' behaviour will correspond more closely to the description of the contingency than the actual contingency (e.g., Catania, Matthews & Shimoff, 1982; see also, Newman, Buffington & Hemmes, 1995, p.463).

Saying and Doing

Another interesting aspect of this literature concerns the relationship between verbal and nonverbal behaviour, or between saying and doing. Matthews, Catania, and Shimoff (1985) required subjects to complete "guess sheets" at numerous points during experimental sessions. These sheets required subjects to either: (i) speculate about the best way to win points (performance descriptions), or, (ii) to describe the operative reinforcement schedules (contingency descriptions). In an earlier experiment (Catania, Matthews and Shimoff, 1982), subjects shaped to produce performance descriptions unequivocally showed nonverbal behaviour which was consistent with these descriptions. However, in the Matthews et al experiment approximately half of the subjects when shaped to produce contingency-based (as opposed to performance descriptions) evidenced non verbal behaviour which was not consistent with these descriptions. This lead the authors to conclude that: "If verbally 'knowing' the schedules is in some way related to performances appropriate to the schedules, it is nonetheless evident that accurately describing the contingencies is insufficient" (p.162).

Thus, depending upon the contingencies operative, a person may say one thing and do another, especially if consequences are arranged such that reinforcement is made contingent upon the verbal component (i.e., the saying). This issue has been extensively examined in the correspondence training literature (e.g., Risley & Hart, 1968; Deacon & Konarski, 1987). Consistent with the findings of Matthews et al, this body of literature has repeatedly demonstrated that if consequences are administered for saying (e.g., a promise to engage in future behaviour), the frequency of saying will change, whereas the doing (specified by the saying) may not. It is only when consequences are administered contingent upon the performance of a promised activity that the performance of the activity will increase. Put simply, this research suggests that if you want people to do something, reinforce them for doing it, not just saying that they will do it.

Categories

Another characteristic of human behaviour which is of relevance to the present thesis is the ability to form and utilise categories. A human who has learned the category "chair" will be able to respond appropriately (e.g., sit on, name, give one to someone who requests one) to many physically different chairs, many of which will have never been encountered before. Recently, behaviour analysts have begun to study the "stimulus equivalence phenomenon" because of the apparent correspondence with language phenomena (Hayes & Hayes, 1992). This research may also provide insight into category related behaviour. For example, Fields, Reeve, Adams and Verhave, (1991) have suggested:

> In terms of physical characteristics, all of the stimuli in a naturally occurring complex category are not perceptually similar. Some stimuli in the category do not bear any physical resemblance to each other; neither do the stimuli in an equivalence class. (p. 311)

In very general terms, stimulus equivalence research involves teaching subjects to match comparison stimuli to sample stimuli. To establish an equivalence class incorporating the stimuli A, B, and C, the relations A-B and B-C could be established by conditional discrimination training. If the stimuli are equivalent, a number of other relations will emerge without further training, namely, B-A, C-B, A-C and C-A. The emerging relations of B-A and C-B are labelled *symmetry*, and the emerging relations A-C is labelled *transitivity* (e.g., Sidman & Tailby, 1982; see also Horne & Lowe, 1996).

There is a growing debate concerning how best to explain the equivalence phenomenon. For example, Hayes and colleagues (e.g., Hayes & Hayes, 1992) propose that it is an instance of a more general phenomena where subjects respond to an arbitrary relationship (contextually defined) between stimuli - "relational frame theory". Sidman and colleagues suggest that equivalence is a primitive function or an evolutionary given. Finally, Horne and Lowe (1996) have proposed that stimulus equivalence can be explained through the existence of a naming relation. (see Horne & Lowe, 1996 for a review of each of the three accounts.) The debate surrounding the definition and explanation of equivalence is beyond the scope of the present thesis. The experiments in the present thesis were not designed to investigate stimulus equivalence, or add to the debate concerning it. Some of the experiments reported in Chapters 2-5 utilise the pre-existing food categories of fruits and vegetables. There is little doubt that humans can utilise such categories; how and why this is the case is not a direct concern of the present thesis.

Foods are continually categorised in western European cultures. For example, categories such as "sweets", "meats", "pulses", "vegetables", and "fruits" are commonplace. Casual observation suggests that children can utilise these categories when behaving with foods. For example children tend to like sweets and tend not to like vegetables. Birch (1981) reports a study in which children were presented a food (either pineapple or cashew nuts) paired with adult attention. Birch reports that following 20 such presentations, the children tended to rate the target food as more preferred (using a verbal ranking procedure) relative to pre-experimental tests. The children also tended to increase their preference ranking of another food drawn from the same category (but not paired with adult attention), providing they were aware of the appropriate food category (i.e., nuts or fruits).

The use of verbal classifications may profoundly alter the way a child responds to a food, especially one which is novel (Horne et al, 1995). For example if a child frames the rule, "vegetables are yukky", this may decrease the likelihood of new vegetables being tasted. Certain classifications of foods may also correspond closely to their reinforcing properties. One of the few apparent innate "preferences" in the human species is that of sweet tastes: a common feature of the members of the "sweet" category is their sweet taste.

Summary

The purpose of this section was to introduce the theoretical framework of behaviour analysis and the underlying philosophy of radical behaviourism. In the introductory section of this chapter (Section 2.1) culture was highlighted as an important determinant of human food choice. Such a view is entirely consistent with radical behaviourism, which conceptualises a culture as a verbal community. The child growing up in a culture will acquire the language of that culture, and this in turn radically transforms their learning. Language allows humans to respond appropriately to (e.g., gain benefits from) contingencies, the consequences of which may not control behaviour directly. It was also suggested that different types of rules (e.g., commands, advice) may lead to different types of rule following (pliance, tracking).

Humans have the ability to describe contingencies, and these descriptions may control their subsequent behaviour. In light of this, when working in the applied field, it may be desirable to provide subjects with contingency descriptions specifying the appropriate response and consequence. Not providing these may result in the subject formulating their own, inaccurate, descriptions.

Because pliance is controlled by speaker mediated consequences, and rule following is only likely to occur in cases where the speaker is perceived to be able to monitor performance, in applied settings it may be more desirable to attempt to promote tracking. Tracking may be more likely to continue after the experimenter is no longer present. This being so, it may be desirable to refer to natural consequences of the behaviour in the rule (e.g., "eat broccoli, it's really good for you"). It is likely to be the case that the natural consequences of the target behaviour are not, initially, sufficient to promote the behaviour (otherwise it would most probably be occurring already). Hence it may be more desirable to initially promote pliance, and then to shift to tracking (or control by the natural contingencies).

With respect to food choice, the concept of rule-governed behaviour may aid the understanding of many instances of human food choice; for example, the behaviour of the dieter, or the child consuming vegetables to avoid the consequences "of mum getting angry" (see Baum, 1994, 1995). Given the apparent importance of rule-governed behaviour for human functioning, it should follow that it plays an important role in the development of food consumption patterns. Consider a boy refusing to consume vegetables because a friend has specified a contingency, "don't eat those, vegetables are yukky!", or a girl refusing a new food she is told "it's a vegetable" (verbal categorisation).

In the following three sections, the research already reported in Section 1.2 will be re-examined from a radical behavioural perspective.

1.3.2: Exposure 2

In Section 1.2.1 a number of experiments examining the role of exposure in the development of food preferences were reported. Re-examining these experiments from a radical behavioural perspective permits a number of useful observations.

Much of the research examining the role of exposure is discussed in terms of the dissipation of neophobia. However, it was suggested in Section 1.2.1 that the assumption that children are neophobic is not necessarily supported by empirical evidence - Birch and Marlin (1982) and Birch, McPhee, Shoba, Pirok and Steinberg (1987) report little difficulty in getting children to consume novel foods. This observation led to the apparent contradiction which may be expressed thus: If children are neophobic, and consequently reluctant or scared to place food in their mouths, how can we increase exposure to the taste of novel foods through "mere" exposure alone?

There are two questions concerning neophobia: (i) are children really neophobic; and (ii) what exactly is neophobia? - there are problems with its conceptualisation. Neophobia is often conceptualised as an inner determinant of behaviour, for example; Pliner and Hobden (1992) claim "...it might be useful to conceptualise neophobia as a personality trait" (p 107). However, it may be more useful to discuss this phenomena in terms of the contexts in which consumption of novel foods is more or less likely. Thus, the experimental situation is one in which consumption of novel foods appears to be very likely.

Of course, it is necessary to account for the apparent ease with which consumption of novel foods is achieved in the experimental setting. And it is also necessary to explain why it appears, on the surface at least, to be at odds with the experiences and concerns of so many parents (e.g., complaints by parents that their children refuse to consume novel foods, see Birch et al, 1987; Pliner & Hobden, 1991).

Birch et al (1987), when discussing a similar issue, argue that mere exposure is in fact an inadequate description of the context in which children are often presented foods. Given the social occasions surrounding food in general, it is likely that the child will be exposed to models, positive social contexts, and so forth. From a behaviour analytic perspective, it is indeed the case that the label "mere exposure" is inadequate; however, this applies not only to normal situations but also to the experimental contexts reported by Birch. What is important to note is that, during these experiments (i.e., Birch et al, 1982, 1987), the subjects were *instructed* to consume foods by the experimenter. Considering the above discussion concerning rule-governed behaviour, this is an important observation.

> When we tell someone else to do something or we tell ourselves to do something, we are using a behaviour change procedure, even though we might not think in these terms. Instructing someone to do something can change behavior quickly and effectively. (Grant & Evans, 1994, p.315)

The results presented by Birch (et al, 1982, 1987) suggest that under the conditions reported in their paper, the provision of instructions was sufficient to promote the consumption of a novel food. If the child was simply presented the food, but not given any instructions, acceptability may have been radically reduced.

The particular form of the instruction employed by Birch was also interesting. For example, in the Birch et al (1987) experiment, the children were told, prior to placing the food into their mouths, that it was not necessary to ingest the food (it could be spat out). Such an instruction may function as a shaping procedure whereby the child initially only places the food on the tongue, then ingests a small amount, and so on. Such procedures will presumably be differentially effective across subjects, depending upon their history with respect to compliance with instructions. This may account for some of the variability which is typically recorded in between-group designed experiments (see Barlow, Hayes & Nelson, 1986; Long & Hollin, 1995).

If children are indeed reluctant to consume new foods, one would assume that an instruction to place food in the mouth probably functions as a ply. Pliance is controlled by apparent speaker mediated consequences. The experimental procedure may set up an implicit escape contingency whereby the child will place the food in his or her mouth in order to be allowed to leave the experimenter's company (c.f., Baer & Detrich, 1990). Pliance is also dependant upon history of the speaker, the listener, and the relationship between the two (Zettle & Hayes 1982, p. 81). For example, pliance is less likely if the listener perceives the speaker to be administering "empty threats", or is aware that the speaker is unable to administer the particular consequences. These observations suggest that the context described as "mere exposure" is interwoven with important social contingencies - the characteristics and role of the speaker issuing the instructions, in particular. In light of this, it would be interesting to compare the effectiveness of "mere exposure" when parents, as opposed to experimenters, provide the instructions to taste new foods. The history of the "battle ground" dinner table may mean that parents may be much less effective in promoting exposure.

It was noted in the earlier section that exposure may allow other variables to operate (Birch et al, 1987; Zellner, 1991). Increased exposure may be one mechanism through which control is transferred from rule control to direct contingency control (recall the earlier example provided by Baum 1995 of the child consuming vegetables) - increasing exposure may make contact with the natural/ultimate contingencies more likely. This may be what Rozin (1982) is referring to when he argues that: (i) culture forces exposure, and (ii) this forced exposure is eventually internalised and the individual develops a "liking" for the food.

According to Baum (1995) contact with, and control by, the ultimate contingency (i.e., contingency shaped behaviour) may not always develop. In such cases, increased exposure may enhance rule-governance. Given that people respond to their own responding (Lowe, 1979, 1983; Poppen, 1989; Skinner 1974, 1989) or describe their own behaviour, if a person, for whatever reason, consumes a food on a number of occasions, the rule "I always eat this food" may develop. This may facilitate the shift from pliance to tracking, which will increase the likelihood that the behaviour will continue to be performed in the absence of the speaker.

Consistent with a rule based account of the exposure literature, a recent experiment (Pelchat & Pliner, 1995) provides evidence suggesting that the provision of different verbal antecedents will alter the likelihood that subjects will taste a new food. Subjects were more likely to chose (and at least sample) a novel food if provided with information regarding its taste (e.g., a label in front of the food read "9 out of 10 students said 'tastes great'", p.158), as opposed to a label showing the name only. Such taste based information may lead to tracking. Furthermore, when providing instructions to change behaviour it may be desirable, initially at least, to provide information regarding the most immediate positive consequence.

A rule-based account also highlights a need to be sensitive to speaker/listener histories. For example, parental instructions may be interpreted by children as: "She always tries to get me to eat yukky foods! This new one is bound to be yukky." On the other hand, experimenters who "play fun games with me wouldn't give me yukky food!" are likely to generate compliance. Although instructions can be effective in promoting behaviour change, in the applied arena it is probably advisable not to rely upon instructional control alone . (For example, it may be desirable, at least initially, to include an imposed contingency to ensure effective behaviour change.)

In summary, it is not clear to what extent the label of "mere exposure" is valid, regardless of whether one is referring to sight or taste exposure. The very fact that a child is presented a food by an experimenter at least suggests the presence of social, speaker mediated contingencies. However, it should be noted that these observations do not necessarily detract from the results of these experiments examining exposure. These observations propose a different conceptualisation of the results. Further research is needed to systematically investigate taste exposure under different rule-governed contexts; for example, different types of rules and different speaker/listener histories (e.g., parents versus experimenters).

1.3.3: Modelling 2

As suggested in Section 1.2.2, modelling (imitation and observational learning) appears to play a central role in the development of children's food preferences. At least two behaviourally oriented accounts of imitation have been proposed. These will be briefly reviewed below, and will be followed by a discussion of observational learning.

Behavioural Accounts of Imitation

It is not surprising that behavioural accounts emphasise the role of direct reinforcement in the promotion and maintenance of imitation. At least two accounts of imitation have been proposed by behavioural researchers: Gewirtz and Stingle (1968) and Baer and Deguchi (1985). These researchers discuss the phenomenon of *generalised imitation*: provided that an observer possesses an imitative repertoire and that some imitations are directly reinforced, the observer will imitate apparently novel behaviours without being directly reinforced for doing so.

According to Gewirtz and Stingle (1968) generalised imitation is a response class which is maintained by direct intermittent reinforcement:

> The first imitative responses must occur by chance, through direct physical assistance, or through training (with shaping or fading procedures applied by a reinforcing agent to occurring responses). When such responses occur, they are strengthened and maintained by direct extrinsic reinforcement from environmental agents. After several imitative responses become established in this manner, a class of diverse but *functionally equivalent* behaviours is acquired and is maintained by extrinsic reinforcement on an intermittent schedule. Differences in response content of the imitative behaviours are thought to play a minimal role as long as the responses are members of the imitative response class as defined functionally *by reinforcing agents*.. ,(p. 379)

Gewirtz and Stingle (1968, p.308) argue that generalised imitation emerges because of *a lack* of discrimination on the part of the observer, concerning those imitations which are and are not reinforced. Children will receive intermittent reinforcement for imitating a variety of models in a variety of settings.

Baer and Deguchi (1985) while accepting that imitation is a response class, disagree with Gewirtz and Stingle on two counts.

First, Gewirtz and Stingle argue that generalised imitation is observed because of a lack of discrimination between reinforced and non-reinforced imitations. However, evidence has been provided suggesting generalised imitation has been recorded in studies where subjects *have* displayed such discrimination. Baer and Deguchi (1985, p.187) report that subjects continue to imitate certain modelled behaviours in the absence of direct reinforcement, and conditions were such that the subjects in their study were aware of this. As long as some other imitations were reinforced, the subjects would continue to display generalised imitation.

Second, Baer and Deguchi argue that although intermittent reinforcement can account for the maintenance of existing imitations, it cannot account for the acquisition of *new* imitative responses. New imitative responses can be acquired *without* shaping or direct reinforcement.

Baer and Deguchi (1985) have instead argued that conditioned reinforcement is central to an account of imitation. Initially the response class of imitation is established through direct contingent reinforcement; however, across time, the similarity of the model's behaviour and the observer's imitative responses become a conditioned reinforcer for new imitations. As long as some members of the response class are reinforced directly, generalised imitations will be maintained. Some empirical evidence to support this view has been provided (e.g., Baer & Deguchi, 1985, pp. 201-214; Kymissis & Poulson, 1994).

One problem, acknowledged by Baer and Deguchi (1985), is that, if imitation is reinforcing, why does it appear to be so selective in everyday life? They suggest that its reinforcing value will alter depending upon the other reinforcers simultaneously available in the environment. Because other more potent and competing consequences are often simultaneously available, modelling as a means of teaching new behaviours is often fragile, and easily overridden.

The above accounts of imitation have been intentionally brief as the experiments reported in Chapters 2 - 6 were not designed to examine the validity of one theoretical account over another. As Deguchi (1984) has noted, while the underlying processes may not yet be clear, there is little question that environmental variables such as modelling can, and do, effect observers' behaviours.

Observational Learning

Learning by observing others will not always be imitative (Catania 1992): people can learn when "not to do things" by observing others. Whitehurst (1978) argues that an observer's behaviour can be controlled by at least one of three aspects of the models behaviour: (i) *discriminative context*, (ii) *topography*, and (iii) *function.*

Discriminative context refers the stimuli present preceding an observer's response. For example, a child may use "cup" to refer to cups and glasses. Following exposure to a model labelling the items correctly, the child may learn that the object glass has the label "glass", and not "cup". In the future the stimulus of glass will control the observer's response "glass".

Topography refers to imitation whereby the observer's response is controlled at least in part by the topography of the modelled behaviour. This issue has been addressed above. Finally, function refers to the outcome of the modelled response. Whitehurst (1978) gives the example of a child who, after watching his father paint a fence with a brush, paints the remainder of the fence with a spray gun; while topographically dissimilar, it has the same function as that of the model's behaviour. It will often be the case that the observer's behaviour will come under the control of the same contingency controlling the response of the model (see Skinner, 1989, pp. 115-116).

Observing the consequences of the modelled behaviour appears to be particularly important in altering the effectiveness of observational learning. In particular, observing a positive consequence (vicarious reinforcement) will increase the likelihood that the observer will perform the modelled act, while the reverse applies in the case of vicarious punishment (Flanders, 1968; Kazdin, 1979; Ollendick, Shapiro & Barrett, 1982; Sharpley, 1985; Thelen & Rennie, 1972).

In explaining the effects of such vicarious reinforcement and punishment, behaviourists have argued that these observed outcomes function as discriminative stimuli signalling to the observer that reinforcement (or punishment) is available (see Deguchi 1984; Kazdin 1989, Skinner, 1989). This may be the result of instructional control (and hence rule-governed behaviour). For example, Skinner (1969) has argued:

> A model to be imitated is a fragmentary rule specifying the topography of the imitative response. When we show someone how to do something, we compose an imitative model. This is a kind of instruction or direction. (p. 163).

In the real world, especially in the case of operant modelling (see Skinner, 1989, p. 115), it is likely that modelling will be accompanied by instructions. When showing someone how to do something expressions such as "look, do it like this", or, "look, bring your arm back slowly before you hit the ball" will precede the modelled act. Experimental evidence suggests that providing such verbal cues enhances the effects produced by modelling, and may be used by the observer as self instructions (Deguchi, 1984).

It is stressed that not all cases of observational learning and modelling result from such processes. Elsewhere Skinner (1974) has argued:

> There is nothing especially verbal about modelling (in teaching sports or the dance, the instructor 'shows a person what to do' in the sense of doing it himself). (1974, p. 108)

Almost regardless of the underlying mechanisms, it is important to acknowledge the role of direct reinforcement on vicarious processes (see Deguchi, 1984). Bandura (1971, 1977) acknowledges that vicarious reinforcement may only produce short term effects. Deguchi argues that if vicarious processes act as discriminative stimuli, then their effects will decrease over time if no direct reinforcement is forthcoming. This has been demonstrated in a number of studies.

For instance, Ollendick, Dailey, and Shapiro (1983) report a study in which 48 children were required to work on puzzles. During the experiment two children would be seated opposite one another, an experimenter would provide one subject with continuous social praise, while the other child was either praised intermittently or not at all. Initially no differences in performance were recorded; however, as trials progressed the performance of the non-praised child deteriorated. The authors concluded that vicarious reinforcement (i.e., observing the other child receive continuous social praise) may act as a punisher in certain contexts (e.g., when consequences are reliably presented to someone else, but are not forthcoming to oneself). Similar findings are reported by Ollendick and Shapiro (1984) and Deguchi, Fujita and Sato (1988).

Nevertheless, Kazdin (1977) has argued that vicarious reinforcement may be particularly useful in that it allows individuals to "contact" reinforcement (vicariously) more frequently than is often the case with direct reinforcement. Kazdin (1973, 1977) reports two studies in which vicarious reinforcement was used to increase attentive behaviour in "mildly retarded [*sic*]" children. In general, the attentive behaviour of children increased if they observed other children being praised for similar attentive behaviour. Given some of the other findings reported in this section, such processes may only be effective provided that the subject is given the opportunity to directly contact the reinforcer in a manner similar to that of the model.

The research reviewed in Section 1.2.2 highlights that modelling, imitation, and observational learning are processes open to manipulation by experimenters wishing to alter the food related behaviour of children. However, the role of direct reinforcement has not been discussed by many, if any, of these authors. Further, in some experiments (e.g., Birch, 1980a) the subjects were not presented target foods in the absence of peers; hence effects beyond "mere compliance" were not demonstrated. (Birch does, however, suggest that the collection of stated preferences after the experiment demonstrated the long term effects of the intervention. This assumption falls foul of the problems associated with this kind of measure; these problems have been noted throughout this chapter.)

It was noted in the previous discussion concerning modelling and food preferences (Section 1.2.2) that few authors have reported changes in consumption. This is a serious limitation which may question the applied significance of these findings.

Regarding the use of modelling to modify behaviour, three recommendations can be made; these are based on the literature reviewed in the present chapter.

1. Given the importance of direct reinforcement, researchers should utilise it where possible. This could be achieved through instructions which describe the consequences of the modelled behaviour (e.g., "go ahead and taste it, it's great!").

2. In cases where such direct consequences are not available (see Section 1.3), contrived consequences could be utilised (e.g. Greer, Dorow, Williams, McCorkle, & Asnes, 1991). This may be particularly advisable given Baer and Deguchi's (1985) suggestion that imitation, or the effectiveness of modelling, is a fragile process in that it can be easily overridden by the availability of other reinforcers which may be simultaneously available. Note that, in the normal eating situation, many other more rewarding activities are likely to be at hand (e.g., watching television).

3. Where possible, it would be desirable to expose subjects to multiple models; these should behave consistently, should be slightly older, or at the least be the same age as the subject (see section 1.2.2).

1.3.4: Rewards and Food 2

In Section 1.2.4 experimental evidence, from a number of authors (e.g., Birch et al, 1982, 1984; Newman & Taylor, 1992), was provided which suggested that rewarding food consumption impacted negatively upon stated preference for the target food. It was also noted that as a consequence of this research, this view has now become widely accepted within the literature concerning human food preferences.

Such a claim may be a little surprising to behaviour analysts who emphasise the importance of consequences in determining behaviour (e.g., Skinner, 1969). Also, applied behaviour analysts have a long tradition of using rewards (or reinforcers) in the applied and clinical field to promote, change, and maintain many different behaviours - and eating behaviour is no exception. A number of published studies have employed rewards to alter children's consumption of foods with no apparent detrimental effects. These experiments will be reviewed, following which the notion that rewarding food consumption impacts negatively upon preference will be questioned.

Effective Reward Use

Hatcher (1979) reports a successful intervention designed to promote solid food consumption with a two-year-old child. Treatment involved making a high frequency behaviour, ingestion of liquids contingent upon the performance of the target behaviour (ingestion of solid foods). Bernal (1972) successfully treated a four-year-old child who in addition to refusing table foods, also refused to self feed. Shaping procedures were employed whereby the child's mother withheld attention until the desired behaviour (i.e., self feeding) was performed. Once self-feeding was established, it was maintained using a procedure similar to that reported in Hatcher; that is, access to frequently consumed items was made contingent upon the consumption of target items. Siegal (1982) utilised response shaping, combined with classical conditioning procedures, to control strong physiological responses (e.g. vomiting) in a successful programme treating a six-year-old child who also refused to eat.

More recently, Handen, Mandell and Russo (1986) report an intervention employed with seven children aged between ten months and five and a half years of age. All the subjects suffered congenital anomalies and food aversions (including regurgitation, and solid food ingestion refusal) and received nutrition through non oral means (e.g., feeding tube). During the intervention the children were presented with between four and six small meals throughout each day. Social praise was provided immediately following each bite of food, and, if a criterion amount was consumed, subjects received access to reward activities (e.g., playing with toys, watching television, reading). The procedures promoted regular oral intake with all subjects, and three no longer requiring supplemental nutrient intake. Parents were instructed to continue the programme at home, and at follow-up (carried out up to 24 months later) five of the seven children were obtaining *all* nutrition via oral means. The sixth child, while eating a regular diet, was unable to absorb enough nutrients through oral intake alone. (The seventh child had died of non-diet related causes.)

Riordan, Iwata, Finney, Wohl, and Stanley (1984) report a successful intervention to increase food consumption, and self feeding, with four children with learning difficulties (aged between 16 and 40 months). Access to reinforcers (e.g., toys, preferred foods, social praise) was made contingent upon target food consumption, which, when established was maintained using intermittent reward delivery. Riordan et al report that target food consumption and self-feeding at follow-up exceeded levels recorded during baseline.

The apparent lack of detrimental effect, and the recording of beneficial effects resulting from the manipulation of contingencies is not limited to work carried out with "clinical populations". A number of studies carried out with "normal subjects", in a pre-school setting, have also failed to report detrimental effects resulting from the use of rewards in promoting consumption.

For example, Stark, Collins, Osnes, and Stokes (1986) combined nutrition training and contingent reward to promote children's healthy snack choices and overt verbal statements about the benefit of such choices. Nutrition training, in the absence of rewards, was relatively ineffective. Further, generalisation of effect to the home setting was only evident following the introduction of procedures designed to promote it. Finally, better generalisation was recorded when these procedures were "tailor made" for each child.

Baer, Blount, Detrich, and Stokes (1987) employed correspondence training procedures to promote healthy snack consumption, over less nutritious snack alternatives. Little change in choice behaviour was recorded when reinforcers were contingent upon saying alone (i.e., before snack time subjects stated that they would choose the more nutritious snacks). However, nutritious snack choice increased when reinforcers were contingent upon actual choice. Following this, intermittent reinforcement was used to maintain nutritious snack choices over a period of weeks.

Given the evidence presented in the present section it would appear that contingency manipulation and reward use does not necessarily result in the negative outcomes described by Birch et al (1982, 1984), Lepper et al (1982), and Newman and Taylor (1992). On the contrary, it would appear that rewarding consumption can result in positive effects, some of which are of considerable clinical significance. This begs a question: How is one to account for the negative effects purported to occur by authors such as Birch et al (1982, 1984) and Newman and Taylor (1992)? This issue will be the focus of the following section.

Radical Behaviourism and Detrimental Effect of Reward

In accounting for detrimental effects resulting from reward use, two issues will be examined. A striking difference between the research of authors such as Birch (et al, 1982, 1984), and Newman and Taylor (1992) and that of behavioural researchers concerns the experimental procedures employed. A number of important methodological and procedural differences will be discussed. The second area concerns the way in which such negative effects are conceptualised (e.g., as a decrease in intrinsic motivation); the validity of such conceptualisation will be questioned. Much of the work cited in the present section concerns the wider debate of the impact of rewards on behaviour and is not necessarily concerned with food preferences in particular.

Methodological issues

Dickinson (1989) highlights the many procedural differences between the typical behavioural experiment and the typical (non-behavioural) experiment which reports negative effects resulting from reward use (Dickinson 1989, p3; see also Bernstein, 1990; Deci 1975, pp. 134-137). The particular areas highlighted by Dickinson include, *the meaning of statistical significance*, *transience*, *type of reward contingency*, and *reward versus reinforcement*. Each of these issues will be examined in turn.

Statistical Significance: Dickinson notes that studies (not investigating food preferences) which are presented as evidence for the detrimental effects of rewards tend to be: (i) highly contrived; (ii) designed to test specific hypotheses; and, (iii) involve complex statistical comparison between groups, and these often yield "small but significant differences".

An examination of mean decreases in stated preferences in some of the experiments reviewed in Section 1.3 supports Dickinson's observation. For example, in the Birch et al (1982) study a mean decrease of 1.4 ranks (of 7 ranks) was recorded; in Birch et al (1984) a mean decrease of 1.13. ranks (of 7 ranks) was recorded; and in the Newman and Taylor (1992) study a mean decrease of 0.83 rank order positions (of 8 ranks) was recorded. However, as reported, all of these decreases in stated preference are statistically significant.

Problems arise when *interpreting* these statistically significant decreases: what does an average decrease in (stated) preference of 1.4 (or 1.13, or .0.83) ranks mean? Statistically significant changes in an outcome variable may not correspond to changes in socially meaningful behaviour (Barlow & Hersen 1984; Dickinson 1989). As Kazdin (1982, p. 252) has argued, "the change may be clear but not clinically important".

Transience: This issue concerns the recording of the dependant variable. Experiments cited as evidence against the use of rewards tend to take "snap shot" measures of the dependant variable (or target behaviour). Typically, target behaviour is measured once before and once following the experimental manipulation (Dickinson, 1989; Flora, 1990; Vasta, 1981). In contrast, in the typical time series behavioural experiment, target behaviour is measured continuously across time. Bernstein (1990) suggests that in the research demonstrating a negative effect of reward use:

> ...there is a consistent preference for the research methods and measures that sample behaviour rather than analyse the conditions that produce it. (p. 232).

Snapshot measures do not permit the examination of the robustness of the recorded changes (Dickinson, 1989, p.7). As Dickinson notes, this is particularly important such that, if negative effects of rewards were shown to be transient, much of their significance would be lost. Consistent with Dickinson's argument, a number of behavioural researchers have demonstrated such transience. Decreases in performance (relative to baseline) have been observed immediately following the withdrawal of an intervention. However, continued recording of the target behaviour (e.g., tooth brushing, see Fischer 1979) often shows that such decreases tend to be recovered and behaviour often increases to levels exceeding those recorded during baseline (Fischer 1979; Flora 1991; Vasta, 1981).

The lack of repeated measures in the experiments by Birch et al (1982, 1984) and Newman and Taylor (1992) is striking. The main outcome variable, stated preference (ranking procedure), was measured on one occasion before the intervention and on one occasion following. Thus, little can be said regarding the long term effects of the use of rewards - is it the case that the decrease in stated preference is temporary and recovered over a short time?

Interestingly, this lack of repeated observation has not prevented these authors from commenting upon the long term effects of their interventions. The robustness of effect is *assumed*, apparently without question. For example Newman and Taylor (1992) make the following comment:

> This negative effect may not be clearly apparent. A large literature (e.g., Bijou, 1985) shows that rewards are successful in encouraging behavioural compliance. For example, children may well put up with eating one food in order to get a reward. In the present study, no child refused to eat the treatment [target] snacks. *It is in the long term* that the accrued evaluations become crucial as they become responsible for sustaining behaviour, when the rewards and other adult influences are no longer operative. (pp. 213-214; emphasis added).

There is a great irony in this quotation. A researcher (Bijou) so closely allied with an experimental tradition of repeated measure, and of the promotion of long term behaviour change, is accused of short-sighted conclusions, by researchers who employ snapshot measures.

A second point, somewhat related to lack of repeated observation, concerns the subjects' exposure to the experimenter imposed reward contingency. Detrimental effects of reward are usually demonstrated in studies where the subjects are exposed to the contingency *on only one occasion*. This is inherently a non-behavioural practice (Dickinson 1989, see also Kazdin, 1989)

In the experiment by Newman and Taylor (1992), each subject was exposed to the contingency on only one occasion. Interestingly, Newman and Taylor comment on this issue but assume that repeated exposure to the contingency would *increase* the apparent negative effects. They assume that one exposure to the contingency is probably not enough to produce a lasting detrimental effect; and they also assume that the single exposure is responsible for the instances of non-significance reported with some of the subjects.

The third experiment reported by Mikula (1989) illustrates the importance of this point. Recall that two of Mikula's experiments were reported above (see Section 1.2.4). These experiments were reported in relation to the effects of presenting a food as a reward. Interestingly it would appear that Mikula was expecting to obtain a negative effect on the stated preference for the food eaten in order to obtain the reward food; however, this was not recorded. Instead, the stated preference for the reward food increased (i.e., there was no negative effect). In the third experiment, using a similar contingent presentation procedure, Mikula reports a decrease in stated preference for the food eaten in order to gain the reward food. Significantly, in light of the present discussion, to achieve this effect Mikula made two procedural modifications. First, the method of obtaining the preference measure was altered; instead of using a ranking procedure, stated preferences were obtained by requiring subjects to provide a hedonic rating of each of the two foods using a five point visual scale. Second, *exposure to the contingency was reduced to one occasion* for each subject. Although not conclusive, given that two variables were changed simultaneously, this suggests that increased exposure to the contingency may make negative effects less likely. Of course, the type of reward contingency employed is crucial, and this will be examined next.

Type of Reward Contingency: Negative effects resulting from reward use are most likely to be observed in cases where rewards are presented non-contingently; people are rewarded for simply engaging in an experimental task. This can be contrasted with procedures where rewards are given contingent upon the performance of a particular behaviour to a specified level or criterion (Dickinson, 1989, p.8). Consistent with this, Lepper and Greene (1978, pp.139-140) note that, in relative terms at least, data derived from studies utilising performance based rewards (the latter example) are less conclusive (regarding the negative effects of rewards) than data gathered using participation based contingencies (the former example). This discrepancy, according to Lepper and Greene, arises because performance based rewards provide more feedback regarding performance, and the controlling aspect of the reward tends to be minimised - intrinsic motivation for the task is less likely to decrease (see Deci, 1975; also Section 1.2.4).

In the experiments reporting detrimental effects of the use of rewards on food preference, it appears that participation based contingencies were used. However, these authors tend to be minimal in their descriptions of the imposed contingency. Birch et al (1984) are the most explicit in their description of a lack of a criterion:

> A rigid criterion was not adhered to in order to minimise having the children experience failure to meet the criterion of the contingency (p. 435)

Birch et al (1982) did employ a criterion: the quantity of food intake, and each day during the intervention this consumption criterion was increased by half an ounce (up to a maximum of two and a half ounces). As noted earlier, a decrease in verbal preference ranking was recorded following the intervention. The imposed consequence for consumption was access to a play activity which had been ranked in the middle position of a verbal ranking carried out prior to the procedure. If, as Birch et al assume, such ranking procedures are valid measures of preference, one must assume that access to such a consequence may not necessarily be rewarding (i.e., it will be of neutral preference). This issue will be discussed next.

Reward versus Reinforcement: Authors who argue that reward use results in negative effects appear unaware of, or ignore, the distinction between rewards and reinforcers (Bernstein, 1990; Dickinson, 1989; Flora, 1990). In the experiments reporting detrimental effects of rewarding food consumption, there is little indication as to whether the consequences were rewarding (or reinforcing) for the subjects. In these experiments the contrived consequence was either another food (Mikula, 1989; Newman & Taylor, 1992) or play activity (Birch et al 1982) which was ranked in the middle of a pre-experimental verbal ranking test. Birch et al (1984) used verbal praise and access to short films as contrived consequences. None of these authors report whether these consequences actually functioned as effective reinforcers in that these were effective in increasing the frequency of the target behaviour. Dickinson (1989) notes:

> ...highly reinforcing rewards may result in post - reward performance increases, while less reinforcing or non reinforcing rewards may result in post reward decreases. (p. 12).

Contrast such procedures with Kazdin's (1989) recommendations for modifying behaviour in the applied setting:

> ...the effects of reinforcement can be maximised by reinforcing behaviour immediately with a *potent reinforcer* that is delivered on a continuous (rich) reinforcement schedule. (p. 112; emphasis added).

Summary

The analysis presented above highlights a number of methodological and procedural limitations concerning the research purported to show negative effects resulting from the use of rewards. Furthermore, these criticisms apply directly to the body of research examining the apparent detrimental effects on food preference resulting from rewarding consumption. Some experiments (e.g., Newman and Taylor, 1992) were open to each of the four criticisms. Individually each issue represents a serious limitation when interpreting findings; taken together the relevance of much of this work to applied fields must be seriously questioned. A quotation from Bernstein (1990), which incorporates some of the issues discussed above, will illustrate:

> ...a certain combination of antecedent conditions is needed to produce the expected change in intrinsic motivation. First, the target activity must be a highly preferred member of the set of alternative activities....Second, the delivery of a consequence must be stated before the reward period begins. The process appears to operate while the rewarded activity is occurring, so unexpected consequences delivered after the behaviour has occurred will have no effect on later performance of the target task.
>
> A third limitation is that the consequence must have some material value....Fourth, the consequence must be contingent on engaging in the target activity, but it cannot be contingent on the quality or amount of target activity. If anything in the delivery of the consequences provides feedback on the quality of the performance, the person's interest in the target activity does not decrease.
>
> ...very few systematic, real-world attempts to encourage target activities with reward would be likely candidates for trouble....Taken as a whole, the list of necessary antecedent conditions suggests that the phenomenon may be robust in carefully constructed laboratory settings but that many natural settings would not produce the effect. (p. 326)

Such research may also be criticised at the theoretical and conceptual levels; such criticisms are examined in the following section.

Theoretical and Conceptual Issues

In addition to highlighting the methodological limitations (discussed above), behaviour analysts also reject the concepts of intrinsic and extrinsic motivation (see Section 1.2.4).

Flora (1990) argues that reference to "decrements in intrinsic motivation" is little more than bad science. Such conceptualisations highlight hypothetical "inner causes" of behaviour and divert attention away from the real causes of behaviour: environmental contingencies. Flora states that when an imposed contingency (the supposed source of extrinsic motivation) is withdrawn it does not mean that *all* contingencies cease to affect behaviour. That is, control is not passed to intrinsic motivation, it is passed to other (natural) contingencies (and self-generated rules). It is the absence of any *obvious* environmental or external consequences which leads researchers to attribute causes of behaviour to inner determinants (labelled as *intrinsic motivation*). The likelihood of this type of explanation arising is increased where behaviour becomes more complex; this is so because identification of controlling variables is also more difficult (Dickinson, 1989; see also, Skinner, 1974). The argument proposed by Dickinson and Flora is supported by definitions of intrinsically motivated behaviour, which is often defined as the performance of activities for which there is no apparent external reward. For example, Deci and Ryan (1985, p.34) provide the following operational definition: "...we infer intrinsic motivation for an activity when a person does the activity in the absence of a reward contingency or control."

Dickinson (1989) proposes that natural and arbitrary reinforcement (e.g., Ferster, 1967; Horcones, 1992; Skinner, 1982) is a more accurate conceptualisation of what has been labelled intrinsic and extrinsic motivation. Aspects of this issue were discussed in the section examining rule-governed behaviour. Behaviour may be initially controlled by instructions and social consequences (e.g., "finish your vegetables or you won't get any ice cream"); however, control may eventually pass to the natural consequences of vegetable consumption (e.g., see Kohler & Greenwood, 1986). Likewise, control may not pass directly to natural consequences: tracks (possibly self-generated) concerning the behaviour and its consequence may result in long term maintenance in the absence of contrived reinforcement. The crucial aspect of this distinction is that there is no functional difference between these types of control: all behaviour is ultimately contingency shaped. This is not the case with the intrinsic/extrinsic motivation distinction (Dickinson, 1989).

Behaviour analysts concede that rewards and imposed contingency manipulation, in certain circumstances, may produce undesirable or negative effects. For example, parents often attempt to manipulate contingencies (e.g., "eat your vegetables then you can have ice cream"), but do so in an ineffective way; they may fail to be consistent, or may (inadvertently) reinforce incompatible behaviours (e.g., the child's feigning illness). People may perceive blatant contingency manipulation as an attempt at bribery or control, which may result in counter control (Balsam & Bondy 1983; Dickinson, 1989; Sidman, 1989; Skinner 1953). What is important, however, is that negative effects such as these are not the result of a decrease in *intrinsic motivation*; such effects result from problems of contingency management (ineffective implementation, naturally occurring competing contingencies etc.). In the experiments apparently demonstrating a negative effect of reward on food preference, the negative effects may well result from incorrect, inappropriate, or ineffective contingency manipulation: put simply, why should a child eat one food in order to gain another food which is not perceived as rewarding? Given the blatantly coercive and badly managed contingencies often used, it is not surprising that a negative impact on the target behaviour (verbal ranking) is observed.

To illustrate the problems concerned with conceptualising behavioural causes in terms of intrinsic and extrinsic motivation, Flora (1990) proposes the following: A possible solution to the problem of heroine addiction is to pay addicts for the performance of this activity. If extrinsic control is made explicit, then intrinsic motivation for heroine taking should decrease. To apply Flora's logic to food consumption, one strategy to improve the quality of children's diets is to pay them for the consumption of foods high in fat and sugar ("junk food"). This should, if Newman and Taylor (1992) are correct, make the likelihood of such food being consumed in the future less likely. As Flora recognises, such procedures would be absurd, but nevertheless, consistent with the intrinsic motivation literature.

Summary

The evidence discussed in the present section has demonstrated that reward use, and contingency manipulation has been successfully utilised in applied settings to modify children's consumption of foods. Again, a number of recommendations can be made concerning how best to utilise rewards.

1. Criterion based (as opposed to participation based) contingencies should be employed.

2. Repeated measures should be employed to allow for the examination of the development of behaviour across time, and where necessary the shaping up of behaviour.

3. Instructions or rules specifying the appropriate contingency should be provided. Contingency specification increases the likelihood that subjects contact the appropriate contingency, and may also decrease the likelihood of negative attributions - which authors such as Deci (1975) argue result in overall negative impacts of reward. Instructions can also be useful in cases where behaviour occurs at a very low level, and thus makes "natural" contact with the imposed contingency unlikely (cf. Baron & Galizio, 1983).

1.4: THE PRESENT EXPERIMENTS

The following five experiments have been designed to investigate the impact of cultural variables on food choice; the role of rewards, instructional control/rule governance and modelling in particular. To investigate the impact of these variables on food preferences, a series of intervention packages (which incorporated some or all of the cultural variables previously discussed) was designed. Such a strategy not only facilitates an examination of these variables relative to the theoretical debates discussed above, it also provides information regarding the malleability of children's food preferences.

Given that the interventions are designed to alter behaviour, specifically to increase the consumption of previously refused foods, the present experiments are also of applied significance. Within behaviour analysis there has been a strong tradition of extending research findings into applied arenas; this field is known as *Applied Behaviour Analysis* (ABA). The aim of ABA is to focus on behaviours and problems which are of "clinical or social relevance" (Kazdin, 1989, p.23). Recent years have seen a great increase of new areas and client groups which have been the focus of the attention of applied behaviour analysts (Cullen, 1988b). Cullen (1988b) continues, ABA is now "dealing with responses which are important to society at large" (p.16).

At the same time there have been some important changes and developments in psychology and related fields. There is increasing awareness of the links that exist between lifestyles and health in general; further, morbidity and mortality could "be prevented or effectively managed by psychological intervention" (*Management Advisory Service to the NHS*, 1989). These acknowledged links are also manifest in the rapid growth of health psychology. Good health is something which is achieved by the individual as opposed a state taken for granted, and health psychology examines the "psychological influences on how people stay healthy, why they become ill, and how they respond when they get ill" (Taylor, 1995, p. 3).

One particular area of lifestyle which has received much attention recently is diet, and it is now widely accepted that diet plays a central role in the prevalence and incidence of certain illnesses. In 1993 the *National Forum for Coronary Heart Disease Prevention* reported the following:

> A healthy diet is, of course, vital to children's growth and development. Conversely, the typical unhealthy diet increases the risk of a variety of health problems both in early childhood and in later life. As well as affecting children's growth and development, diet in childhood may influence the development of dental disease, constipation and other bowel disorders, nutritional anaemia, obesity and overweight, and may increase the risks, in adulthood, of low bone mass, coronary heart disease, stroke, and some cancers including breast and bowel cancer. (p. 11)

Similar concerns over children's diets, and the links with certain forms of illness, have been expressed by Government (e.g., COMA, 1989, 1991; Dept. of Health, 1991), and the World Health Organisation (e.g., "Health for All by the Year 2000", 1985). These concerns become more urgent when viewed in the light of research showing the presence of fatty streaks in the aortas of children as young as three, and in the coronary arteries of young teenagers (Newman, Freedman, & Boors, 1986). The apparent poor quality of children's diets in general is not just a problem now, it is a problem for the future. Dietary habits established in childhood are often "carried through" into adulthood (Lobstein, 1988; Logue, 1991; *National Forum for Coronary Heart Disease Prevention*, 1993).

A number of recommendations have been proposed regarding changes to diets; people should eat less fat and sugar, and consume more fibre. For many children, who would not fall into the category of "chronic food refusal" or "failure to thrive", major improvements in diets could be achieved by: (i) the consumption of a more balanced diet, and (ii) the consumption of more (fresh) fruits and vegetables (e.g., Lobstein, 1988). In discussing such dietary changes Lobstein has noted the following:

> This doesn't mean that children have to give up what they appear to be enjoying so much...It does mean, for all children, a matter of getting a balance. Fatty items should be less dominant on the plate, while fresh fruits and vegetables, and the pulses...should feature more often. (p. 155).

The evidence presented in the present chapter has continually suggested that cultural variables are major determinants of diet. Given that these variables are open to manipulation (and numerous example have been provided), it follows that psychologists (especially applied behaviour analysts) are in an advantageous position to help improve the diets (and consequently health) of children (and adults).

This is by no means a new and unique observation: many of the authors cited in this chapter have acknowledged the possible impact of their findings on the area of health. It is the purpose of the present series of experiments to further add to this knowledge by: (i) investigating new issues with respect to modelling and peer interventions; and (ii) developing and evaluating a series intervention packages designed to increase children's consumption of previously refused fruits and vegetables.

A particular strength of the present series of experiments is the outcome measure used - the amount of target food consumed by the subject. This dependant variable was chosen for a number of reasons, not least that food is not food until it is consumed (Goldberg, 1992). Also, saying and doing are two distinct behaviours, each of which change depending upon consequences. It is not the purpose of the present experiments to simply increase the frequency with which children say they like or dislike a particular food.

CHAPTER 2

EXPERIMENT 1: PEER BEHAVIOUR AND NOVEL FOOD CONSUMPTION

2.1 INTRODUCTION

It was reported in the previous chapter that children's food related behaviour (e.g., consumption, choice, stated preference) can be affected by observing the behaviour of others. The literature reviewed in Chapter 1 (Section 1.2.2) suggests that if children observe the food choices of others (e.g., peers) they will alter their choices or stated preferences, to correspond more closely to those of the models (e.g., Duncker, 1938; Marinho, 1942; Birch, 1980a). Further, some variables impacting upon such imitation or observational learning have been examined; Harper and Sanders (1975) demonstrated that modelling was more effective if a familiar adult, as opposed to an unfamiliar adult, was observed consuming the target food (see also, Greere et al, 1991).

Parental reports often testify to the impact of modelling. However, anecdotal evidence suggests that negative modelling (i.e., the model refusing the target food), may play an important role in determining the foods children *refuse* to eat. Most parents are likely to be familiar with the hypothetical example provided in Chapter 1: A child refuses a regularly consumed food apparently because an admired friend, who has been invited for dinner, is seen to reject this food. What is particularly interesting is that to date no published studies have examined the impact of such negative modelling on the food choices of children. The collection of such data would allow a formal assessment of what (anecdotally) appears to be a powerful determinant of children's food preferences.

The purpose of this first experiment was to examine the impact of peer behaviour on children's consumption of a novel food, and in particular the impact of negative peer modelling (i.e., where models reject a food). Subjects were presented with a novel food in one of three contexts: (i) in the presence of peers who accepted the food; (ii) in the presence of peers who rejected the food; and, (iii) in the absence of peers. This allowed a comparison to be made of the impact of positive and negative modelling/peer influence. A second aim of the experiment was to examine whether initial "aversions" established by negative peer modelling could be reversed by exposure to "positive" peer modelling.

The target foods employed in the present experiment were created for experimental purposes, and thus were novel. This allowed for the control of differential exposure histories across subjects. The present experiment also aimed to avoid establishing an aversion to any food which the child might encounter in a real life context.

2.2 METHOD

Participants

Subjects

Thirty-five children, 18 males and 17 females, aged between 5 and 7 years (mean age 6.00 years) were recruited from three local primary schools. The parents of children attending these schools were sent a letter requesting permission for their children to participate in the experiment. The subjects were randomly selected from all those cases where consent for participation was gained. Thirty six subjects were recruited, but one subject (female) failed to attend.

Confederates

Eight children aged between 8 and 11 years, recruited from a different school to that of the subjects, participated as confederates to provide the positive and negative peer influence. The confederates were divided into two groups each consisting of two males and two females, and both groups were trained to act both positively and negatively towards two target foods.

Foods

Two blue foods (physically different from each other) were presented to each child during the study: potato bread and quorn, both of which were coloured blue and given the labels "fodrick" and "gwark" respectively. The blue colourings and the names were chosen in an attempt to ensure the foods would be perceived as entirely novel by the subjects. No (processed) blue foods (except for some fizzy drinks and sweets) were commercially available at the time of the experiment (Walsh, Toma, Tuveson, & Sondhi, 1990). For half of the subjects the quorn was presented as a target food, while, as a test for generalisation of effects, potato bread was presented as a "second" blue food. The reverse applied to the remaining subjects.

In addition to the target items, four other food stuffs were presented to all the children during each presentation; these were grapes, carrot, pitta bread and cheese. Portion size of each food item (including the blue foods) was approximately 20mls. The foods were presented in circular green plastic bowls (approximately 14 cm in diameter).

Target Behaviour and Measurement

The dependant variable was the amount of target (and second) blue food consumed. An observer (blind to subjects' group allocation and consumption context - see *Procedure*) estimated each subject's consumption of all the foods. For this, the following observational scale was used:

0, up to 25%, > 25% to 50%, > 50% to 75%, > 75% to 100%

Estimations were made by examining each subject's plate waste. The two blue foods were presented in portions of uniform shape and size, the shape of which aided the measurement of the amount consumed: quorn (gwark) was presented in a cube form (measuring approximately 2 cm), while potato bread (fodrick) was presented in discs of approximately five centimetres in diameter. To further ensure the validity of the consumption estimations an experimenter was always present during food presentations to ensure that any target food not consumed by a subject remained in the presentation bowl. In addition, all food presentations were video recorded throughout; the subjects were not made aware of this.

Design

A mixed design was employed where subjects were randomly allocated to one of three conditions (between subjects), but during which repeated measures were recorded on four separate occasions within each of the groups (within subjects). The food presentation schedule is presented in Table 2.1, below.

Table 2.1: Schedule of food presentations during Experiment 1.

	Presentation Context		
Presentation	**Group A**	**Group B**	**Group C**
1	Positive peerinfluence	Negative peer influence	Alone
2	Alone	Alone	Alone
3	Positive peer influence	Positive peer influence	Alone
4	Alone	Alone	Alone

This schedule not only allowed a between groups comparison of consumption, but also a number of within group comparisons. Presentations 1 and 3 versus Presentations 2 and 4 in Groups A and B allowed a comparison of acceptability when peers were present and absent. Furthermore, presentations across Group B allowed a comparison of negative *and* positive peer influence within the same subjects. Finally, presenting a second blue food to all subjects (during Presentations 2 and 4) allowed an examination of generalisation effects, that is, acceptability of a food which was the same colour as the target item but which had not itself been the focus of peer influence.

Exposure to confederate groups and food was counterbalanced. Half of the subjects in Groups A and B were exposed to one group of confederates during Presentation 1 (see Table 2.1 above), and the second group of confederates during the third presentation. This order was reversed for the remaining subjects in Groups A and B. Half of the subjects in each group were presented with quorn as a target food and potato bread as a second food to test for generalisation; the reverse applied to the remaining subjects. These procedures controlled for any effects resulting from exposure to a particular food or confederate grouping.

To ensure that any differential results obtained across the three experimental groups could not be attributed to differences related to the subjects schooling, one third of the subjects in each group were recruited from each of the three primary schools.

Procedure

The study was carried out over six weekend days (i.e., Saturdays and/or Sundays) with six subjects participating each day. Subjects were invited to the School of Psychology's Centre for Child Development to take part in an "activity day". Following an hour of organised team games (e.g., football, tug-of-war) subjects participated in two hours of individual activities (e.g., computer games, jigsaws and puzzles). Throughout this two hour period each subject played eight different games, each lasting for 5 or 10 minutes. At predetermined times between these activities, on four separate occasions (corresponding to the four presentations) each subject was presented with a snack consisting of either one (the target food) or both blue foods, and the four other food items described above (see *Foods* section, above).

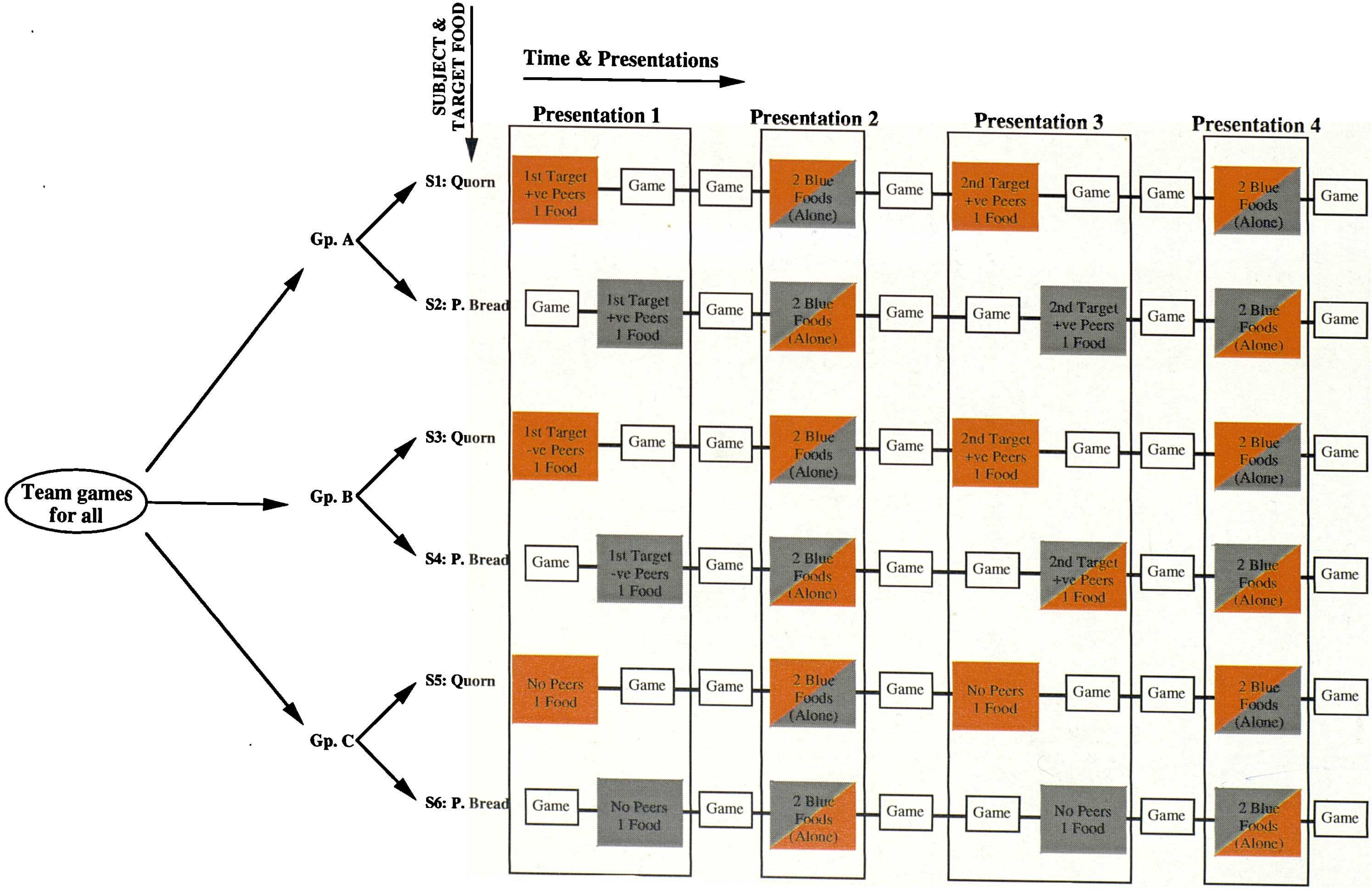
Figure 2.1: A schematic representation of the four food presentations on any one day during Experiment 1. This shows subject allocation to Group A (Gp. A), Group B (Gp. B), and Group C (Gp. C), and the target food (i.e., quorn or potato bread) presented to each of the participating subjects.

Key:

Quorn presentations

Potato bread presentations

P Bread	Potato bread
1st &2nd Target	The first and second presentation in presence of peers.
1 Food	Presentation of target blue food.
2 Foods	Presentation of target and second blue food.
+ve Peer	Positive peer influence
-ve Peer	Negative peer influence
Alone	No peer influence


Time & Presentations
SUBJECT & TARGET FOOD
Presentation 1
Presentation 2
Presentation 3
Presentation 4
Team games for all
Gp. A
Gp. B
Gp. C
S1: Quorn
S2: P. Bread
S3: Quorn
S4: P. Bread
S5: Quorn
S6: P. Bread
1st Target +ve Peers 1 Food
1st Target -ve Peers 1 Food
No Peers 1 Food
2 Blue Foods (Alone)
2nd Target +ve Peers 1 Food
Game

A schematic representation of the food presentations and experimental procedure is given in Figure 2.1. During each of the four food presentations a different experimenter, who was unaware of the subject's previous consumption of the any of the foods, was present.

Presentation 1

Each day when the team games were completed, three of the six subjects were taken to separate rooms to play the first of their individual games (in parallel). The remaining three subjects were told that they could have a snack before playing some games. The snacks were presented to these three subjects in parallel (see Figure 2.1, Presentation 1).

Group A, positive peer influence: The subject who was assigned to Group A was taken to a room where four confederates (i.e., one of the confederate groups) were seated at a table. An experimenter who was already present in the room greeted the subject and told him/her to be seated at the table. The experimenter collected a tray on which there were five bowls containing the foods (1 blue target food, and four other foods). The experimenter gave a bowl to each confederate (in a predetermined order), and then presented one to the subject. On completion of serving the food, the experimenter moved away from the table to ensure he or she had minimal contact with the children. As each confederate was presented with a bowl they stated a line from the following rehearsed script:

Confederate 1	"*Hmmm, what is this blue stuff?*"
Confederate 2	"*Oh, wow, this is gwark/fodrick!*"
Confederate 3	"*Great! I've had this blue stuff before and it's lovely!*"
Confederate 4	"*I've never tried it, let me taste it [tastes some]. Yes it is fantastic!*"

Following this dialogue each confederate continued to consume the target item whilst making appreciative noises. Once the target item was consumed, the confederates consumed the remaining food items but did not make any comment concerning this behaviour. At no point was the subject asked to consume any food by the experimenter. Each session lasted for five minutes, and the experimenter covertly monitored the subject throughout to ensure that any food not consumed remained in the bowl.

Following this food presentation the subject was taken by a different experimenter to another room to play their first "individual" game. Meanwhile, another experimenter collected the bowls and took them to another room where the subjects' consumption of the foods was measured.

Group B, negative peer influence: The procedure for the Group B subject was the same as described above with the following exception: as each confederate was presented with a bowl of food they stated a line from the following rehearsed script:

Confederate 1b	"*Ugh! This blue stuff looks disgusting!*"
Confederate 2b	"*That's gwark/fodrick and it's foul!*"
Confederate 3b	"*Yuk! I've had that blue stuff before and it is gross!*"
Confederate 4b	"*I've never tried it, is it really that bad? I'll taste a t iny bit [tastes some]. Uch! It is revolting!*"

Group C, control: The Group C subject was taken to a room and presented the foods by an experimenter in the absence of any peers.

While the first three subjects were playing their respective individual games, the remaining three subjects were given their first food presentation. Each subject was assigned to one of the three groups, and the relevant procedure described above was replicated with that subject.

Presentation 2

When all six subjects had undergone their first exposure to a target food, all subjects played a second individual game for 10 minutes. Directly following this all six subjects were presented with a second snack (in parallel) during a session which lasted for five minutes (see Figure 2.1, Presentation 2). During this presentation each subject was presented with six foods; the blue target food, a second blue food (to test for generalisation of effects), and the four other foods described above. During this second presentation only the subject and an experimenter (who was unaware of the subject's consumption during the earlier presentation) were present. As was the case during the previous presentation, at no point did the experimenter instruct the subject to consume any food.

Presentations 3 and 4

After the second food presentation, all the subjects continued to play individual games for a further 10 minutes. Following this the procedure used for Presentations 1 and 2 was repeated so that each subject was presented with the target food on a further two occasions and the second blue food on a further one occasion (see Figure 2.1, Presentations 3 & 4). Thus, during the experiment each subject was presented with a blue target food on four occasions and a second blue food on two occasions.

During the final two food presentations the following modifications to the procedure were made: Subjects in Group B were exposed to a different confederate group who provided *positive,* as opposed to negative, peer influence. Subjects in Group A were exposed a different group of confederates who once again provided positive influence. On this occasion the following rehearsed script was used:

Confederate 1	"*Oh wow, it's that blue stuff again!*"
Confederate 2	"*Fantastic I love this Gwark/Fodrick!*"
Confederate 3	"*Yes it's lovely, I want to eat loads of this blue stuff!*"
Confederate 4	"*It's delicious!*"

During the two hours of individual games and food presentations verbal contact between subjects was prevented.

2.3 RESULTS

Group Analysis

Target food Consumption

Mean target food consumption, during each of the four presentations, was calculated for each of the three groups; the mean values are displayed in Table 2.2, below. Visual inspection of these data (presented in Figure 2.2) reveals that the highest consumption levels were recorded with Group A in the presence of positive peers, during Presentations 1 and 3 (means, 71% and 83% respectively). Further, Group A's high consumption was maintained during Presentations 2 and 4 when the target food was presented in the absence of confederates (mean 58% and 75% respectively). Conversely, low mean consumption levels were recorded with Group B during Presentation 1 when the negative peers were present (mean 2%), and Presentation 2 in the absence of peers (mean 0%). Nevertheless, Group B's consumption increased during Presentation 3 when the food was presented in the presence of positive peers (mean 56%). Further, this increase in consumption was maintained during Presentation 4, when the food was again presented in the absence of peers (mean 60%). Mean consumption of Group C (controls) was stable across the four presentations (means, 41%, 45%, 41%, and 36%, respectively).

Second Food Consumption

Table 2.3 compares the mean consumption of the target and second blue food during Presentations 2 and 4. This table indicates that, in general, second blue food consumption was similar to target food consumption (during Presentations 2 & 4).

A visual inspection of Figure 2.3 reveals that during Presentation 2 (in the absence of peers), Group A's mean consumption of the second blue food was 65 percent, as compared to 58 percent for the target food. During Presentation 4, Group A's consumption of the second blue food was 67 percent, as compared to 75 percent for the target food. Group B's second blue food consumption was similar to target food consumption during Presentation 2; no target food was consumed and mean consumption of the second food was only 4 percent. However, this was not the case during Presentation 4; although Groups B's target food

Table 2.2

Table showing the mean target food consumption (indicated by shading) for Group A (positive peer influence), Group B (negative and positive peer influence), and Group C (control), during each of the four presentations during Experiment 1. This table also shows the mean consumption of quorn (Quorn) and potato bread (P Bread) when presented as a target food within each group

	Presentation 1	Presentation 2	Presentation 3	Presentation 4
	Mean	Mean	Mean	Mean
Gp. A Quorn	71%	33%	83%	67%
Gp. A P Bread	71%	83%	83%	83%
Gp. A Total	71%	58%	83%	75%
Gp. B Quorn	0%	0%	42%	33%
Gp. B P Bread	4%	0%	71%	88%
Gp. B Total	2%	0%	56%	60%
Gp. C Quorn	25%	20%	30%	25%
Gp. C P Bread	54%	67%	50%	50%
Gp C Total	41%	45%	41%	36%

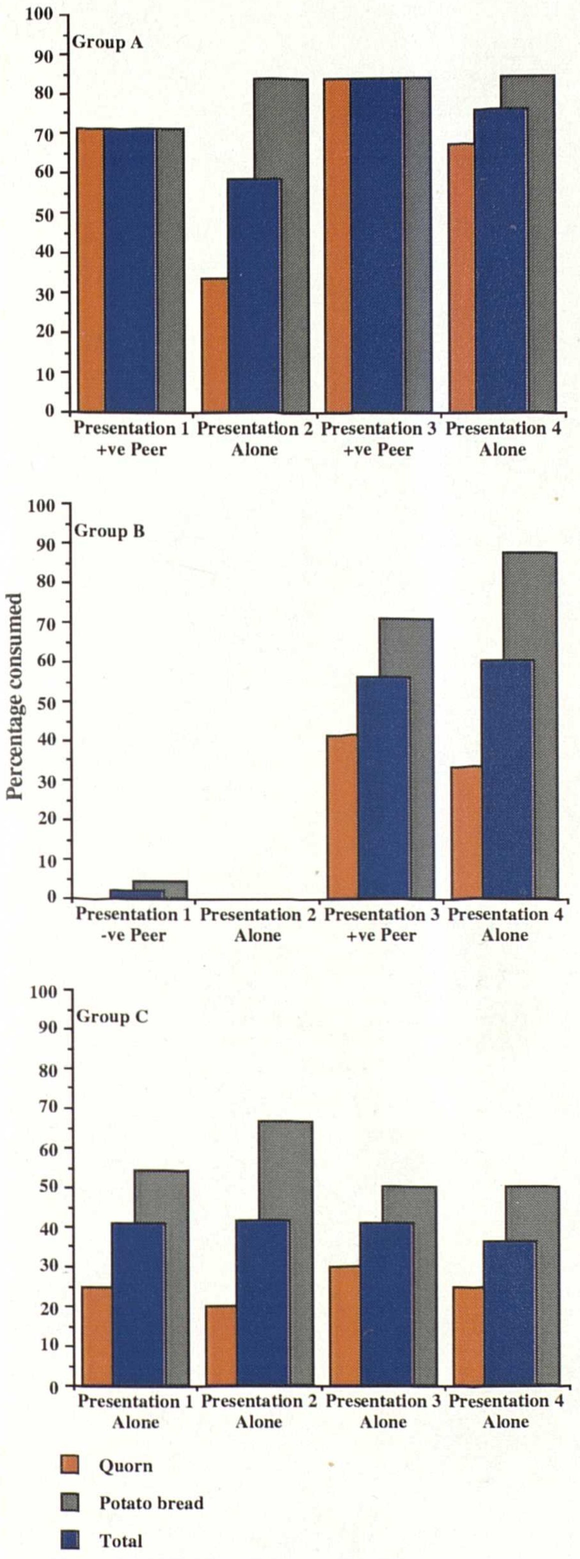


Figure 2.2: This shows each groups' mean consumption of the target food during each of the four presentations in the positive peer influence condition (+ve Peer), the negative peer influence condition (-ve Peer), and the no peer influence conditions (Alone). This shows the overall group mean consumption (total), and within group mean consumption of quorn and potato bread when presented as target foods.

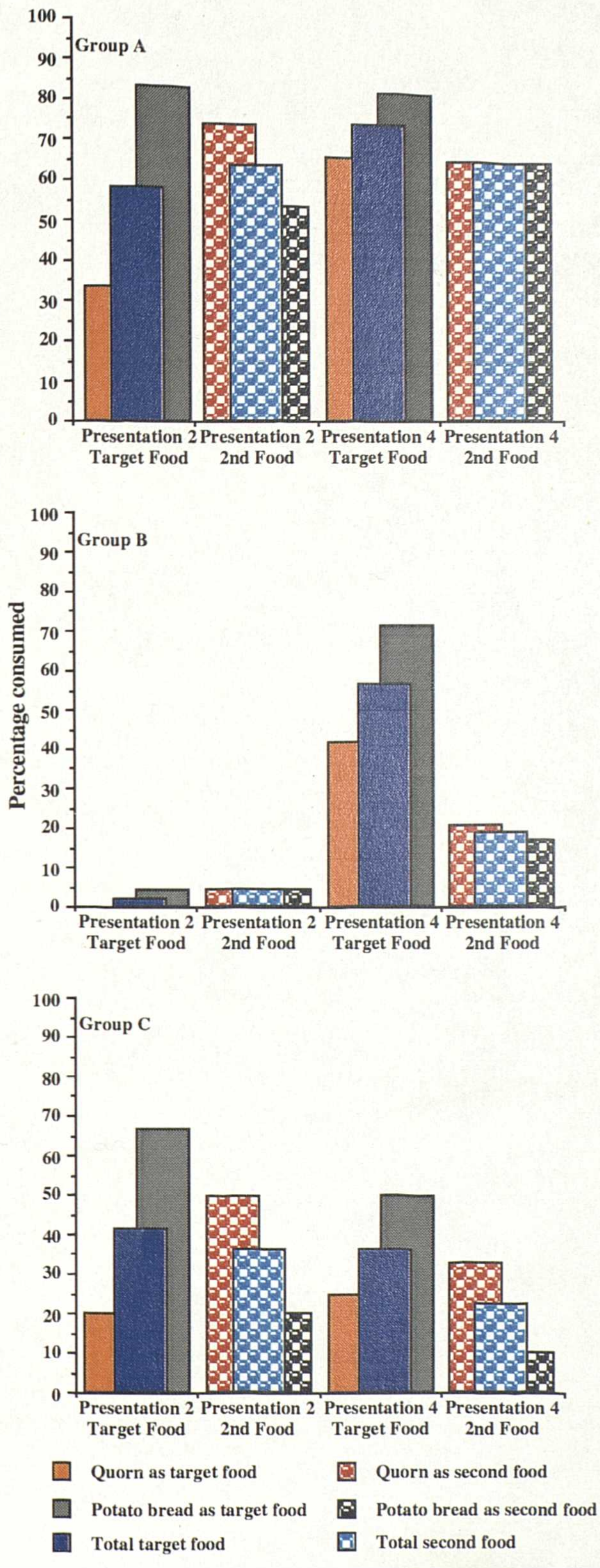


Figure 2.3: This compares each groups' mean consumption of the target and second blue foods when presented during Presentations 2 and 4. This also shows overall group mean consumption of the target and second blue food (total), as well as within group mean consumption of quorn and potato bread when presented as target and as a second blue food.

Table 2.3

Table showing each groups mean consumption (indicated by shading) of the target (Targ) and second blue food (2nd) during Presentations 2 and 4. This table also shows within group mean consumption of quorn (Quorn) and potato bread (P Bread) when presented as a target or second blue food.

	Presentation 2		Presentation 4	
Group & Food	Targ	2nd	Targ	2nd
Gp. A: Targ - Quorn 2nd - P Bread	33%	54%	67%	67%
Gp. A: Targ - P Bread 2nd - Quorn	83%	75%	83%	67%
Gp. A Total	58%	65%	75%	67%
Gp. B: Targ - Quorn 2nd - P Bread	0%	4%	33%	17%
Gp. B: Targ - P Bread 2nd - Quorn	0%	4%	88%	21%
Gp. B Total	0%	4%	60%	19%
Gp. C: Targ - Quorn 2nd - P Bread	20%	20%	25%	10%
Gp. C: Targ - P Bread 2nd - Quorn	67%	50%	50%	33%
Gp C Total	45%	36%	36%	22%

consumption increased (i.e., from zero to mean 60%) in response to the positive peer influence, an increase of similar magnitude was not evident with second food consumption (mean 19%).

During Presentation 2 Group C's consumption of the second blue food was 36 percent (compared to 45% for the target food). During Presentation 4 Group C's second blue food consumption was 22 percent, compared to 36 percent for target food consumption.

Statistical Analysis

To examine the impact of positive and negative peer influence on subjects' consumption of the target and second food, a repeated measures mixed design ANOVA was implemented. However, subsequent analysis revealed that the raw data were not parametric (i.e., spread of values was bi-modal), and so a randomisation test was implemented. This procedure allows a post-hoc comparison between two selected mean values, either within or across groups, similar to Tukeys multiple comparison test. Comparisons are achieved through the generation of data-appropriate values (referred to hereafter as *gen Q*) with which to compare the observed value corresponding to the difference between the two selected mean values (referred to hereafter as *obs Q*). The distribution of the generated values (i.e., the *gen Q*) for each comparison is presented in Appendix 1B.

In the analysis presented below the particular comparisons calculated were selected in order to answer particular questions relating to the experimental hypotheses. The analysis is not being proposed as an exhaustive investigation of every possible comparison of mean values in the present data set. Also, differences in the consumption of quorn and potato bread were not investigated in the analysis presented below. This is because a preliminary analysis suggested that there was not a main effect for type of food (see Appendix 1A for a discussion of this point, and a description of how randomisation tests are conducted).

Presentation 1: A comparison of the mean values recorded across the groups during Presentation 1 revealed that Group B's consumption (negative peer influence) differed significantly from that of Group A (*obs Q*, 2.825, $p<0.01$) and Group C (*obs Q*, -1.595, $p<0.05$). However, the difference between the mean consumption recorded with Groups A and C (i.e., positive peer influence versus control) was not significant (*obs Q*, 1.230).

Presentation 2: A similar pattern of results was recorded during Presentation 2 when each of the three groups were presented the food in the absence of peers. Group B's mean consumption (0%) differed significantly from that of Group A (*obs Q*, 2.397, $p<0.01$), and Group C (*obs Q*, -1.868, $p<0.01$). Also, the consumption levels in Groups A and C were not significantly different (*obs Q*, 0.529).

Second food consumption: Analysis revealed that within each group, target and second blue food consumption did not differ significantly during Presentation 2. Further, the mean consumption of the second blue food recorded with Group A and Group B differed significantly (*obs Q*, 2.482, $p<0.01$).

Presentations 3 and 4: During presentation 3, when Group A subjects were exposed to positive peer influence for a second time, Group A's consumption differed significantly to the mean consumption recorded with Group C (*obs Q*, 1.723, $p<0.01$). Furthermore, a significant difference in target food consumption was also recorded between Groups A and C during Presentation 4 (*obs Q*, 1.587, $p<0.05$).

A within-group examination of Group B's consumption revealed that exposure to positive peer influence promoted significant increases in consumption. A comparison of Group B's mean consumption during Presentation 1 and 3 (i.e., negative peer influence versus positive peer influence) reveals a significant effect (*obs Q*, 3.326, $p<0.01$). The impact of positive peer influence was also evident during Presentation 4. Group B's mean consumption during Presentation 4 was significantly higher than that recorded during Presentation 2 (*obs Q*, -3.71, $p<0.01$). Furthermore, within Group B mean target food consumption during Presentations 3 and 4 (i.e., positive peer present versus peers absent) did not differ significantly.

Second food consumption: During Presentation 4 Group A's consumption of the second blue food was significantly greater than that recorded with Group C (*obs Q,* 1.805, $p<0.05$).

Although exposure to positive peer influence increased target food consumption within Group B, a corresponding increase in second blue food consumption was not evident. Consumption of the second blue food did not differ across Presentations 2 and 4 (*obs Q*, -0.895); furthermore, during Presentation 4, target and second blue food consumption differed significantly (*obs Q,* 2.558, $p<0.01$).

Individual Subject Consumption

The analysis presented above involved the comparison of group mean values across groups and presentations. Although mean values provide an overall picture of group performance, a mean value can be more or less representative of the performance of any given individual within a group. For example, at one extreme, a mean of 50 percent may result from half of the subjects in a group performing/scoring at 100 percent, and the remaining half scoring/performing at zero percent. At the other extreme, a mean of 50 percent could reflect every subject in the group performing/scoring at 50 percent. In these examples, although the mean values are the same, the effect of the experimental manipulation would be very different. In the former case the experimental manipulation appears effective, but only with half of the subjects. In the latter case, the manipulation appears to be moderately effective with all of the subjects.

To begin to examine this issue in the present experiment, an "acceptability" score was calculated. Acceptability refers to the number of subjects within each group who consumed any amount of the target food during a given presentation. This essentially provides a very broad measure of the number of subjects within Groups A and B who (at least partially) imitated the confederates. In Table 2.4, acceptability is compared to group mean consumption. A visual inspection of these data (presented in Figure 2.4 for target food, and Figure 2.5 second food) suggests that the consumption means are highly correlated with the number of subjects within the group consuming the food. That is, generally, the consumption means are representative of the spread of effect within a group.

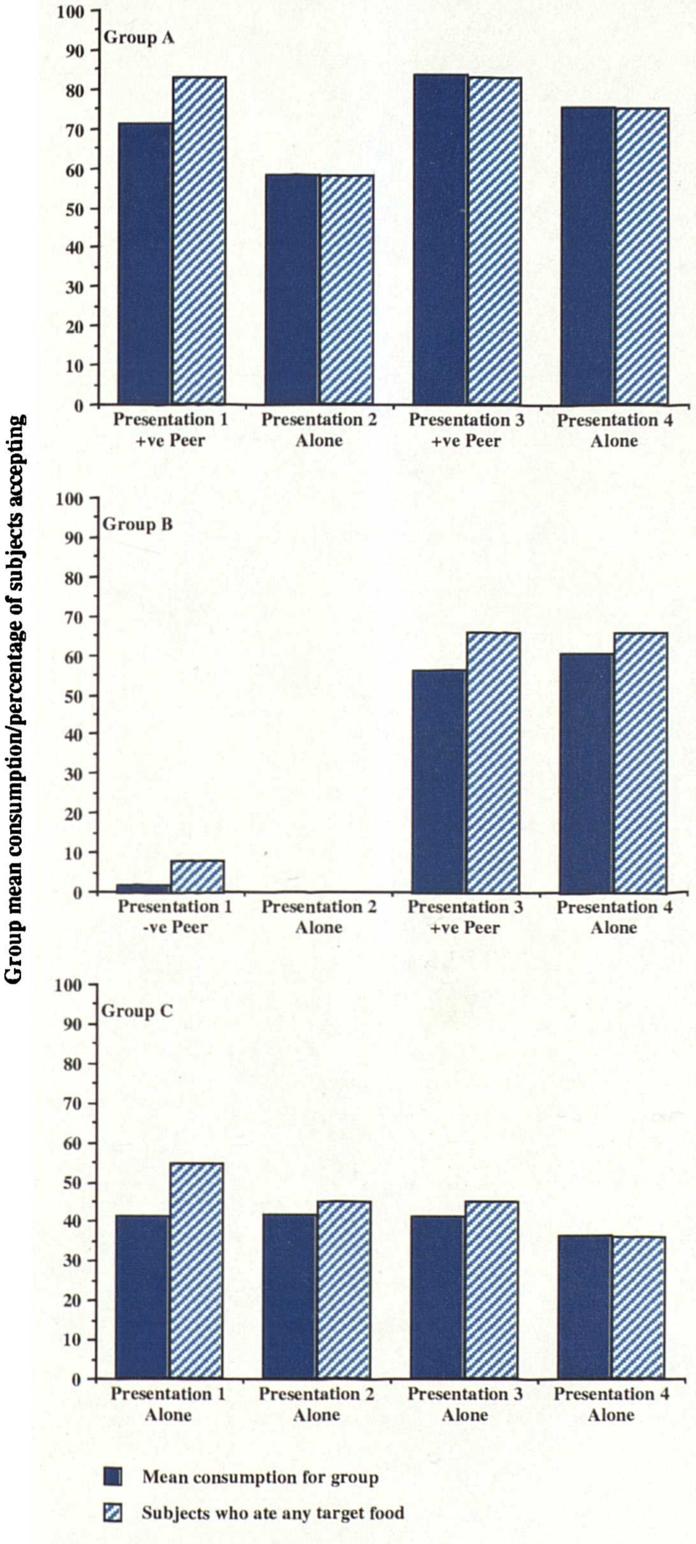
Table 2.4

A comparison of the number of subjects within each group who consumed any target food (during a presentation) with the corresponding group mean consumption level.

Legend:

Accept	Proportion of subjects consuming any target food
% Accept	Percentage of subjects consuming any target food
Mean	Mean target food consumption
P Bread	Potato bread

	Presentation 1			Presentation 2			Presentation 3			Presentation 4		
	Accept	% Accept	Mean	Accept	% Accept	Mean	Accept	% Accept	Mean	Accept	% Accept	Mean
Gp. A Quorn	5/6	83%	71%	2/6	33%	33%	5/6	83%	83%	4/6	67%	67%
Gp.A PBread	5/6	83%	71%	5/6	83%	83%	5/6	83%	83%	5/6	83%	83%
Gp. A Total	10/12	83%	71%	7/12	58%	58%	10/12	83%	83%	9/12	75%	75%
Gp.B Quorn	0/6	0%	0%	0/6	0%	0%	3/6	50%	42%	2/6	33%	33%
Gp.B PBread	1/6	17%	4%	0/6	0%	0%	5/6	83%	71%	6/6	100%	88%
Gp. B Total	1/12	8%	2%	0/12	0%	0%	8/12	67%	56%	8/12	67%	60%
Gp. C Quorn	2/5	40%	25%	1/5	20%	20%	2/5	40%	30%	1/5	20%	25%
Gp.C PBread	4/6	67%	54%	4/6	67%	67%	3/6	50%	50%	3/6	50%	50%
Gp C Total	6/11	55%	41%	5/11	45%	45%	5/11	45%	41%	4/11	36%	36%



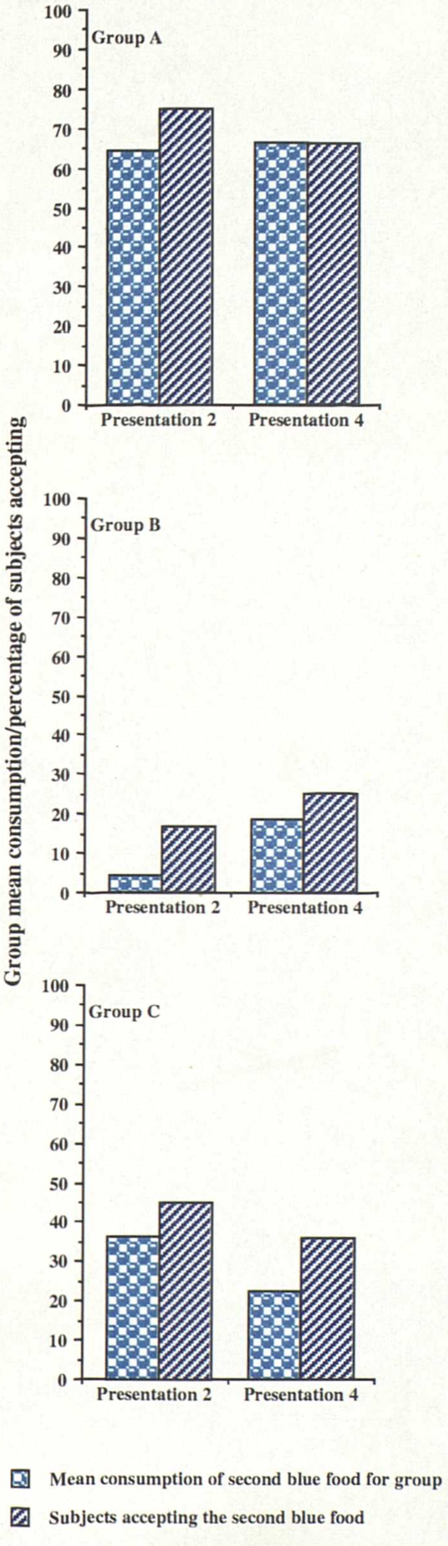


Figure 2.4: This compares group acceptance of the target food (i.e., the percentage of subjects within each group who consumed any of the target food), with mean consumption of the target food, across the four presentations of Experiment 1.

Figure 2.5: This compares group acceptance of the second food (i.e., the percentage of subjects within each group who consumed any of the second blue food), with mean consumption of the second blue food, during Presentations 2 and 4.

In the analysis presented above, the acceptability score is insensitive to the individual consumption patterns recorded within each group. For example, with some subjects in Group A, target food consumption was high and stable across the four presentations. Conversely, the consumption of other subjects in this group increased across the four presentations, or was only evident in the presence, but not the absence, of confederates. The comparison of acceptability and mean consumption is also insensitive to the degree of imitation recorded across subjects. For example, one subject may only consume 25 or 50 percent of the target food in the presence of peers, another subject may consume 100 percent of the target food. To examine the impact of the peer interventions on particular individuals, and to examine the performance across presentations, a more detailed (descriptive) analysis of individual consumption patterns is presented in Appendix 2.

2.4: DISCUSSION

The present results demonstrate that peer behaviour affected children's consumption of a food which was novel prior to the experiment: subjects' target food consumption tended to correspond to the behaviour of peers. The impact of peer influence was also evident: (i) when the target food was presented in the absence of peers, and, (ii) in the subjects' consumption of the second blue food, in some cases.

The present results suggest that negative peer influence is very effective in promoting rejection of the target (and second) food. In both the presence of negative peers, and during a subsequent presentation in their absence (i.e., Presentation 2), the consumption recorded with subjects in Group B was lower than that recorded with the other groups. The present results also demonstrated that positive peer influence enhanced the subjects consumption of the target food. Although Group A's consumption was not significantly different to that of the control group during Presentations 1 and 2, the potency of positive peer influence was clearly demonstrated in at least two ways, namely:

1. During Presentations 3 and 4 Group A's mean consumption of the target (and second) food was significantly greater than that of the control group (Group C). Given that a significant difference was observed during Group A's second exposure to positive peers, it may be that positive peer influence has a cumulative effect across time. However, the limited nature of the repeated measures in the present experiment prevent any firm conclusions regarding this point.

2. Within Group B, exposure to positive peer influence during Presentation 3 resulted in significant increases in target food consumption (relative to Presentation 1). Furthermore, this increase was maintained during Presentation 4 when the subjects were presented the foods in the absence of peers. Thus, positive peer influence can, to an extent at least, override the negative effects resulting from exposure to negative peers. However, within Group B the effects resulting from exposure to the positive peers did not generalise to the second blue food. Although negative peer influence was effective in promoting rejection of this food during Presentation 2, a similar effect in the opposite direction was not

recorded during Presentation 4. If, as suggested earlier, positive peer influence has a cumulative effect upon consumption, it may follow that subsequent exposure to positive peer influence may increase Group B's consumption of the second blue food.

These results are consistent with previous research examining the influence of peers' behaviour on children's food preferences (e.g., Duncker, 1938; Marinho, 1942; Birch, 1980a: see Chapter 1, Section 1.2.2). However, the present results extend this body of literature by providing data regarding the impact of negative peer influence on novel food consumption. To date no published research has manipulated negative peer influence as independent variable, when examining peer behaviour and novel food consumption. Such influence appears to have a potent impact upon the consumption of a novel food, and may be more powerful than positive peer influence (in the five to seven age range). When the negative peers were present *only one* subject consumed any target food (at the 25% level), and *none* of the subjects consumed the food when presented in the absence of peers (during Presentation 2). Rozin (1986) notes that the animal literature (e.g., Garcia, Ervin, & Koelling, 1966) supports the view that aversions are established more readily than preferences or likes (with respect to one trial learning). Such a negative learning bias is perceived to have survival advantage (also see Rozin & Fallon, 1987, p.32). Nevertheless, it is noteworthy that "aversions" of the type created in the present experiment can be overridden through exposure to positive peers.

The findings regarding negative peer influence confirms what has been observed anecdotally, and may be particularly relevant to the applied researcher/clinician. For example, when trying to promote consumption of a particular food, it may be useful to ensure the client has minimal exposure to peers who reject the target food. Further research is necessary to establish the validity of such claims, for example, the effects of negative peer influence may be transient (the present design precludes any conclusions regarding the long term effects of peer behaviour).

Although consistent with previous research, a comparison of the present results with previous research is hindered because of the different outcome measures used. As noted in Chapter 1 much previous research has relied upon measures of stated preference or choice. Furthermore, in cases where consumption measures have been reported, the effects of peer interventions are somewhat unclear. For example, a study conducted by Birch (1980a) was described in Chapter 1. During this experiment, Birch exposed subjects to a four day peer intervention, during which subjects were offered a choice of vegetable A or B. The peer intervention targeted vegetable A, however, the consumption of this vegetable remained constant across the four day period. Across the same period, the consumption of vegetable B decreased. Hence, by the final day of the intervention, consumption of the target vegetable accounted for a greater *proportion* of total experimental vegetable consumption than was the case on the first day of the intervention. Although Birch reports this as a significant effect of the peer intervention, it could also be argued that the peer intervention was merely successful in *decreasing* consumption of the non-target vegetable.

The results of the present experiment clearly demonstrate the impact of peer behaviour on the subjects' *consumption* of the target food. Although the designs of the present experiment and Birch (1980a) are very different, and preclude direct comparison, it will be useful to examine variables which may account for the observed differences with respect to consumption (Birch reports very clear effects with respect to stated preferences).

First, different foods were used in the two experiments. In the present study the foods were created for experimental purposes, in order to control for previous exposure history. Birch (1980a), on the other hand, used pre-existing foods (vegetables). Modelling/peer influence may impact more readily in cases where there is little or no history with respect to a given food.

The second issue concerns the status of the peers/confederates. In Experiment 1 the peers were trained confederates, thus the experimenter had control over what they said, and whether or not they consumed the target foods. In contrast, Birch (1980a) appears to have relied upon "natural" peer influence in that the peers were not trained to engage in any particular behaviours (these children exhibited a positive stated preference for the target food prior to the experiment). Such procedures will not, for example, ensure that the peers reliably consume the foods, or provide any positive overt verbalisations regarding the foods. Consumption could actually be accompanied by negative verbalisations; "I only eat this because grown-ups force me to". Hence, the modelling context of the present experiment may have been very different to that of Birch (1980a).

Further research could establish whether it is indeed necessary to train peers to engage in certain overt verbal and non-verbal behaviour (as in the present experiment). Depending upon the value of "natural" peers, it may be necessary to incorporate other components into the peer based intervention (e.g., token rewards: c.f., Greere et al, 1991). If confederate verbalisations are demonstrated to be necessary, researchers could select "natural" models who will be most likely to engage in overt verbalisations. Such a strategy may circumvent the practical problems associated with peer training (e.g., "unnatural performances").

The confederate verbalisations (and other behaviour) may serve a number of functions in the modelling scenario. First, the confederate verbalisations may facilitate the operation of vicarious reinforcement/ punishment (see, for example, Kazdin, 1979, 1989; Ollendick, Shapiro, & Barrett, 1982). For example, confederates providing positive peer influence stated:

"I've had this blue stuff before and it's really lovely"
"Let me taste it.....Yes, it is fantastic!"

Conversely confederates providing negative peer influence said:

"I've had that blue stuff before and it is gross"
"I'll taste just a tiny bit.....Uch, it's revolting!"

Coupled with the non-verbal behaviour (e.g., facial expressions of disgust), such behaviour may convey to the subjects that positive or negative consequences are available by consuming/rejecting the food.

Behavioural researchers (e.g., Gewirtz & Stingle, 1968; Ollendick et al, 1983; Deguchi, 1984; Baer & Deguchi, 1985) have emphasised the role of direct reinforcement in the promotion and maintenance of imitation and observational learning. Hence, although vicarious reinforcement may be effective in the short term, its effects are likely to be transitory if the imitation is not directly reinforced (see Deguchi, 1984). For example, Deguchi, Fujita, and Sato (1988) demonstrated that children *initially* imitated a video model who was observed to be rewarded for a lever pressing behaviour. However, imitation tended to decrease across time (repeated measures) if subjects were not provided with external rewards for performing the observed task (see also Section 1.3.3).

Given the restricted time course and evaluation of the interventions in the present experiment, little can be said about the impact of the peer interventions in the long term. The interventions in the present experiment may simply change behaviour in the very short term. Also, given that the subjects were not presented contrived consequences for imitation, decreases in imitation across time, similar to those reported by Deguchi et al (1988), may be expected. However, control by direct consequences may have occurred in the present experiment in at least two ways (these consequences may not, however, increase the long term effectiveness of the interventions).

First, the natural consequences of consumption may have been effective in controlling the subjects behaviour. Skinner (1989) has argued that imitating a model may bring the observer's behaviour under the control of the same contingency controlling the model's behaviour. For example, subjects in Group A may have imitated the confederates in order to contact the taste of the target food. Natural consequences of consumption (e.g., taste) may account for the observed trend of higher potato bread consumption. That is, subjects presented the potato bread continued to consume this item in the absence of peers because of the natural consequences of this behaviour. Conversely, the natural consequences of quorn consumption may not have been sufficient in many cases to maintain consumption in the peers absence.

Given that the confederate verbalisations made a verbal reference to the consequences of consumption, the subjects' behaviour (i.e., acceptance or rejection of the food) may have been under verbal or instructional control. Because the confederates made reference to a behaviour and its natural consequence, the verbalisations may have functioned as tracks for the subjects to follow (see, Zettle & Hayes, 1982). However, the confederate verbalisations may have promoted pliance (or counter pliance) on the part of the subjects, and this is the second way in which direct consequences may have controlled the subjects' behaviour.

The confederate behaviour may have implied the operation of social contingencies surrounding the consumption of the target food. Confederate verbalisations may have implied consequences other than those directly concerning the properties of the food. For example, the subjects may have perceived a failure to imitate as increasing the chances of contingent punishment (group/social rejection) or positive reinforcement (group/social acceptance). This may account for the behaviour of the subjects who reliably imitated in the presence of peers, but failed to do so in the absence of peers.

However, it is necessary to point out that although a subject's behaviour may be initially controlled by the implicit social contingencies surrounding the confederate behaviour, the natural consequences of consumption may subsequently control the target response.

The peers verbalisations may also be useful in accounting for the generalisation which was evident in the consumption of the second blue food. Generalisation may have resulted from the physical similarity of the two foods. For example Skinner (1953) notes that:

> If we reinforce a response to a round, red spot one square inch in area, a yellow spot of the same size and shape will be effective because of the common properties of size and shape; a square, red spot of the same area will be effective because of its color and size; and a round, red spot half a square inch in area will be effective because of the common properties of color and shape. (p. 132)

In the context of the present experiment, however, generalisation may result from the verbal behaviour of the confederates. Essentially, the subjects were instructed, by the confederates, that blue foods were either good or bad.

A number of modifications could be incorporated into future research to begin to examine the account appropriate for the present results. First, if the confederate verbalisations are functioning as tracks, rule following will not be controlled by apparent speaker mediated consequences. Hence, the tracks could be provided through various mediums (e.g., by an experimenter, a televised model, in written form), and rule following should still be observed. Another modification would be to reduce the impact of the implicit social contingencies. For example, subjects could observe the confederates through a one-way mirror, or on television. This would expose the subjects to vicarious reinforcement/punishment, and the appropriate verbalisations, but may reduce the impact of the implicit social contingencies. Finally, subjects could be exposed to models who do not engage in overt verbal behaviour relating to the target food or its consumption.

The variability within and across groups is likely to mean that the accounts proposed above will be more or less accurate with particular subjects. For example, a generalised imitation account would predict that simply observing a model consuming a food (i.e., the model does not engage in any other perceptible overt behaviour) will be sufficient to promote consumption with some subjects. Accounts of generalised imitation (e.g., Gewirtz & Stingle, 1968; Baer & Deguchi, 1985) argue that imitation constitutes a response class which will be intermittently reinforced. Conversely, as demonstrated in the present experiment, peer interventions may be ineffective with particular children. In these cases the addition of an imposed contingent reward component to a peer intervention, may increase the likelihood of imitation being observed.

The subjects in the present experiment were presented the foods in both the presence and absence of the confederates. Given that subjects often consumed the foods in the absence of the confederates (during Presentations 2 and 4), it would be tempting to conclude that peer influence will result in more than "mere compliance" on the part of the subjects. As suggested, this pattern of behaviour could be discussed in terms of promoting tracking as opposed to pliance. However, it is not clear the extent to which the apparent social consequences continued to operate with some subjects when presented the foods in the absence of peers. All the food presentations were carried out in the same nursery, a context which was unfamiliar to the subjects. The subjects had met the confederates during the physical activities (prior to the food presentations), and then again during some of the snack sessions. The subjects may have perceived the confederates as "the older children who appear every so often". Hence, although the confederates were physically absent during some presentations, their influence may have been operative (see also, Birch, 1980a). However, evidence against this is provided by cases where subjects consumed the target foods only in the presence of peers. With these subjects at least, social contingencies were not perceived to be ubiquitous to the extent that compliance was promoted in the peers' absence.

In conclusion, at least two variables have been identified which may have controlled the subjects consumption in the present experiment: implicit social contingencies, or the natural consequences of target food consumption/ rejection. Given the limited time course of the present experiment, little can be said regarding the long term effects of the present intervention. However, it may be that control by natural consequences of consumption (e.g., taste) may be more likely than the implicit social contingencies, to maintain consumption beyond the experimental context.

As stated earlier, the interventions, and their assessment, were brief, thus little can be said about the development of behaviour across time, or the maintenance of behaviour change. Similarly, the circumstances under which behaviour was recorded were contrived, and the foods presented were novel. Hence, the extent to which these results may be extrapolated to natural environments and the promotion of consumption of normal foods is unclear. In the light of this, the remaining experiments reported in the thesis present a more intensive analysis, examining changes in consumption across time. During these experiments, behaviour is continually sampled across time as opposed to a reliance upon snap shot measures.

The extent to which modelling may be employable in natural settings will depend upon many practical constraints (e.g., the availability of appropriate models). Nevertheless, the present results do highlight the short term potency of peer behaviour in determining whether children consume a novel food. In light of this, the interventions reported in the following chapters contain a modelling component. In order to overcome the practical problems associated with *in vivo* models, televised models will be employed.

CHAPTER 3

MODIFYING CONSUMPTION OF PREVIOUSLY REFUSED FOODS

GENERAL METHOD FOR EXPERIMENTS 2 - 5.

3.1 INTRODUCTION

Experiment 1 demonstrated that it is possible to promote consumption of a novel food with children aged between five and seven years, and this was the case even with children with a history of rejection of the particular food item (Group B subjects who were exposed to negative peer influence initially). However, the experiment investigated only short term acceptance or rejection, hence from its results we can say little of the promotion, maintenance, and development of *stable* consumption patterns. For example, would the trends in acceptability (across all groups), increase or decrease if presentations were continued in the absence of any peer pressure? Would Group A subjects (exposed to positive peer influence) continue to accept the target item, or would a decline in acceptability be recorded if further interventions were not implemented?

The experiments reported in the following three chapters examined not only whether it is possible to alter consumption in the short term, but also whether it is possible to produce permanent shifts in consumption over time. Thus this series of "home based" experiments had a twofold purpose, namely: (i) to examine the possibility, using behavioural techniques, of modifying children's consumption of previously refused foods; and (ii) if this modified consumption were achieved, to maintain it over a number of presentations.

A series of intervention packages was developed. They were designed to promote (and maintain) consumption of previously refused foods. The data presented in Experiments 2 and 3 concerns the development of these packages, which incorporated video modelling, instructions, and rewards. An analysis of the effectiveness of some of the components (in relation to the complete package) was carried out during Experiments 4 and 5.

Each experiment was conducted in a home environment over a period of several months. Target behaviour was recorded during the family evening meal. Single case methodology was used to examine the effectiveness of the various intervention packages.

3.2: General Method

Participants

Subjects

Sixteen children aged between five and seven years participated in four experiments. To recruit subjects, a letter describing the aims of the research programme was sent to parents of children attending local primary schools. An experimenter interviewed any parent(s) of eligible subjects (see below) who had returned a reply slip attached to the letter. Interviews were conducted at home (in the absence of the children), after which parents indicated their willingness for their child to participate in an experiment.

Only those children meeting the following criteria were eligible to participate in any of the four experiments: (i) they reliably refused, or had never tried, a number of fruits and/or vegetables (according to parental report); and (ii) they did not have an older sibling less than 15 years of age.

None of the children were told (whilst participating) that they were subjects in an experimental study.

Parents

The socio-economic background of participating parents was not controlled, but this varied across the whole spectrum of British society from long term unemployment to affluent double incomes.

Prior to the beginning of each experiment, at least one parent in each family agreed to: (i) allow an experimenter to visit the home regularly, at a time when no contact with the subject would occur (e.g., when the subject was at school, or in bed - usually the former); and (ii) to implement experimental procedures in accordance with written and verbal instructions. Parent - subject interactions, relating to experimental procedures, were continuously monitored on video (see *Recording equipment*, below) and, when necessary, feedback to parents was provided.

Setting and Foods

The experiments were carried out in the subjects' homes, and the target behaviour was recorded during regular family meal times. Parents were required to present a number of experimental foods (i.e. specified fruits and/or vegetables) in addition to the regular evening meal on five occasions each week (usually with the weekday evening meal). Each experimental food was either fresh, frozen, or tinned as determined by the following factors: (i) availability for the duration of each experiment, hence exotic fruits tended to be tinned; and (ii) ease of preparation (e.g., tinned pulses were used). Wherever possible fresh varieties were used. Each experimental food was presented in a portion of approximately 30mls. The constitution of some foods (e.g. broccoli, cauliflower, baby sweetcorn) permitted them to be portioned by an experimenter prior to delivery. The portions of other foods (e.g. tinned pulses, raspberries, coleslaw) were measured out by parents, using a 30ml measuring scoop (provided by the experimenter).

Equipment

Recording equipment

A video camera (Panasonic WV-CD2E colour CCTV) was installed in the dining area of each subject's home to allow audio and visual recording of his or her behaviour during the evening meal. The camera was focused to yield an image which included the subject's head and upper body, and the plate containing the evening meal. In the majority of cases the subject was the only member of the family to be included visually on the recording.

The camera imaging head was disguised as a smoke detector, and was attached to a spotlight rail mounted on a wall, with two other fully functional spotlights (see Fig 3.1). The signal received by the camera was sent (via concealed cables) to a video recorder (Ferguson Videostar FV41R) hidden in a cupboard (or similar place). The equipment was controlled by a remote switch which could be operated by the parents.

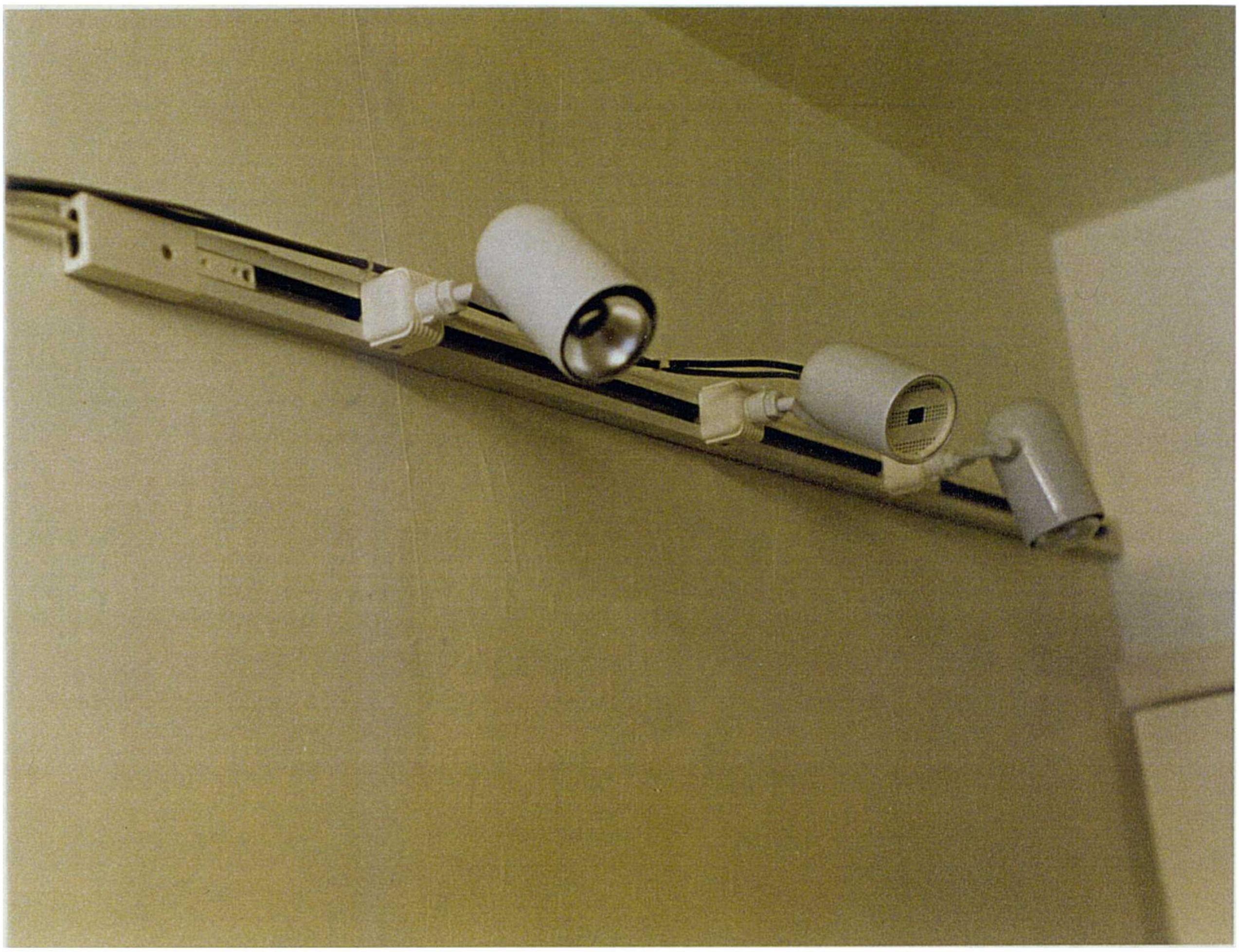


Figure 3.1

A photograph of the recording equipment as seen from the subject's viewpoint when installed in the family dining room.

Diaries

Parents were supplied with a diary. This was used by the experimenter to specify the presentation schedule for the experimental foods, and by parents to record the following information: (i) subjects' target behaviour (see *Target behaviour and measurement*); (ii) where applicable, siblings' experimental food consumption; (iii) the ingredients of the evening meal; (iv) people present during the meal; (v) any other relevant information (e.g. subjects' experimental food related comments made off-camera).

Films

A series of short video films (each lasting approximately eight minutes) was produced at the School of Psychology, Bangor. These were given to parents to enable them to implement one or more of the interventions during each experiment. The films depicted a group of heroes, older children called "The Food Dudes", doing battle against an evil gang of adult "baddies", called "The Junk Food Junta". In each film the Food Dudes monitored the "life force" of the earth (an imaginary force around the earth), while the Junk Food Junta attempted to destroy it by getting people to eat junk food. In order to beat the Junk Food Junta, and keep the Life Force strong, the Food Dudes had to consume "Vital Life Force Foods" (i.e. experimental fruits or vegetables), and encourage other children to consume these foods. Thus in each video the Food Dudes modelled consumption of one or more of the experimental foods, and they extolled the food's virtues. In a message section at the end of each film two Food Dudes, one boy and one girl, asked the viewer to join the struggle by eating the featured target food or category of foods. This message section was used to instruct the subjects to perform the target behaviours, and, where appropriate, to describe any experimenter-imposed contingency that was in operation.

Although this basic film structure was used in each experiment, the content of the end message, and the sequences featuring foods and modelled consumption, were edited to allow the implementation of different experimental conditions. The nature of these edits are described, where necessary, in the *Method* section of each experiment.

Question cards

A series of A4 question cards was produced to accompany the series of Food Dude intervention films.[1] Each time a subject viewed a Food Dude intervention film, he or she was required to complete a question card; this required the subject: (i) to name the target food(s), or food category featured in the film; (ii) to answer two questions relating to the general content of the film; and, (iii) following a subsequent evening meal, to state how much of the featured food(s) he or she had consumed. These cards were designed to encourage the subjects to monitor their performance of the target behaviour. The procedures of some of the experiments required slight modifications to be made to these cards; these will be described in the relevant *Method* sections where appropriate.

Rewards

Stickers, badges, baseball caps, and t-shirts bearing the Food Dudes logo were used as rewards in all experiments. Sticker charts were created using A4 pieces of card bearing the Food Dudes logo; an example is given in Appendix 3A. In addition, for each subject, parents were required to choose a selection of inexpensive toys (costing less than £3.00), and one more expensive toy (costing up to £20.00).

A token reward system was also used in Experiments 2 and 3. Parents were sent a number of different coloured stickers, the tokens, and a non-decorative chart onto which these could be placed. In each case the back-up reward was a family day trip to a theme park (or similar destination).

Dependant Variables and Recording

Target behaviour

The dependant variable in all the home-based experiments was the quantity consumed, by the subject, of the particular experimental foods presented during a given evening meal. Consumption was defined as food being taken into the mouth and ingested; food placed into the mouth and spat out did not qualify as consumption.

[1] These were not used during the first intervention in Experiment 5.

Data collection

Parents were trained during the Prebaseline phase to measure experimental food consumption using the following observational scale:

(a) 0 (b) up to 25% (c) > 25 to 50% (d) > 50 to 75% (e) > 75 to 100%

Training involved verbal instruction and, when necessary, corrective feedback was provided by an experimenter. Where possible, foods were portioned in a way which aided measurement. For example, if subjects were presented with mange tout, four pieces would be served: if the subject ate any or all of one piece, the parents were instructed to record 25 percent consumption; if the subject ate all of one piece and any or all of a second piece, consumption was recorded at 50 percent; and so on.

Parents had little difficulty using this measurement scale and 100 percent agreement between parental estimates of consumption, and an experimenter's estimations of subject's consumption from video recordings was obtained within one or two sessions.

Data collected during the home-based experiments revealed that subjects' consumption tended to fall at the upper end of the categories used in the observational scale. For example, if a parent rated a subject's consumption to have occurred within category "d", that is, the range of above 50 percent up to 75 percent, in the majority of cases actual consumption would have been 75 percent (or very close). Cases where consumption was recorded as being just within the lower boundary of each category (e.g., in the present example, 52% or 55%) were rare. The only exception to this was category b (up to 25%) which incorporated small nibbles of the foods, by the subjects, where the actual amount consumed may have been 5 percent (if measurable).

Given these patterns of consumption, when reporting consumption amounts in subsequent chapters, the upper range in each category will be used; that is, consumption will be described using one of the following: zero, 25 percent, 50 percent, 75 percent, and 100 percent (each of which correspond to the five categories of the observational scale).

Practical constraints prevented the use of a more accurate measure. A weighed comparison before and after presentation was an option initially considered. However, due to the time scale of each experiment, it was felt that such a refinement imposed upon parents may have resulted in fatigue, and thus have countered compliance. The presence of the recording equipment allowed the experimenter to monitor the parental estimations of consumption and to ensure, as far as possible, that the consumption measures were reliable.

Reliability

To assess the reliability of each parent's measures of consumption, a second observer viewed a random selection of at least 25 percent of the video-recorded evening meal sessions for each subject and estimated experimental food consumption, using the observational scale described above. These sessions were evenly distributed across all the experimental phases excluding follow-ups (the recording equipment was removed prior to follow-up presentations). To avoid possible bias, the second observer was unaware of experimental procedures and conditions.

The Percentage Agreement Index (PAI) was used to calculate the agreement, or otherwise, between parent's consumption estimates, and those of the second observer. This index calculates the percentage of times that two observers agree that a target behaviour occurred (Suen & Ary, 1989). The PAI is calculated using the following formula:

$$p\% = \frac{\text{No. of agreements}}{\text{No. of agreements + No. of disagreements}} \quad \text{X } 100$$

Values of $p\%$ range from 0% to 100% (Suen & Ary 1989).

According to Suen and Ary (1989), the PAI is the most widely used of the inter-observer agreement indices. Another measure, the Smaller/Larger Index, which is also frequently employed by researchers, was also considered for use. This index compares only the sum totals of each observer's records and thus has important shortcomings. Consider the following example: A parent estimates a subject's target food consumption on eight occasions, recording 25 percent consumption on each of the first four occasions, and zero on the remaining four. A second observer records the exact opposite (i.e., zero consumption on the first four, and 25 percent consumption on the last four). A comparison of the sum totals of estimated consumption would yield an agreement index of 100 percent, without the two observers ever agreeing in any single instance.

While the PAI overcomes this problem, it has been criticised on the grounds of its susceptibility to inflation by chance agreements. Such chance inflation is more likely to occur when the target behaviour occurs at either very high or very low levels. Suen and Ary (1989) give the example of two observers who record the occurrence of a behaviour which actually occurs at a low frequency, for example, one which occurs on only five of the 100 sessions viewed. The first observer may correctly report the occurrence of the behaviour on the five occasions. The second observer may, because of fatigue or distractions, fail to report the occurrence of the behaviour at all. Using the PAI an agreement index of 95 percent would be calculated. Hence, while it appears that there is consistency, this may be due in large part to chance because the two observers never agreed about the occurrence of the behaviour.

Because observers in the present series of experiments were required to apply a measuring scale (described above) to the target behaviours, it may be argued that the PAI was less likely to be inflated by chance agreements. The parents and second observers were required to report whether the target behaviour occurred or not during a given session. In cases where consumption *was* recorded, both observers had also to report the level at which it occurred, that is, the amount consumed. For example, a parent may report 25 percent target food consumption during a given session. The second observer when watching the same session may report target food consumption at the 50 percent level. Although both observers report *the occurrence* of the target behaviour, they disagree with respect to the amount consumed, and this is recorded as a disagreement. Hence, the possibility of the PAI being spuriously inflated by chance agreements is reduced, at least in cases where consumption is said to occur.

This calculation, however, will yield a relatively conservative measure of reliability: this is because it is likely to be insensitive to the *degree* of any disagreements recorded. For example, a parent may report that a subject consumes 100 percent of the target food while the second observer may report 75 percent consumption. This would be recorded as a difference, as would the case where a parent reports 100 percent consumption and the second observer reports zero consumption. In the former example the difference between the two reports is small: one category difference. In the latter case, the reports are polarised. Further, in the former case both observers would report consumption *to criterion or above*, (see Experiment 2, *Procedure*) while this is not so in the latter case.

Small differences (i.e., one category difference) in reported consumption may be expected, at least in some cases, given that the conditions under which the two observers estimate consumption were different. Typically, the parent was very close to the subject when estimations were made, whereas the second observer was viewing a video recording of the meal where the ability to discriminate between different foods on the plate was reduced.

In light of the above problems, a second PAI was calculated. In this calculation the estimates of consumption were collapsed into one of two categories: above criterion and below criterion. In the present series of experiments, this was a most important behavioural distinction given that one of the main aims was to examine the effectiveness of interventions to increase consumption from below criterion to above (i.e., from below 75% to above 75%). This modified PAI was calculated as follows:

$$p\% = \frac{(A + B)}{(A + B) + (C + D)} \times 100$$

Where: A = Number of agreements of consumption above 75%
B = Number of agreements of consumption below 75%
C = Number of disagreements of consumption above 75%
D = Number of disagreements of consumption below 75%

This modified PAI may have been more likely to be inflated by chance agreements, and hence may be open to some of the criticisms discussed above. However, an examination of the PAI and the modified PAI in combination should provide a more informative measure of reliability.

Finally, in cases where disagreements were recorded, the size (i.e., the number of categories between the two observations) of the difference was graphed. If in the majority of cases the difference was of one category (e.g., 25% versus zero) this may reflect the different conditions (i.e., in situation versus video recordings) under which the observations occurred. If, however, a large proportion of four category differences (e.g., zero versus 100%) were recorded, this may cast doubt on the reliability of the measures.

Experimental Design

In each of the four home-based experiments, a multiple baseline design was used to evaluate the effectiveness of the various intervention packages. In the first home-based experiment (Experiment 2, reported in Chapter 4), a multiple baseline design across children and food category (i.e. fruits, vegetables and pulses) was used. In the subsequent experiments, however, only a multiple baseline design across food category was used. The multiple baseline across children element of the design was deemed unnecessary following an examination of the data generated by Experiment 2. No reliable differences across the children's consumption attributable to the differential exposure histories during the initial baseline phase was observed. Further, the number of exposures in baseline was not differentially predictive of the effectiveness of the intervention. This change in design had the added benefit of increasing the time efficiency of this experimental investigation.

Multiple baseline designs allow the control of extraneous variables by applying an intervention to one behaviour while continuing to monitor other behaviours. If the frequency of a behaviour changes only after the intervention has been applied to each one in turn, the possibility that the changes are due to variables other than the intervention is unlikely (Kazdin, 1982; Barlow & Hersen, 1984).

With respect to the present series of experiments, the multiple baseline design also allows for an examination of the effectiveness of an intervention within and across food categories. For example, certain interventions may prove more effective with one category of foods than with another.

For subjects with younger siblings, above the age of two, yoked procedures were employed. Here the behaviour of the subjects dictated both their own and their siblings progress through the experiment. Hence experimental food selection was based on the subject's rejection of the food, even if the sibling consumed the food reliably. Also, during the intervention phases, which involved experimenter-imposed reward contingencies, rewards were administered to both subject and sibling based on the performance of the subject alone. This design was used because of reports from parents which suggested that rewarding only the subject could lead to friction between children in the same family.

Procedure

During the course of each experiment the participating children were not told that their meal time behaviour was being video-recorded. An experimenter visited the home of each family regularly throughout each experiment, varying between three to five occasions per week, depending upon the particular experimental phase. During the visits the experimenter: (i) delivered experimental foods to the parent(s); (ii) administered instructions and materials enabling the parent(s) to appropriately implement the various experimental phases; and (iii) changed video tapes in order to enable constant monitoring of the subjects' target behaviour. When necessary, parents were also given feedback regarding their compliance with experimental procedures and instructions.

At the beginning of each experimental phase the parent(s) of each subject were given spoken and written instructions informing them about experimental procedures. In all phases of all the home-based experiments parents were instructed as follows:

1. *Please record each day, with the video equipment supplied, the normal evening meal.*

2. *It is crucial that you* ***neither encourage nor discourage the eating of the additional [experimental] foods.*** *Simply eat your own portions without comment. You should deal with your child's eating of the normal meal in the normal way, but please do not comment on the amount of additional food that is or is not eaten.*

3. *Please avoid presenting the additional foods at other meals.*[2]

4. *It is important that you present the amount of additional food specified in the diary. These foods should be presented exactly as indicated in the diary schedule, regardless of your child's response.*

During each experiment, the experimental foods were presented (to each family member present) as part of the regular evening meal, five evenings each week. The experimental vegetables were presented on the same plate as the other ingredients of the evening meal. The experimental fruits were presented after the main meal, and before the regular dessert (if one was presented). The fruits were presented in stainless steel bowls provided by the experimenter. These bowls were oval, measured approximately 20 cm x 14 cm, and were divided into two compartments, thus allowing two fruits to be kept separate. If only one fruit was presented, parents were instructed not to put any other food (e.g., ice cream) in the empty compartment.

Prebaseline

The prebaseline phase served a number of experimental purposes. At the beginning of this phase the recording equipment (described above) was installed into each participating household. Following an habituation period of between three and five days, food presentations began.

For the remainder of this phase, subjects and other family members were presented with a wide range of fruits and vegetables. This allowed the experimenter to identify a number of these foods which were reliably

[2] This allowed the experimenter to control the level of exposure that each subject received to the experimental foods, but did not apply to the Prebaseline phase of any experiment. The Prebasleine phase was used to determine the items to be presented as experimental foods.

refused by each subject, but accepted by the parents.[3] The criterion for reliable refusal was zero consumption by the subject on at least three consecutive test days during the prebaseline phase.

Ensuring that the parents (if normally present at the meal) consumed the experimental foods allowed the experimenter to keep constant throughout the study any possible effects arising from the parent(s) modelling the target behaviour.

This phase also familiarised parents with the general experimental procedures prior to the beginning of baseline trials.

During Experiments 3, 4, and 5 this phase was also used to assess each subject's knowledge of basic food categories (i.e., fruits and vegetables). This was deemed necessary as the interventions employed in each of these experiments were applied to categories of foods (as opposed to specific named food items as in Experiment 2). Lack of modified consumption following the application of a given intervention package may result from either: (i) an ineffective intervention package, or (ii) the subject's ignorance of the items constituting the targeted category. The assessment procedure is described in Chapter 5 (*Method*).

Baseline

The baseline phase began when the appropriate number of experimental foods had been determined for each subject (see the *Method* section of each experiment for information relating to the specific numbers of experimental foods presented, and the category from which each was drawn). Subjects were presented with each experimental food on at least three occasions; this is the minimum number of presentations required to establish a trend in responding (Barlow & Hersen, 1973; Barlow & Hersen, 1984).

At the beginning of baseline an experimenter reminded the parents of the instructions given to them at the beginning of the prebaseline phase.

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[3] In a small number of cases the experimental foods were not accepted by one parent in the family - see individual experiments for information concerning this.

Intervention phases

Across the four home-based experiments, various intervention packages were systematically introduced after the baseline phase. In all cases, the interventions centred around the Food Dudes theme described earlier. Further, all interventions involved an experimenter-imposed reward contingency being introduced with respect to each subject's consumption of some or all of the experimental foods. The only exception to this was the first intervention implemented during Experiment 5.

A complete description of the intervention packages introduced during each experiment is provided in the appropriate Method sections.

All the interventions were implemented by the subject's parent(s), following instruction from an experimenter. Designing intervention packages based on the Food Dude theme had a benefit in that it was less likely that the parents would be (incorrectly) perceived by the children as the contingency-managing agents. Any experimenter-imposed contingency was described in (Food Dude) films or letters. Further, instructions to consume the experimental foods were provided by the Food Dudes (not the parents). Finally, subjects were told (by parents) that any Food Dude related material arriving at the their homes (letters, videos, rewards etc.) had been sent by the Food Dudes, independent of the parents.

It was intended that this design feature would reduce the possibility that any parent would reward his or her child inappropriately (e.g., in response to the child's badgering of the parent). Some parents may have experienced difficulties implementing and managing reward contingencies effectively in the past. The present design may circumvent any such parent-child history. This may be particularly pertinent when implementing contingencies to alter children's consumption of previously refused foods. Many parents experience some form of difficulty concerning their child's eating (Harris 1994; Pliner & Pelchat, 1986), and meal times for both parents and children can often be anxiety provoking and result in conflict (Birch 1990; see also, Pliner & Pelchat, 1986; Rozin, 1991). Given such a history and context, parents may experience difficulty implementing an intervention rigorously and thus undermine the experimental contingencies. The intervention may have little effect for this reason alone.

CHAPTER 4

EXPERIMENT 2: A FOOD SPECIFIC INTERVENTION TO INCREASE CONSUMPTION OF PREVIOUSLY REFUSED FOODS

4.1 INTRODUCTION

The purpose of this experiment was to examine the effectiveness of an intervention package designed to modify the consumption of previously refused foods (fruits, vegetables, and pulses). Following a period of "mere exposure" subjects were exposed to a series of interventions designed to increase the consumption of a number of specific targetted foods, referred to by name in the interventions (e.g., broccoli, blackeye beans, and kiwi fruit).

Two interventions were employed. The initial intervention package included: (i) a series of Food Dude intervention films, a series of video films, and (ii) an imposed reward contingency. Thus, in the course of the intervention, subjects were exposed to video models consuming the target food (e.g., broccoli), and a verbal instruction and contingency description (e.g., "eat broccoli and you can win a prize"). Subjects were repeatidly presented with a total of six foods (2 fruits, 2 pulses, and 2 vegetables), three of which were targetted using the intervention package. The second intervention package, which also targetted specifically named foods, utilised token rewards in an attempt to maintain any modified consumption resulting from exposure to the previous intervention.

4.2: METHOD

Participants

Subjects

Four children participated. Three were girls (Brenda, Susan and Rachel) and one a boy (John). Their mean age at the start of the experiment was 79.25 months, or, approximately, 6.6 years. All the children had a younger sibling. Pertinent details of each subject are provided in Table 4.1, below.

Table 4.1. Subjects who participated in Experiment 2.

Subject	Gender	Age at start	Sibling gender	Sibling age
Rachel	Female	6.42 years	Male	3.58 years
John	Male	6.08 years	Female	3.75 years
Brenda	Female	7.16 years	Female	4.08 years
Susan	Female	7.00 years	Male	4.67 years
Mean age of subjects at start = 6.67 years				

Parents

Neither Rachel's nor Brenda's father was present for the majority of meal presentations (this was because of employment commitments); in all other cases both parents were usually present at meals. However, because Susan's father had a medical condition, he was not presented with the experimental foods.

Foods

Six experimental foods were selected for each subject. In all cases experimental foods were presented in three pairs - two pulses, two fruits and two vegetables. Each evening one pair of experimental foods was presented to the subjects. One food in each pair was a *target food* (i.e. it was subject to intervention); the second food served as a control (to test for generalisation). The specific foods presented to each subject are shown in Table 4.2.

Table 4.2. Foods presented to each subject during Experiment 2

Subject	Food status	Fruit	Pulse	Vegetable
Rachel				
	Target	Kiwi	Blackeye beans	Celery
	Control	Lychee	Butter beans	Coleslaw
John				
	Target	Guava	Blackeye beans	Broccoli
	Control	Lychee	Chickpeas	Cauliflower
Brenda				
	Target	Guava	Blackeye beans	Broccoli
	Control	Mango	Chickpeas	Sprouts
Susan				
	Target	Kiwi	Blackeye beans	Celery
	Control	Guava	Butter beans	Broccoli

Equipment

Two versions of the Food Dude video film, a "Primer video" and an "Intervention video", were used during this experiment. Both versions contained the features described above (see *General Procedure,* Chapter 3). There were, however, the following additions:

The Primer Video (PV1)

The food featured in this version of the Food Dudes video film was jack fruit - a food which was not presented to any of the children throughout the experiment.

At the end of the film a voice-over message informed the viewer: (i) that he or she had been chosen as a *possible* member of the Food Dudes Club; and (ii) that he or she could find out how to help the Food Dudes and thus "win some fab prizes" (by watching the Food Dudes film to be sent the following day).

The Intervention Video (IV1)

Five versions of this film were produced. Each version featured one of the five different target foods which were presented across the four subjects (see Table 4.2).

During the message section at the end of each film, two Food Dude characters, one girl and one boy, instructed the viewer to "eat the target food and all other healthy foods". In addition, the two Food Dude characters provided a verbal description of the experimenter-imposed contingency which was operative during the First Intervention phase (see *Procedure*, Intervention 1). (A transcript of this message section is presented in Appendix 3B.)

Experimental Design

A multiple-baseline design across foods and subjects was employed. Each pair of experimental foods was presented for between six and ten occasions, to each subject, during the initial baseline phase (Baseline 1). Following Baseline 1, subjects were exposed to an intervention package (Intervention 1); this was designed to increase their consumption of the target food items. Intervention 1 incorporated: video modelling (The Food Dude Intervention film), a specific instruction ("eat the target food and all other healthy foods"), and, a reward contingency. Following a second baseline phase (Baseline 2), subjects were exposed to a second intervention (Intervention 2). Intervention 2 utilised a token reward procedure designed to maintain target food consumption across seven presentations.

The food presentation procedures, simultaneous presentation of target, and control foods, in conjunction with the multiple-baseline design, allowed an examination of the effectiveness of Intervention 1 both within and across food categories. For example, introducing Intervention 1 with a target pulse (e.g. blackeye beans) could result in an increase in the consumption of other similar foods, the control pulse for instance, or other healthy foods from a different category - the target vegetable for example.

The three pairs of experimental foods were presented to each child in a different order. This was designed to control for any potential effects arising from: (i) the order or sequence in which the foods were presented during Baseline 1; and (ii) the order in which Intervention 1 was applied to each target food from each category. For example, introducing Intervention 1 in the sequence, target fruit, target vegetable, target pulse, may be more or less effective than introducing it in the sequence, target pulse, target vegetable, target fruit. The subject numbers were insufficient to allow complete counterbalancing.

Reliability

A number of interobserver agreement indices were calculated for each child. Standard and modified measures of overall PAI, which combines all six foods for each subject, are as follows:

Rachel - 98 percent (modified PAI, 100 percent), John - 86 percent, (modified PAI, 95 percent), Brenda - 89 percent (modified PAI, 98 percent), and, Susan - 73 percent (modified PAI, 92 percent).

As expected, the modified reliability index, which compares differences in the observers recordings of consumption either above or below criterion, yields higher percentage agreements - each modified index exceeds 90 percent agreement.

Percentage agreement indices for each subject's six experimental foods are presented in Appendix 4A. Also presented in Appendix 4A is a graph showing the distribution of the size (i.e., the number of categories between two observers reports) of differences in cases of disagreement between observers. Of the 27 disagreements recorded, the majority (22) were within one category.

Procedure

General Procedure

Each subject was presented with two experimental foods (i.e. a pair of fruits, pulses, or vegetables) as part of the evening meal, five days per week, throughout the experiment. The presentation of the three pairs of foods was cycled. For example, a subject may have been presented two pulses on day one, two fruits on day two, and two vegetables on day three - on day four this cycle of presentations would begin again, and so on throughout the experiment. The order in which the three pairs of foods were presented differed across subjects but remained constant for each subject.

Baseline 1

Each subject was presented with each pair of foods on at least six separate occasions.

Intervention 1

Following the completion of Baseline 1, at some point after the evening meal, each subject viewed a copy of the PV1 film. This film was designed to familiarise the subject with the concept of the Food Dudes. It also informed the subject that the Food Dudes IV1 film, to be sent the following day, contained information regarding how prizes might be won.

On the following day (the first target evening) each subject was sent the first in a series of Food Dudes IV1 films which they viewed at a time prior to the evening meal. In the course of viewing the film the subject was: (i) instructed by the Food Dudes to eat the particular target food featured in the film, and (ii) told that compliance with the instruction would yield a reward.

During the subsequent evening meal each subject was presented with the target food (e.g. kiwi), which had been featured in the film, and its control pair member (e.g. lychee). After the evening meal the subject was given a question card and told to answer all the questions, one of which required the subject to state the quantity of target food he or she had consumed during the evening meal. The subject was then told, by a parent, that the film and completed card were to be returned to the Food Dudes, who would determine whether any prizes had been won. Rewards were contingent upon the subject consuming to a criterion level of 75 percent or above.

When each subject was again presented with the first target experimental food (i.e., three experimental days later), this procedure was repeated. On this occasion, however, prior to watching the same IV1 film, where appropriate, the subject was presented with a reward and sticker for target food consumption on the previous target evening.

When a subject had collected three stickers and rewards for consuming the first target experimental food, baseline conditions were resumed for the presentation of that food. Following the procedure described above, the subject was then required to collect three rewards and stickers for the consumption of the target member of the second category pair. Finally, again following the same procedure, the subject was required to collect three rewards and stickers for the consumption of the target member of the remaining category pair.

Thus across the first intervention phase subjects were required to collect a total of nine rewards and stickers. In general the rewards were inexpensive toys; however, slightly bigger rewards, labelled promotion packs in the IV1 film, were awarded at various stages during the phase. For example, the first reward all subjects received was a "Food Dude membership pack" containing a Food Dude badge and sticker, a small torch, and a "treasure chest" money box. Any subject collecting three stickers was awarded a baseball cap bearing the Food Dudes logo, in addition to an inexpensive toy. A transistor radio, also bearing the Food Dudes logo, was given to subjects when six stickers had been collected. Any subject who collected nine stickers was awarded a "super prize" (as described in the intervention film). This included: (i) a t-shirt bearing the Food Dudes logo; (ii) a toy, up to the value of £20; (iii) a "life time" Food Dude membership certificate (see Appendix 3A for an example); and (iv) a letter from the Food Dudes praising the subject's performance throughout the intervention phase and an instruction to continue consuming the target and other healthy foods. A copy of this letter is presented in Appendix 3A.

If a subject failed to consume a target food, to criterion or above, on any target evening (i.e., any evening when a Food Dude IV1 film was shown) the following shaping procedure was implemented: On the subsequent intervention day, three experimental days later, in addition to the appropriate intervention film, the subject was sent a letter from the Food Dudes. This letter restated the experimenter imposed contingency and encouraged the subject to consume the target food. No reward, or sticker, was given for cases where target food consumption was below 50 percent. If 50 percent of the target food had been consumed, the subject was given a reward but no sticker (which contributed to the "super prize"). However, the reward would be withheld if a subject continued to consume the same target food at the 50 percent level (or below) on subsequent target evenings.

Baseline 2

Conditions during this phase were identical to those in Baseline 1, and each pair of foods was presented to each subject on at least three separate occasions.

Intervention 2

During this phase, each pair of experimental foods was presented on only one occasion each week, and the duration of this phase was seven weeks (real time). Intervention 2 utilised a token reward system and was designed to maintain each subject's consumption of the target foods across the seven weeks of this phase.

On the first day of this phase, each subject was sent a letter and a chart (printed on A4 card) from the Food Dudes (see Appendix 3A for examples of both). The letter stated that the subject could win a family day trip, to a destination of their choice, by consuming the three target foods.

The charts were divided into seven sections, one for each week of the phase. Each section was further divided into three sub sections, one for each target food (the name of each target food was printed in these boxes). Below each sub section there were three blank spaces onto which small stickers (the tokens) could be placed. The subjects were instructed, in the letter, that each time they were presented with a target food they were to use the chart to record the amount they consumed (parents assisted where necessary). If on any occasion they ate all the target food, a yellow sticker was to be placed onto the card; if they ate 75 percent, a green sticker was placed on the card; and, if they ate 50 percent or below, a red sticker was placed on the card. The instruction in the letter, which was also written on the bottom of the A4 chart, stated that:

"You get a yellow sticker every time you eat all of the vital [target] food. You get a green sticker every time you eat nearly all of the vital food. You get a red sticker if you don't eat enough. Reds are no good!"

The letter also stated:

"Fill this new Progress Card with yellow or green stickers and you could gain promotion to the next level. When the card is full, send it back to us, and you could win first prize in the Dude of the Year lottery."

Stickers were given out by the parent(s) following the evening meals. The subjects did not receive any feedback, for example letters, from the Food Dudes for the duration of this phase.

At the end of this phase each subject was instructed to return their A4 charts, filled with stickers, to the Food Dudes who would determine whether a prize (the day trip) was to be awarded. Rewards were given in cases where a target of 75 percent consumption across the phase had been met. Reward delivery took the form of a letter. This stated explicitly that the subject had won a trip because he or she had consumed the target foods. Any tickets which were necessary for entry to the subject's chosen destination were also included with the letter. Parents were also given £50 to cover any expenses incurred during the day trip.

Following receipt of this letter, the recording equipment was removed from the subject's house and the parents were instructed that it was no longer necessary to restrict the presentation of the experimental foods.

Follow-up

Follow-up data were collected two months and six months after the end of Intervention 2. Baseline conditions were resumed and the pairs of experimental foods were presented three evenings per week for a three week period.

4.3 RESULTS

Rachel

Rachel's daily consumption of the experimental foods throughout the experiment is presented in Figure 4.1. Figure 4.1.1 displays Rachel's mean consumption of each of the six foods during each phase of the experiment.

Baseline 1

Figures 4.1 and 4.1.1 show that Rachel did not consume any of the six experimental foods

Intervention 1

In Rachel's case Intervention 1 was applied to the target foods in the following order: (i) celery, (ii) kiwi fruit, and (iii) blackeye beans. As the intervention was applied to each food, in turn, consumption increased from zero to 100 percent. Further, 100 percent consumption was recorded with all three target foods while the intervention package was operative with each. There was no recorded consumption of any control foods.

Baseline 2

When Intervention 1 was withdrawn and baseline conditions resumed with a target food, consumption of that food returned to baseline levels (i.e., zero). However, the target fruit was an exception; throughout Baseline 2 Rachel continued to consume kiwi reliably at maximum levels.

Intervention 2

The introduction of Intervention 2 resulted in Rachel consuming celery and blackeye beans, the two target foods she had not consumed during Baseline 2. In addition, the high consumption recorded with kiwi during Baseline 2 continued. For the (7 week) duration of Intervention 2 target behaviour was very stable, and Rachel consumed each of the three target foods at maximum levels on every occasion they were presented.

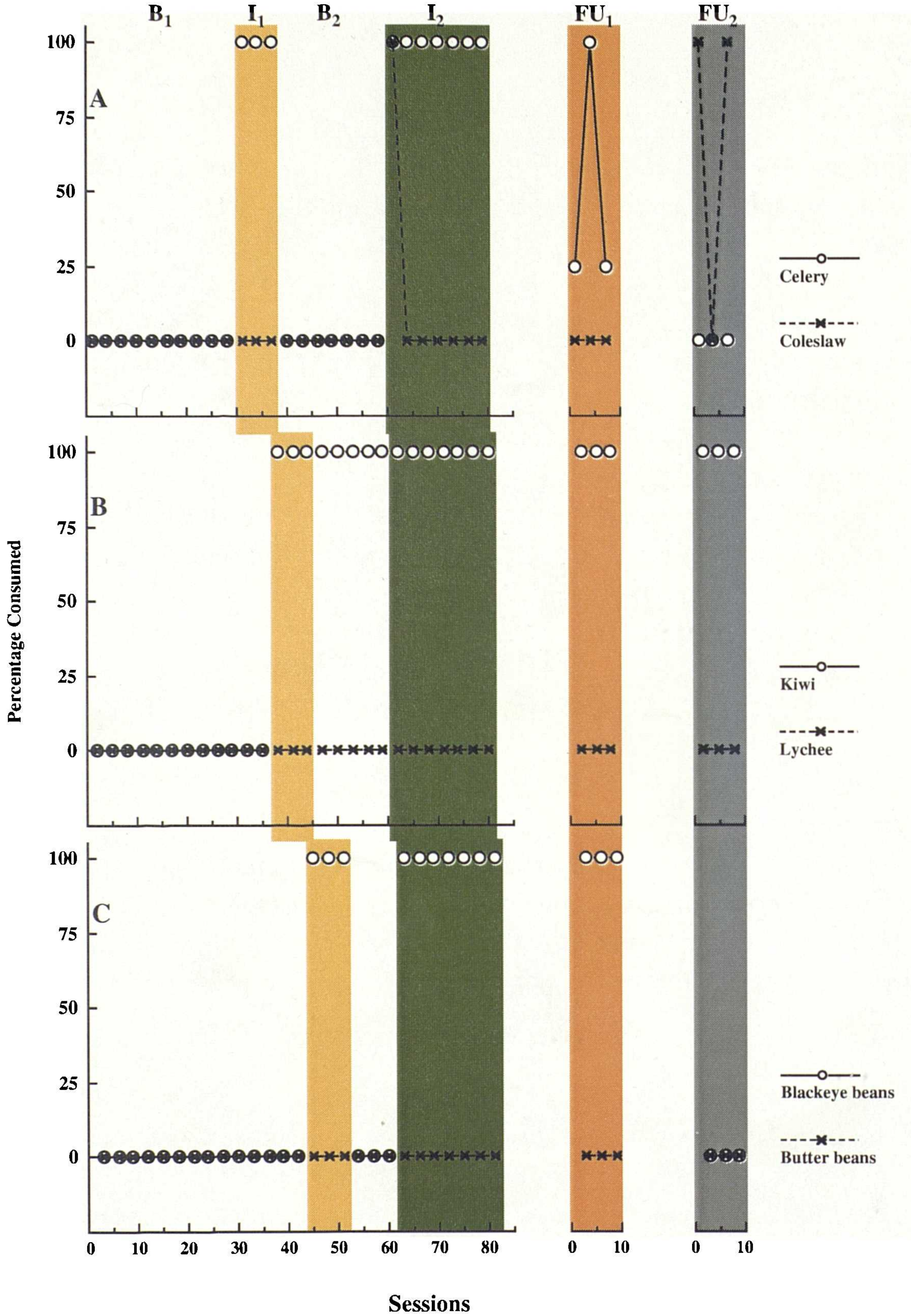


Figure 4.1: Rachel's daily consumption of the three pairs of experimental foods during Baseline 1 (B_1), Intervention 1 (I_1), Baseline 2 (B_2), 2 Month follow-up (FU_1), and 6 Month follow-up (FU_2). Target foods are shown by —o— ; control foods are shown by --x-- . Graph A shows celery & coleslaw consumption; Graph B shows kiwi & lychee consumption; Graph C shows blackeye bean & butter bean consumption.

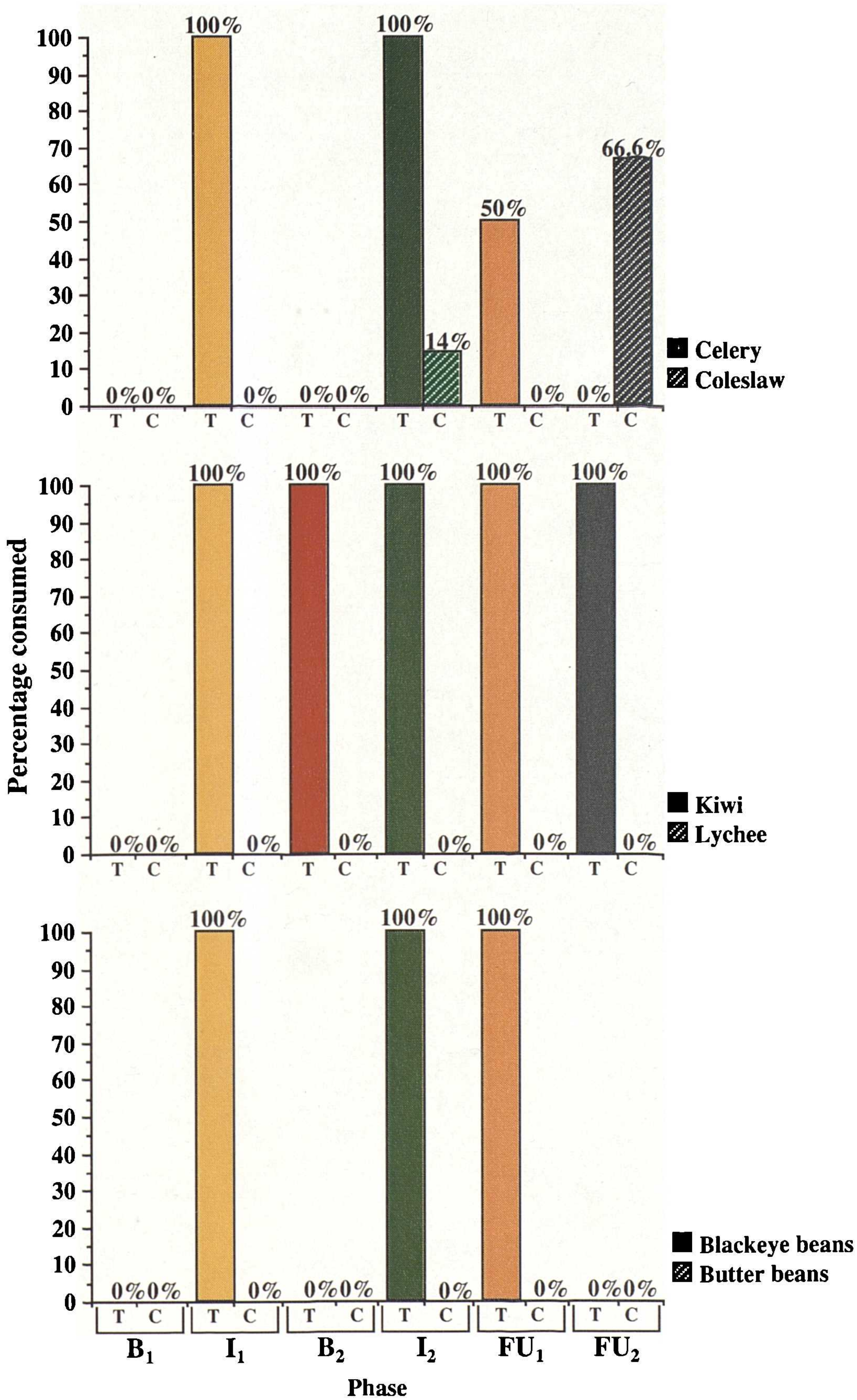


Figure 4.1.1: Rachel's mean consumption of the three pairs of experimental foods during each experimental phase: Baseline (B_1), Intervention 1 (I_1), Baseline 2 (B_2), Intervention 2 (I_2), Two Month follow-up (FU_1), and Six Month follow-up (FU_2)
Target food consumption is shown by: T ■
Control food consumption is shown by: C ▨

With the exception of the first day of this phase, when 100 percent of coleslaw was consumed, no control food consumption was recorded.

Follow-up

2 Month follow-up: During the first follow-up phase two target foods, kiwi and blackeye beans, were reliably consumed at maximum levels. Consumption of celery was more variable and mean consumption was approximatly 50 percent (see Figure 4.1.1). No control food consumption was recorded.

6 Month follow-up: During the second follow-up phase Rachel consumed only one target food; this was kiwi and it was reliably consumed at maximum levels. Coleslaw, the control vegētable, was consumed at maximum levels on two of the three occasions that it was presented. No other control food consumption was recorded.

John

John's daily consumption of the experimental foods throughout the experiment is presented in Figure 4.2. Figure 4.2.1 displays his mean consumption of each of the six foods during each phase of the experiment. John's consumption throughout the experiment was very similar to that described for Rachel.

Baseline 1

John did not consume any of the six experimental foods during the initial baseline phase.

Intervention 1

In John's case Intervention 1 was applied to the target foods in the following order: (i) blackeye beans, (ii) guava, and (iii) broccoli. As was the case with Rachel, as the intervention was applied to each food, in turn, consumption increased from zero to criterion (or above). Maximum consumption was recorded with all three target foods on virtually every evening while the intervention package was operative with each.

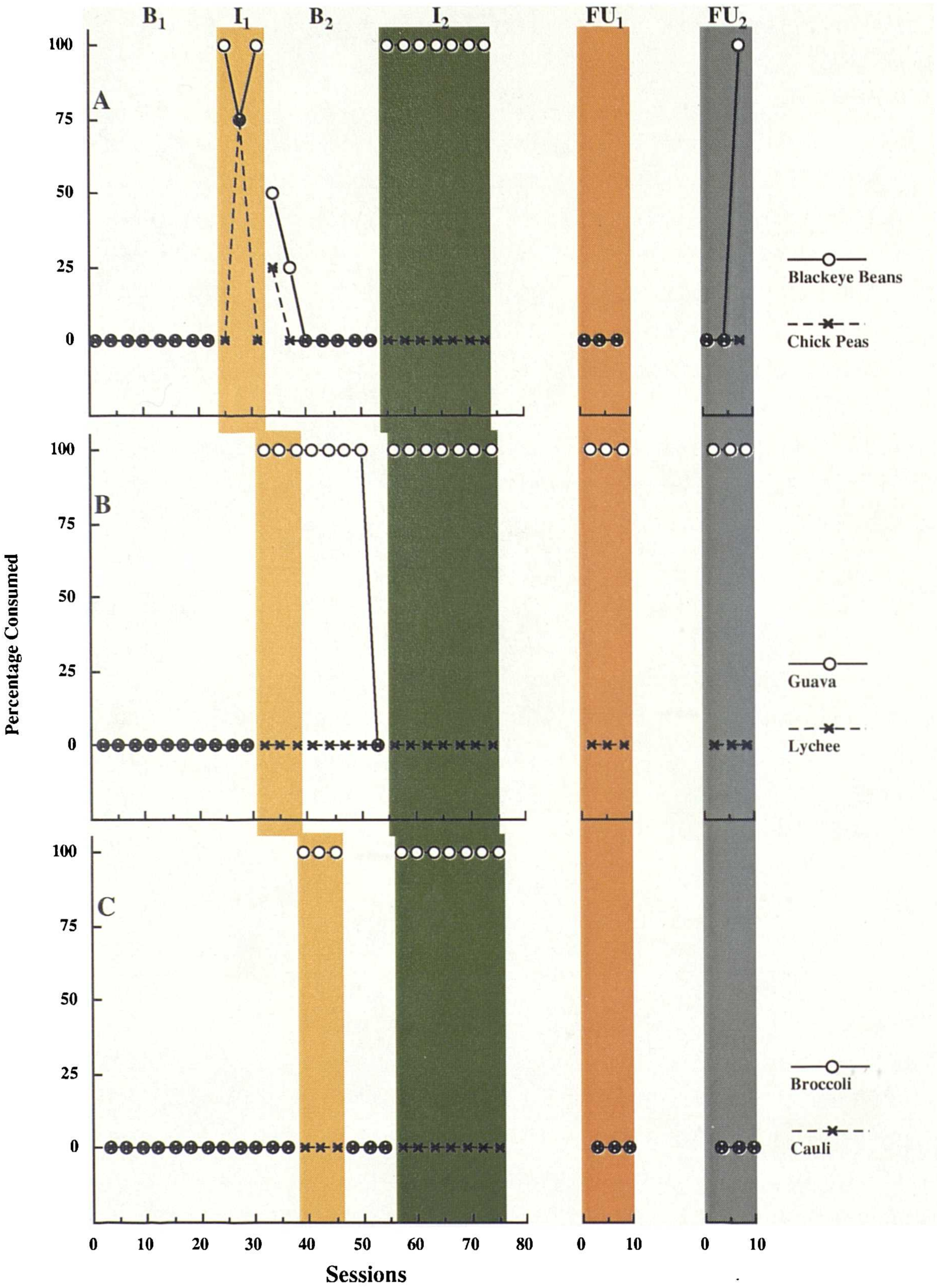


Figure 4.2: John's daily consumption of the three pairs of experimental foods during Baseline 1 (B_1), Intervention 1 (I_1), Baseline 2 (B_2), 2 Month follow-up (FU_1), and 6 Month follow-up (FU_2). Target foods are shown by —o— ; control foods are shown by --x--. Graph A shows blackeye bean & butter bean consumption; Graph B shows guava & lychee consumption; Graph C shows broccoli & cauliflower consumption.

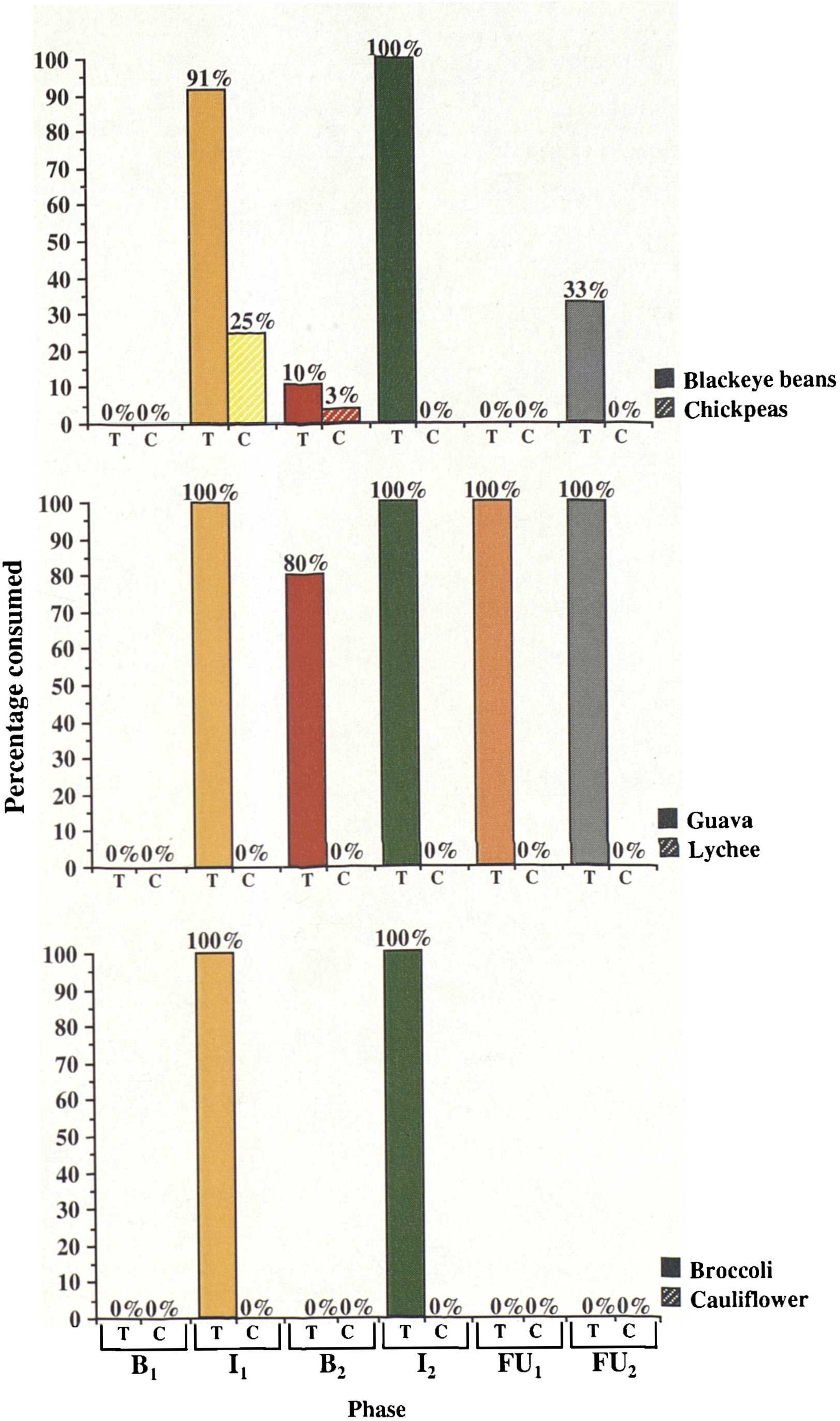


Figure 4.2.1: John's mean consumption of the three pairs of experimental foods during each experimental phase: Baseline (B_1), Intervention 1 (I_1), Baseline 2 (B_2), Intervention 2 (I_2), Two Month follow-up (FU_1), and Six Month follow-up (FU_2)
Target food consiumption is shown by: T ■
Control food consumption is shown by: C ▨

On the second evening that blackeye beans were targeted, John consumed 75 percent of the chickpeas presented. This was the only occasion when any control food was consumed.

Baseline 2

As was the case with Rachel, the high consumption recorded with the target fruit was maintained during the baseline phase which followed the withdrawal of Intervention 1. Little consumption of the other target foods was evident. Broccoli consumption immediately declined to zero following the withdrawal of intervention 1; blackeye bean consumption also decreased to zero, but at a slower rate. No control foods were consumed during this phase.

Intervention 2

Immediately following the introduction of Intervention 2 consumption of those foods refused or consumed at low levels during Baseline 2 increased. The high guava consumption recorded during Baseline 2 continued. Similar to Rachel, John reliably consumed the target foods at maximum levels for the (7 week) duration of Intervention 2. John did not consume any control food during this phase.

Follow-up

During both follow-up phases John reliably consumed maximum amounts of the target fruit, guava, and reliably rejected the target vegetable, broccoli. Blackeye beans, the target pulse, were reliably rejected during the first follow-up phase. John continued to reject blackeye beans at the beginning of the second follow-up phase, but on the final presentation he consumed 100 percent of this target pulse. John's mother reported that another child (a friend of John's) had been present during the meal on this occasion. This child, when presented with the blackeye beans, asked what the beans were called and said he did not like them. John named the blackeye beans and "demonstrated" how to eat them.

Similar to the earlier phases of the experiment, John did not consume any control food during either follow-up phase.

Brenda

Brenda's daily consumption of the experimental foods throughout the experiment is presented in Figure 4.3. Figure 4.3.1 displays her mean consumption of each of the six foods during each phase of the experiment. Brenda's consumption throughout the experiment was consistent with that of the two subjects reported previously.

Baseline 1

Little consumption of the experimental foods was recorded. Both fruits (target, guava; control, mango) were consumed on the first day of the experiment (25% of each). One hundred percent of the target vegetable, broccoli, was consumed on the fifth occasion it was presented. Other than this, no experimental food consumption was recorded.

Intervention 1

In Brenda's case Intervention 1 was applied to the target foods in the following order: (i) guava, (ii) broccoli, and (iii) blackeye beans. Consistent with the two subjects reported earlier, as the intervention was applied to each food, in turn, consumption increased from zero to criterion (or above). Stable maximum consumption was recorded with two of the three target foods: broccoli and blackeye beans. Target fruit consumption was more variable, but it was reliably consumed to criterion or above (mean 83%; see Figure 4.3.1).

On the first evening of this phase, when guava was the target food, mango (the control fruit) was consumed at maximum levels. No other control food consumption was recorded.

Baseline 2

Consumption of all three target foods (including the target fruit) decreased to zero immediately following the withdrawal of Intervention 1. Brenda continued to reject the target pulse, blackeye beans, for the entire phase. Consumption of broccoli and guava was more variable, with an increase in consumption being recorded mid-way through the phase. Broccoli was consumed on three occasions, twice at 100 percent and once at 50 percent (mean 31%; see Figure, 4.3.1). Guava was consumed on four occasions; twice at 100 percent and twice at 25 percent (mean 25%). In addition, Brenda's consumption of the control fruit

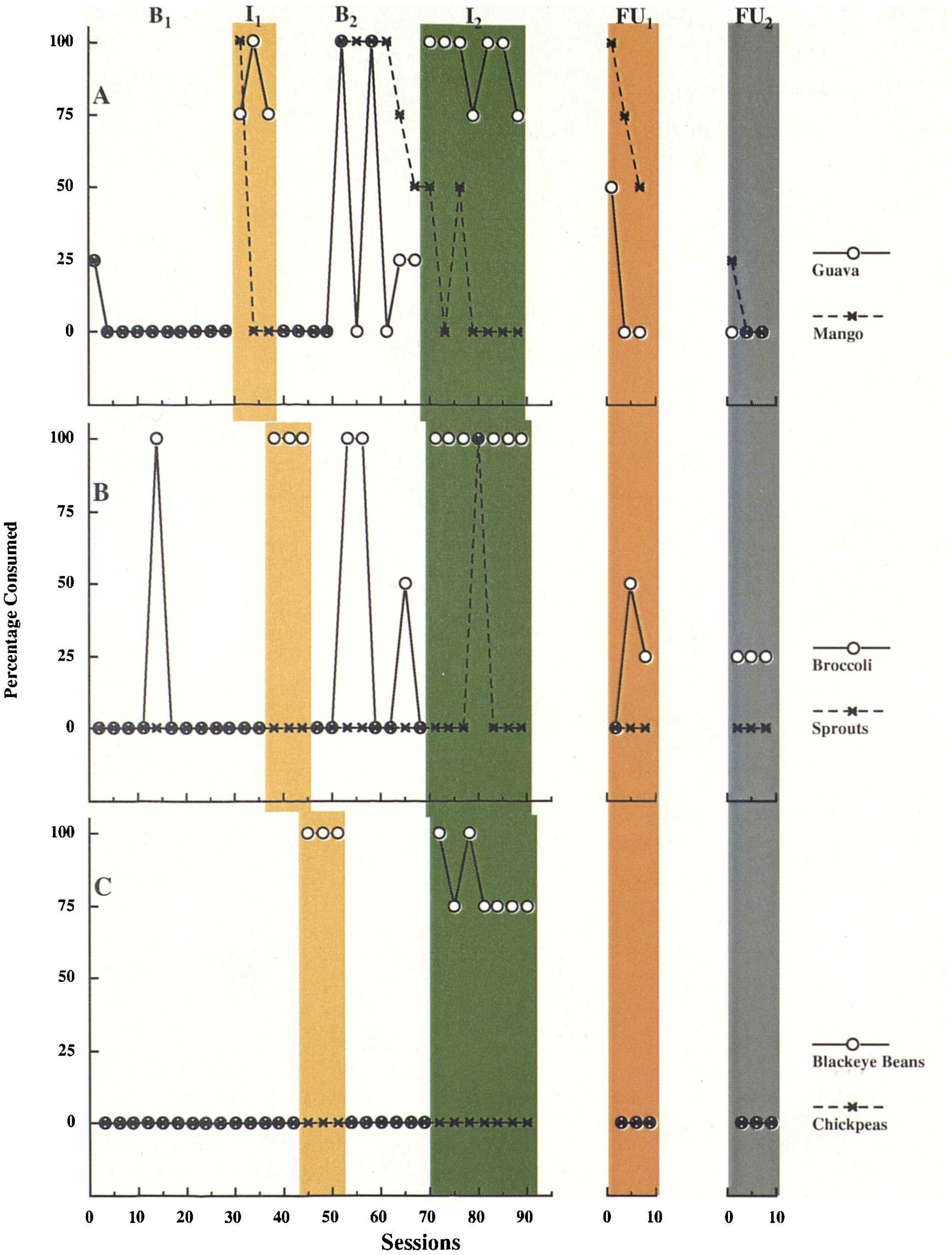


Figure 4.3: Brenda's daily consumption of the three pairs of experimental foods during Baseline 1 (B_1), Intervention 1 (I_1), Baseline 2 (B_2), 2 Month follow-up (FU_1), and 6 Month follow-up (FU_2). Target foods are shown by —o— ; control foods are shown by --x--. Graph A shows guava & mango consumption; Graph B shows broccoli & sprout consumption; Graph C shows blackeye bean & chick pea consumption.

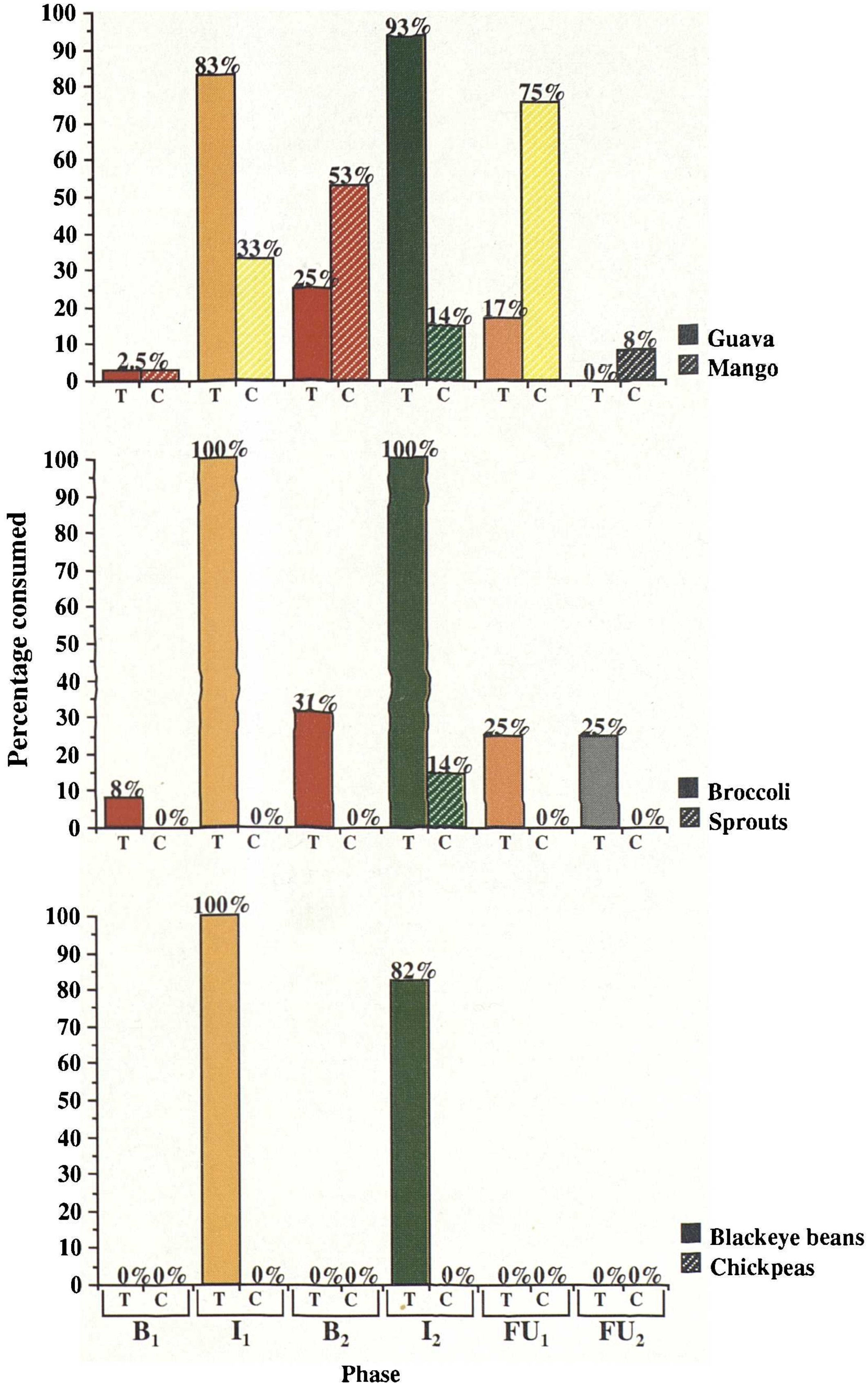


Figure 4.3.1: Brenda's mean consumption of the three pairs of experimental foods during each experimental phase: Baseline (B_1), Intervention 1 (I_1), Baseline 2 (B_2), Intervention 2 (I_2), Two Month follow-up (FU_1), and Six Month follow-up (FU_2)
Target food consumption is shown by: T ■
Control food consumption is shown by: C ▨

(mango) also increased. Mango was consumed on six occasions, five of which were at the 75 percent level or above. Hence, control fruit consumption during this phase exceeded that recorded with the target fruit (53% versus 25%). The increases in consumption during Baseline 2 immediatly followed the withdrawal of Intervention 1 from targetting blackeye beans, the last of the three foods to be targetted. Finally, prior to the introduction of Intervention 2, consumption of the two target items returned to zero.

Intervention 2

The introduction of Intervention 2 resulted in an increase in Brenda's consumption of the three target foods, and each item was consumed to criterion (or above) for the duration of this phase. However, compared to the two subjects reported above, Brenda's consumption of the traget fruit, guava, and the target pulse, blackeye beans, was slightly more variable.

Relative to Baseline 2, Brenda's consumption of the control fruit decreased. However, as there was a downward trend in consumption during the latter presentations of Baseline 2, it is not clear if the lower consumption was a response to the introduction of Intervention 2. Little other control food consumption was recorded.

Follow-up

2 Month follow-up: Figures 4.3 and 4.3.1 shows that Brenda's consumption of the target foods tended to be variable and low; mean consumption never exceeded 25 percent. Blackeye beans were reliably rejected and guava was only consumed on the first presentation (at the 50% level). Broccoli consumption was low and variable across the phase (mean 25%, see Figure 4.3.1).

The only control food consumed was the fruit, mango. Although consumption of this item declined steadily across the phase, mean consumption (75%) exceeded that recorded with the target fruit.

6 Month follow-up: Brenda's consumption of the six experimental foods was low during this phase. The target pulse and fruit (blackeye beans and guava) were reliably rejected. Consumption of broccoli, the target vegetable, was stable but low (25%). Similar to the previous phase, the only control food consumed was mango, but mean consumption was much lower during this phase (8% versus 75%).

Susan

Susan's daily consumption of the experimental foods throughout the experiment is presented in Figure 4.4. Figure 4.4.1 displays her mean consumption of each of the six foods during each phase of the experiment. Susan's consumption throughout the experiment was similar to the three subjects reported previously.

Baseline 1

Figure 4.4 shows that Susan's consumption of the experimental foods was the most variable of the four subjects. However, Figure 4.4.1 shows that the mean consumption of any individual food never exceeded 34 percent.

Intervention 1

In Susan's case Intervention 1 was applied to the target foods in the following order: (i) kiwi, (ii) blackeye beans, and (iii) celery. Consistent with the other three subject as the intervention was applied to each food, in turn, consumption increased to maximum levels. Also, as the intervention was operative with each food, stable maximum consumption was recorded. The only exception to this was the first target evening with celery when below criterion consumption (i.e., 50%) was recorded. Following the shaping procedure described in the *Procedure* section, on the second target evening with this food, in addition to the IV1 film, Susan was sent a letter of encouragement (from the Food Dudes). Because Susan had consumed 50 percent of the target vegetable (on the first intervention evening), she was also sent a reward, but the sticker, contributing to her "super prize", was withheld. This was the only occasion where any of the four subjects failed to consume a target food to criterion level during a target evening.

In addition to the increased target food consumption, Susan's consumption of two of the control foods also increased following the introduction of Intervention 1. Mean consumption of the control fruit, kiwi, and control pulse, blackeye beans, was high (83%, see Figure 4.4.1). Broccoli, the control vegetable, was not consumed.

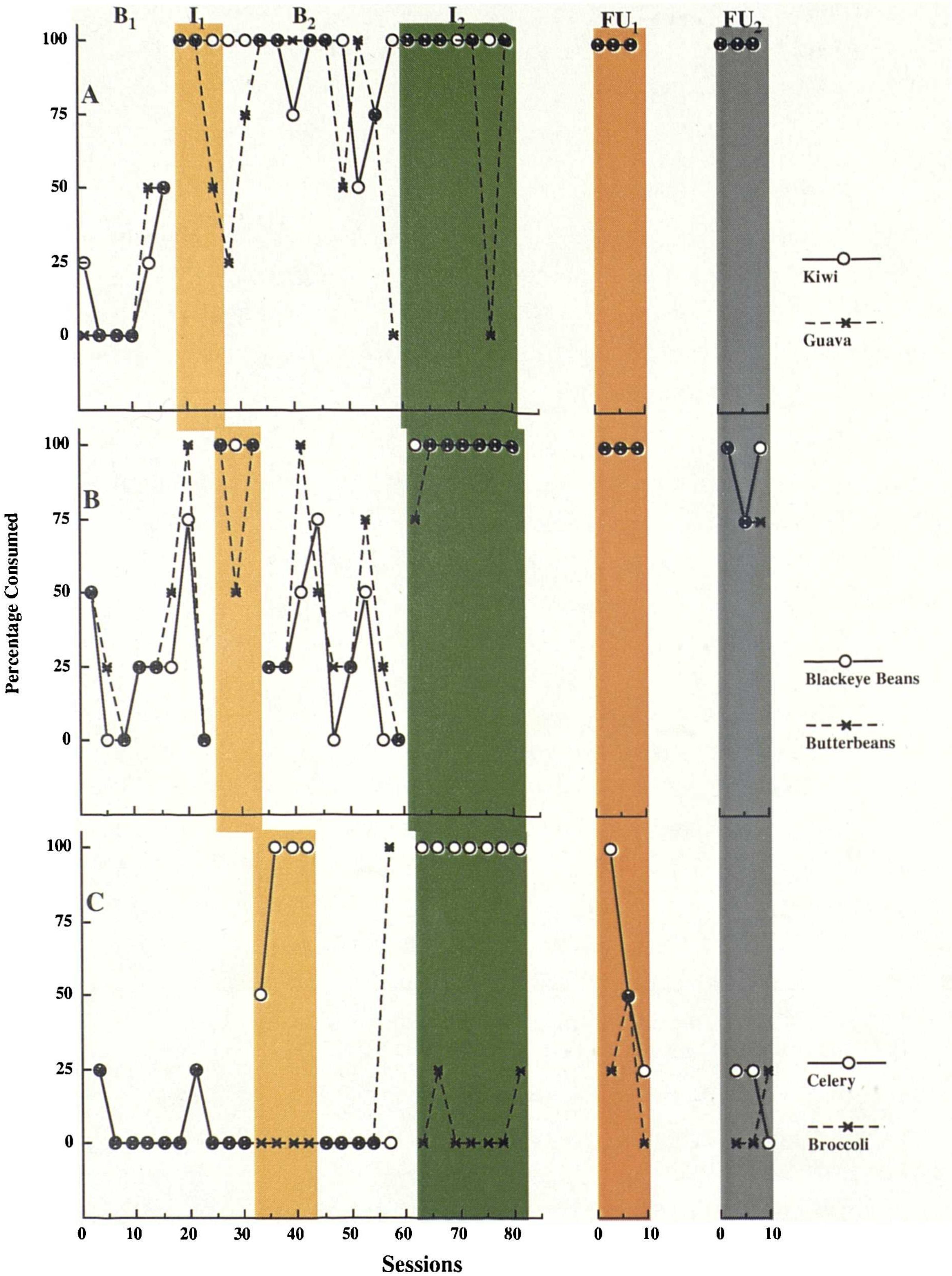


Figure 4.4: Susan's daily consumption of the three pairs of experimental foods during Baseline 1 (B1), Intervention 1 (I1), Baseline 2 (B2), 2 Month follow-up (FU1), and 6 Month follow-up (FU2). Target foods are shown by —o— ; control foods are shown by --✱-- . Graph A shows kiwi & guava consumption; Graph B shows blackeye bean & butter bean consumption; Graph C shows celery & broccoli consumption.

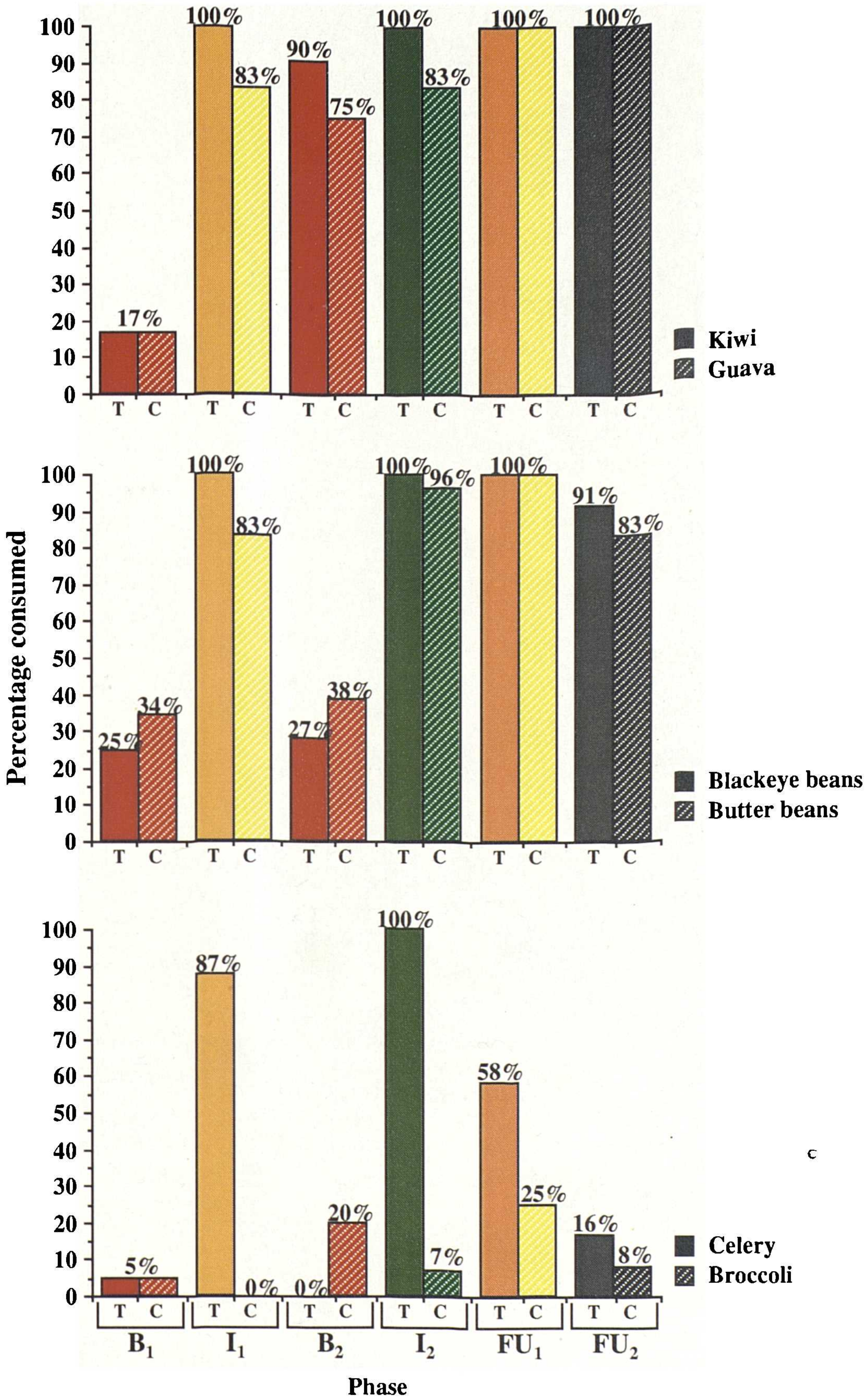


Figure 4.4.1: Susan's mean consumption of the three pairs of experimental foods during each experimental phase: Baseline (B1), Intervention 1 (I1), Baseline 2 (B2), Intervention 2 (I2), Two Month follow-up (FU1), and Six Month follow-up (FU2)
Target food consumption is shown by: T ■
Control food consumption is shown by: C ▨

Baseline 2

Immediately following the withdrawal of Intervention 1 Susan's consumption of celery and blackeye beans returned to baseline levels (mean, zero and 27% respectively). As was the case with Rachel and John, Susan's consumption of the target fruit, kiwi, remained high during this phase (mean 90%). Susan also continued to consume the control fruit, guava, and although more variable (relative to the target fruit), consumption was high (mean 75%, see Figure, 4.4.1). Consumption of the control pulse, butter beans, which was high during Intervention 1, decreased to baseline levels. Broccoli, the control vegetable, was consumed just once at the maximum level.

Intervention 2

Similar to the cases reported previously, Susan's consumption of the three target foods was high (maximum) and stable for the duration of this phase. In addition, consumption of the control fruit (guava) and control pulse (butter beans) was also stable and high (similar consumption had been recorded during Intervention 1).

Follow-up

2 Month follow-up: Susan's consumption of the two fruits and the two pulses was stable and high. Celery consumption was initially high (i.e., 100%), but declined sharply across the phase (mean 58%; see Figure 4.4.1).

6 Month follow-up: Susan's consumption of both fruits remained high and stable. Consumption of both pulses was also high, but slightly more variability was recorded relative to the previous phase. Consumption of the target vegetable, celery, was low (mean 16%).

Summary of Results

Figures 4.5 and 4.6 display grouped summary data of the subjects' consumption of the three target and three control foods (respectively) during each experimental phase. Figure 4.7a and 4.7b displays similar data for overall (i.e., three foods combined) target and control food consumption.

During the initial baseline phase, little consumption of any of the experimental foods was recorded with any of the subjects. Figure 4.7a shows that overall target food consumption was three percent as compared to four percent for control food (Figure 4.7b).

Target food consumption increased markedly as Intervention 1 was applied to each food, and following the introduction of Intervention 1, all the subjects consumed all the target foods to criterion (or above). In every case, consumption was high and stable for the period during which the intervention was operative with a target food. With the exception of the target fruits, consumption tended to decline during Baseline 2. Introduction of Intervention 2 resulted in high and stable consumption of all target foods being recorded across all subjects.

Intervention 1 and 2 tended to have a reduced effect on the consumption of the control foods, relative to the target foods. Susan was the only child who consumed any control foods at levels comparable with that recorded with target foods. Furthermore, Susan's control food consumption is largely responsible for the small increase in the overall consumption of the control food during the phases following baseline, indicated by Figure 4.7b.

Finally, the follow-up phases indicated long term maintenance of consumption with some target foods, especially the target fruits. Figure 4.7a shows that generally, target food consumption tended to be greater during the first follow-up phase (relative to the second). However, during both follow-up phases every subject consumed at least one target food at levels which were above those recorded during the initial baseline phase (see Figure 4.5).

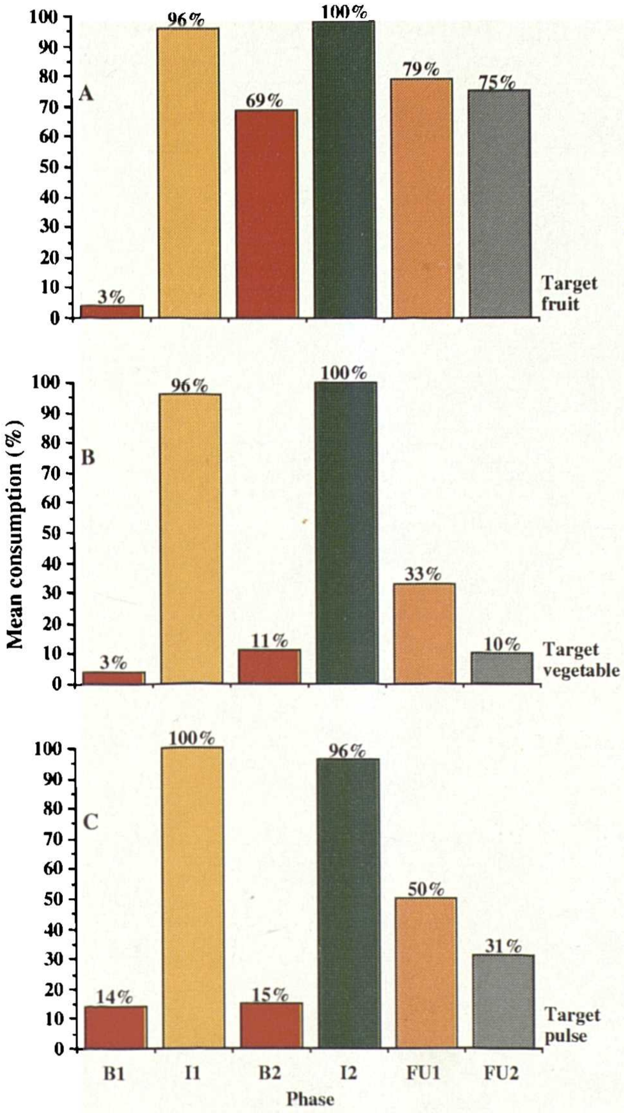


Figure 4.5: Grouped mean (i.e. all subjects combined) target food consumption during each experimental phase: Baseline (B1), Intervention 1 (I1), Baseline 2 (B2), Intervention 2 (I2), Two Month follow-up (FU1), and Six Month follow-up (FU2). Graph A shows mean target fruit consumption; Graph B shows mean target vegetable consumption; Graph C shows mean target pulse consumption.

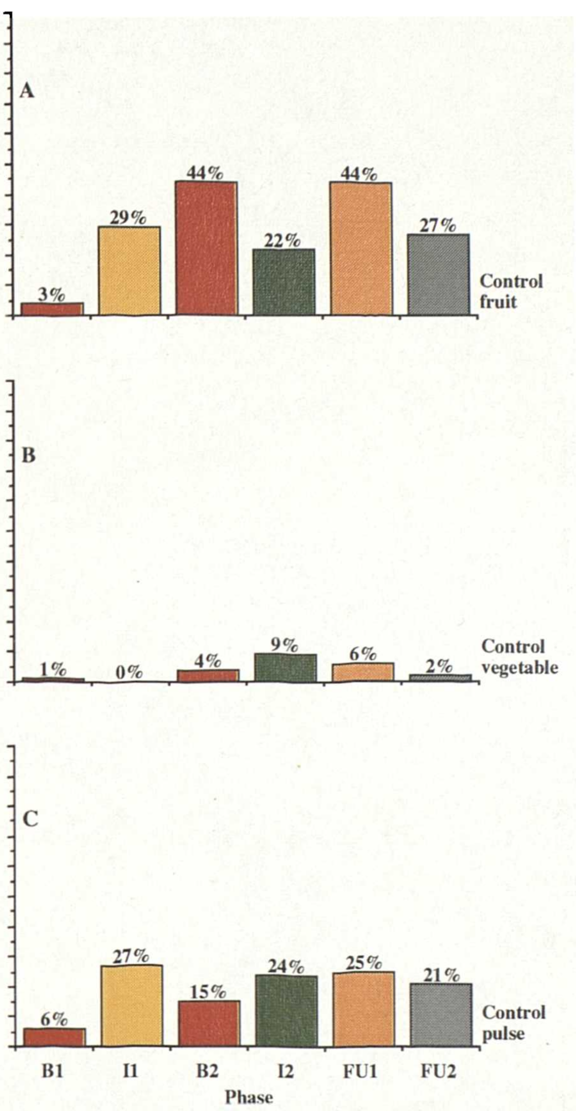


Figure 4.6: Grouped mean control food consumption during each experimental phase: Baseline (B1), Intervention 1 (I1), Baseline 2 (B2), Intervention 2 (I2), Two Month follow-up (FU1), and Six Month follow-up (FU2). Graph A shows mean control fruit consumption; Graph B shows mean control vegetable consumption; Graph C shows mean control pulse consumption.

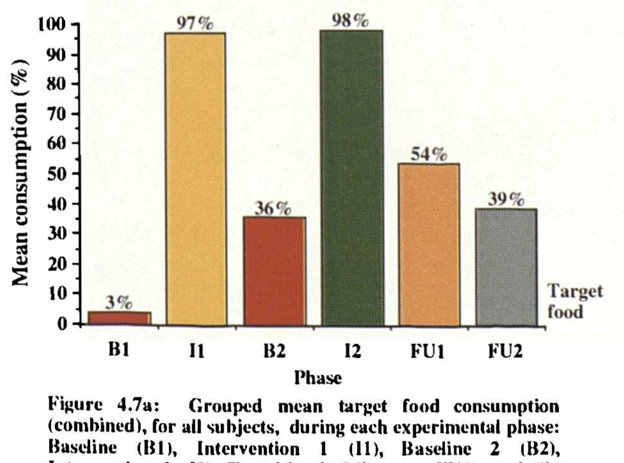


Figure 4.7a: Grouped mean target food consumption (combined), for all subjects, during each experimental phase: Baseline (B1), Intervention 1 (I1), Baseline 2 (B2), Intervention 2 (I2), Two Month follow-up (FU1), and Six Month follow-up (FU2).

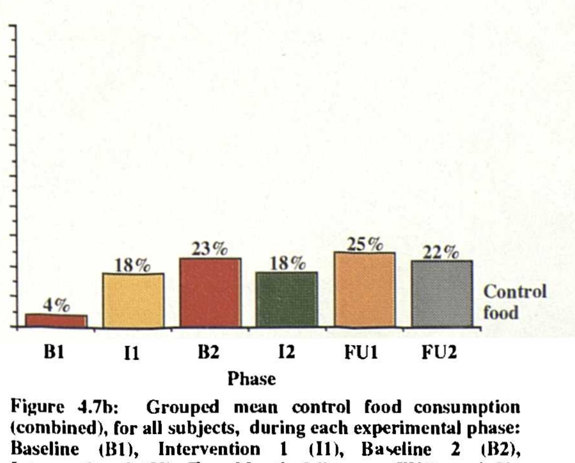


Figure 4.7b: Grouped mean control food consumption (combined), for all subjects, during each experimental phase: Baseline (B1), Intervention 1 (I1), Baseline 2 (B2), Intervention 2 (I2), Two Month follow-up (FU1), and Six Month follow-up (FU2).

4.4: Discussion

The procedures employed in the present experiment successfully modified the subjects' consumption of the target foods. During Baseline 1 little consumption of the experimental foods was recorded. Introduction of Intervention 1 resulted in all four subjects consuming all of the target items on at least three separate occasions. This consumption was maintained for a further seven taste exposures - these followed the introduction of Intervention 2. Thus, by the end of the experiment each subject had consumed each target food to criterion or above, on at least 10 separate occasions, over a period of 10 weeks. It would appear that not only is it possible to influence consumption in the short term, as demonstrated in Experiment 1, it is also possible to manipulate consumption patterns, in the home setting at least, over a number of weeks and months. This finding is consistent with the literature in a number of ways.

Simply presenting the experimental foods to the subjects did not increase the likelihood that these foods would be consumed. Consumption during baseline was characteristically low and stable, as was control food consumption throughout the entire experiment (with the exception of Susan). This finding is consistent with the claim (Birch et al, 1987) that to enhance the preference for the taste of a food, visual exposure alone is insufficient: exposure to the taste of the food is necessary. It is important to note, however, that Birch et al's outcome variable was stated preference and not the actual amount of food consumed.

The importance of cultural and environmental variables in determining what is eaten by humans was discussed in Chapter 1. In the present experiment the manipulation of non-biological variables, that is, reward contingencies, video modelling, and instructions, resulted in the children consuming foods which they had previously rejected. The potency of such manipulation is highlighted in at least two ways, namely:

1. The abrupt change in target behaviour as the intervention packages were applied in turn to the different target foods. In the majority of cases the amount consumed changed from zero to 100 percent.

2. During the follow-up phases, consumption levels in many cases exceeded those during Baseline 1, suggesting the interventions produced durable effects. Again, some target foods (and control foods) were consumed at maximum levels.

A number of features of the present data suggest that subjects' consumption of the target foods was rule-governed as opposed to being controlled directly by the imposed or any naturally occurring contingency. One observation to support of a rule-governed account concerns the time delay between consumption of the target foods and delivery of the contrived consequence. During Intervention 1 this delay was usually three (experimental) days, and in some cases it was even greater in real time. For example, John's second target evening with guava took place on a Wednesday; on the following evening broccoli and cauliflower were presented while blackeye beans and butter beans were presented on the Friday evening. Because no experimental foods were presented during the weekend (see *Method*), John did not receive his reward (i.e., toy and sticker) for consuming guava until Monday, the next target evening with this food.

Delays of this size are too great for the programmed consequences to directly affect the target behaviour (Lowe & Higson 1983; Lowe, Horne & Higson 1987). According to Michael (1980), in such cases it is likely that effects are mediated through a verbal description of the contingency (see also, Hayes & Hayes, 1993).

It is possible that some immediate and natural consequence may have directly reinforced the target behaviour during Intervention 1. If this was the case, however, it did not continue to reinforce the behaviour during Baseline 2. One possible exception to this was target fruit consumption which tended to remain high following the withdrawal of Intervention 1. The inherent taste properties of fruit may have been responsible for the high consumption, that is, fruit consumption may have been naturally reinforced by the sweet taste. This being so, many of the programmed (contrived) rewards presented during Intervention 1, and especially Intervention 2, may have been superfluous to the maintenance of consumption. Hence, while such consumption may have initially been under instructional or rule control, direct contingency control may have been readily achieved. It must be stressed, however, that the present data does not permit any firm conclusions regarding the variables controlling the subjects' consumption of the target foods.

Long delays between contrived consequence and target behaviour were also a central feature of Intervention 2 where subjects were required to collect tokens over a seven week period in order to gain reward. Previous authors (Lowe & Higson 1983; Lowe, Horne & Higson 1987) have noted that verbal mediation is central to the effective implementation of token reward programmes. For example, it is common for verbal descriptions of contingencies to be posted throughout the hospital ward, or other setting, within which the programme is operative. Token delivery is often accompanied by a description of the behaviour for which the token is being awarded.

At least two observations concerning the present procedures are consistant with the account proposed by Lowe and colleagues. First, during Intervention 2 a detailed description of the contingency was provided to each subject in a letter and on the token collection chart. Second, the subjects were observed to make spontaneuos verbalisations concerning the token rewards and the operative contingency. For example, immediately after Rachel consumed her blackeye beans, on the first occasion this item was presented during Intervention 2, she said: "I'm having another yellow sticker!" (yellow stickers were presented for 100% consumption). Approximately 12 minutes later Rachel (aided by her mother) began to complete her sticker chart saying, "I've got to put all [i.e., 100%] down again! Another yellow for me". Following this Rachel began to talk about her choice of destination for the family day trip (the reward).

Behaviour controlled by a rule is only consistent with a contingency to the extent that the rule is consistent with the contingency (Skinner, 1969; Catania, Matthews, & Shimoff, 1990). It was noted in Chapter 1 that (verbally able) human schedule performance will, on occasions at least, correspond more closely to descriptions of a contingency than to the contingency itself (see, Bufffington & Hemmes, 1995; Catania, Shimoff, & Matthews, 1989; Lowe, 1983). Much of the research carried out investigating this issue is not directly applicable to the present experiment (e.g., much of this research was carried out with adult subjects performing under controlled laboratory conditions). Nevertheless it is noteworthy that during the present experiment subjects were provided with an instruction to eat the target food, and they tended to consume in excess of the requirement of the contingency. For example, during Intervention 1 target food consumption at the 75 percent level would have resulted in access to the maximum amount of available contrived rewards. However, most of the subjects tended to consume at the maximum level, almost without exception.

Drawing a distinction between sight and taste exposure Birch et al (1987) claim that between 10 and 15 taste exposures to a novel food may be necessary in order to produce a shift in stated preference. Although not directly applicable to the present experiment, this finding suggests that one possible strategy for increasing long term maintenance of consumption is to increase each subject's taste exposure to the foods.

One example in the present data may provide supporting evidence for the role of taste exposure. During Baseline 2, Rachel did not consume any of the target pulse; blackeye beans. This was in direct contrast to the very high consumption recorded during Intervention 1. During the first follow-up phase, where conditions were similar to Baseline 2, Rachel consumed all the target pulse. It may be that the seven taste exposures during the second intervention were at least partly responsible for the maintained consumption.

Nevertheless, it is not clear whether it is appropriate to attribute the long term maintenance of consumption to taste exposure alone. Depending upon the context in which the exposure occurs, other variables may be operative. As noted in Chapter 1, and demonstrated in the present experiment, exposure is only one of a number of variables which can be manipulated. Hence increasing the duration of Intervention 2 while increasing exposure would also increase the subjects' self monitoring of consumption across time, or exposure to token reward. Simply performing the behaviour more frequently may strengthen rule governance (e.g. "These are [specific food], I always eat these") given that verbally able adults can "respond verbally to their responding" (Lowe & Higson, 1983, p. 215).

The interventions employed in the present experiment were successful in promoting the consumption of the target foods. However, the interventions had a limited effect on the subjects' control food consumption. This may come as little surprise given that: (i) the instruction named only the target food, and (ii) the rewards were contingent upon the consumption of the target food only. To promote the consumption of the control foods, one could introduce the intervention package with these foods in a manner similar to the target food. This procedure may be a little "uneconomical" in that it would require numerous separate interventions.

A second, more economic possibility concerns structuring the interventions around categories of foods. Hence, the subjects would be instructed (by the Food Dudes) to "eat all vegetables", and be rewarded contingently upon the consumption of all vegetables presented that evening. This is the strategy adopted in the next experiment.

The results of the present study are of relevance to the debate concerning the effects of rewards upon behaviour. Some authors have argued that presenting a reward contingent upon the consumption of a food will result in a decrease in preference for that food (e.g., Birch et al, 1982, 1984; Mikula, 1989; Newman & Taylor, 1992; see also, Chapter 1, Section 1.2.4). Far from demonstrating any such negative effects, the present procedures appear to have greatly enhanced the children's preferences for (at least some of) the target foods. Given that rewards are used in each of the four home-based experiments, this issue will be discussed in greater detail in Chapter 7.

CHAPTER 5

EXPERIMENT 3: A CATEGORY BASED INTERVENTION TO INCREASE CONSUMPTION OF PREVIOUSLY REFUSED FOODS

5.1: INTRODUCTION

Experiment 2 demonstrated that it is possible to promote children's consumption of previously refused foods by exposing them to an intervention package which utilised a food specific instruction and reward contingency. Although the package was effective in promoting the consumption of the food named in the instruction, little consumption of concurrently presented control foods was recorded. The purpose of the present experiment was to examine procedures designed to promote generalisation.

In attempting to increase the spread of effect across a range of foods, Experiment 3 employed a similar intervention package to that used in Experiment 2, but it was applied to *categories* of foods. For example, instead of being instructed to eat "broccoli", the children were instructed to eat all "vegetables". Rewards were presented contingent upon the consumption of a number of experimental vegetables presented during the session.

A second purpose of the present experiment was to promote long term maintenance of effects. The results of Experiment 2 indicated that although target food consumption was high during the intervention phases, during follow-up phases consumption was diminished (target fruits were usually an exception). To promote long term changes in consumption during the present experiment, the number of taste exposures to some of the experimental foods was increased during the second intervention phase.

5.2: METHOD

Participants

Subjects

Four children participated. Three were girls (Kirsty, Alison and Sally) and one a boy (Jeff). Their mean age at the start of the experiment was 6.08 years as compared to 6.67 years in Experiment 2. Two of the children, Jeff and Sally, each had a younger brother, and Alison had an older sister. Pertinent details of each subject are presented in Table 5.1, below.

Table 5.1. Subjects who participated in Experiment 3.

Subject	Gender	Age at start	Sibling gender	Sibling age
Jeff	Male	6.50 years	Male	3.42 years
Kirsty	Female	5.83 years	*	*
Alison	Female	5.67 years	Female	15 years
Sally	Female	6.30 years	Male	1.82 years
Mean age of subjects at start = 6.08 years				

Parents

Jeff's mother was not present for the majority of meals (because of employment commitments). Kirsty's mother, a single parent, was present during most meals. In the other two cases, Alison and Sally, both parents were usually present.

Foods

Twelve experimental foods were selected for each subject: eight vegetables and four fruits. Sally was the only exception to this; she was presented with twelve vegetables. This was because she accepted most of the fruit items presented during the Prebaseline phase.

All the experimental foods were target foods in that they were all subject to the first intervention. The specific foods presented to each subject are shown in Table 5.2.

Table 5.2. Foods presented to each subject in Experiment 3

Jeff	Kirsty	Alison	Sally
Vegetables:	**Vegetables:**	**Vegetables:**	**Vegetables:**
Kidney Beans	Kidney Beans	Kidney Beans	Kidney Beans
Courgettes	Courgettes	Courgettes	Courgettes
Beetroot	Chick Peas	Chick Peas	Chickpeas
Green Beans	Green Beans	Asparagus	Asparagus
Celery	Cauliflower	Celery	Celery
Sprouts	Sprouts	Coleslaw	Coleslaw
Butter Beans	Baby Sweetcorn	Red Pepper	Butter Beans
Blackeye Beans	Sugarsnap Peas	Borlotti Beans	Blackeye Beans
			Borlotti Beans
Fruit:	**Fruit:**	**Fruit:**	Flageolet
Guava	Guava	Raspberries	Beansprouts
Lychee	Prunes	Prunes	Water chestnuts
Blackberries	Kiwi	Blackberries	
Gooseberries	Loganberries	Loganberries	

Equipment

A series of Food Dude video films similar to the originals used in Experiment 2 were produced. These were different to the originals in the following ways:

The primer video (PV2)

The sequence of the film which featured the Food Dudes consuming jack fruit was removed. This was because the subsequent intervention targetted either fruits or vegetables. Displaying a specific food may have disrupted the subjects' understanding of the category based intervention.

The intervention video (IV2)

Sequences featuring specific foods were replaced with sequences featuring a number of different fruits or vegetables. During the message section at the end of the film, the two Food Dude characters instructed the viewer to "*eat all fruits/vegetables.*" A transcript of this message section is presented in Appendix 3B.

Three versions of this film were produced, two featuring vegetables and one featuring fruits. It was necessary to produce two versions of the former in order to incorporate the majority of the different vegetables presented across all the subjects The specific foods featured in each version are presented in Table 5.3.

Table 3.5. Foods featured in each version of the Food Dude Intervention films used in Experiment 3.

Version 1 Vegetable 1	Version 2 Vegetable 2	Version 3 Fruit
Blackeye Beans	Blackeye Beans	Blackberries
Celery	Celery	Gooseberries
Courgettes	Courgettes	Guava
Kidney Beans	Kidney Beans	Lychee
Butter Beans	Butter Beans	Passion Fruit
Broccoli	Beetroot	Prunes
Coleslaw	Asparagus	Rhubarb
Green Beans	Cauliflower	
Haricot Beans	Peas	
Carrots	Sprouts	
Broad Beans	Chick Peas	
Borlotti Beans	Flageolet	

Experimental Design

The designs of Experiments 2 and 3 were similar. This facilitated a comparison of the effectiveness of the food specific and food category intervention packages. However, in order to incorporate the category based procedures, and to expand upon the findings of Experiment 2, a number of design changes were necessary, namely:

1. The number of experimental foods presented to each subject was increased from the 6 to 12. This increase facilitated the examination of the effectiveness of the food category intervention packages across a range of exemplars from a targetted category.

2. During the Prebaseline phase, each subject was required by their parents (under the instruction of an experimenter) to categorise most of the foods presented during each meal. This allowed the experimenter to assess each subject's ability to correctly categorise the experimental foods.

3. The intervention packages employed during the first and second intervention phases (I1 & I2 respectively) were modified to allow the targetting of categories of foods (as opposed to specifically named exemplars). As previously mentioned, the children were instructed to "eat all fruits/vegetables". Hence rewards were contingent upon the subject consuming, to criterion or above, all of the experimental foods from the targetted category which were presented on a given target evening.

4. At the beginning of Intervention 2 each of the 12 experimental foods were allocated to one of two groups: a high exposure group and a low exposure group. Each group comprised of six experimental foods (two fruits and four vegetables, or in Sally's case six vegetables), and group allocation was based on consumption during I1 (see Procedure, Intervention 2, below). Only those foods from the high exposure group were presented during Intervention 2, thus ensuring each subject was exposed to six of the experimental foods on a greater number of occasions than the remaining six. Any generalisation of effect resulting from this higher exposure to half of the foods was examined with the six low exposure foods.

This procedure also ensured that the high exposure foods were presented to the subjects on at least fifteen occasions; this exceeded the level of exposure that the subjects had with most of the target foods in Experiment 2.

As in Experiment 2, following Baseline 1 the subjects, were exposed to two intervention phases which were separated by a second baseline phase (B2). Immediately following Intervention 2 a Generalisation condition was introduced, during which only the low exposure group (those foods *not* presented during I2) were presented under baseline conditions - this was a test for generalisation (see 4 above).

To control for possible order effects, I1 was applied to the fruit category first with two of the subjects. The reverse was the case with the remaining two subjects.

Reliability

A number of interobserver agreement indices were calculated for each child. Standard and modified measures of overall PAI, which combines all 12 experimental foods for each subject, are as follows:

Jeff - 87 percent (modified PAI, 99 percent), Kirsty - 88 percent (modified PAI, 97 percent), Alison - 93 percent (modified PAI, 100 percent), and, Sally - 82 percent (modified PAI, 97 percent).

Similar to the Experiment 2, the modified reliability index, which compares differences in the observers recordings of consumption either above or below the 75 percent level, yields higher percentage agreements - each modified index exceeds 96 percent agreement.

Percentage agreement indices for each subject's 12 experimental foods are presented in Appendix 4B. Also presented in Appendix 4B is a graph showing the distribution of the size (i.e., the number of categories between two observers reports) of differences in cases of disagreement between observers. Of the 38 disagreements recorded the majority (31) were within one category.

Procedure

General procedure

Each subject was presented with three experimental foods as part of the evening meal, five days per week throughout the experiment. In each case the foods presented were two vegetables and one fruit; Sally was, of course, an exception to this and was presented with three vegetables.

Prebaseline

The prebaseline phase was as described in the *General Method* (Chapter 3) and implemented in the previous experiment (Experiment 2). However, in addition, procedures were introduced to examine each subject's ability to correctly categorise fruits and vegetables, including all of those presented during the experiment.

Testing procedures were implemented by parents. Shortly after the evening meal commenced each subject was asked, by his or her parent(s), to name the food items on his/her plate. If the subject could not name any food, or named the food incorrectly, the parent(s) provided the correct name. The subject was then asked to categorise each food into one of the following categories: *vegetables*, *fruit*, *meat*, *fish*, and *other*. The category *other* included pasta, rice, dairy products, and so on. This procedure was repeated when the fruits were presented. Given that the experimental foods were presented as part of the evening meal, they were easily incorporated into these procedures.

The subjects had little difficulty performing this task. Prior to the beginning of Baseline 1, each child could correctly categorise the twelve experimental foods presented to them during the remaining phases.

Baseline 1

During this phase each experimental food was presented on at least three separate occasions. If any subject spontaneously consumed an experimental food (to criterion or above criterion), on more than one occasion, the item was withdrawn and replaced with another from the same category. This happened infrequently: Kirsty consumed 100 percent of mango on the second and third occasions on which it was presented, and so this was replaced with guava. Similarly Alison consumed sprouts which were replaced with kidney beans, and guava which was replaced with prunes.

Intervention 1

Conditions during this phase were similar to those in the corresponding phase in Experiment 2. However, because the intervention package was applied to food categories, a number of procedural changes were implemented:

1. On any given target evening, prior to the evening meal, each subject would view one of the Food Dude Category Intervention films. In the course of viewing the film the subject was: (i) instructed by the Food Dudes to "*eat all fruits/vegetables*" depending on which category had featured in the film, and (ii) told that compliance with the instruction would yield a reward.

2. As in Experiment 2, rewards were contingent upon the subject consuming 75 percent or more of the target foods. However, the criterion level applied to food *categories* and not specific items of food (as was the case in Experiment 2). Thus, if the target category was fruit a subject would be required to consume at least 75 percent of the one fruit presented. If, however, vegetables were targetted, it was necessary for a subject to consume at least 75 percent *in total* of the two experimental vegetables presented. This would be, for example, at least all of one item and 50 percent of the second, or 75 percent of each item. (Sally was required to consume at least 75% in total across the three vegetables presented on any given evening).

3. As the intervention was designed to target food categories - not specific foods - and because exemplars from both categories were presented each day, subjects were consequently exposed to the intervention package daily (as opposed to every third evening as in Experiment 2).

4. As in Experiment 2, subjects were awarded rewards and stickers on each occasion they consumed the target foods to criterion or above. The subjects were required to collect four stickers for consuming foods from the first category targetted, following which they were required to collect four stickers for consuming foods from the second category. When each subject collected his or her first sticker they were awarded a membership pack as described in the corresponding section of Experiment 2. A promotion pack was awarded in cases where a subject collected four stickers - this pack contained a baseball cap and a transistor radio, both bearing the Food Dudes logo. Any subject who collected eight stickers was awarded a "super prize" as described in the previous experiment. (Sally was required to collect eight stickers for consuming vegetables.)

5. If a subject failed to consume the experimental foods from the targetted category on any target evening, the shaping procedure employed during Experiment 2 was followed. However, on the first occasion this occurred, in addition to a letter (and where appropriate, a reward) the subject would be sent a photograph showing the contents of the junior membership pack.

Baseline 2

Each of the 12 experimental foods were presented on at least one occasion; time constraints prevented the extension of this phase to allow three presentations of each food.

Intervention 2

During this phase the subjects were presented with only half of their 12 experimental foods: four vegetables and two fruits (Sally was presented with six vegetables). These *high exposure* foods were randomly selected from the experimental foods in the appropriate category which had been consumed on at least one occasion, to criterion or above, during Intervention 1. Any experimental food not previously consumed to criterion or above was automatically assigned to the low exposure group, and consequently not presented during this phase. These procedures of group allocation were used because Intervention 2 was designed to maintain consumption of (some of) the foods which had been promoted by Intervention 1: Intervention 2 was not designed to promote the consumption of previously refused foods. Table 5.4 shows the six high exposure foods presented to each subject.

Table 5.4: The six high exposure foods presented to each subject during Intervention 2.

Jeff	Kirsty	Alison	Sally
Green beans	Courgettes	Chick peas	Kidney beans
Sprouts	Green beans	Celery	Chick peas
Butter beans	Cauliflower	Coleslaw	Celery
Blackeye beans	Sprouts	Red pepper	Coleslaw
Guava	Guava	Prunes	Beansprouts
Lychee	Loganberries	Loganberries	Water chestnuts

Each of the six high exposure foods was presented to each subject on 15 occasions. Food presentations continued as described in the General Procedure section. The total duration of the phase was six weeks.

Subjects monitored their own consumption of the high exposure experimental fruits and vegetables using a token reward system similar to that used in the corresponding phase of Experiment 2. Yellow stickers were awarded for criterion consumption of fruits, green stickers were awarded for the criterion consumption of vegetables, and red stickers were awarded for below criterion consumption of either category of foods. The rewards were the same as those used during the corresponding phase of Experiment 2.

Generalisation

Prior to the evening meal on the first day of this phase, each subject received a letter which read as follows:

> *Dear Name of Subject,*
>
> *You're a Dude of many foods. You have done great in our fight against General Junk and his evil Junk Food Junta. You have made the grade and your names have been entered in the "Dude of the year Grand Lottery". The winners will soon be picked. It could be you, the luckiest Dude around, who gets a fab day out at somewhere really cool!*
>
> *Keep eating,*

During this phase, the low exposure experimental foods (i.e., the six foods not presented during I2) were presented under baseline conditions, on three occasions each. No imposed self monitoring or token reward system was operative.

Each subject received notification of any prizes won for consumption during Intervention 2 at the end of the Generalisation phase.

Follow-up

Follow-up data were collected two months and six months after the end of the Generalisation phase. Baseline conditions were resumed and each experimental food was presented on three occasions.

5.3: Results

Jeff

Jeff's daily consumption of fruits and vegetables throughout the experiment is presented in Figure 5.1. Consumption of the twelve individual foods is presented in Figure 5.1.1a (high exposure foods), and 5.1.1b (low exposure foods). The mean consumption of each food during each experimental phase is presented in Figure 5.1.2a (high exposure foods) and 5.1.2b (low exposure foods).

Baseline

Jeff did not consume *any* experimental fruits or vegetables during the initial Baseline phase.

Intervention 1

Food category consumption: In Jeff's case the intervention was applied to the vegetable category first. Little increase in vegetable consumption was recorded across the first four target evenings - mean consumption increased from zero, during Baseline 1, to approximately 19 percent (range, 0% - 50%). On the fifth day of this phase the intervention package was withdrawn from the vegetable category and applied to the fruit category. This resulted in an increase in fruit consumption. Although some variability in fruit consumption was evident, mean consumption was quite high (64%: range, 0% - 100%). Further, maximum fruit consumption was recorded on four of the seven evenings on which the intervention was operative.

While the fruit category was targetted the vegetables were presented under baseline conditions (i.e., Baseline 2). The low consumption recorded while the intervention was previously operative with vegetables continued and vegetables were consumed on only two occasions at the 50 percent level (mean 14%: range, 0% - 50%).

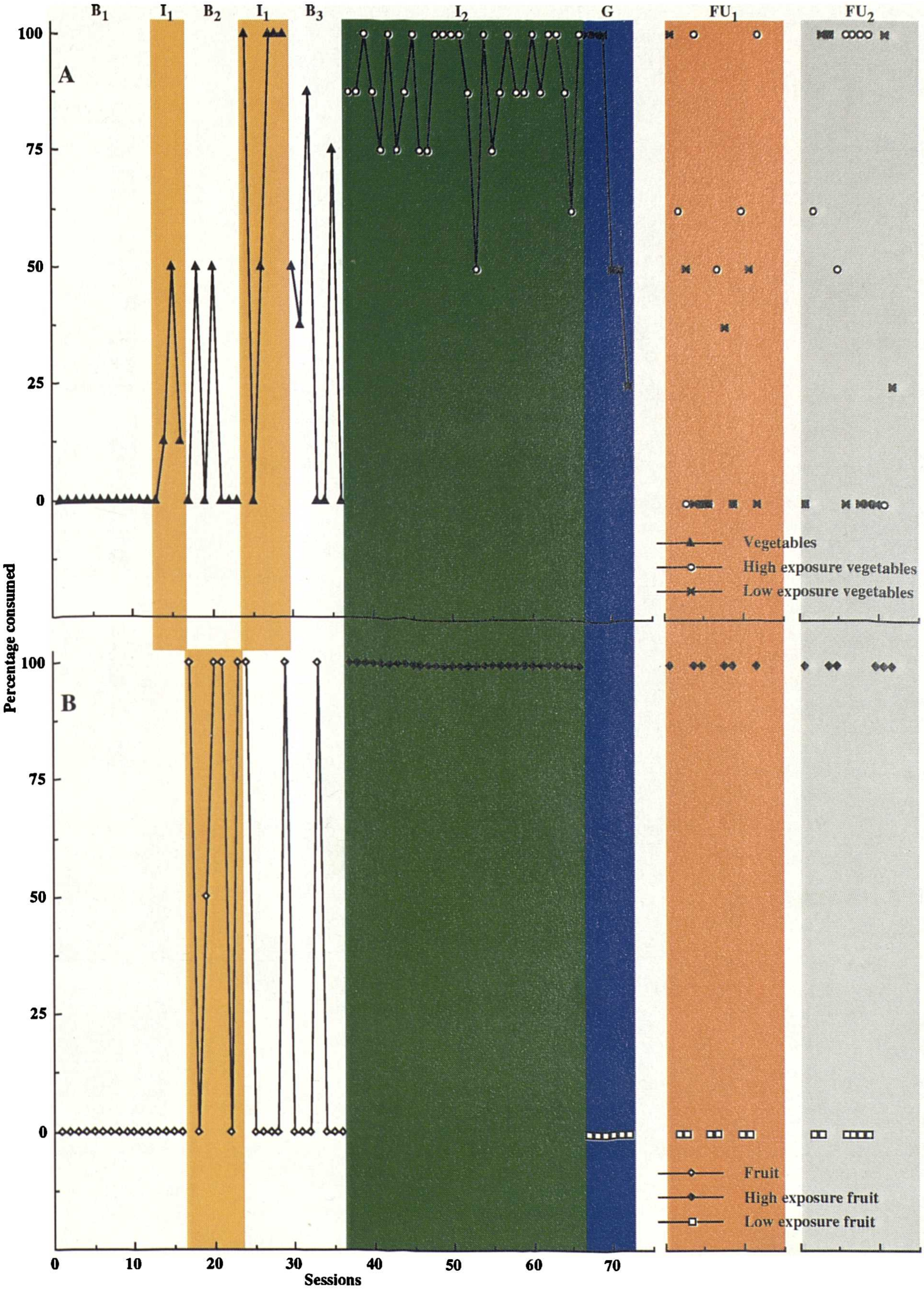


Figure 5.1: Jeff's daily consumption of the 12 experimental foods during Baseline (B1), Intervention 1 (I1), Baseline 2 & 3 (B2 & B3), Intervention 2 (I2), Generalisation (G), 2 Month follow-up (FU1), and 6 Month follow-up (FU2).
Graph A displays vegetable consumption: (▲), Any two of the eight experimental vegetables; (○), any of the four experimental vegetables presented during I2; (✱), any of the four experimental vegetables not presented during I2.
Graph B displays fruit consumption: (◇), Any one of the four experimental fruits; (◆), any of the two experimental fruits presented during I2; (□), any of the two experimental fruits not presented during I2.

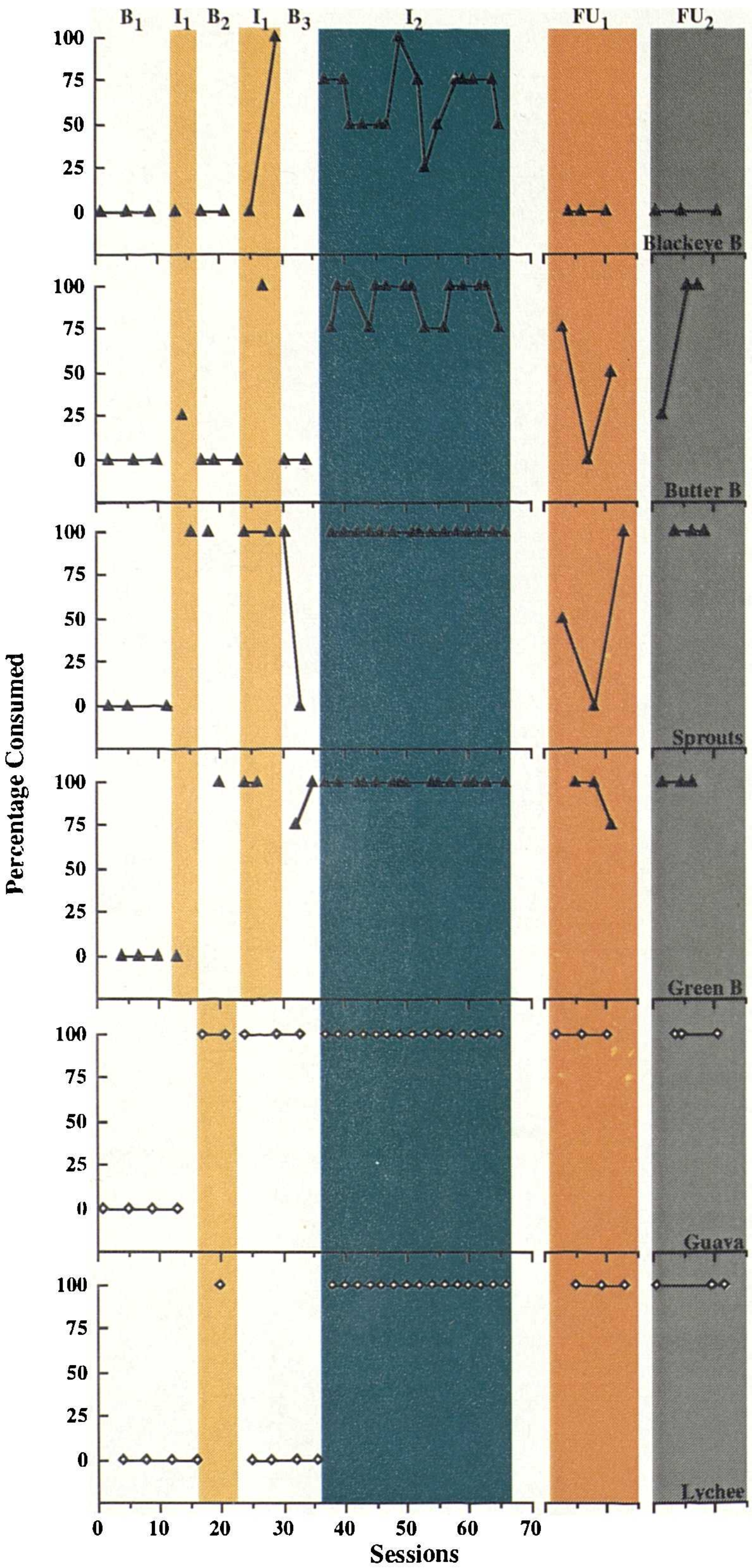


Figure 5.1.1a: Jeff's daily consumption of the four high exposure vegetables and two high exposure fruits during Baseline 1 (B_1), Intervention 1 (I_1), Baseline 2 & 3 (B_2 & B_3), Intervention 2 (I_2), 2-month follow-up (FU_1), and 6-month follow-up (FU_2)

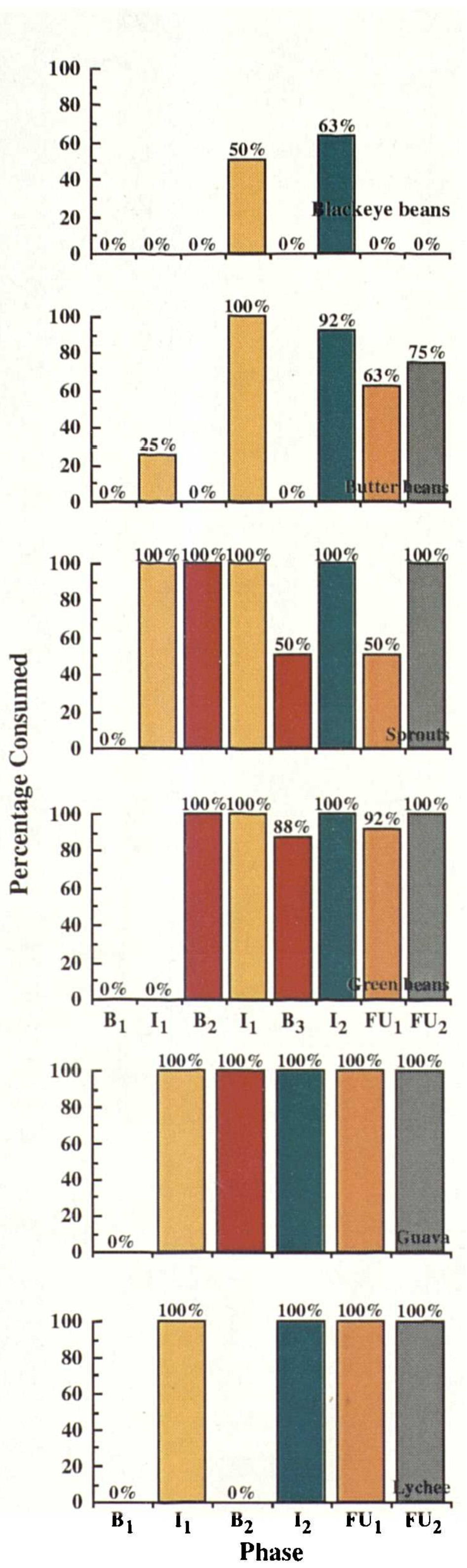


Figure 5.1.2a: Jeff's mean consumption of the four high exposure vegetables and two high exposure fruits across experimental phases

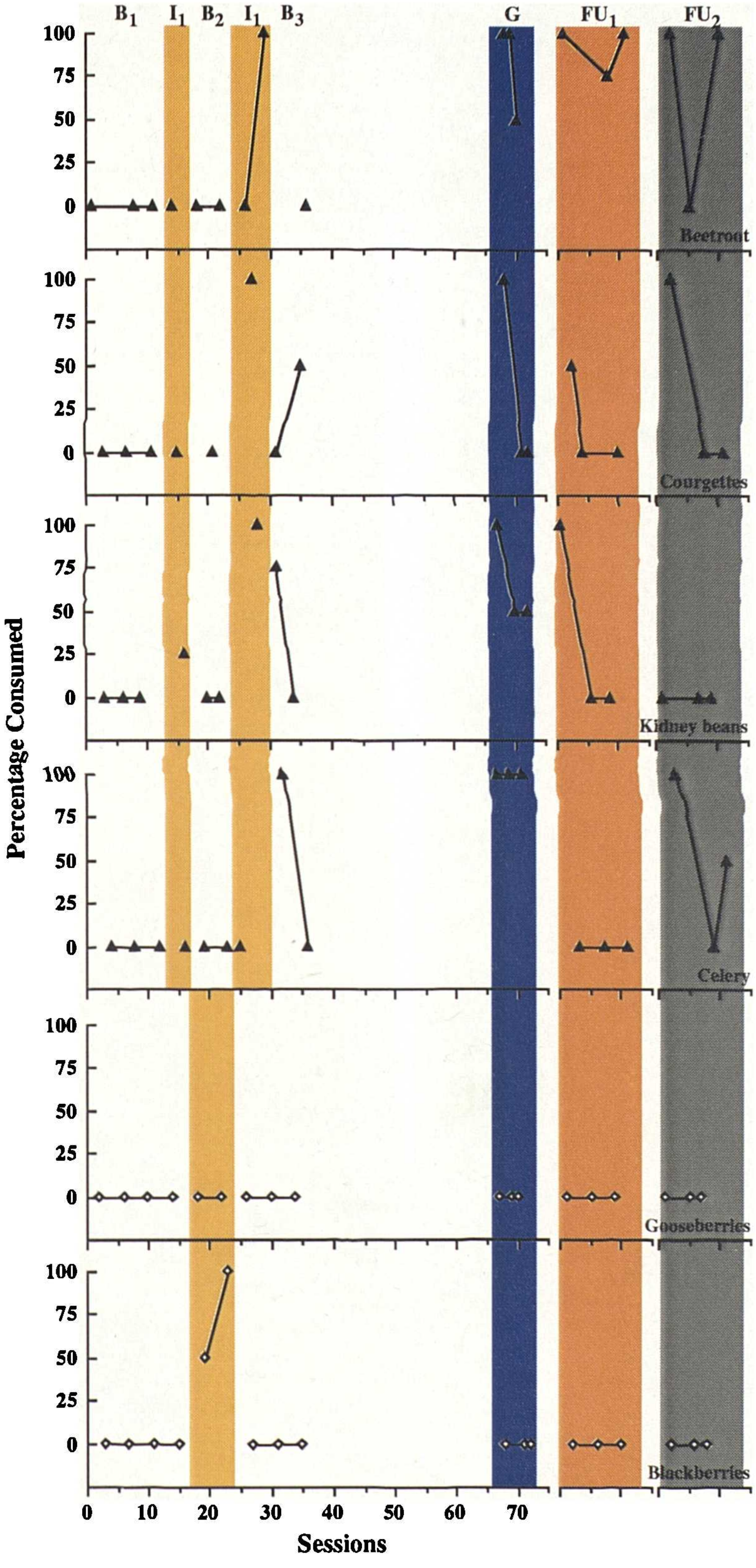


Figure 5.1.1b: Jeff's daily consumption of the four low exposure vegetables and two low exposure fruits during Baseline 1 (B_1), Intervention 1 (I_1), Baseline 2 & 3 (B_2 & B_3), Generalisation (G), 2-month follow-up (FU_1), and 6-month follow-up (FU_2)

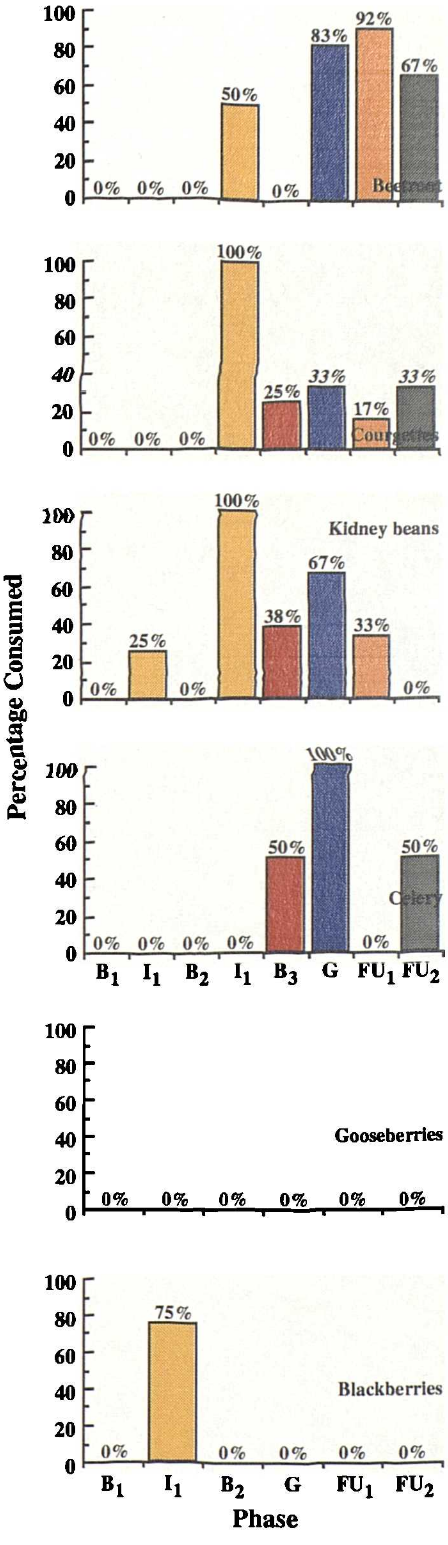


Figure 5.1.2b: Jeff's mean consumption of the four low exposure vegetables and two low exposure fruits across experimental phases

When the intervention package was applied to the vegetable category for a second time Jeff's vegetable consumption increased. Maximum vegetable consumption was recorded on four of the following six target evenings with stable maximum consumption recorded across the final three presentations. Mean vegetable consumption was 75 percent, as compared to a maximum of 19 percent recorded during any of the previous phases.

Individual food consumption: Examination of Figures 5.1.1 (a & b) and 5.1.2 (a & b) shows that although Jeff did not consume the foods in the vegetable category to criterion on any of the first four target evenings, he did consume 100 percent of the sprouts presented on the third target evening. Jeff also consumed 25 percent of butter beans and kidney beans (on the second and fourth target evenings respectively).

When the fruits were targetted, guava and lychee consumption increased from zero (during Baseline 1) to 100 percent. Blackberry consumption also increased, but at a slower rate (50% consumption, then 100%; mean consumption 75%). Gooseberries were the only fruit not consumed during this phase.

The introduction of Intervention 1 with vegetables for a second time resulted in Jeff consuming each of the vegetables, with the exception of celery, at maximum levels on at least one occasion. Of the vegetables eaten during this phase, blackeye beans and beetroot were consumed at the lowest levels (mean consumption 50%). Both were refused on the first (of two) presentations but were consumed at maximum levels on the second presentation. Sprouts and green beans were consumed at the highest levels (mean 100%).

Baseline 2 (fruits) & 3 (vegetables)

Food category consumption: Withdrawal of Intervention 1 resulted in a decrease in the consumption of both categories. However, consumption across Baseline 2 (fruits) and Baseline 3 (vegetables) was variable. Maximum fruit consumption was recorded on three occasions, but other than this, fruits were reliably rejected. Vegetable consumption to criterion (or above) was recorded on two occasions, but variability across the phase was evident with consumption ranging from zero to approximately 88 percent (mean 36%).

Individual food consumption: When Intervention 1 was withdrawn, the only fruit Jeff continued to consume was guava (reliably at 100%). Of the vegetables, only green bean consumption remained high (mean 87.5%). The consumption of sprouts and kidney beans declined from criterion levels to zero across Baseline 3, resulting in overall means of 50 percent and 37.5 percent respectively. Likewise, celery, the only vegetable not consumed during Intervention 1, was consumed at maximum level on the first presentation but rejected on the second (mean 50%). Courgette, the only other vegetable consumed during this phase, was consumed on one occasion at the 50 percent level (mean 25%).

Intervention 2

Food category consumption: The introduction of Intervention 2 resulted in increased consumption of both categories of foods (relative to the previous Baseline phase). Maximum fruit consumption was recorded across the entire phase. Vegetable consumption was also high (mean 80%) and although some variability was evident (range, 50% - 100%), below criterion consumption was recorded on only two occasions.

Individual food consumption: During Intervention 2 both the fruits, guava and lychee, and two of the vegetables, green beans and sprouts, were reliably consumed at maximum levels. Jeff's butter bean consumption showed some variability but never fell below 75 percent. Of the six high exposure foods, Jeff's consumption of blackeye beans was the most variable (ranging between 25% & 100%) and lowest during this phase. On two occasions blackeye beans were consumed at the 25 percent level; however, consumption levels of 75 percent or above were recorded on 8 of the 15 presentations giving a mean of 63 percent for this phase.

Generalisation

Food category consumption: Jeff's vegetable consumption was initially very high (100% on each of the first three presentations) but declined during the second half of the phase. Jeff did not consume any fruits during this phase.

Table 5.5 compares mean consumption of the low exposure fruits and vegetables during the Generalisation phase and Baseline 2 (fruits) and 3 (vegetables), the previous experimental phase during which these foods were presented. This table shows that Jeff's consumption of the low exposure vegetables increased from 32 percent to 71 percent; no change in fruit consumption was recorded as Jeff reliably rejected these during both phases.

Table 5.5: A comparison of Jeff's mean consumption of the low exposure fruits and vegetables during Baseline phase 2 (fruits) and 3 (vegetables) with mean consumption during Generalisation.

	Mean consumption	
	Baseline 2 & 3	**Generalisation**
Fruits	**0%**	**0%**
Vegetables	**32%**	**71%**

Individual food consumption: The four vegetables presented during this phase were initially consumed at maximum levels. Celery consumption continued at maximum levels throughout the phase. A decline in the consumption of the other three vegetables was recorded, this being greatest with courgettes (mean consumption 33%). The mean consumption of beetroot and kidney beans was high (83% and 67% respectively).

A comparison of Jeff's consumption of these six foods during Baseline 3 and Generalisation can be seen in Figure 5.1.2b. Substantial increases in mean consumption of beetroot (0% versus 83%) and celery (50% versus 100%) can be seen. Mean consumption of the remaining two vegetables, courgettes and kidney beans, was also higher during the Generalisation phase (as compared to Baseline 3) but the differences are less striking.

Follow-up

Food category consumption: During both follow-up phases Jeff consumed more experimental foods (from both categories) than he had during Baseline 1. Further, while fruit consumption was similar across both follow-up phases (mean 50% in both cases), mean vegetable consumption was greater during the later follow-up (as compared to the earlier follow-up phase).

Fruit consumption was similar across both follow-up phases. Jeff consumed maximum amounts of the two high exposure fruits (guava and lychee), and reliably rejected both low exposure fruits (blackberries and gooseberries, the latter which had never been consumed throughout the experiment).

Vegetable consumption during both follow-up phases was variable, but in both cases the mean consumption of the high exposure vegetables was higher than that of the low exposure group. During the first follow-up phase Jeff's mean consumption of the high exposure vegetables was 42 percent (range 0% - 100%) as compared to 26 percent for the low exposure (range 0% - 100%). During the second follow-up phase mean consumption of both groups increased; however, the mean high exposure consumption of 68 percent exceeded the 36 percent consumption recorded with the low exposure group.

Individual food consumption: Figure 5.1.1a shows that of the four high exposure vegetables, Jeff's consumption of green beans was high and stable during both follow-up phases (91.6% and 100%). Conversely, blackeye beans were reliably rejected during both follow-ups. Consumption of butter beans and sprouts was variable during the first follow-up phase with means of 41.6% and 50% respectively. Consumption ranged from zero to 100 percent with sprouts and zero to 75 percent with butter beans. Mean consumption of both these items increased during the second follow-up - sprouts were reliably consumed at maximum levels while butter bean consumption increased across the phase resulting in a mean of 75 percent (range 25% - 100%).

Of the four low exposure vegetables celery was rejected during the first follow-up and although mean consumption increased to 50 percent during the second follow-up, variability was evident (ranging from 0% - 100%). Jeff consumed kidney beans only once (100%) during follow-up; this was on the first presentation of the first follow-up phase. Courgette consumption showed a similar pattern of consumption which decreased across the phase. Of the four low exposure vegetables, mean beetroot consumption was greatest. During the first follow-up mean consumption was 92 percent, but this decreased to 67 percent during the second follow-up phase. Also greater variability (of beetroot consumption) was evident during the latter, as compared to the former follow-up.

Kirsty

Kirsty's daily consumption of fruits and vegetables throughout the experiment is presented in Figure 5.2. Consumption of the twelve individual foods is presented in Figure 5.2.1a (high exposure foods), and 5.2.1b (low exposure foods). The mean consumption of each food during each experimental phase is presented in Figure 5.2.2a (high exposure foods) and 5.2.2b (low exposure foods).

Baseline

Food category consumption: During Baseline Kirsty consumed little of either category. Vegetables were consumed twice (on the 8th and 21st session), but at low levels, and fruit was consumed only once at the 75 percent level.

Individual food consumption: Figures 5.2.1 a and b show that three vegetables, kidney bean, cauliflower, and baby sweetcorn, were each consumed once (at the 25% level). In addition Loganberries were consumed once at the 75 percent level; this was on the second occasion they were presented.

Intervention 1

Food category consumption: In the case of Kirsty, Intervention 1 was applied to the fruit category first and mean fruit consumption increased from 5 percent during Baseline 1 to 61 percent. Similar to Jeff, some variability in consumption was evident (range 0% - 100%); however, Kirsty consumed fruit to criterion or above on four of the following seven target evenings.

When Intervention 1 was introduced with the Vegetable category, Kirsty consumed 100 percent of the vegetables presented on four of the six target evenings (mean 85%). Further, while Intervention 1 was operative, Kirsty's vegetable consumption *never* fell below 50 percent.

Individual food consumption: Introduction of Intervention 1 resulted in an immediate increase (to criterion or above) in kiwi and loganberry consumption. Guava consumption also increased (also to criterion), but at a slower rate (25% then 100%). The intervention had little effect on Kirsty's consumption of Prunes (consumed once at 25%).

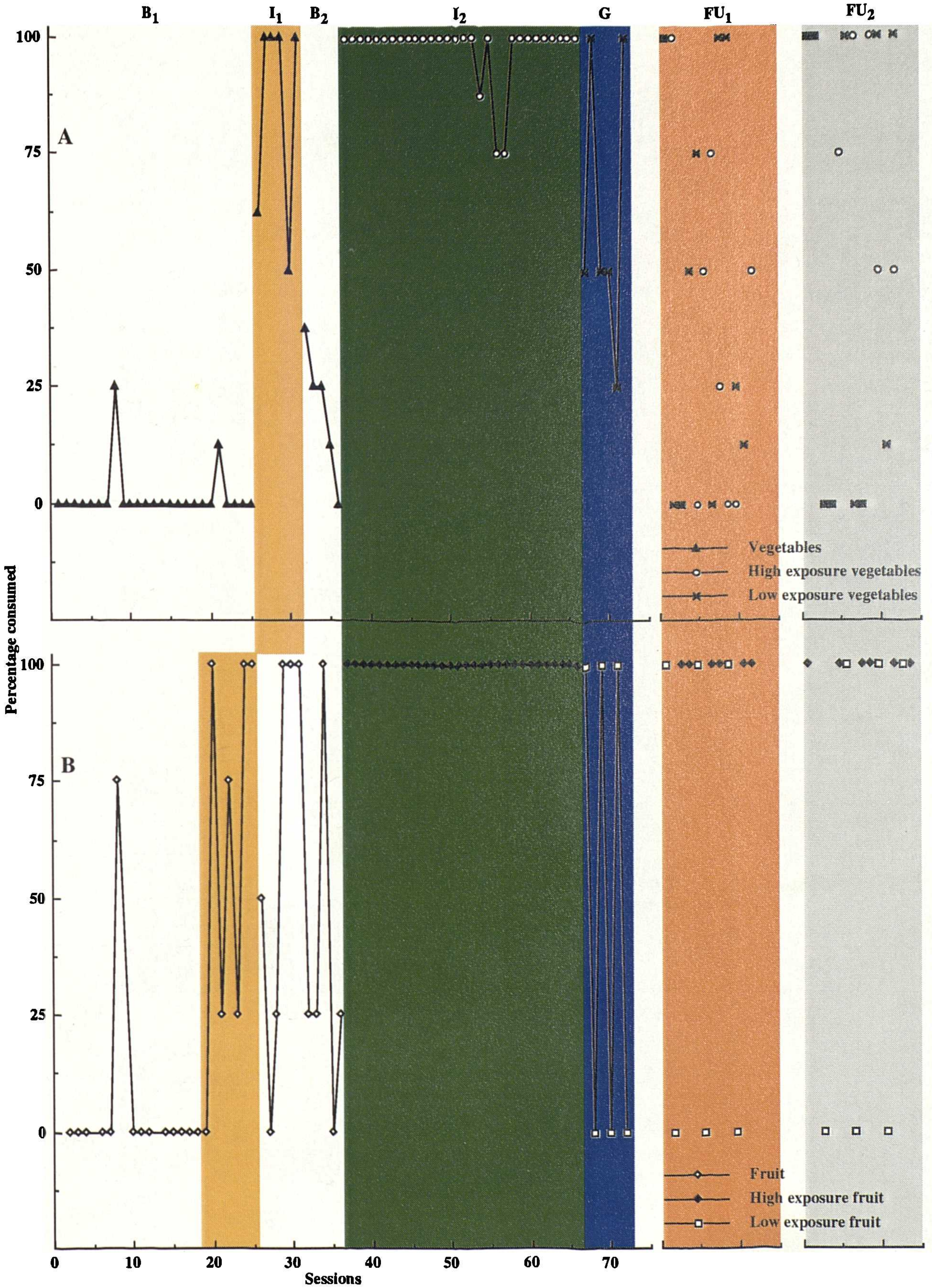
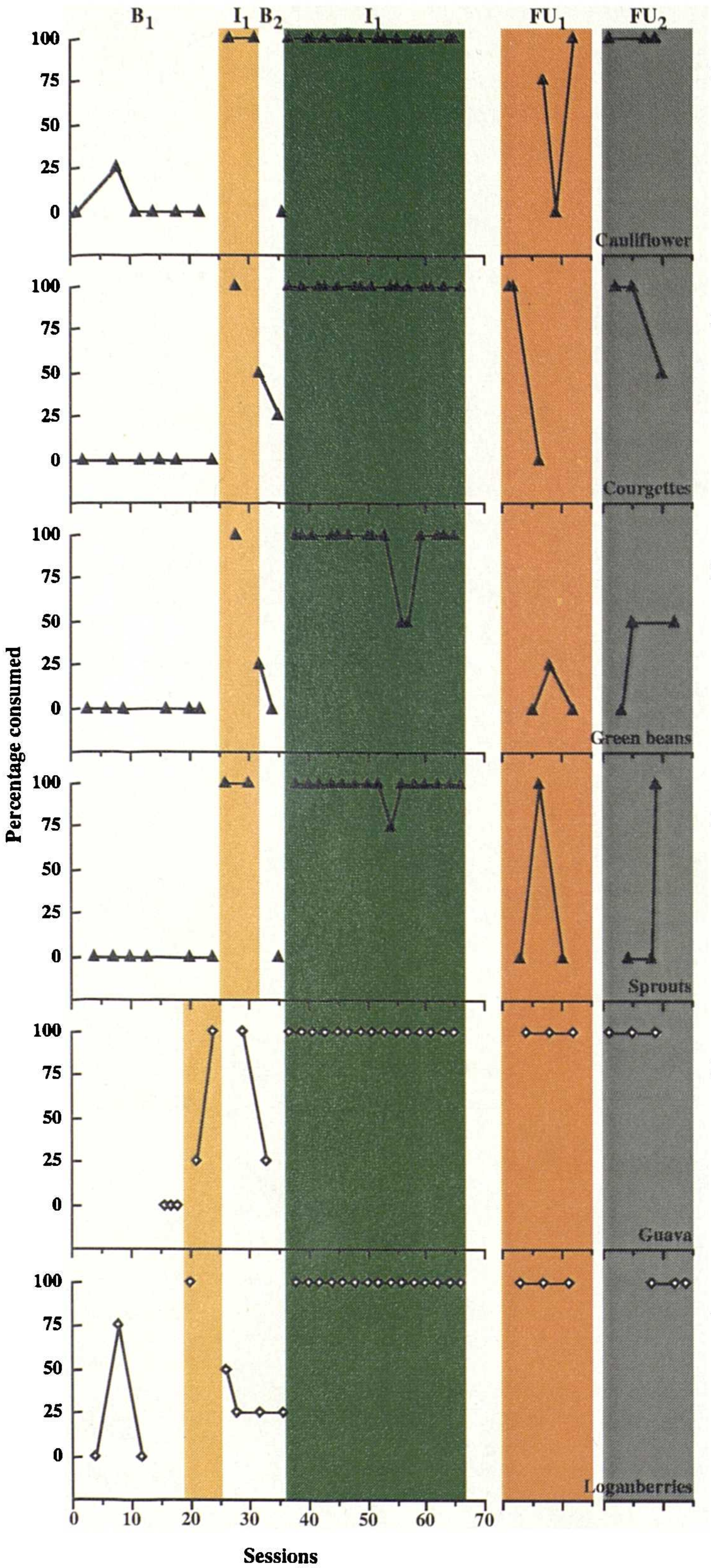


Figure 5.2: Kirsty's daily consumption of the 12 experimental foods during Baseline (B1), Intervention 1 (I1), Baseline 2 (B2), Intervention 2 (I2), Generalisation (G), 2 Month follow-up (FU1), and 6 Month follow-up (FU2).

Graph A displays vegetable consumption: (▲), Any two of the eight experimental vegetables; (o), any of the four experimental vegetables presented during I2; (✱), any of the four experimental vegetables not presented during I2.

Graph B displays fruit consumption: (◇), Any one of the four experimental fruits; (◆), any of the two experimental fruits presented during I2; (□), any of the two experimental fruits not presented during I2.



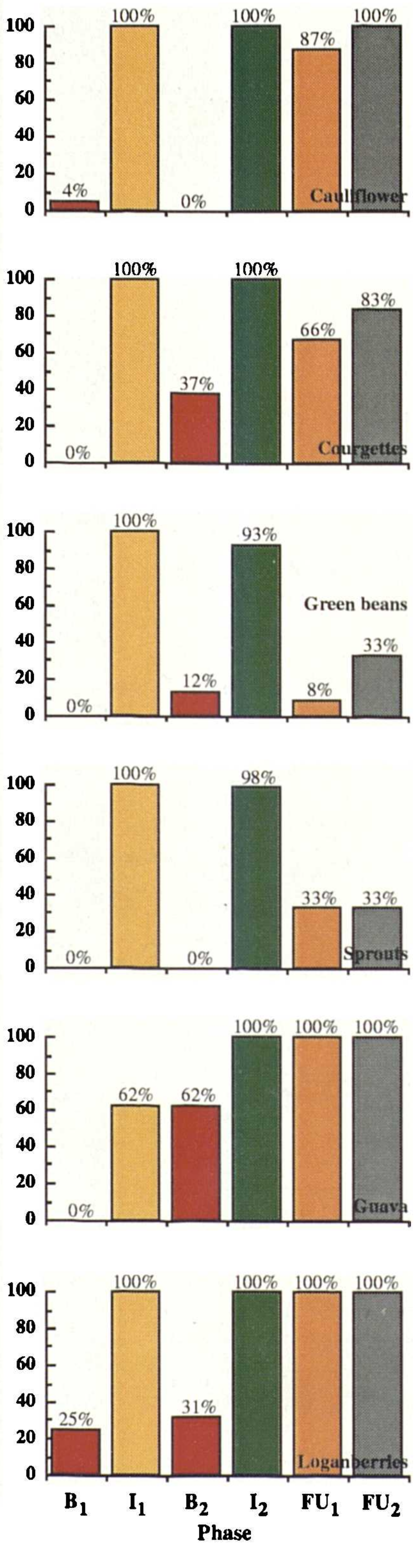


Figure 5.2.1a: Kirsty's daily consumption of the four high exposure vegetables and two high exposure fruits during Baseline 1 (B_1), Intervention 1 (I_1), Baseline 2 (B_2), Intervention 2 (I_2), 2-month follow-up (FU_1), and 6-month follow-up (FU_2)

Figure 5.2.2a: Kirsty's mean consumption of the four high exposure vegetables and two high exposure fruits across experimental phases

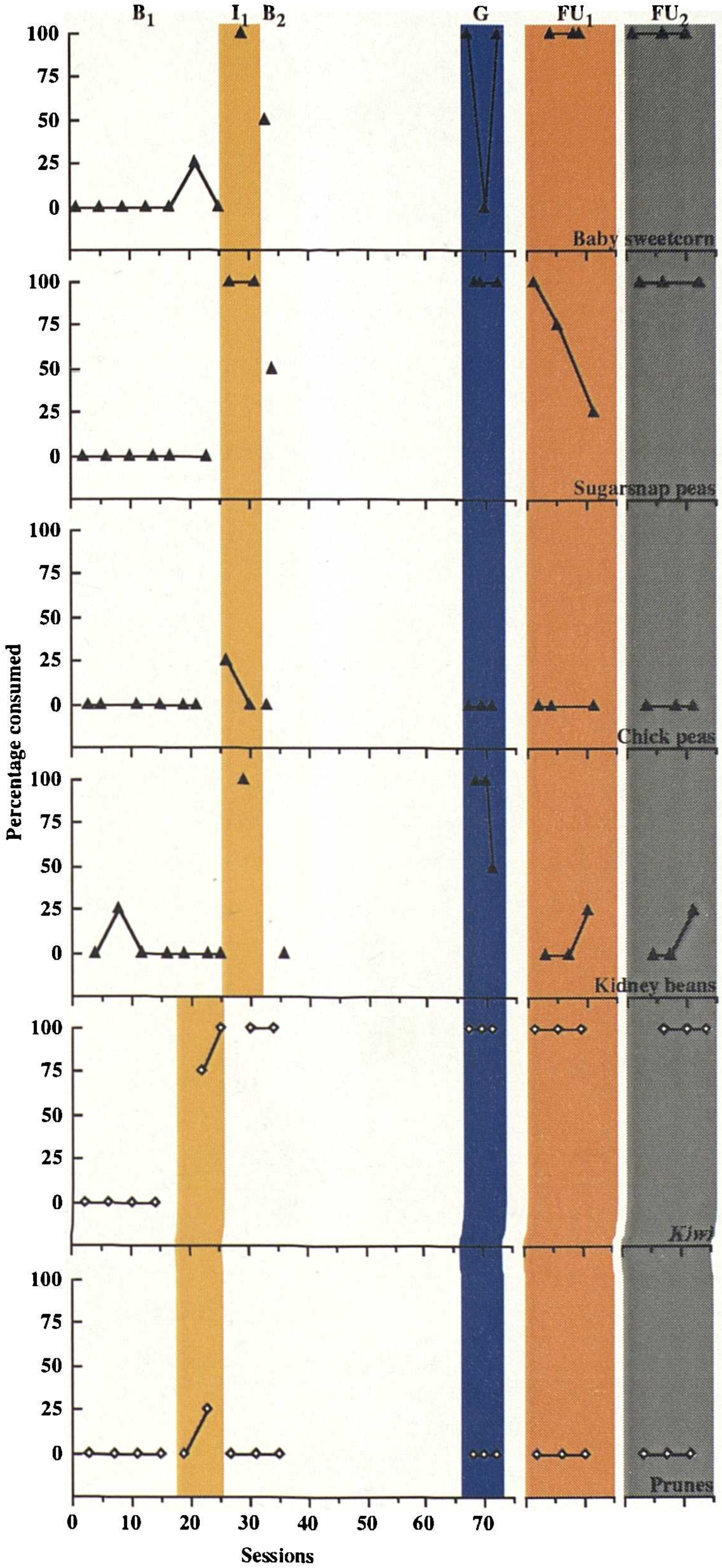


Figure 5.2.1b: Kirsty's daily consumption of the four low exposure vegetables and two low exposure fruits during Baseline 1 (B1), Intervention 1 (I1), Baseline 2 (B2), Generalisation (G), 2-month follow-up (FU1), and 6-month follow-up (FU2)

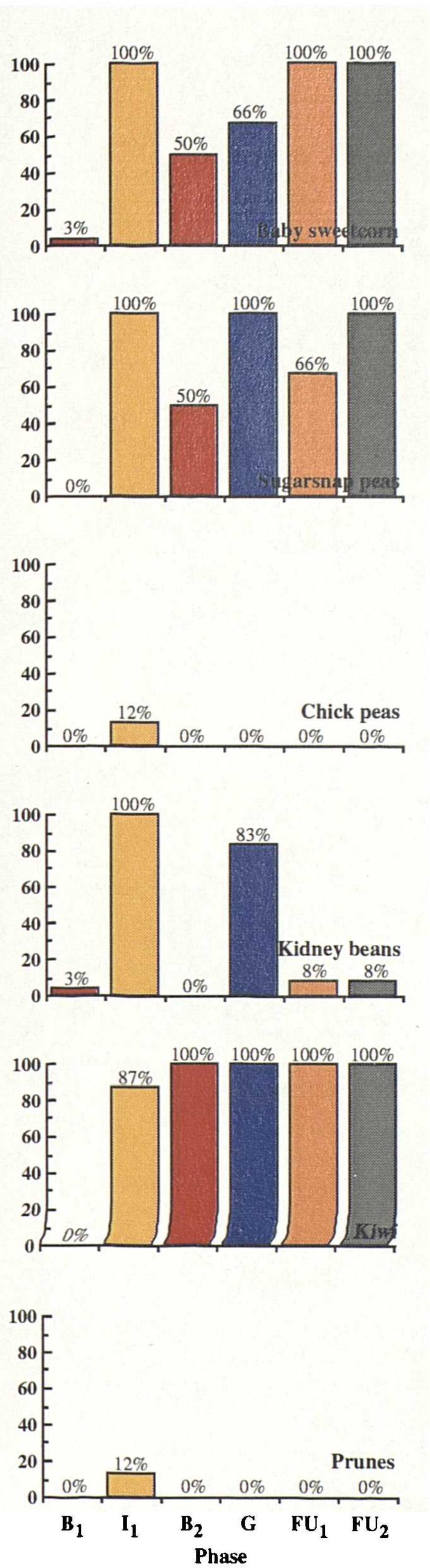


Figure 5.2.2b: Kirsty's mean consumption of the four low exposure vegetables and two low exposure fruits across experimental phases

When Intervention 1 was applied to the vegetable category, with the exception of chickpeas, Kirsty consumed all the vegetables reliably at maximum levels.

Baseline 2

Food category consumption: Withdrawal of Intervention 1 resulted in a decrease in the consumption of fruits and vegetables. Vegetable consumption decreased steadily across the phase. Although maximum fruit consumption was recorded on four occasions, variability was evident across the entire phase (and ranged from zero to 100%).

Individual food consumption: Kirsty continued to consume 100 percent of the kiwi fruit throughout Baseline 2. Guava consumption was initially high (100%), but it declined to 25 percent on the second presentation. Kirsty's consumption of Loganberries, while lower (mean 31%) was quite stable. Prunes were consistently rejected.

Of the vegetables, Kirsty consumed baby sweetcorn and sugarsnap peas at the 50 percent level. Mean consumption of courgettes and green beans was lower (37.5% and 12.5% respectively). The other vegetables were not consumed during Baseline 2.

Intervention 2

Food category consumption: The introduction of Intervention 2 resulted in an increase in Kirsty's consumption of both food categories, relative to Baseline 2. Similar to Jeff, maximum fruit consumption was recorded across the entire phase and although vegetable consumption was slightly more variable (ranging from 75% - 100%) it never fell below criterion.

Individual food consumption: During Intervention 2 Kirsty consumed all six foods reliably at maximum levels, with the exception of green beans which were consumed twice at 50 percent, and sprouts which were consumed once at 75 percent.

Generalisation

Food category consumption: Fruit and vegetable consumption was variable across this phase. Fruit consumption oscillated between zero and 100%, with maximum consumption being recorded on three of the six presentations. Vegetable consumption ranged from 25 to 100 percent, with maximum consumption recorded on two occasions.

Table 5.6 shows that, as was the case with Jeff, overall consumption of vegetables was greater during Generalisation than during Baseline 2. Mean consumption of the low exposure vegetables increased from 25 percent to 58 percent. Mean fruit consumption was the same (i.e., 50%) across Baseline 2 and Generalisation.

Table 5.6: A comparison of Kirsty's mean consumption of the low exposure fruits and vegetables during Baseline 2 and Generalisation.

	Mean consumption	
	Baseline 2	Generalisation
Fruits	50%	50%
Vegetables	25%	58%

Individual food consumption: Figure 5.2.1b shows that during Generalisation Kirsty consistently consumed kiwi at maximum levels and consistently rejected prunes. Kirsty consumed the maximum amount of sugarsnap peas, and her consumption of kidney beans and baby sweetcorn, while more variable, was also high (83.3% and 66% respectively). Chick peas, a food not consumed at high levels during Intervention 1, was not eaten on any occasion during this phase.

Figure 5.2.2b allows a comparison of the mean consumption of each of these six foods during Baseline 2 and Generalisation. This figure shows that the greatest increase in consumption was recorded with kidney beans which were rejected during Baseline 2 but consumed at 83% (mean) during Generalisation. Increases in mean consumption were also evident with baby sweet corn and sugarsnap peas.

Follow-up

Food category consumption: As was the case with Jeff, during both follow up phases Kirsty consumed more experimental foods (from both categories) than she had during Baseline 1. Further, while fruit consumption was high (mean 75%) and similar across both follow-up phases, Kirsty's vegetable consumption was higher during the later follow up phase.

During both follow-up phases Kirsty reliably consumed 100 percent of both high exposure fruits (guava and lychee). One of the low exposure foods (kiwi) was also consumed at maximum levels, while the second (prunes) was reliably rejected.

Mean consumption of the high and the low exposure vegetables was similar during the two month follow-up with respective means of 42 percent and 44 percent being recorded. Consumption of both groups was higher during the second follow-up (compared to the first); mean high exposure vegetable consumption was 63 percent compared to 52 percent for the low exposure group.

Individual Food Consumption: During both follow-up phases, Kirsty consumed all the guava, lychee and kiwi, the latter of which was not a high exposure food (i.e., not presented during Intervention 2). Prunes (the second low exposure fruit) were not consumed during any of the follow-up presentations.

Considering the four high exposure vegetables, Kirsty's consumption of cauliflower was variable (mean 58%, range 0% - 100%) during the first follow-up phase, whilst during the second follow-up this food was reliably consumed at maximum levels. Although courgette consumption showed a decreasing trend in both of the follow-up phases, mean consumption remained quite high in each case (66% during FU1 and 83% FU2). Conversely, sprouts were consumed only once (at 100%) during each follow-up. Finally, little consumption of green beans was evident during the first follow-up, and although some increase was evident during the second follow-up, mean consumption was still low (33%).

Concerning the low exposure vegetables, Baby sweetcorn was consumed at maximum levels during both follow-ups. Kirsty's consumption of sugarsnap peas was initially high but declined (from 100% to 25%) across the first follow-up phase - this food was then consumed at maximum levels during the second follow-up phase. Conversely, little consumption of chickpeas and kidney beans was evident during either follow-up.

Alison

Alison's daily consumption of fruits and vegetables throughout the experiment is presented in Figure 5.3. Consumption of the twelve individual foods is presented in Figure 5.3.1a (high exposure foods), and 5.3.1b (low exposure foods). The mean consumption of each food during each experimental phase is presented in Figure 5.3.2a (high exposure foods) and 5.3.2b (low exposure foods).

Baseline

During Baseline, Alison consumed 100 percent of the raspberries on the third occasion they were presented; however, this high consumption was not maintained on the following presentation. Alison did not consume any other experimental food during this phase.

Intervention 1

Food category consumption: In the case of Alison, Intervention 1 was applied first to the fruit category and on the first target evening Alison consumed 50 percent of blackberries (the highest consumption level recorded on the first day of this phase with any of the subjects). Maximum fruit consumption was recorded on each of the four remaining sessions of this phase (and each individual fruit was consumed once at the maximum level).

Consumption of vegetables also increased when the intervention was operative with this category. However, considerable variability was evident with below criterion consumption recorded on 6 of the 10 occasions when vegetables were targetted. Nevertheless, vegetable consumption increased from zero during Baseline 1 to a mean of 43 percent.

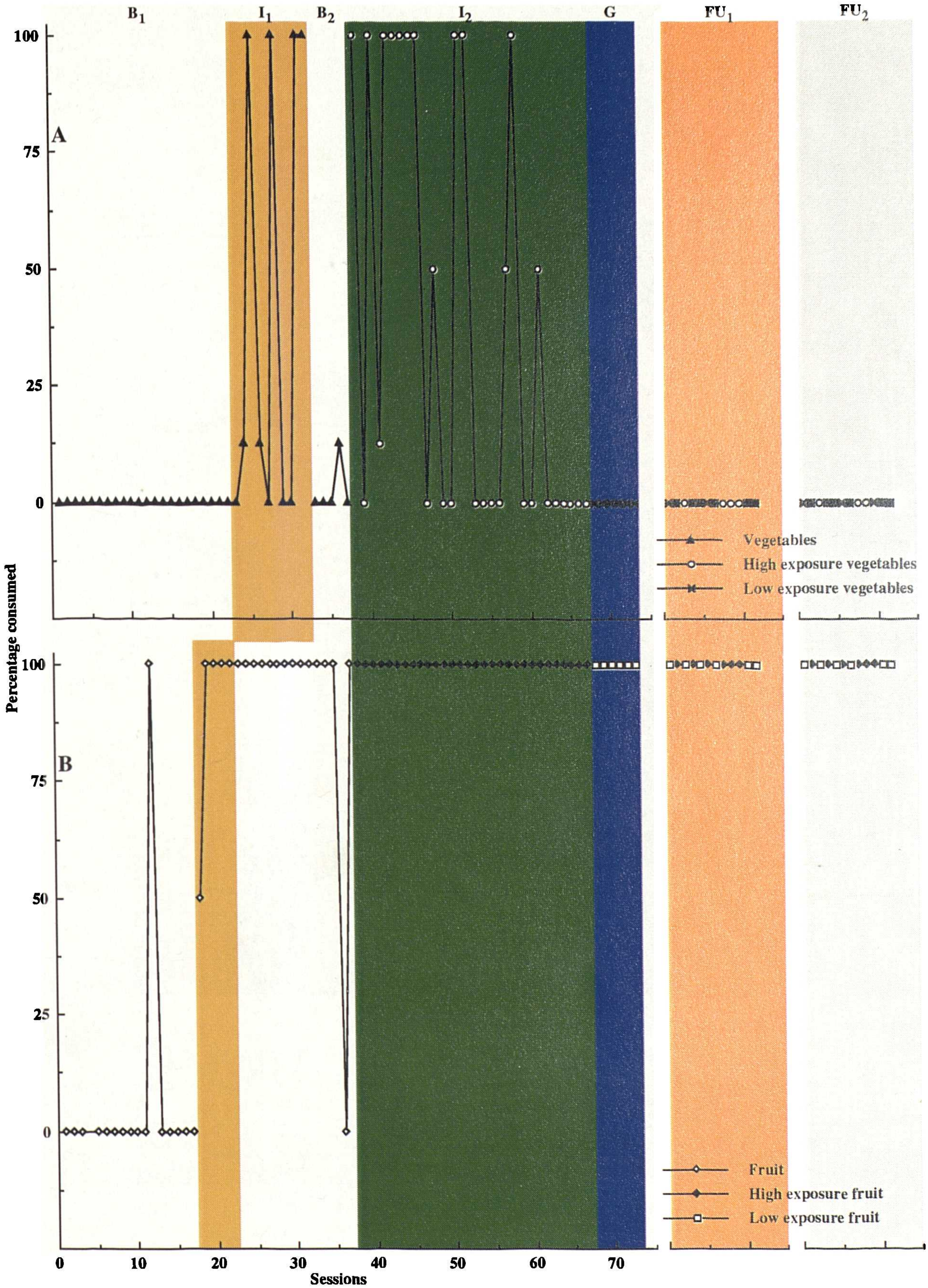


Figure 5.3: Alison's daily consumption of the 12 experimental foods during Baseline (B_1), Intervention 1 (I_1), Baseline 2 (B_2), Intervention 2 (I_2), Generalisation (G), 2 Month follow-up (FU_1), and 6 Month follow-up (FU_2).
Graph A displays vegetable consumption: (▲), Any two of the eight experimental vegetables; (○), any of the four experimental vegetables presented during I_2; (✱), any of the four experimental vegetables not presented during I_2.
Graph B displays fruit consumption: (◇), Any one of the four experimental fruits; (◆), any of the two experimental fruits presented during I_2; (□), any of the two experimental fruits not presented during I_2.

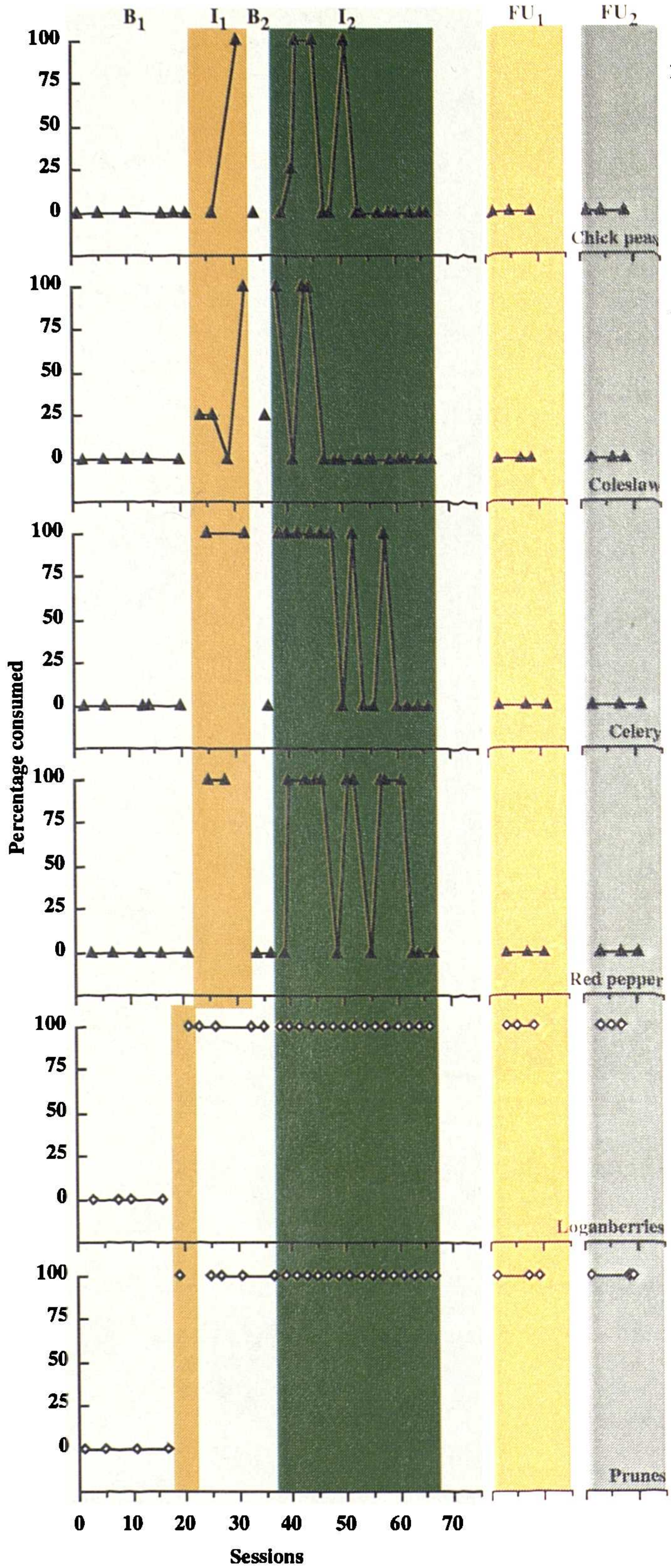


Figure 5.3.1a: Alison's daily consumption of the four high exposure vegetables and two high exposure fruits during Baseline 1 (B_1), Intervention 1 (I_1), Baseline 2 (B_2), Intervention 2 (I_2), 2-month follow-up (FU_1), and 6-month follow-up (FU_2)

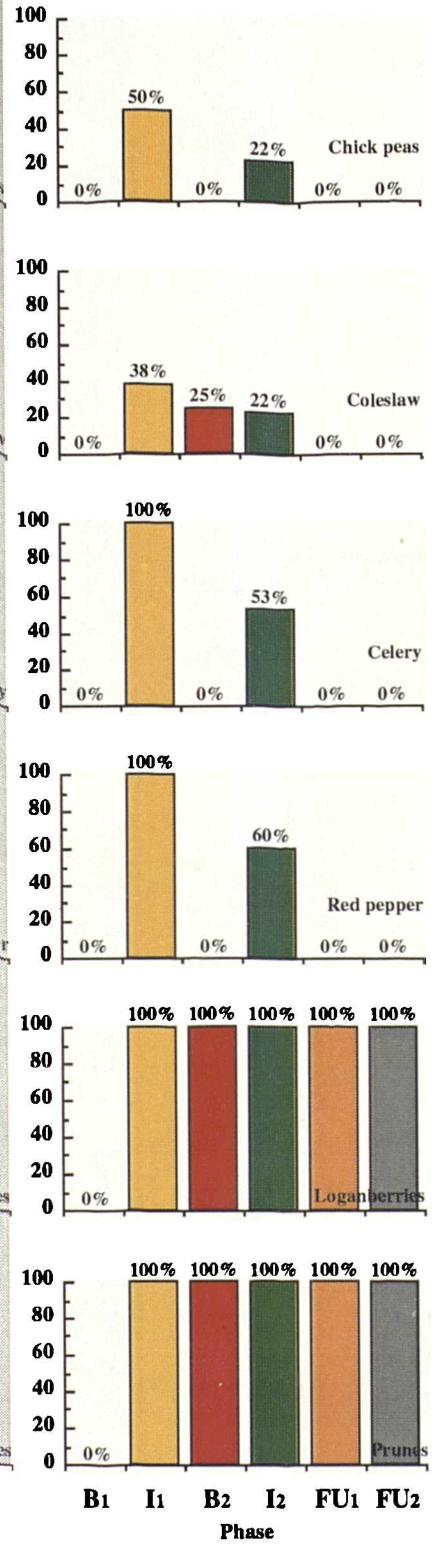


Figure 5.3.2a: Alison's mean consumption of the four high exposure vegetables and two high exposure fruits across experimental phases

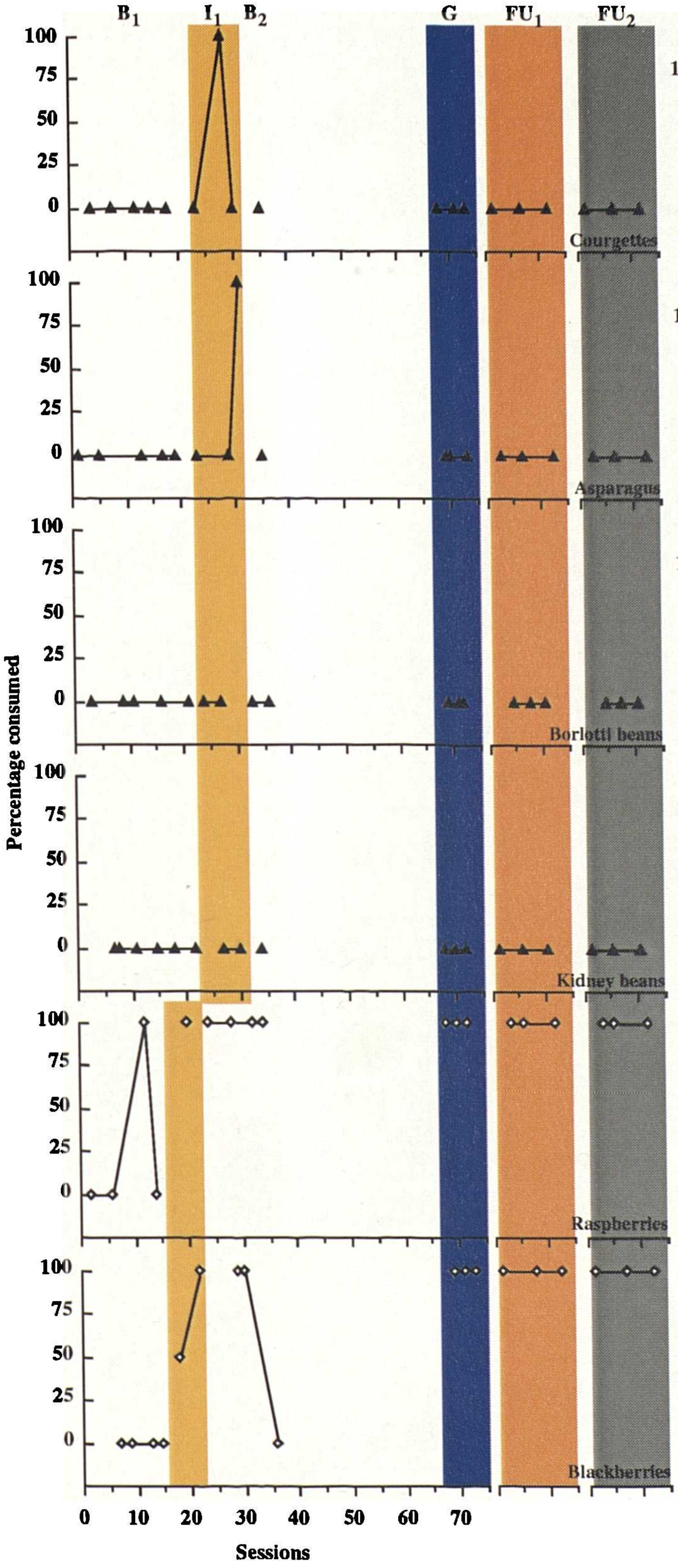


Figure 5.3.1b: Alison's daily consumption of the four low exposure vegetables and two low exposure fruits during Baseline 1 (B1), Intervention 1 (I1), Baseline 2 (B2), Generalisation (G), 2-month follow-up (FU1), and 6-month follow-up (FU2)

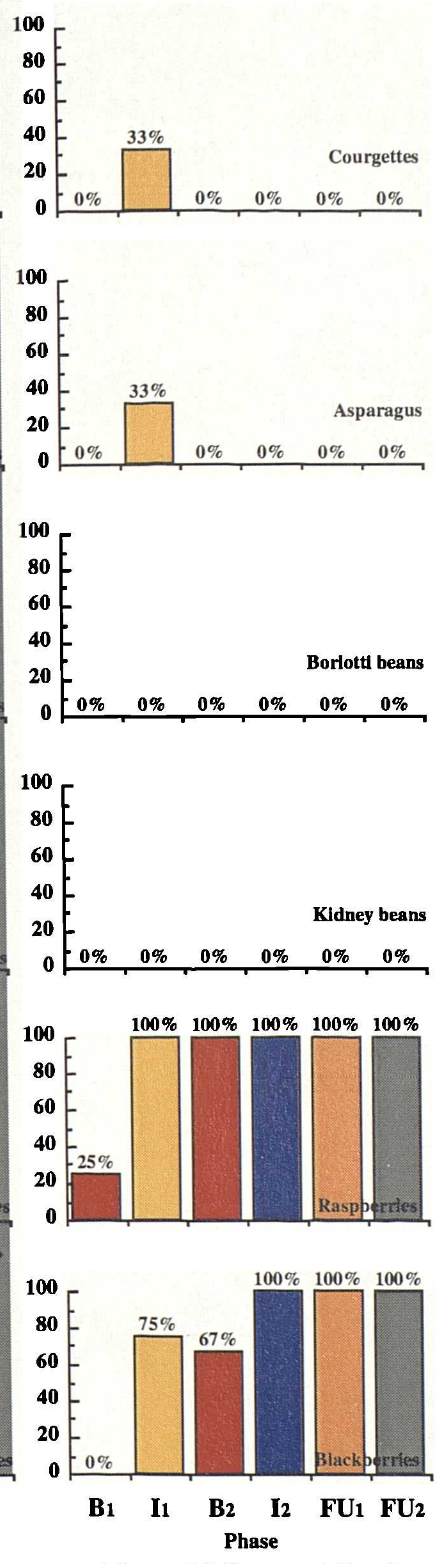


Figure 5.3.2b: Alison's mean consumption of the four low exposure vegetables and two low exposure fruits across experimental phases

Individual food consumption: Alison consumed six of the eight vegetables (excluding kidney beans and borlotti beans) on at least one occasion at maximum levels when Intervention 1 was operative. However, consumption across these foods was variable. Red pepper and celery were reliably consumed at maximum levels, while a slower acceleration in the consumption of coleslaw, chick peas, and asparagus was recorded (mean 38%, 33%, and 33% respectively). Alison's courgette consumption was more variable with maximum consumption being recorded only on the second of the three occasions it was presented (no consumption was recorded on the other two presentations).

Baseline 2

Food category consumption: Alison continued to consume all the fruits when Intervention 1 was withdrawn (with the exception of one evening when blackberries were rejected on the final presentation of this phase). Vegetable consumption returned to Baseline levels.

Intervention 2

Food category consumption: Alison's fruit consumption during Intervention 2 was very high and stable (100%), as it had been during Baseline 2. This was not the case with vegetable consumption.

Initially, vegetable consumption was high (but some variability was evident). During the first half of Intervention 2, Alison consumed vegetables to criterion or above on 9 of the 15 occasions. However, during the second half of this phase, above criterion consumption was recorded on only one occasion. Further, all vegetables presented across the last six sessions were rejected. Compared to the other subjects, Alison's vegetable consumption was low during this phase (mean 39%).

Individual food consumption: Of the four vegetables presented during Intervention 2, red pepper and celery were consumed in greater amounts than chick peas and coleslaw. Red pepper and celery were consumed at maximum levels on nine and eight occasions respectively (mean 60% and 53% respectively). Chick peas and coleslaw were consumed at maximum levels on only three occasions (chick peas were also consumed at 25% on one occasion) resulting in means of 22 percent in each case. With all four vegetables, consumption was variable, ranging from zero to 100 percent, and tended to decline across the phase - zero consumption being recorded across (at least) the final three presentations in each case.

Generalisation

Food category consumption: During the generalisation phase, Alison's consumption of the two categories of experimental foods became polarised: consumption of the fruit category (raspberries and blackberries) was maximum, while consumption of vegetables (courgette, asparagus, borlotti beans, and kidney beans) was zero.

Follow-up

Alison's consumption during both follow-up phases was very similar: she consistently consumed all four fruits at maximum levels and consistently rejected all eight vegetables.

Sally

Sally's daily consumption of vegetables throughout the experiment is presented in Figure 5.4. Consumption of the twelve individual foods is presented in Figure 5.4.1a (high exposure foods), and 5.4.1b (low exposure foods). The mean consumption of each food during each experimental phase is presented in Figure 5.4.2a (high exposure foods) and 5.4.2b (low exposure foods).

Baseline

During Baseline Sally (who was not presented any fruits) consumed vegetables on two occasions. The individual foods consumed were water chestnut (50%) and chick peas (25%) on the second session, and celery (25%) on tenth session.

Intervention 1

Food category consumption: With the exception of the first evening, Sally consumed 100% of the vegetable category *on every target evening* during Intervention 1.

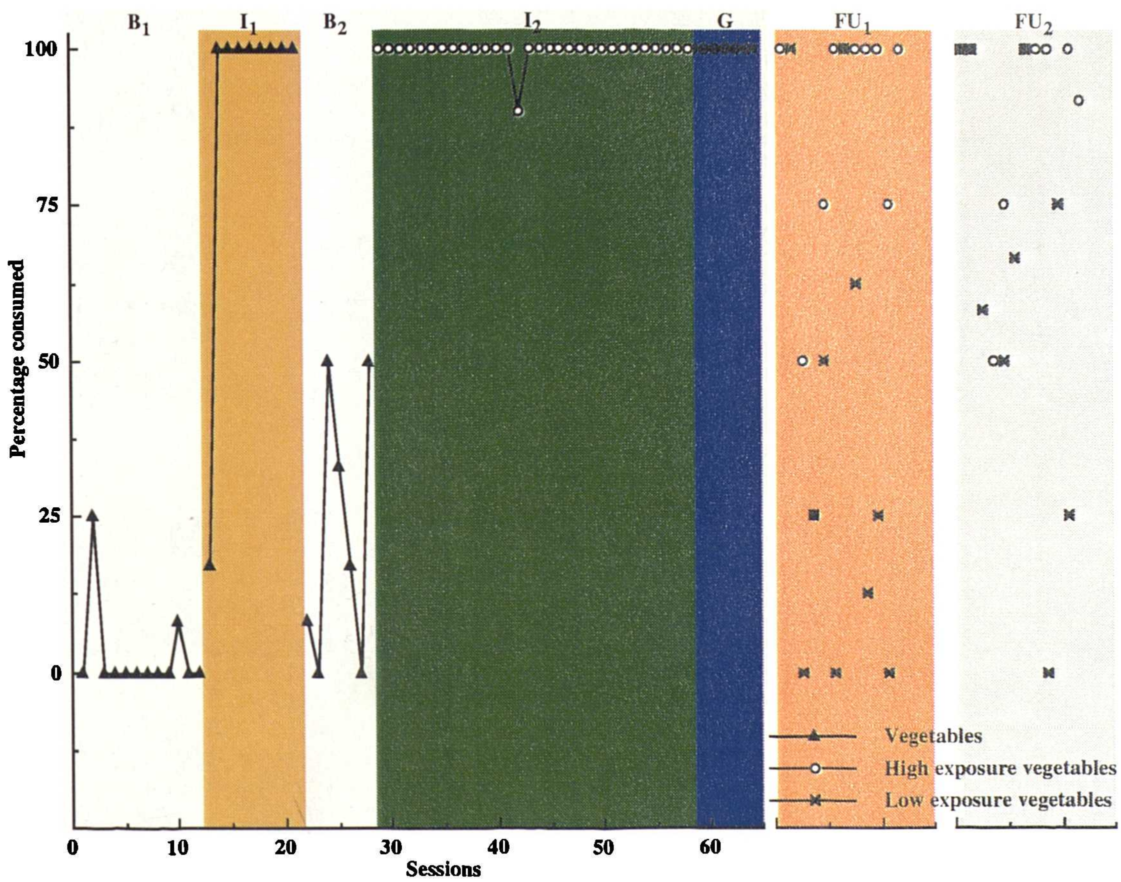


Figure 5.4: Sally's daily consumption of the 12 experimental vegetables during Baseline (B_1), Intervention 1 (I_1), Baseline 2 (B_2), Intervention 2 (I_2), Generalisation (G), 2 Month follow-up (FU_1), and 6 Month follow-up (FU_2). (▲), Any two of the 12 experimental vegetables; (○), any of the six experimental vegetables presented during I_2; (✱), any of the six experimental vegetables not presented during I_2.

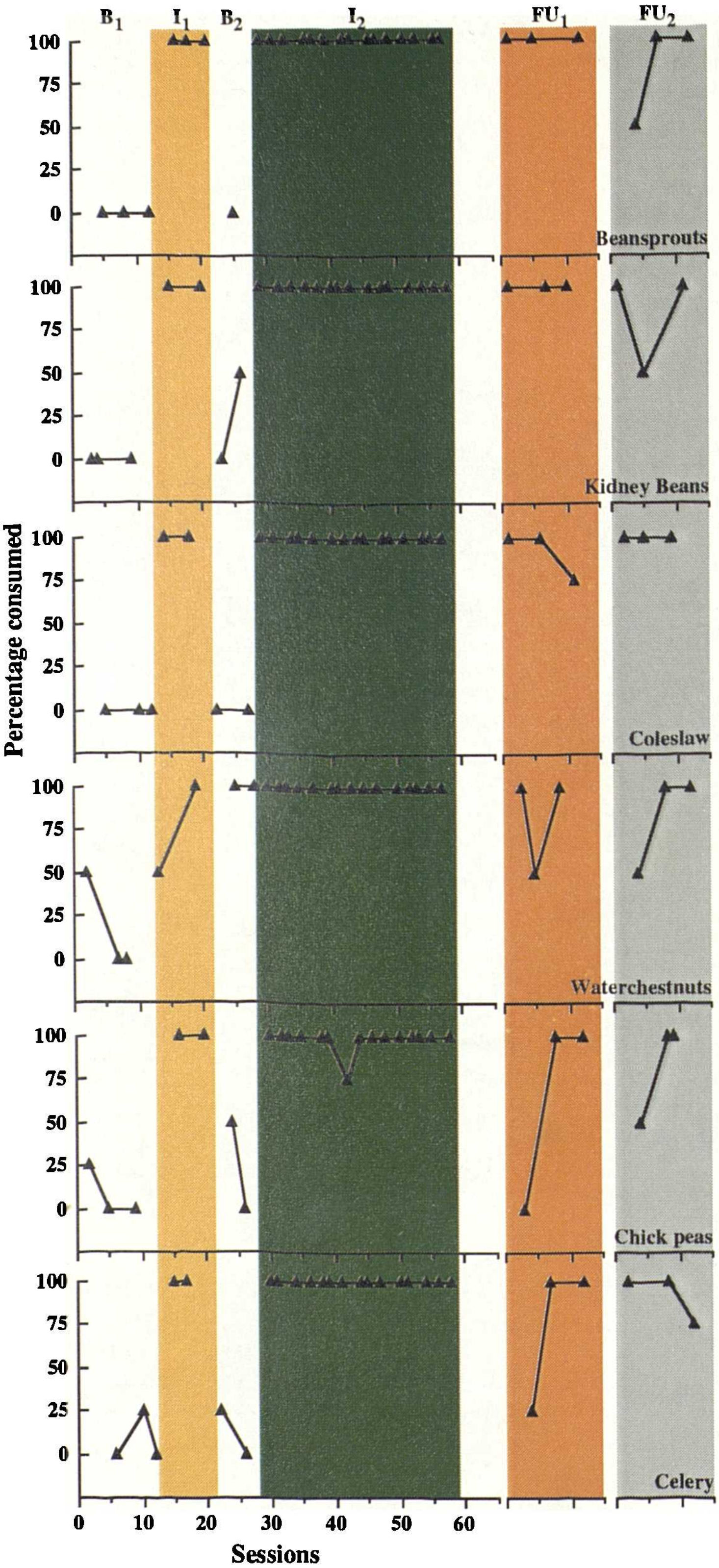


Figure 5.4.1a: Sally's daily consumption of the six high exposure vegetables during Baseline 1 (B_1), Intervention 1 (I_1), Baseline 2 (B_2), Intervention 2 (I_2), 2-month follow-up (FU_1), and 6-month follow-up (FU_2)

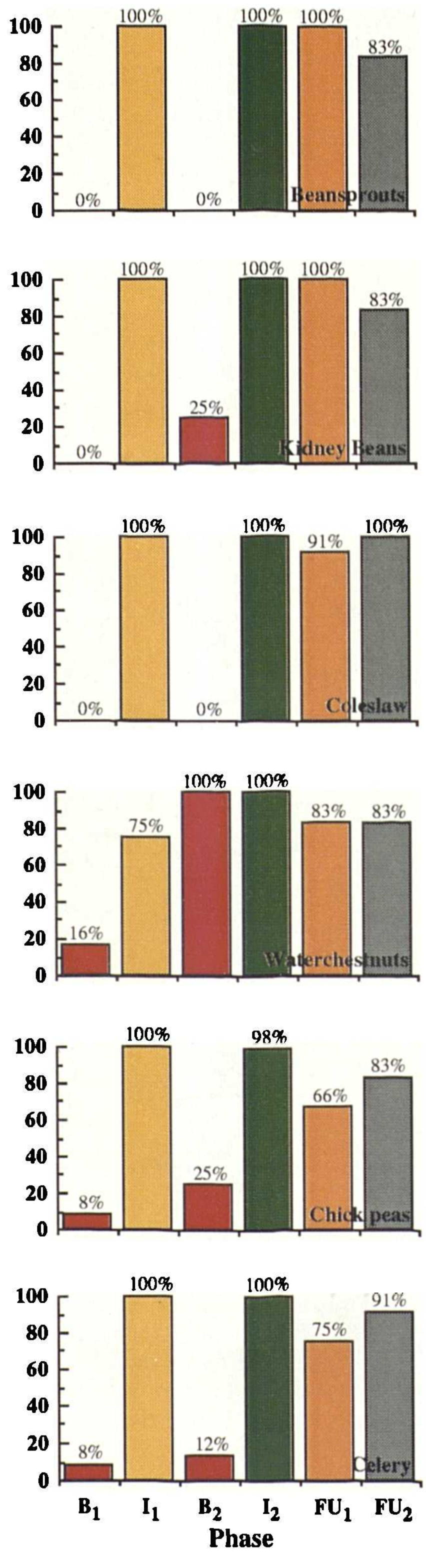


Figure 5.4.2a: Sally's mean consumption of the six high exposure vegetables across experimental phases

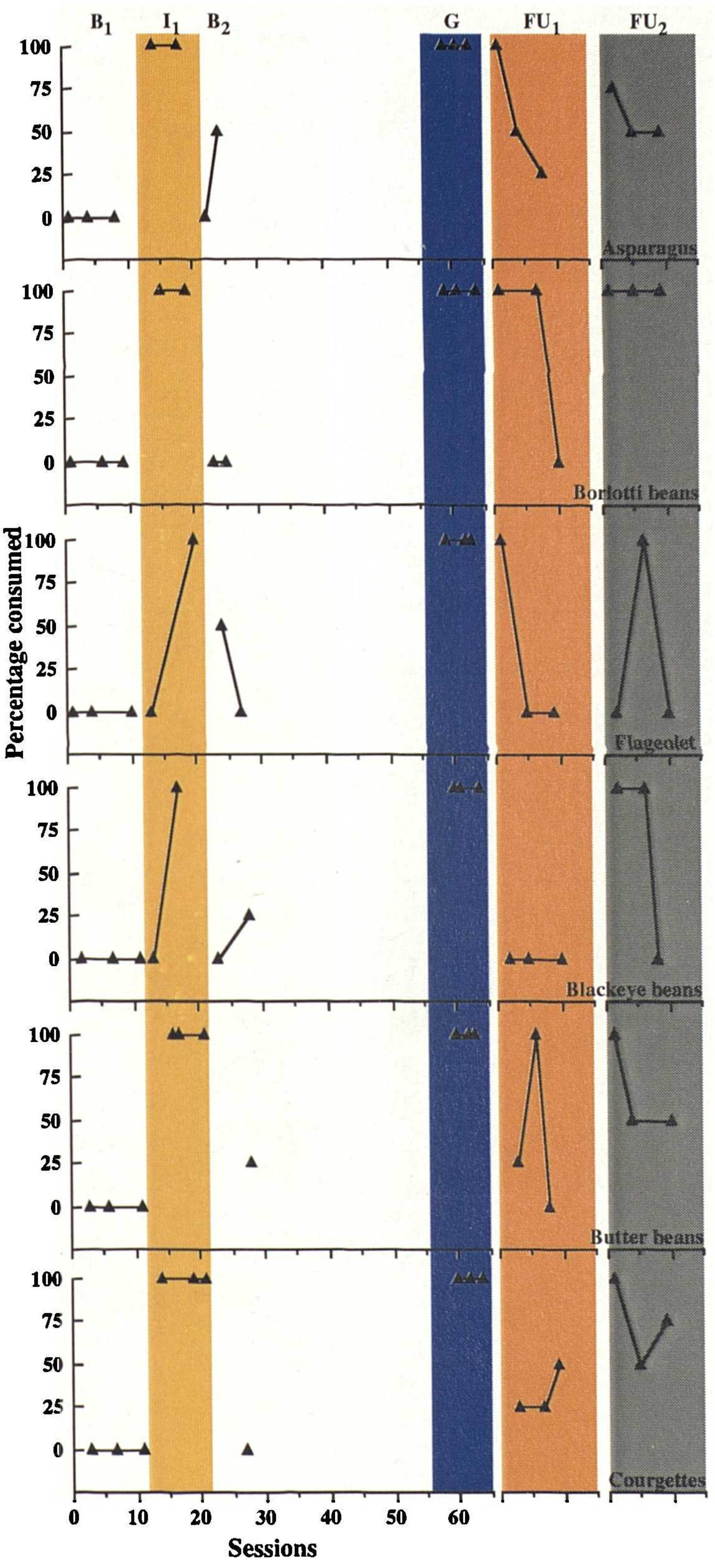


Figure 5.4.1b: Sally's daily consumption of the six low exposure vegetables during Baseline 1 (B_1), Intervention 1 (I_1), Baseline 2 (B_2), Generalisation (G), 2-month follow-up (FU_1), and 6-month follow-up (FU_2)

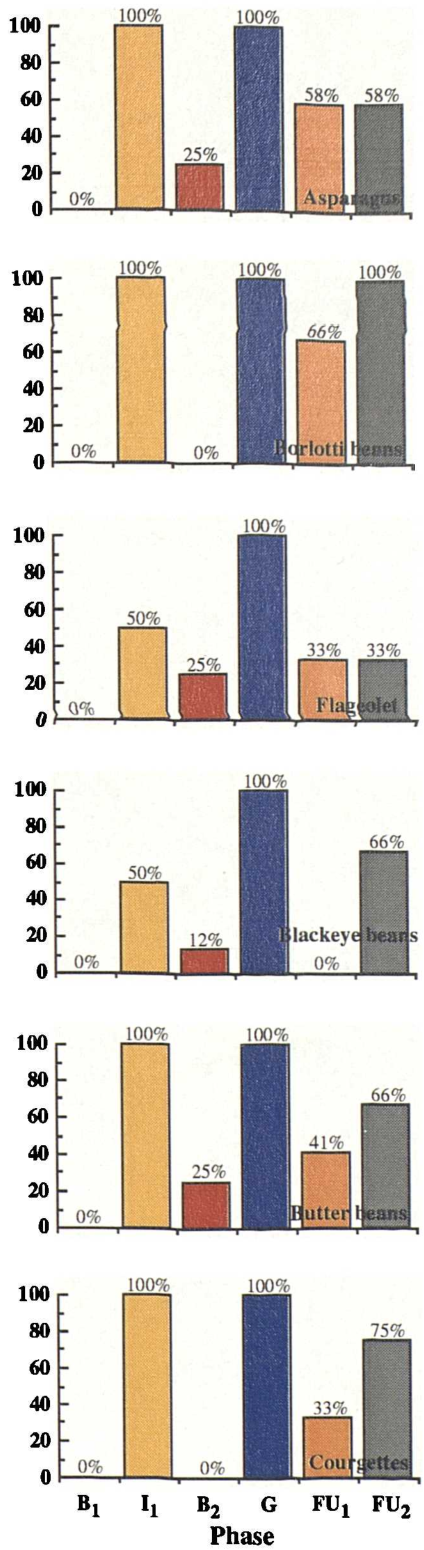


Figure 5.4.2b: Sally's mean consumption of the six low exposure vegetables across experimental phases

Individual food consumption: Sally consumed each of the 12 vegetables at maximum levels on at least one occasion. On the first target evening (the only occasion on which below criterion consumption was recorded), flageolet, blackeye beans, and water chestnuts were the three foods presented. Sally ate 50 percent of the water chestnuts (none of the four subjects ever consumed above criterion on the first target evening).

Baseline 2

Food category consumption: Withdrawal of Intervention 1 resulted in mean vegetable consumption decreasing from 94 percent (during Intervention 1) to 23 percent, and consumption tended to be variable, never exceeding 50 percent.

Individual food consumption: Following the withdrawal of Intervention 1, Sally continued to consume water chestnut at maximum levels. Mean consumption of the remaining vegetables did not exceed 25 percent.

Intervention 2

Food category consumption: During Intervention 2, with one exception, Sally consumed 100 percent of the vegetables presented (the exception being the 14th session of the phase: 92% was consumed).

Individual food consumption: Each of the six vegetables presented to Sally during this phase were consumed at maximum levels on each presentation, with one exception. Chick peas were consumed at the 75% level on one occasion (session 14).

Generalisation

Maximum consumption of all six vegetables was recorded during this phase. Similar to Jeff and Kirsty, an increase in consumption, relative to Baseline 2 was recorded. Table 5.7 shows that during Baseline 2 Sally's mean consumption of the six low exposure vegetables was 15 percent, this increased to 100 percent during the Generalisation phase. Figure 5.4.2b shows that the highest mean consumption of any individual low exposure food during Baseline 2 was 25 percent.

Table 5.7: A comparison of Sally's mean consumption of the low exposure vegetables during Baseline 2 and Generalisation.

	Mean consumption	
	Baseline 2	**Generalisation**
Vegetables	**15%**	**100%**

Follow-up

Food category consumption: Sally's mean consumption during both follow-up phases was the highest of the four subjects. Similar to Jeff and Kirsty, overall consumption during the second follow-up phase was higher than during the first. Also, high exposure vegetable consumption exceeded low exposure vegetable consumption. During the first follow-up phase mean consumption of the high exposure vegetables was 86 percent compared to 39 percent for the low exposure group. During the second follow-up phase high exposure consumption was similar to that recorded during the earlier follow-up (88%). Low exposure vegetable consumption increased (relative to the earlier phase), but the mean of 66 percent was still lower than that recorded for the high exposure group. Finally, across both follow-up phases, less variability was recorded with the high exposure foods which ranged from 50 to 100 percent consumption - consumption of the low exposure vegetables ranged from zero to 100 percent.

Individual food consumption: Figure 5.4.2a shows that during both follow-up phases, the mean consumption of each of the six high exposure vegetables never fell below 66 percent. Further, maximum or near maximum consumption was recorded with four of these vegetables: beansprouts, kidney beans, coleslaw, and water chestnuts.

Consumption of each of the six low exposure vegetables tended to be lower and more variable. During the first follow-up, consumption of asparagus, flageolet, and borlotti beans declined across the phase (mean 58%, 33%, and 66% respectively). Butter bean consumption (mean 41%) was variable. Courgette consumption (mean 33%) increased slightly on the final presentation. Sally did not consume any blackeye beans during the first follow-up.

During the second follow-up mean consumption of four of the low exposure vegetables increased (relative to the first follow-up). Borlotti beans were reliably consumed at maximum levels and blackeye beans were consumed at maximum levels on the first two presentations. Butter bean and courgette consumption also increased. Sally's consumption of asparagus and flageolet was similar across both follow-up phases.

5.4: DISCUSSION

Consistent with the previous experiment, the present results further highlight the malleability of food preferences (i.e., consumption) in this age range. In addition, the present results demonstrate that applying intervention packages to food categories can promote consumption across *a range* of previously refused fruits and vegetables. When using a food specific intervention package (as in Experiment 2) to promote consumption across different foods, it was necessary to change aspects of the intervention. For example, each particular food was specificed in instructions and during the modelling scenes in the videos. This was not the case during the present experiment. For example, following exposure to the intervention package on a given target evening a child may consume beetroot and courgettes. On the following target evening, exposure to the *same* intervention may promote the consumption of sprouts and green beans.

The present results are consistent with, and support, the conclusions drawn in the previous chapter. For example, the change in target behaviour following the introduction of the interventions, although in some cases not as abrupt as those recorded during Experiment 2, highlights the potency of the procedures. Further, the present results support the claims made in the previous chapter regarding the (possible) role of rule-governed behaviour in the subjects' consumption of the experimental foods. The delay between consuming the experimental foods and reward delivery, although shorter than that in Experiment 2 (i.e., 1 day versus 3 days), is still too great for the contrived consequences to directly control the target behaviour. Also, similar to Experiment 1 "insensitivity" to schedule parameters was evident in many cases, with behaviour frequently corresponding more closely to the verbal instruction than to the actual imposed contingency.

Additional support for a rule based account of (initial) increases in consumption is also provided by the present data. During the previous experiment the subjects were instructed to eat a specific food, and this food was featured in a number of sequences in the film. For example, there was a full screen "still" of the target food. A number of fruits or vegetables were featured (see Table 5.3, above) in the corresponding sequences of the category intervention films. However, not all the experimental foods employed in the present study were featured (directly) in the films. For example, Kirsty was presented with baby sweetcorn, sugarsnap peas, kiwi, and loganberries. Sally was presented with beansprouts and water chestnuts, and Alison was presented with red pepper, raspberries, and loganberries. These foods were consumed during Intervention 1, but were not featured visually during the intervention films. However, considering that the instruction requested subjects to "eat all fruits/vegetables" it is likely that consumption came under verbal regulation. Owing to the absence of pictorial representation for these foods, consumption could not be guided by visual similarity. Hence, it is likely that appropriate responding required the subjects to utilise the verbal categories (e.g., fruit or vegetables), in order to select additional foods to consume.

An initial comparison of the food specific and category based procedures may suggest a difference in potency, especially in the promotion of the consumption of specific food items. For example, during Experiment 2, Intervention 1, only one target evening was unsuccessful (Susan's first target evening with celery). In the corresponding phase of the present experiment, unsuccessful target evenings were recorded with *all* children, often on more than one occasion. A number of factors may be important with respect to this point.

During the present experiment, the requirement of the reward contingency imposed upon vegetable consumption was increased; subjects were required to consume two 30ml portions of vegetables, as opposed to one (as was the case during Experiment 2). More unsuccessful target evenings may have occurred during the previous experiment if the subjects were instructed to "eat broccoli *and* cauliflower", the consumption of *both* being necessary for access to reward. However, while the contingency requirements were increased with vegetable consumption, this was not the case with fruit consumption. In both experiments subjects were required to consume one 30ml portion of fruit in order to gain a reward. A number of unsuccessful target evenings with fruit were recorded during the present experiment; in contrast, on every evening when fruits were targetted during Experiment 2, above criterion fruit consumption was recorded. Hence, it is not clear whether differences in the food specific and category based interventions can be accounted for by differences in contingency requirements.

Comparison is further confounded because a number of fruits (e.g., lychee, gooseberries, and prunes) employed in the present experiment were not employed as target foods during Experiment 2. Further, examining the effectiveness of the category procedures with the fruits common to both experiments does not permit firm conclusions to be drawn. For example, the change in Jeff's guava consumption is comparable (even during Baseline 2) with that recorded with the relevant subjects during Experiment 2. This is also the case with Kirsty's kiwi consumption, *but not* her consumption of guava (during both Intervention 1 and Baseline 2).

A second issue concerns the different instructions employed across the two experiments. Target behaviour is more clearly defined by a food specific instruction - an instruction to "eat broccoli" is more precise than an instruction to "eat vegetables". Also, the latter instruction (eat vegetables) incorporates a much wider behaviour repertoire than the former (eat a specific item).

Given the above discussion it is also necessary to note that a difference in potency across the two intervention procedures may indeed be expected. Food specific interventions are, by definition, designed to increase subjects' consumption of particular (named) foods. Category based procedures, on the other hand, are designed to promote consumption across a range of foods. Given this, it may come as little surprise that category based procedures may indeed be less potent with some specific foods.

The present experiment also provides evidence that category based procedures may enhance the consumption of foods (from the targeted categories) in the absence of an experimentally imposed contingency. During the Generalisation phase, which followed Intervention 2, the six low exposure foods were presented under baseline conditions. In general, the mean consumption levels recorded during this phase exceeded the consumption of these foods during Baseline 2 (when conditions were similar). In the period between these two phases, the subjects were only exposed to the "high exposure" foods during Intervention 2. However, it is necessary to qualify claims about generalisation:

1. Generalisation was evident with only three of the four children; there was no evidence of generalisation with Alison[4].

2. Generalised consumption was only evident with vegetables - no increased fruit consumption, relative to Baseline 2, was recorded during the Generalisation phase.

3. Finally, increases in consumption during the Generalisation phase were only recorded with foods which had been consumed (to criterion) in previous experimental phases. Hence, no *new* foods (i.e., foods reliably rejected, or consumed at low levels during all previous phases) were consumed during the Generalisation phase. Thus it is unclear whether the effects generalise beyond the group of experimental vegetables presented to, and consumed by, each subject (further research is necessary to establish the validity of this latter claim).

Relative to Experiment 2, the number of programmed taste exposures occurring across the present experiment was increased from 10 to 15 (see Birch et al, 1987). During follow-up, the mean consumption recorded with the high exposure foods exceeded that recorded with the low exposure foods. Figure 6 shows mean consumption of the high and low exposure food groups during Baseline 2 and both follow-up phases, for all subjects combined (Graph A) and for each child (Graphs B - E). Graph A shows that during the first follow-up phase, group mean consumption of the high exposure foods was 61 percent as compared to 35 percent for the low exposure foods. During the second follow-up these figures increased to 69 and 44 percent, respectively.

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[4] The extent to which Alison's data are relevant to this discussion concerning generalisation is unclear. By the end of Intervention 2 Alison was reliably rejecting all vegetables, hence it may be necessary to increase the effectiveness of the intervention in general before one would expect to observe any generalisation. Put simply, how can you observe generalisation of effect when there is no effect to generalise?

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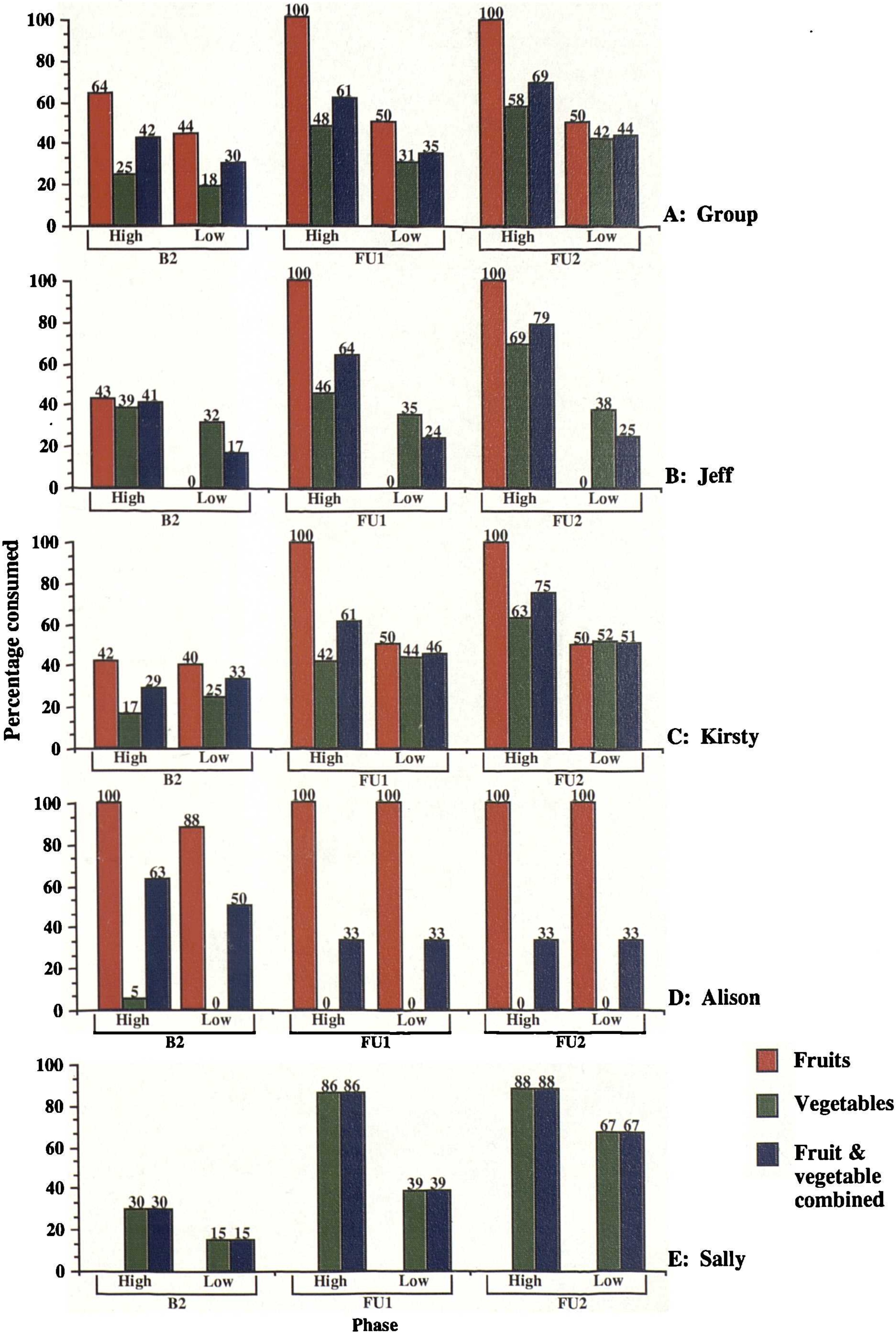

Figure 6: Mean consumption of the high and low exposure fruits, the high and low exposure vegetables, and the high and low exposure groups (i.e., fruits & vegetables combined), during Baseline 2 (B2), 2 month follow-up (FU1) and 6 month follow-up (FU2). Fruit consumption is shown in red, vegetable consumption is shown in green, and combined fruit and vegetable consumption is shown in blue. Graph A shows grouped mean consumption (i.e., all 4 subjects combined); Graph B shows data for Jeff; Graph C shows data for Kirsty; Graph D shows data for Alison; and, Graph E shows data for Sally.

However, it is not clear from the present data whether the increased taste exposure to the high exposure foods was responsible for the higher consumption recorded with the high exposure foods. For example, Figure 6 (Graph A) also shows that during Baseline 2, which occurred prior to the differential taste exposure, consumption of the high exposure group of foods was higher than the low exposure group of experimental foods (42% versus 30%). Although this difference is quite small, the greater consumption of the high exposure foods during follow-up may reflect a pattern of consumption which was evident prior to any differential taste exposure. Similar trends (i.e., higher consumption of the high exposure group relative to the low exposure group) during Baseline 2) were recorded with three of the four subjects: Jeff (Graph B), Alison (Graph D), and Sally (Graph E).

Kirsty's consumption during Baseline 2 is of particular interest. During Baseline 2 Kirsty's consumption of the high exposure foods *was lower* than her consumption of the low exposure foods. This trend was reversed during both follow-up phases. However, during the first follow-up phase, her consumption of the high and low exposure vegetables was similar (42% and 44% respectively).

Further investigation is required to clarify the role of exposure in the promotion of long term consumption. For example, in future research the allocation of foods to either the high or low exposure conditions could be based on consumption during Baseline 2 (as opposed to a random allocation procedure as used in the present experiment). This would ensure greater similarity of consumption prior to the differential taste exposure.

As with the previous experiment, the relationship between taste exposure and long term maintenance appears not to be straight forward. For example, with the three children, consumption of one or more of the low exposure foods *matches or exceeds* the consumption recorded with some of the high exposure foods. Also, during follow-up Kirsty's highest consumption is recorded with Baby sweet corn, a low exposure food.

The apparent importance of exposure, or the importance of a maintenance intervention (Intervention 2) which results in increased exposure is highlighted in the present results. With all of the subjects, with the exception of Alison, consumption of the high exposure foods was higher during follow-up than Baseline 2. Of course, as discussed earlier (Chapter 4), it is unclear whether this increase in consumption is due to taste exposure alone.

Comparing consumption during the follow-up phases across Experiments 2 and 3 shows that in both experiments, long term fruit consumption was stable. However, during Experiment 2 vegetable consumption tended to decrease during the later follow up phase - a trend reversed in the present experiment. The different trends in consumption may result from the category based procedures. However, it has also been suggested that enhanced generalisation may be obtained if more instances of the target behaviour are trained (Stokes & Baer, 1977). The number of vegetable exemplars trained in the present experiment was 8 or 12, while only two were trained during the previous experiment.

Intervention 2 was not entirely successful in maintaining Alison's consumption of vegetables. This intervention was differentially effective with respect to different foods: celery and red pepper were consumed in greater amounts than chick peas and coleslaw. Such "food specific effects" have been recorded in Experiment 2, and with the other subjects in the present experiment.

One reason for Alison's decline in consumption across Intervention 2 may be that the target behaviour was not well enough established during Intervention 1 where variability in consumption was evident. Hence, the shift from material to token based reward may have been premature. Extending the length of Intervention 1, utilising the more potent reward to establish greater stability in the target behaviour, may have been necessary prior to the introduction of token rewards.

A second possible alteration concerns separating Intervention 2 into two shorter interventions. This may be particularly effective given that Alison's consumption was quite high during the early stages of this phase. Hence, this higher consumption would have been directly rewarded, following which another (perhaps longer) token reward based intervention could be introduced. This latter intervention could further maintain the target behaviour which may now be more established.

In conclusion, a comparison of the procedures employed during Experiments 2 and 3 suggests that category based procedures are more economical. Using a similar time scale and a similar intervention package, children in the present study consumed between 10 and 12 previously rejected foods - many of which were consumed at high levels during the follow-up phases. This is compared to the three previously refused foods consumed by most children during the previous experiment. The results of the present experiment also support, and expand, the conclusion drawn in the previous chapter regarding the (possible) role of rule-governed behaviour in the subjects' consumption of previously refused foods.

CHAPTER 6

USING MODIFIED INTERVENTIONS TO PROMOTE CONSUMPTION OF PREVIOUSLY REFUSED FOODS

6.1 INTRODUCTION

The three experiments reported so far have demonstrated the importance of non-biological variables in determining what children eat. The focus of each experiment differed as follows:

- Experiment 1 examined the short term effects of peer influence; subjects tended to accept or reject a novel food consistent with the behaviour of confederates.
- Experiment 2 reported the use of a multi-component intervention package which increased subjects' consumption of a number of specifically named (previously rejected) target foods (e.g., kiwi, celery, blackeye beans).
- Experiment 3 employed a similar intervention package to that used during Experiment 2, but applied to food categories (fruit and vegetables). Exposure to this category intervention package resulted in increased consumption across a range of exemplars from the targeted categories.

Both Experiments 2 and 3 also demonstrated long term effects whereby subjects continued to consume some target foods six months after the end of the intervention phases (greater long term effects were observed in Experiment 3).

The packages used during the first intervention phase in both Experiments 2 and 3 were complex in that they comprised of a number of components. For example, during the intervention films the Food Dudes provided the viewer with a number of instructions and contingency descriptions. The experimenter imposed contingency was described by instructions such as: "*Eat vegetables and you can win a prize*". Other contrived contingencies concerning the Life Force and the behaviour of General Junk were described in statements such as: "*Help us defeat General Junk and save the Life Force of the earth*". Natural consequences of target food consumption were also specified through statements such as "*vegetables are yummy*".

Other features of the intervention films included modelling and vicarious reinforcement. Each film contained a sequence during which the Food Dudes ate and enjoyed the target foods. Social contingencies, in the form of gang membership (i.e., the viewer could become a Food Dude), and assisting the Food Dudes in their struggle also featured prominently.

A second major component of the intervention packages was the use of an imposed reward contingency. Rewards (e.g., badges, small toys, baseball caps) were presented contingent upon a subject consuming the target foods to criterion (or above). In cases where a subject failed to consume to criterion, feedback was provided which restated the contingency and target behaviour.

Multi-component interventions are appealing to, and thus often used by, Applied Behaviour Analysts because such interventions increase the likelihood of behaviour change (Kazdin, 1989). However, Kazdin (1989) also notes that in using such multi-component packages, little can be said regarding the importance (or otherwise) of particular components of the intervention package. With respect to the present home-based experiments, dissecting the intervention package would be of both applied and theoretical interest.

The practical limitations often imposed upon the applied researcher and clinical practitioner means that the development of cost effective intervention procedures is paramount. For example, manipulating contingencies in applied settings is often time consuming in that it requires regular experimenter contact and feedback provision. Similarly, the production of intervention films can be both costly and time consuming. Further, video interventions can be inflexible - during Experiment 2 (which employed a food specific intervention) a separate film had to be produced for each target food. Hence, a demonstration that one of the components (i.e., the intervention films or the imposed contingency) of the intervention package is superfluous would have beneficial implications for future applied work. Such a demonstration would aid the development of more economical and manageable intervention procedures.

With respect to theoretical issues, Kazdin (1989) notes that although multi-component interventions are desirable, it is often the case that the effectiveness of individual components has been demonstrated by previous research. Hence, this may question the need for multi-component interventions. With respect to the present intervention package, research reviewed in Chapter 1 suggests that exposure to models choosing or eating foods may enhance children's stated preferences and choices for those foods. This was supported by the results of Experiment 1 which demonstrated that children's consumption tended to correspond to the consumption of peers'. Given that the Food Dude intervention films utilised modelling, one may predict that exposure to the intervention films alone (i.e., in the absence of the imposed contingency and corrective feedback) would have a beneficial effect on children's preferences for target foods.

The theoretical significance of this is increased when one considers the research concerning the second major component of the package; contingent rewards. The reader is reminded that within the mainstream food preference research literature it is widely accepted that exposure to contingent rewards will impact negatively on (stated) food preferences (see Chapter 1, Section 1.2.4). The validity of such a claim has been questioned by a number of behavioural researchers, and by the results of Experiments 2 and 3. Thus, examining the impact of a reward contingency, in the absence of the series of intervention films, will further inform this debate. For example, those authors who support the view that rewards impact negatively on preferences may argue that the reward component is producing negative effects, but these are being overridden by the positive effects resulting from the video modelling and other features included in the films (e.g., the positive context created as the subjects help the Food Dudes in the battle against the Junk Food Junta).

The purpose of the two experiments reported in the present chapter was to begin an analysis of the effectiveness of two modified versions (i.e., certain components not utilised) of Intervention 1 employed in Experiment 3. The modifications were designed to inform both the theoretical and the applied issues discussed earlier.

Experiment 4 reports the results of a "Reward Only" Intervention in which the intervention film component of the Complete Intervention (i.e., Intervention 1, Experiment 3) was removed. Subjects were instructed, via written instructions (and contingency specification) to "eat all fruits/vegetables", and offered a reward contingent upon compliance. Because the intervention film component was absent, subjects were not provided with information concerning the Life force and General Junk, and were not exposed to video models consuming the target foods. (Corrective feedback was provided.)

Subjects participating in Experiment 5 were exposed to a "Video Only" Intervention which utilised the series of intervention films in the absence of an experimenter imposed reward contingency. Thus, subjects were provided with instructions, and exposed to video models (and the other information contained in the films), but were not offered, or presented with, rewards contingent on the consumption of target foods.

Given that the subjects were verbal, the instruction component (and contingency description) was used in both modified interventions, hence the labels of Video Only and Reward Only are merely descriptive. The possible ubiquity of verbal regulation and rule-governance in human behaviour may mean that it would be difficult to eliminate the verbal component of the intervention. Even if no instruction was given, subjects may formulate their own contingency specifications (see for example, Lowe, 1979). Subject's verbal formulations of the imposed contingency may be inaccurate, thus making comparison with the results obtained from the use of the Complete Intervention difficult.

It was decided to undertake a component analysis of the category based intervention, as opposed to the food specific intervention employed during Experiment 2. The category based procedures were, on the whole, more effective in promoting consumption across a range of target foods. Hence, unless otherwise stated, the procedures during the present experiment replicated those of Experiment 3.

6.2: EXPERIMENT 4. "REWARD ONLY" INTERVENTION

6.2.1 Method

Participants

Subjects

Four children participated. Three were boys (James, Bob, and Rory) and one a girl (Carol). Their mean age at the start of the experiment was 6.04 years compared to 6.08 years in Experiment 3. Two of the children, Rory and James, each had a younger brother. Pertinent details of each subject are presented in Table 6.1 below.

Table 6.1: Subjects who participated in Experiment 4.

Subject	Gender	Age at start	Sibling gender	Sibling age
Carol	Female	5.33 years	*	*
Bob	Male	6.08 years	*	*
Rory	Male	6.33 years	Male	4.17 years
James	Male	6.42 years	Male	3.75 years
Mean age of subjects at start = 6.04 years				

Parents

Bob's father was not present for the majority of meal presentations because of employment commitments. In all other cases both parents were usually present at meals.

Foods

In each case the experimental foods presented were eight vegetables and four fruits - these are displayed in Table 6.2, overleaf.

Table 6.2: Foods presented to each subject during Experiment 4

Carol	Bob	Rory	James
Vegetables:	**Vegetables:**	**Vegetables:**	**Vegetables:**
Sprouts	Sprouts	Kidney Beans	Asparagus
Peas	Courgettes	Coleslaw	Blackeye Beans
Chick Peas	Chick Peas	Chick Peas	Chickpeas
Baby sweetcorn	Baby sweetcorn	Baby sweetcorn	Spinach
Sugarsnap Peas	Green Beans	Sugarsnap Peas	Avocado
Beansprouts	Celery	Beetroot	Beansprouts
Broccoli	Broccoli	Broccoli	Haricot Beans
Cauliflower	Cauliflower	Cauliflower	Mushrooms
Fruit:	**Fruit:**	**Fruit:**	**Fruit:**
Guava	Guava	Guava	Grapefruit
Melon	Pineapple	Kiwi	Lychee
Peaches	Kiwi	Prunes	Prunes
Raspberries	Loganberries	Mango	Gooseberries

Experimental Design

The design and procedures employed during Experiment 4 replicated those employed in Experiment 3 with the difference that, following Baseline, all the subjects were exposed to a sequence of two intervention conditions, namely:

1. *Reward Only Intervention:* This was a modified version of Intervention 1 used in Experiment 3. The Food Dude film component was removed, hence subjects were exposed to an intervention which utilised only instructions to eat all fruits/vegetables to earn a reward, and a reward contingency.

2. *Complete Intervention:* This was a replication of Intervention 1 used in Experiment 3.

The Complete Intervention was only introduced in cases where the Reward Only Intervention did not modify consumption on a par with that recorded during Intervention 1, Experiment 3.

Introducing the two different intervention packages within the same experiment allowed a within subject comparison of effectiveness of the modified and complete intervention packages in promoting consumption of previously refused foods. Further, the similarity of the designs employed in Experiments 3 and 4 also permitted such a comparison *across* subjects.

No follow-up presentations were carried out during the present experiment; this was because a maintenance intervention (i.e., Intervention 2, token reward) was not introduced. The purpose of the present experiment was to examine the effectiveness of a modified intervention, as compared to the Complete Intervention package, in promoting subjects' consumption of previously rejected foods. Issues relating to the long term maintenance of consumption were not a primary concern.

Reliability

A number of argeement indices were calculated for each subject. Standard and modified measures of overall PAI, which combines all 12 experimental foods for each subject are as follows:

Carol - 92 percent (modified PAI, 100%), Bob - 93 percent (modified PAI, 100%), Rory - 92 percent (modified PAI, 100 percent), and, James 93 percent (modified PAI, 100%).

Consistant with the two home-based experiments reported previously, the modified reliability index (comparing the observers' recordings of consumption either above or below the 75 percent level) yields higher percentage agreements - each modified PAI was 100 percent. Nevertheless, in the present experiment all four of the standard PAIs exceeded 90 percent.

Percentage agreement indicies for each subject's 12 experimental foods are presented in Appendix 4C. Also presented in Appendix 4C is a graph showing the distribution of the size (i.e., the number of categories between the two observers reports) of differences in cases of disagreement between observers. Consistant with the two previously reported home-based experiments the majority of disagreements recorded were within one category - of the 19 disagreements, 17 were within one category.

Procedure

Prior to the beginning of Baseline all subjects could correctly categorise the 12 experimental foods presented during the remaining phases. Very little "spontaneous" consumption was recorded during Baseline. Carol consumed kiwi on the first occasion it was presented so it was replaced with melon. James consumed blackberries which were replaced with prunes.

Reward Only Intervention

Procedures during the (Reward Only) Intervention replicated the procedures employed during Intervention 1 in Experiment 3, with the following differences:

Subjects were exposed to the Reward Only Intervention package as opposed to the Complete Intervention package. Following the final evening meal presented during Baseline, each subject was presented an A4 card by his or her parent. In addition to the Food Dudes logo, the following text was printed on the card:

> *You have been chosen as a possible member of the Food Dude Gang. You could become a Food Dude and win some amazing prizes. To find out how, fill in this card and ask your parents to post it back to us at the Magno-Monitoring Station. Check out the card we will send you tomorrow, and you could be a winner!*

<u>*Application Form*</u>
I would Like to Join the Food Dudes!
I would like to win some fab prizes!
The Food Dudes are Ace!

This card was presented in place of the Food Dudes Primer film (PV2) employed during Experiment 3.

On each subsequent day of this phase, prior to the evening meal, as opposed to viewing a Food Dude Intervention film, each subject was presented with a Food Dude Instruction Card (see Appendix 3B). Similar to the Food Dudes question cards used in Experiments 2 and 3, the instruction cards were modified to include: (i) a written instruction to "*eat all fruit/vegetables*" (corresponding to the instruction in the intervention films); and, (ii) a written explanation of the reward contingency (also corresponding to the description supplied by the series of films). These cards allowed the subjects to be presented with information relating to the experimentally imposed reward contingency, and reward programme, without exposure to the additional information contained in the Food Dude intervention films.

Complete Intervention

The Complete Intervention was introduced only in cases where exposure to the Reward Only Intervention did not result in modified consumption of one or both categories of foods (to a level comparable with that recorded during Intervention 1 in Experiment 3). The procedures during this phase were similar to those employed during Intervention 1 in Experiment 3. However, the following modification was incorporated into the procedures:

On the first day of this phase, prior to the evening meal, each subject was presented with an intervention film and a letter from the Food Dudes which included the following advice:

> *To help you on your way to getting <u>eight</u> stickers, we have sent you this fab video. Watch it and see the Food Dudes in action! Watch it and find out how you can help the Food Dudes!*

6.2.2: RESULTS

Carol

Carol's daily consumption of fruits and vegetables throughout the experiment is presented in Figure 6.1. Her consumption of the 12 individual experimental foods is presented in Figure 6.1.1.

Baseline

Food category consumption: Carol did not consume any vegetables and her fruit consumption was very low - rising from zero to 25 percent on only three occasions (melon was consumed on 2 occasions, sessions 8 and 12, and raspberries on one, session 11).

Reward Only Intervention

Food category consumption: In Carol's case the Reward Only Intervention was applied to the fruit category first, resulting in an increase in fruit consumption. Carol consumed 100 percent of fruit on four of the five evenings when the intervention was operative with this category. Withdrawal of the intervention resulted in a decline in fruit consumption, relative to the intervention phase; however, Carol continued to consume fruit, at maximal levels, on half the presentations during the final Baseline phase.

Introduction of the Reward Only Intervention had no effect on Carol's vegetable consumption, this remained at Baseline levels across the four days when the intervention was operative. Following this the Complete Intervention package was introduced with the vegetable category.

Individual food consumption: Figure 6.1.1 shows that during the Reward Only Intervention, raspberries were the only fruit that Carol did not consume at maximum levels (these were consumed once at the 50% level). When this intervention was withdrawn Carol continued to consume guava and melon consistently at maximum levels. Peaches were not consumed during Baseline 2.

As noted above no vegetable consumption was recorded during this phase.

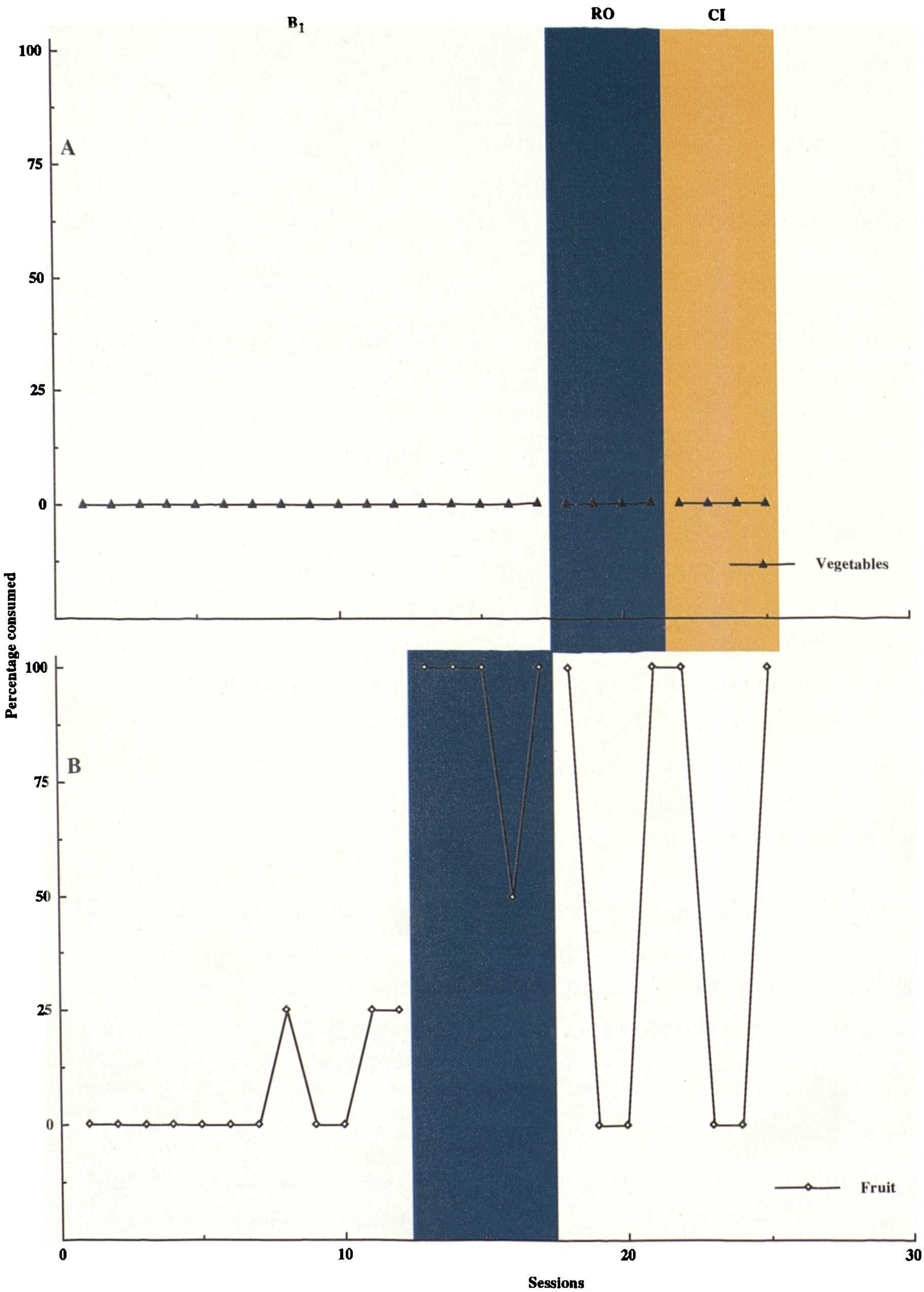

Figure 6.1: Carol's daily consumption of the 12 experimental foods during Baseline (B_1), Reward Only Intervention (RO), Complete Intervention (CI), and Baseline 2 (B_2). Graph A displays vegetable consumption; (▲), Any two of the eight experimental vegetables. Graph B displays fruit consumption; (◆), Any one of the four experimental fruits.

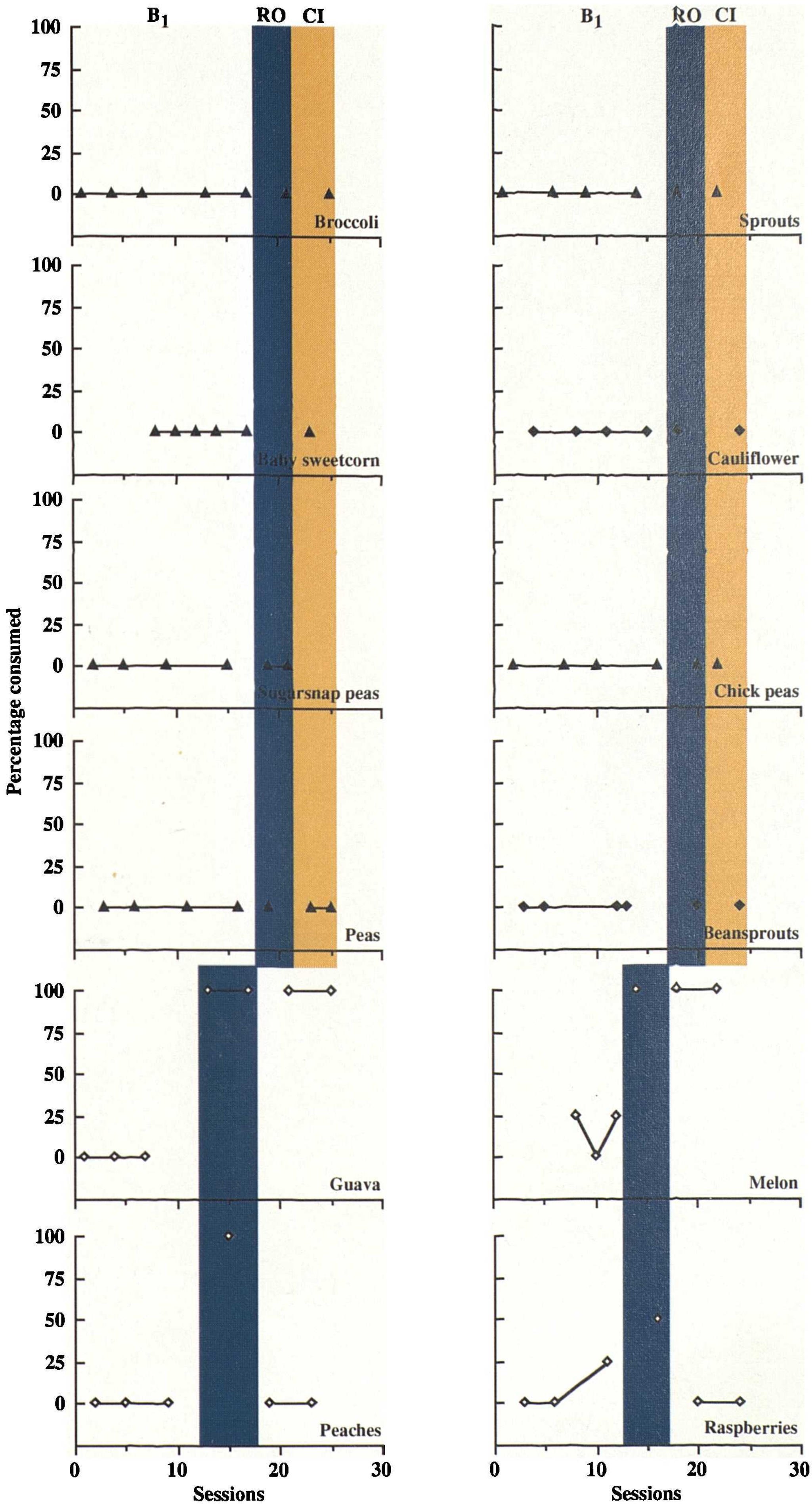

Figure 6.1.1: Carol's daily consumption of each of the 12 experimental foods during Baseline (B1), Reward Only Intervention (RO), and Complete Intervention (CI).

Complete Intervention

As was the case with the Reward Only Intervention, introduction of the Complete Intervention package did not result in an increase in Carol's consumption of vegetables.

At the request of Carol's parents the study was concluded following the Complete Intervention phase; no Baseline 2 data for vegetable consumption were collected.

Bob

Bob's daily consumption of fruits and vegetables throughout the experiment is presented in Figure 6.2. His consumption of the 12 individual experimental foods is presented in Figure 6.2.1.

Baseline

Bob did not consume *any* experimental fruits or vegetables during the Baseline phase (see Figure 6.2).

Reward Only Intervention

Food category consumption: In Bob's case the Reward Only Intervention was applied to the fruit category first, resulting in an increase in fruit consumption. While no increase in consumption was recorded on the first evening, Bob consumed 100 percent of the fruit on four of the remaining five days of this phase.

Withdrawal of the Reward Only Intervention resulted in Bob's fruit consumption returning to Baseline levels. No fruit was consumed during Baseline 2 (24 sessions).

When the Reward Only Intervention was introduced with the vegetable category consumption initially increased to approximately 38 percent on each of the first two evenings. On the remaining two days of this phase, however, zero consumption was recorded. Following this the Complete Intervention package was introduced with the Vegetable category.

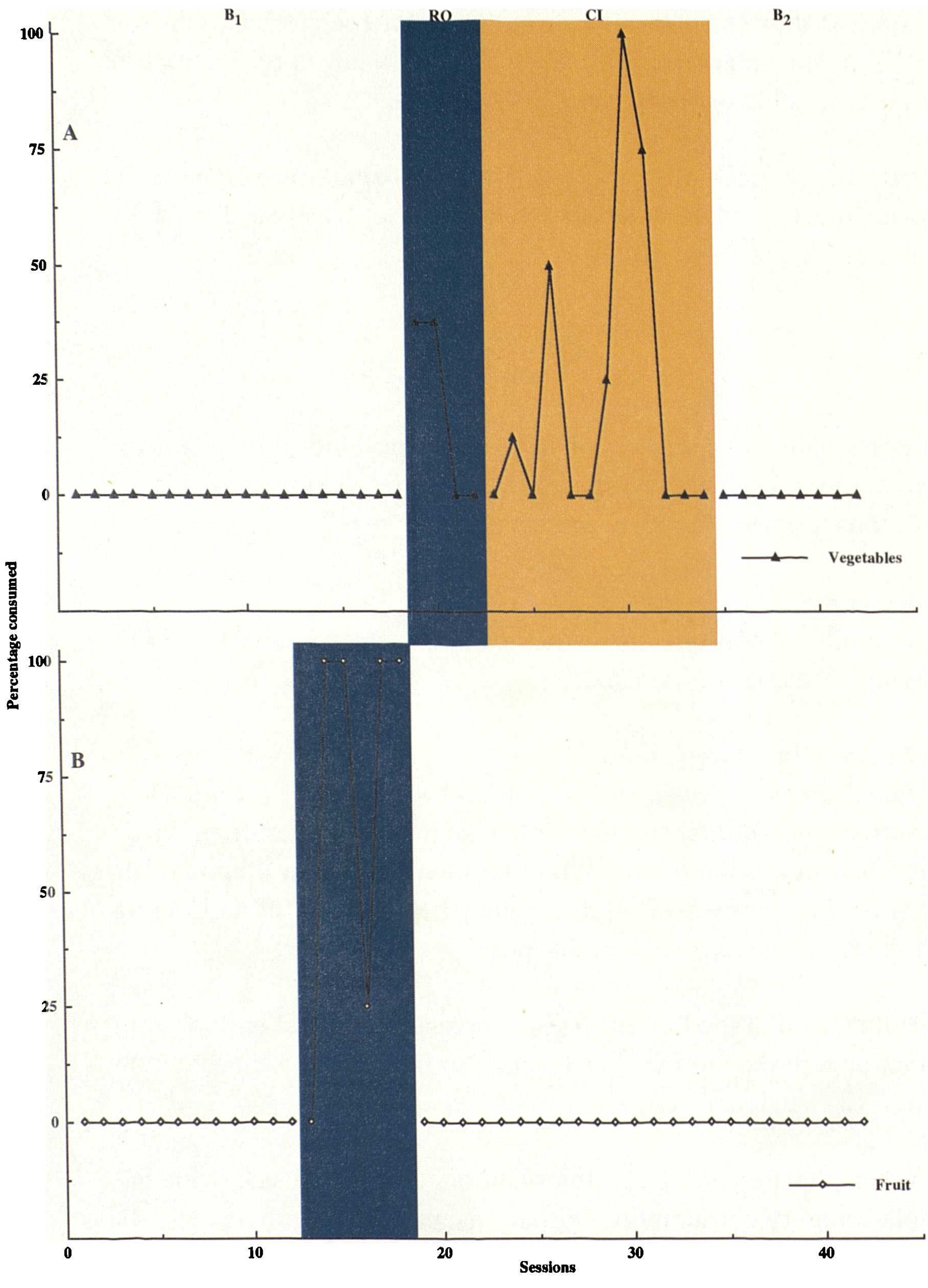

Figure 6.2: Bob's daily consumption of the 12 experimental foods during Baseline (B1), Reward Only Intervention (RO), Complete Intervention (CI), and Baseline 2 (B2). Graph A displays vegetable consumption; (▲), Any two of the eight experimental vegetables. Graph B displays fruit consumption; (◆), Any one of the four experimental fruits.

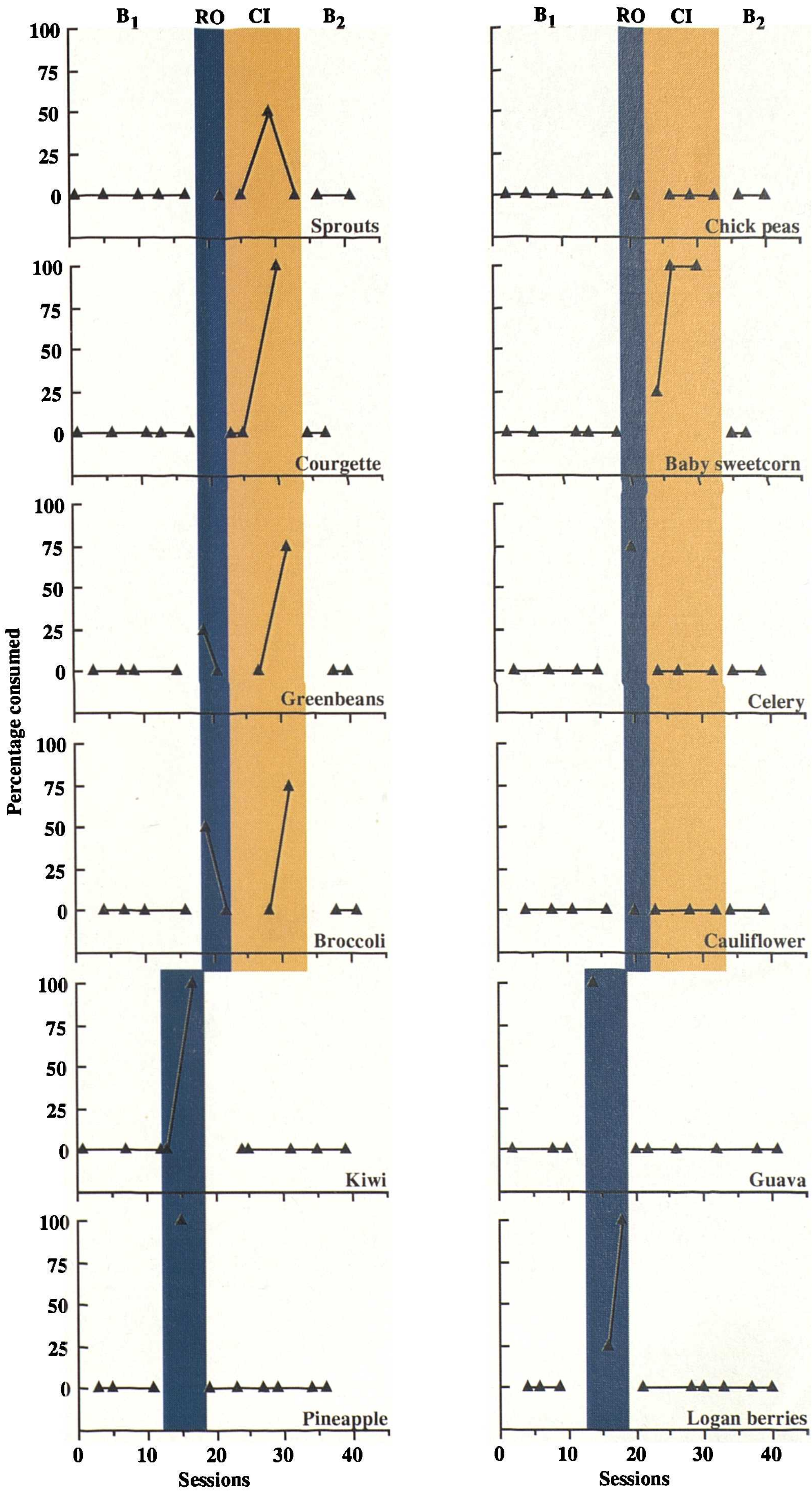

Figure 6.2.1: Bob's daily consumption of each of the 12 experimental foods during Baseline (B1), Reward Only Intervention (RO), Complete Intervention (CI), and Baseline 2 (B2).

Individual food consumption: Figure 6.2.1 shows that during the Reward Only Intervention phase Bob consumed each of the four fruits, at maximum levels, on one occasion. Bob's consumption of guava and kiwi increased at a slower rate relative to the consumption of the remaining two fruits (pineapple and loganberries).

With regard to the vegetables, celery consumption increased (from zero during Baseline 1) to 75 percent. Consumption of green beans and broccoli initially increased (25% and 50% respectively) following the introduction of the intervention. However, both of these foods were refused on the second occasion that each was presented. Bob continued to reject sprouts, chickpeas, and cauliflower.

Complete Intervention

Food category consumption: This intervention was introduced with the vegetable category only. Vegetable consumption across this phase was variable. Little consumption was recorded across the first three days of this phase, but consumption increased to 50 percent on the fourth day. This increase was not sustained, however, and Bob rejected all vegetables presented on the following two occasions (fifth and sixth evenings). On the eighth and ninth evenings consumption increased to criterion or above (100% and 75% respectively). This above criterion consumption was not maintained and Baseline consumption levels were recorded across the remaining three sessions of the phase.

Bob did not consume any vegetables during Baseline 2 which followed the withdrawal of the Complete Intervention.

Individual food consumption: Figure 6.2.1 shows that Bob's consumption of four vegetables - green beans, broccoli, courgettes and baby sweetcorn - increased (to between 75 and 100%) across the phase when the Complete Intervention Package was operative. Of these four vegetables, mean consumption of baby sweetcorn was highest at 75 percent.

Celery, chickpeas, and cauliflower were consistently rejected, the former of which had been consumed at the 75 percent level during the Reward Only Intervention. Sprouts, a vegetable which Bob did not consume during the previous intervention phase, was consumed at the 50 percent level on the second of the three occasions on which it was presented.

As was noted above, none of the eight vegetables, or four fruits were consumed during Baseline 2.

Rory

Rory's daily consumption of fruits and vegetables throughout the experiment is presented in Figure 6.3. His consumption of the 12 individual experimental foods is presented in Figure 6.3.1.

Baseline

During Baseline, Rory did not consume any experimental vegetables and fruit was consumed only once (mango 25%, session 15).

Reward Only Intervention

Food category consumption: In Rory's case the Reward Only Intervention was initially applied to the vegetable category. A small increase (38%) on the third and fourth evenings was recorded; however, this increasing trend did not continue, and vegetable consumption declined across the remainder of the phase.

Following this the Reward Only Intervention was withdrawn from the vegetable category and introduced with the fruit category. This resulted in an increase in fruit consumption: Rory consumed fruit to criterion or above on four of the following six evenings when the intervention was operative.

Following a procedure similar to that reported in Chapter 5 (see Jeff, *Intervention 1*) the Reward Only Intervention was introduced with the vegetable category for a second time. This did not modify Rory's consumption and he reliably rejected all the experimental vegetables presented. Following this the Complete Intervention was introduced with the vegetable category.

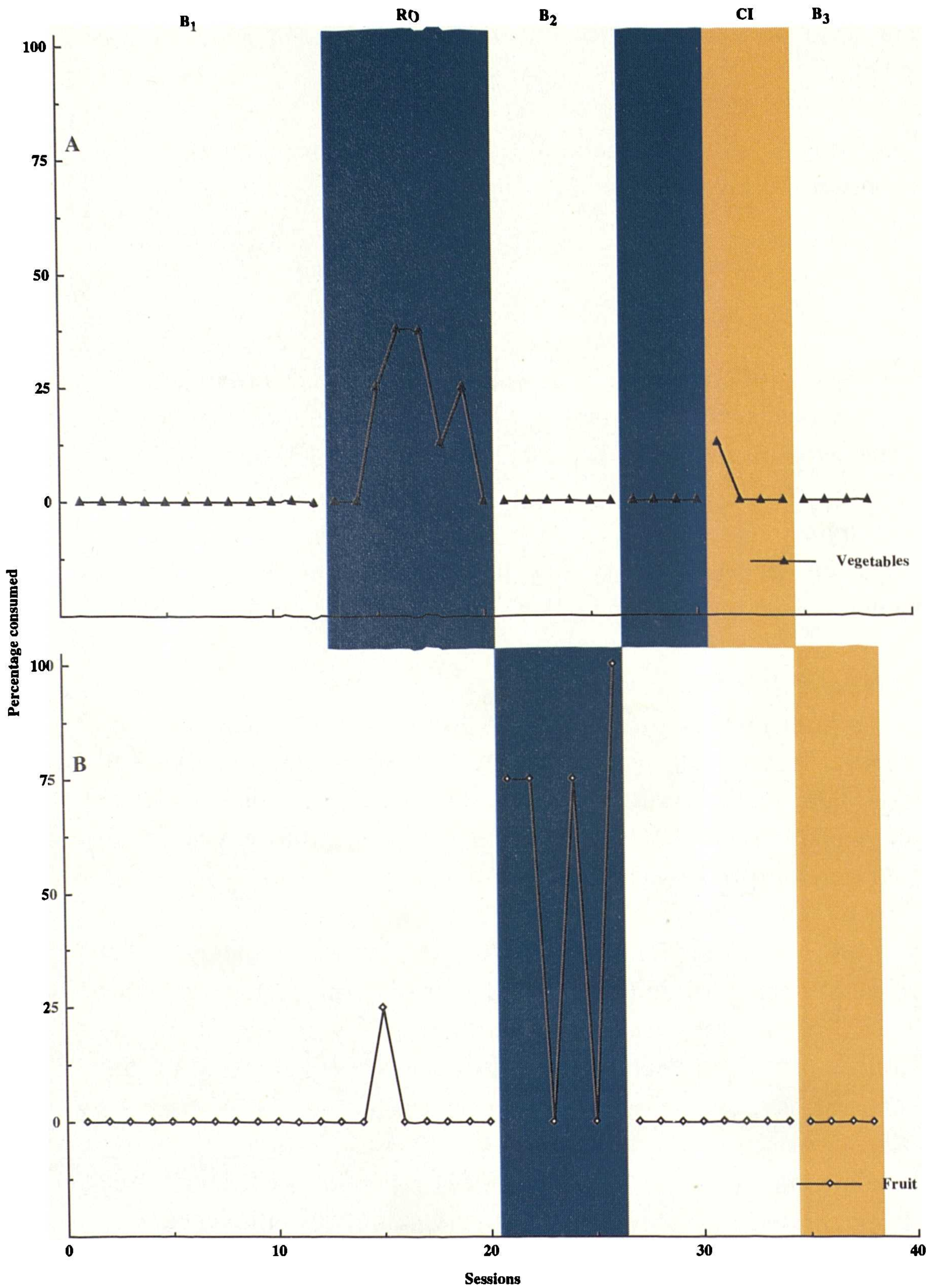

Figure 6.3: Rory's daily consumption of the 12 experimental foods during Baseline (B1), Reward Only Intervention (RO), Baseline 2 (B2), Complete Intervention (CI), and Baseline 3 (B3). Graph A displays vegetable consumption; (▲), Any two of the eight experimental vegetables. Graph B displays fruit consumption; (◆), Any one of the four experimental fruits.

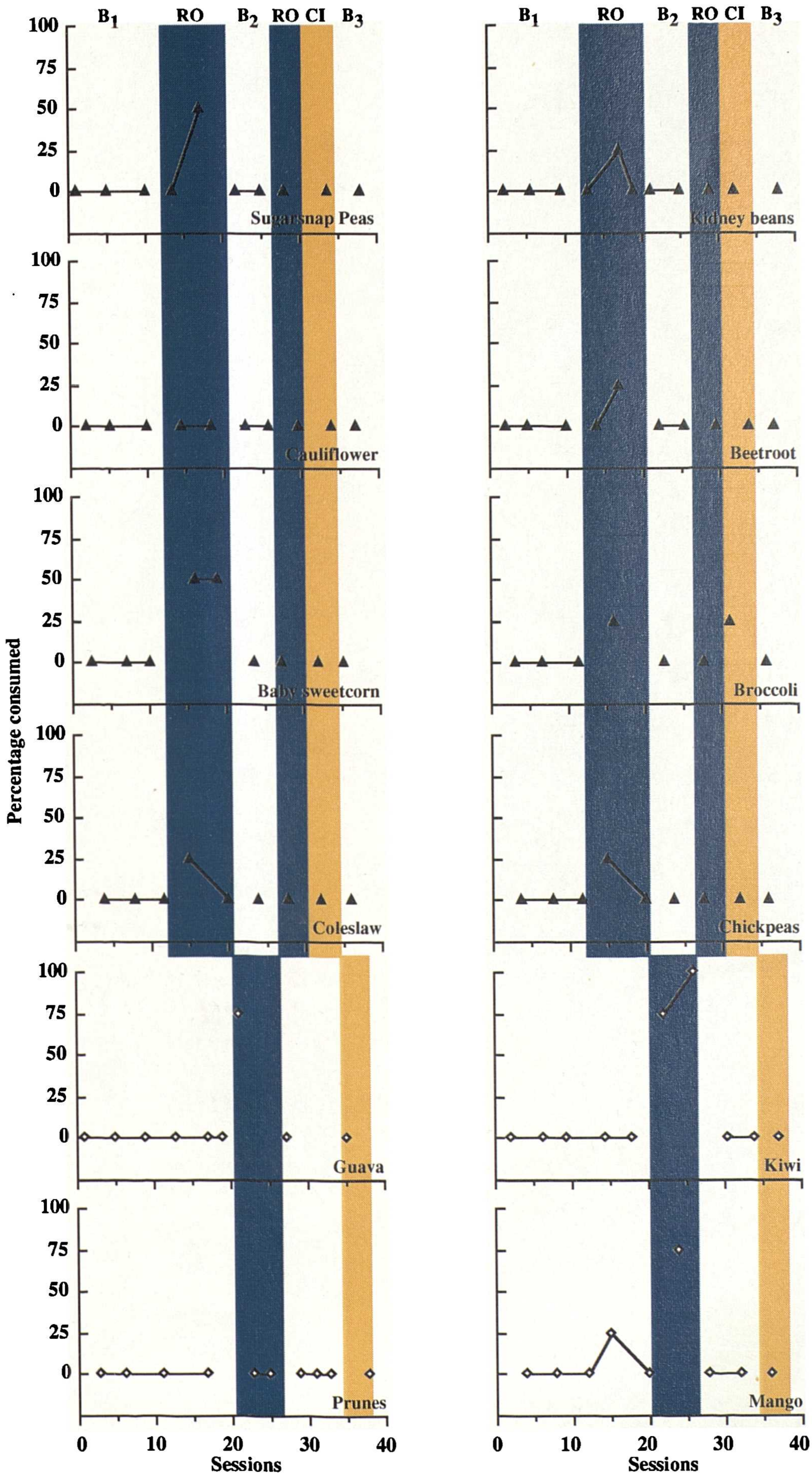

Figure 6.3.1: Rory's daily consumption of each of the 12 experimental foods during Baseline (B1), Reward Only Intervention (RO), Baseline 2 (B2), Complete Intervention (CI), and Baseline 3 (B3).

Individual food consumption: Figure 6.3.1 shows that when the Reward Only Intervention was initially applied to the vegetable category seven of the eight vegetables were consumed on at least one occasion; however, this consumption never exceeded 50 percent. Withdrawal of this intervention resulted in consumption of all vegetables returning to levels recorded during Baseline.

When the Reward Only Intervention was introduced with the fruit category, Rory consumed three of the four fruits at levels of 75 percent or above. Prunes were rejected on the two occasions on which they were presented. When the intervention was withdrawn Rory's consumption of all four fruits returned to levels recorded during Baseline (zero).

As noted above, no vegetable consumption was recorded when the Reward Only Intervention was reintroduced with the vegetable category.

Complete Intervention

With the exception of the first day when Rory consumed 12.5 percent of the vegetables presented (broccoli 25%), no vegetable consumption was recorded when the Complete Intervention was operative.

Finally, the Complete Intervention Package was applied to the fruit category; however, Rory continued to reject all four fruit items as he had during Baseline 2 phase.

James

James' daily consumption of fruits and vegetables throughout the experiment is presented in Figure 6.4. His consumption of the 12 individual experimental foods is presented in Figure 6.4.1.

Baseline

Similar to the other subjects little consumption of either category of food was recorded during Baseline. On one occasion (2nd session) James consumed 25 percent of the spinach presented.

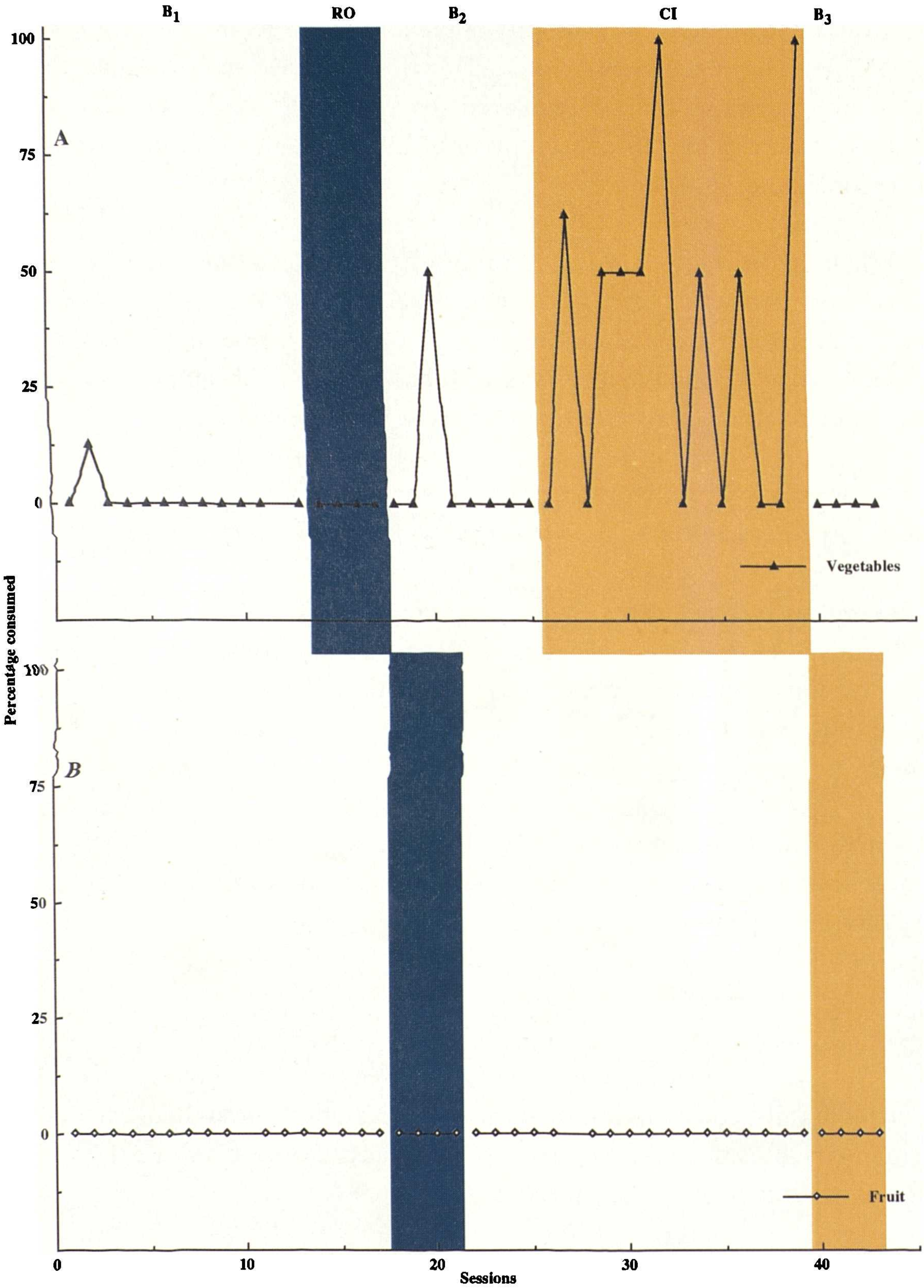

Figure 6.4: James' daily consumption of the 12 experimental foods during Baseline (B1), Reward Only Intervention (RO), Baseline 2 (B2), Complete Intervention (CI), and Baseline 3 (B3). Graph A displays vegetable consumption; (▲), Any two of the eight experimental vegetables. Graph B displays fruit consumption; (◇), Any one of the four experimental fruits.

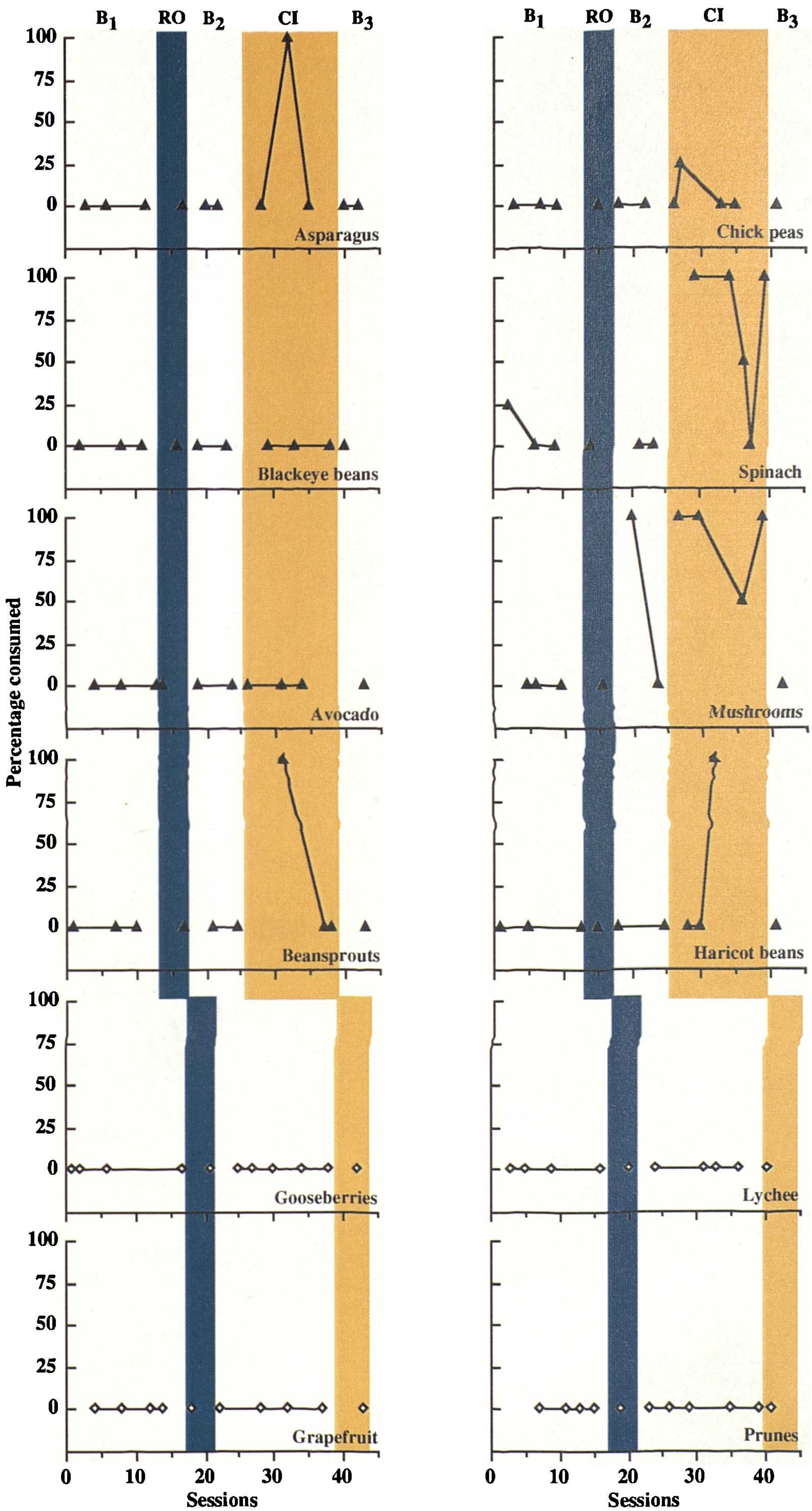

Figure 6.4.1: James' daily consumption of each of the 12 experimental foods during Baseline (B1), Reward Only Intervention (RO), Baseline 2 (B2), Complete Intervention (CI), and Baseline 3 (B3).

Reward Only Intervention

In James' case the Reward Only Intervention was introduced with the vegetable category first but no increase in vegetable consumption was recorded. Further, no increase in the consumption of fruits was evident when the intervention was operative with this category.

While the intervention was operative with the fruit category, James consumed 50 percent of the vegetable category on one occasion. During the evening meal James' father, although contravening experimental procedures, instructed James "how to eat mushrooms" (i.e., by putting mushrooms and chips on the fork simultaneously, prior to placing them in the mouth). Because of this the introduction of the Complete Intervention Package was delayed and the twelve foods were each presented on a further occasion. Vegetable consumption returned to zero.

Complete Intervention package.

Food category consumption: Introduction of the Complete Intervention Package resulted in an increase in James' vegetable consumption, however, his consumption remained variable across this phase. James consumed 50 percent, or more, of the vegetables presented on four of the first six evenings. On the seventh evening maximum vegetable consumption was recorded; however, consumption on the following evenings declined, oscillating between 50 percent and zero until the final evening (14th session) when James again consumed all the vegetables presented to him. Vegetable consumption returned to Baseline levels when the intervention was withdrawn.

When the Complete Intervention was introduced with the fruit category James continued to reject all the fruits presented, as he had during the entire experiment.

Individual food consumption: Visual inspection of Figure 6.4.1 shows that the Complete Intervention Package had a variable effect on James' consumption of the eight individual vegetables. Blackeye beans and avocado were never consumed, while chick peas were consumed once at 25 percent. James' mean consumption of beansprouts, haricot beans and asparagus was 33 percent in each case, however, a different trend was recorded with each. Beansprout consumption was initially high (100%), but later declined; conversely, haricot bean consumption was initially low (zero) but increased to maximum levels during the final presentation. No trend was obvious with respect to James' consumption of asparagus, which was consumed at maximum levels on the second of the three presentations on which it was presented. Mean spinach consumption was high (70%); but this item was rejected on one occasion towards the end of this phase. The highest mean consumption (87.5%) was recorded with mushrooms, the food item consumed during Baseline 2: consumption of this item never fell below 50 percent.

6.2.3: Discussion

The purpose of the present experiment was to examine the effectiveness of a modified version of the intervention employed in Experiment 3. This modified intervention incorporated an imposed reward contingency, a verbal specification of this contingency, and a category instruction (e.g., "eat all fruit/vegetables and win a prize"). A comparison of the results of Experiments 3 and 4 shows that the Reward Only intervention was less effective than the Complete package, when used in Experiment 3, in promoting consumption of previously refused foods. This suggests that the series of Food Dude Intervention films, or some element contained within these, was a necessary component of the Complete Intervention package.

Although the overall effectiveness of the Reward Only intervention was reduced, when compared to results obtained during Experiment 3, the modified intervention was differentially effective in promoting fruit and vegetable consumption. In the case of three subjects, Carol, Rory, and, Bob, the Reward Only intervention was sufficient to promote fruit consumption. Further, these increases were comparable with changes in fruit consumption recorded during Experiment 3 in at least three ways: (i) mean consumption levels; (ii) in terms of *spread of effect* across the fruit category; and, (iii) the *rate* at which fruit consumption increased. These three points are closely related and will be discussed in turn:

Mean Consumption

Table 6.3 compares the mean fruit consumption recorded with subjects in Experiments 3 and 4 (excluding James). This shows that similar changes in fruit consumption were recorded across the two experiments which employed different intervention packages.

Table 6.3: Mean fruit consumption recorded during the phase when the Complete Intervention and Reward Only intervention were operative with fruits during Experiments 3 and 4 respectively.

Experiment 3 (I1) Complete Intervention		**Experiment 4 Reward Only**	
Subject	**Mean fruit consumption**	**Subject**	**Mean fruit consumption**
Jeff	64%	Bob	71%
Kirsty	61%	Rory	54%
Alison	90%	Carol	90%

Spread of Effect

Given the present design (and that of Experiment 3) it would have been possible for subjects to gain the complete programme of reward (for the fruit category) by selectively consuming specific fruits. For example, a subject could consume two fruits on two occasions each, thus gaining four rewards and stickers. However, this was not the case with the above three subjects; Carol and Rory consumed three of the four fruits to criterion, or above, and Bob consumed all four. This spread of effect across the category is comparable with fruit consumption during Intervention 1 of Experiment 3: Jeff and Kirsty consumed three fruits, and Alison consumed all four.

Rate of Increase

Although the spread of effect was similar to that recorded in the previous experiment, if the Reward Only Intervention was less potent, the rate at which fruit consumption increases may be slower. A means of measuring rate in the present (and previous) experiment is to examine the number of sessions the intervention was operative before the complete programme of reward was obtained. An intervention being operative for a shorter period may suggest a more powerful package (i.e., less unsuccessful target evenings would be recorded); conversely, an intervention which is required to be operative for longer to produce a comparable effect may highlight a weaker (initial) effect. (The issues of "spread of effect" and "rate of increase" may be closely related. For example, if a subject consumed only one or two fruits (i.e., weak spread of effect), in order to obtain the programme of reward the intervention would have to be operative longer than would be the case if all the fruits were reliably consumed.)

Table 6.4 displays the period (in sessions) for which the Reward Only and the Complete package were operative during Experiments 3 and 4 respectively. This table shows that, for the three subjects highlighted, the operative period for each intervention is comparable.

Table 6.4: Period for which the Complete Intervention and Reward Only intervention were operative with fruits during Experiments 3 and 4 respectively.

Experiment 3 (I1) Complete Intervention		**Experiment 4 Reward Only**	
Subject	**Intervention period**	**Subject**	**Intervention period**
Jeff	7 sessions	Bob	6 sessions
Kirsty	7 sessions	Rory	6 sessions
Alison	5 sessions	Carol	5 sessions

The differential effectiveness of the Reward Only intervention in promoting fruit and vegetable consumption may reflect the (generally) different intrinsic properties of the two categories: fruits tend to be sweeter than vegetables. This is consistent with the findings of Experiments 2 and 3, and some of the literature reported in Chapter 1

This analysis may also be extended to, at least partially, account for the lack of effect recorded with James' consumption of fruits. Gooseberries and grapefruit are not sweet fruits. It is interesting to note that the Complete Intervention package had no effect on Jeff's consumption of gooseberries during Experiment 3. James was also presented with prunes and the effects of the Complete Intervention package recorded with this food during Experiment 3 are equivocal. Two children, Alison and Kirsty, were presented with prunes during Experiment 3; following exposure to the Complete Intervention package Alison reliably consumed prunes, Kirsty continued to reject them. Hence, it may be that even the Complete Intervention would not be effective in promoting consumption with the subset of fruits presented to James. Future research could establish the subsets of fruits and vegetables which may require more potent intervention before modified consumption is recorded.

6.3: EXPERIMENT 5 "VIDEO ONLY" INTERVENTION

Experiment 4 demonstrated that the Reward Only Intervention was less effective than the Complete Intervention package (Experiment 3) in promoting consumption of previously refused foods (and in particular, vegetables). This suggests that the Food Dude intervention film, or some element contained within, is a necessary component of the Complete Intervention package, and Experiment 5 was designed to test this hypothesis. Subjects were exposed to a Video Only Intervention package during which they were exposed to the series of Food Dude intervention films. Subjects were not offered (or presented with) any tangible rewards for consuming any fruits or vegetables, and they were not provided with feedback regarding performance. The design of the present experiment was very similar to that of Experiment 4.

6.3.1: Method

Participants

Subjects

Four children participated. Three were boys (Eddie, Ian, and George) and one a girl (Deborah). Their mean age at the beginning of the Experiment was 5.92 years compared to 6.08 years in Experiment 3, and 6.04 years in Experiment 4. Two of the children, Eddie and Ian, each had a younger sibling. Pertinent details of each subject are presented in Table 7.1.

Table 7.1: Subjects who participated in Experiment 5.

Subject	Gender	Age at start	Sibling gender	Sibling age
Ian	Male	6.08 years	Female	4.25 years
Deborah	Female	6.00 years	*	*
Eddie	Male	5.50 years	Male	4.67 years
George	Male	6.08 years	*	*
Mean age of subjects at start = 5.92 years				

Parents

Ian's father was not present for the majority of meal presentations (because of employment commitments). George belonged to a single parent family, but his mother was present during most meals. In the other two cases, Eddie and Deborah, both parents were usually present.

Foods

In each case the experimental foods presented were eight vegetables and four fruits - these are displayed in Table 7.2, overleaf.

Equipment

A series of "No reward" Food Dude intervention films was produced for use in the present experiment. These corresponded to the series of films used during Experiment 3 (I1), but, in each film, sequences describing the imposed reward contingency and the reward system were removed.

Table 7.2: Foods presented to each subject during Experiment 5

Ian	Deborah	Eddie	George
Vegetables:	**Vegetables:**	**Vegetables:**	**Vegetables:**
Asparagus	Sprouts	Asparagus	Sprouts
Courgettes	Courgettes	Courgettes	Courgettes
Chickpeas	Chick Peas	Chick Peas	Baby Sweetcorn
Kidney Beans	Baby sweetcorn	Green Beans	Green Beans
Sugarsnap Peas	Sugarsnap Peas	Sugarsnap Peas	Sugarsnap Peas
Celery	Asparagus	Celery	Celery
Beansprouts	Green Beans	Broccoli	Broccoli
Red Pepper	Cauliflower	Cauliflower	Cauliflower
Fruit:	**Fruit:**	**Fruit:**	**Fruit:**
Kiwi	Rhubarb	Kiwi	Kiwi
Lychee	Melon	Mango	Mango
Guava	Plums	Guava	Pineapple
Blackberries	Gooseberries	Loganberries	Raspberries

Experimental Design

The design and procedures employed during Experiment 5 replicated those employed in Experiment 4 save that following Baseline all the subjects were exposed to a sequence of two intervention conditions, namely:

1. *Video Only Intervention:* This was a modified version of Intervention 1 used in Experiment 3. Subjects were exposed to a series of Food Dude Intervention films which included a category based instruction but, there was no imposed reward contingency was operative. Hence, subjects were not offered any tangible reward for compliance with instructions.

2. *Complete Intervention*: This was a replication of Intervention 1 used in Experiment 3.

As was the case during Experiment 4, the Complete Intervention was only introduced in cases where the Video Only Intervention did not modify consumption on a par with that recorded during Intervention 1, Experiment 3.

Reliability

The standard and modified measures of overall PAI, which combines all 12 experimental foods presented to the subject, are as follows:

Ian - 86 percent (modified PAI, 97%), Deborah - 85 percent (modified PAI, 99%), and Ian, 86 percent (97%).

No PAI was calculated for George. Because of practical constraints, different recording equipment to that used with the other children in the home-based experiments (see Chapter 3) was installed in George's home. From the recordings obtained from George it was not possible for a second observer to reliably confirm parental estimations of consumption (for example, often the second observer could not accurately discriminate between the different foods presented to George). Nevertheless, with the recording equipment used in George's case it was still possible for the experimenter to monitor parent/child interactions to ensure adherence with experimental procedure. Further, George's comments during the meal would often be consistant with his mother's estimations of consumption. Finally, George's data was very consistant with that recorded with the other three children.

In the three cases where percentage agreement indicies were calculated, consistant with the previous experiments, the modified index exceedes the standard index. Nevertheless, the standard PAI yields a calculation of at least 85 percent agreement in in each case. Percentage agreement indicies for these three subject's 12 experimental foods are presented in Appendix 4D. Also presented in Appendix 4D is a graph showing the distribution of the size of differences in cases of disagreement between observers. Of the 35 differences recorded, 31 were within one category.

Procedure

Prior to the beginning of Baseline all subjects could correctly categorise the 12 experimental foods presented during the remaining phases. Few cases of "spontaneous consumption" were recorded during Baseline: Ian consumed green beans which were replaced with asparagus; Deborah consumed broccoli and grapefruit which were replaced with asparagus and plums respectively.

Video only intervention

Procedures during the Video Only intervention phase replicated the procedures employed during Intervention 1 Experiment 3, with the following modifications:

1. Subjects were exposed to the Video Only Intervention as opposed to the Complete Intervention package. On the first day of this phase after the evening meal each subject viewed a modified (i.e., references to tangible rewards removed) copy of the Food Dudes Primer Film (PV2).

2. On each subsequent day of this phase, prior to the evening meal, each subject viewed one of the "no reward" Food Dude Films, which corresponded to the series of IV2 intervention films used during Experiment 3. In addition the subjects were not required to complete any question cards.

Complete intervention

The procedures during this phase replicated those employed during the First Intervention phase in Experiment 3 with the following modification:

At the beginning of this phase the subjects were not sent a copy of the Primer video to watch as they were already "familiar" with the Food Dudes (as a result of exposure to the Video Only Intervention). Instead, in addition to the first intervention film, each subject was sent a letter which stated:

Dear [name of Subject]

We have chosen you as a possible member of the Food Dudes gang! Help us protect the Life Force of the earth and you will win some fantastic prizes! To find out how to be a winner watch the new video we have sent!

6.3.3: Results

Ian

Ian's daily consumption of fruits and vegetables throughout the experiment is presented in Figure 7.1. His consumption of the 12 individual experimental foods is presented in Figure 7.1.1.

Baseline

Ian's consumption of both categories of food was very low. On the eighth session 12.5 percent of the vegetables (25% Red Pepper) presented were consumed, and on the 15th session 25 percent of the fruit (25% Kiwi) was consumed.

Video only intervention

Food category consumption: In Ian's case the Video Only Intervention was applied to the vegetable category first. No increase in consumption was recorded; Ian reliably rejected all the vegetables presented across the four days that the intervention was operative. A similar effect was recorded when the intervention was applied to the fruit category; with the exception of the first evening, when 25% of the fruit was consumed, fruits were consistently rejected.

Ian continued to reject the vegetables presented following the withdrawal of the Video Only Intervention. On the fourth evening, however, he consumed 75% of the vegetables presented. In response to this, the introduction of the Complete Intervention package was delayed to determine whether this increase would continue. Across the remainder of this Baseline 2 phase vegetable consumption was unstable, but characteristically low (ranging from zero to 50%).

During Baseline 2 Ian consumed at least some fruit on every occasion except one; further, on the penultimate day of this phase, Ian consumed 100% of the fruit presented. Because the Complete Intervention package had already been introduced with the vegetable category, and vegetable consumption had increased, fruit presentations under baseline conditions were not extended.

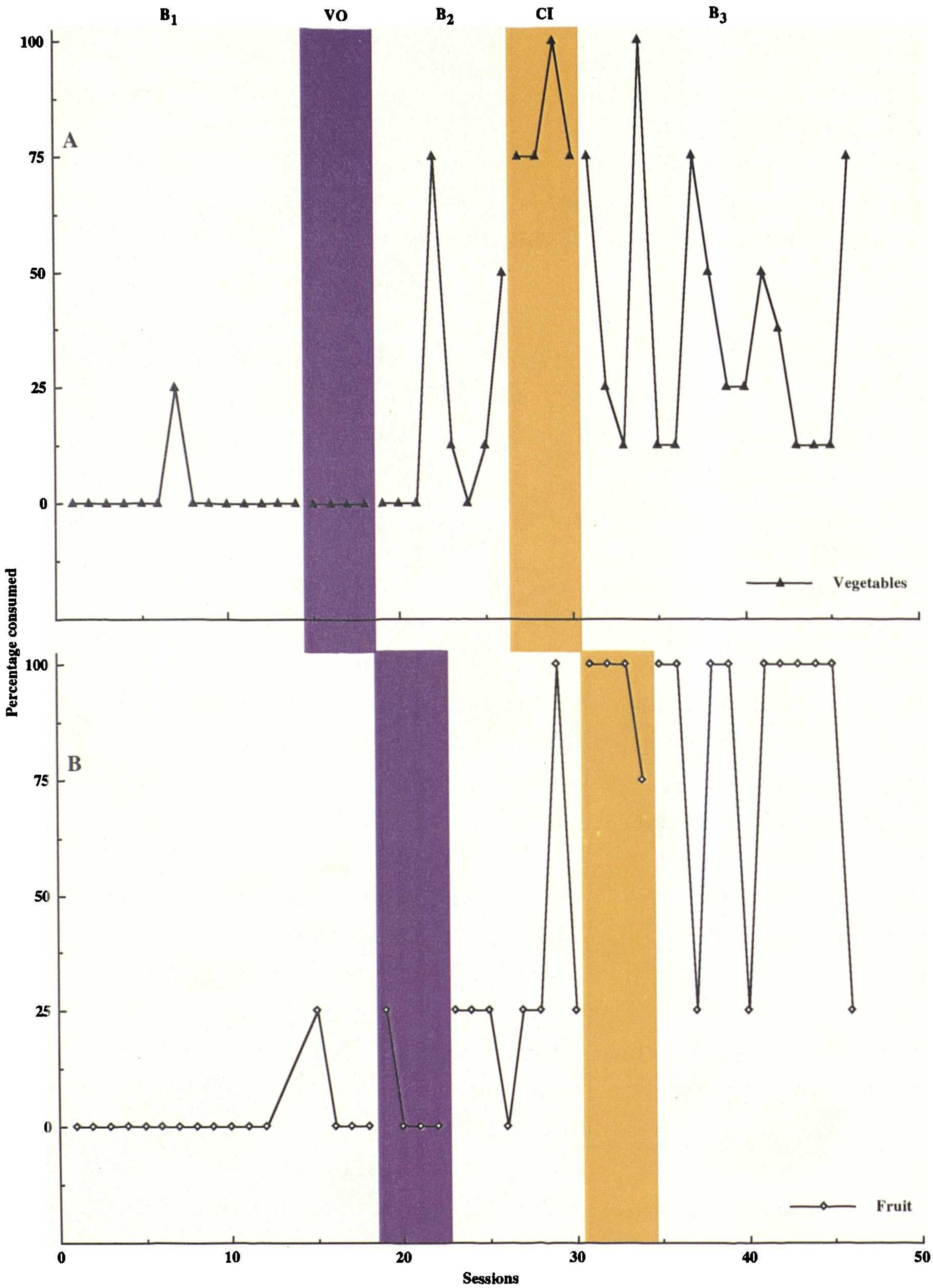

Figure 7.1: Ian's daily consumption of the 12 experimental foods during Baseline (B1), Video Only Intervention (VO), Baseline 2 (B2), Complete Intervention (CI), and Baseline 3 (B3). Graph A displays vegetable consumption; (▲), Any two of the eight experimental vegetables. Graph B displays fruit consumption; (◇), Any one of the four experimental fruits.

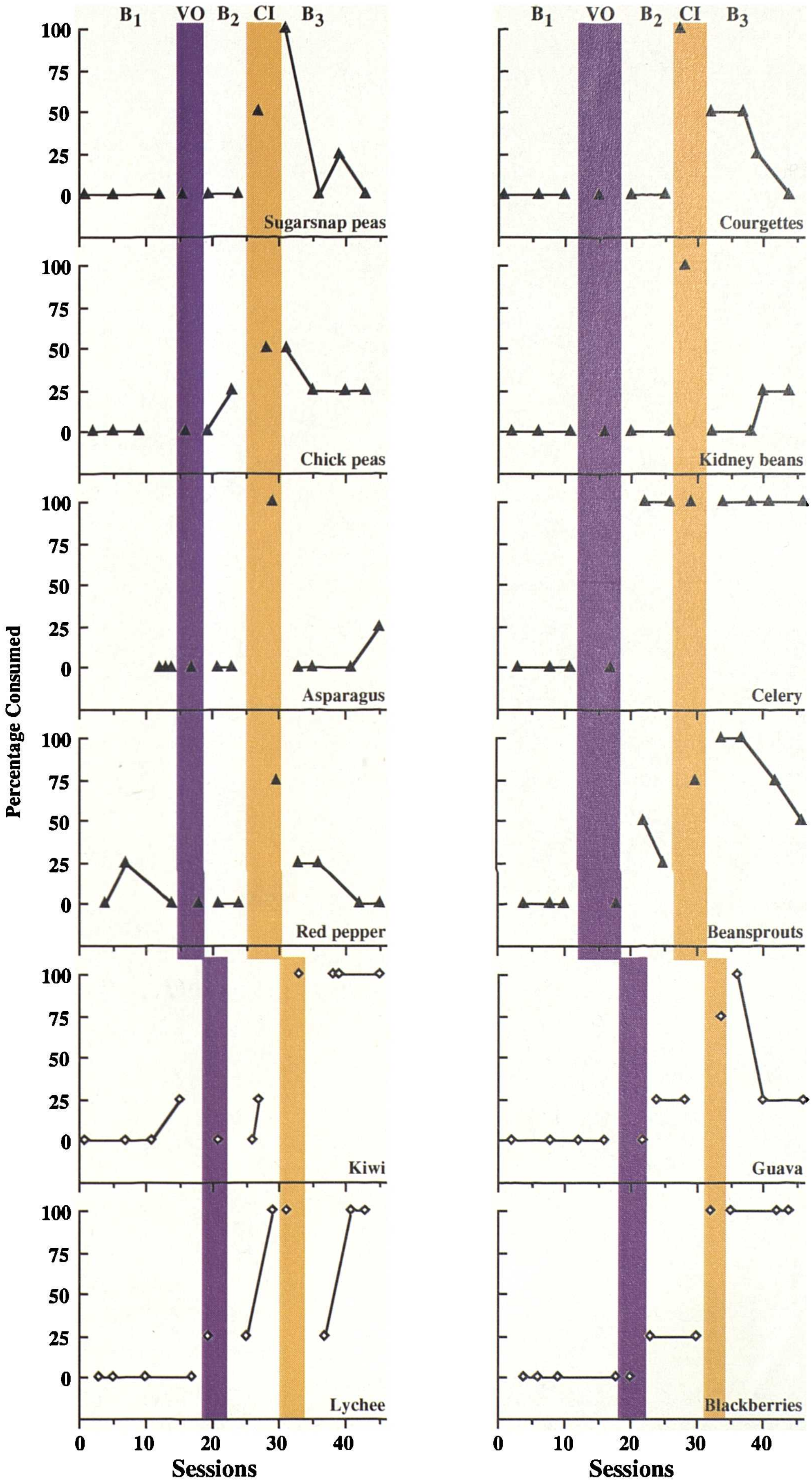

Figure 7.1.1: Ian's daily consumption of the 12 experimental foods during Baseline (B_1), Video Only Intervention (VO), Baseline 2 (B_2), Complete Intervention (CI), and Baseline 3 (B_3).

Video only intervention

Individual food consumption: Figure 7.1.1 shows that during the Video Only Intervention the only food Ian ate was lychee at the 25 percent level.

During Baseline 2 Ian consumed three of the eight vegetables. On the fourth day of this phase, when criterion vegetable consumption was recorded, Ian consumed 100 percent of celery and 50 percent of beansprouts. Across the remainder of this phase celery consumption remind high, but beansprout consumption declined (25%). Also, Ian consumed 25 percent of chickpeas once.

During Baseline 2 each of the four fruits were consumed at least once. Kiwi was consumed once at 25 percent, and blackberries and guava were consistently consumed at the 25 percent level. Lychee consumption increased from 25 percent to maximum levels (on the penultimate session of this phase).

Complete intervention

Food category consumption: During the period when the Complete Intervention package was applied to each food category Ian's consumption of the targeted category *never* fell below criterion. Hence, Ian gained the complete programme of reward in the shortest possible time span.

Ian's consumption of vegetables during Baseline 3, the phase following the withdrawal of the Complete Intervention, was variable but exceeded levels recorded during the initial Baseline phase. Mean vegetable consumption was 38 percent and ranged between 12.5 and 100 percent.

Mean fruit consumption (81%) exceeded mean vegetable consumption (38%) during Baseline 3; maximum fruit consumption was recorded on 9 of the 12 fruit presentations of this phase.

Individual food consumption: When the Complete Intervention package was introduced with the vegetable category, Ian consumed all eight vegetables: sugarsnap peas and chick peas were consumed at the 50 percent level; beansprouts and red pepper were consumed at the 75 percent level; asparagus, kidney beans, courgettes, and celery were consumed at maximum levels. However, the latter food, celery, had been consumed at maximum levels during Baseline 2.

During Baseline 3 Ian consistently consumed maximum amounts of celery. Mean beansprout consumption was also high (mean 81%) but declined across the phase. Consumption of sugarsnap peas was initially 100 percent, but declined to zero by the end of the phase. A decline in courgette consumption was also evident. Consumption of the remaining vegetables tended not to exceed 25 percent.

During the final baseline phase blackberries and kiwi were consistently consumed at maximum levels. Lychee consumption which was initially low (i.e., 25%) but increased to 100 percent; conversely, guava consumption while initially high (100%) declined to 25 percent.

Deborah

Deborah's daily consumption of fruits and vegetables throughout the experiment is presented in Figure 7.2. Her consumption of the 12 individual experimental foods is presented in Figure 7.2.1.

Baseline

Food category consumption: During Baseline Deborah did not consume any vegetables - fruits were consumed on three occasions: plums on two occasions (11th session, 50% and 17th session, 25%), and 25 percent of melon once (session 20, 25%).

Video only intervention

Food category consumption: The Video Only Intervention was introduced with the vegetable category first, however, no vegetable consumption was recorded. Further, little effect was recorded when the intervention was operative with fruit.

Following this the Complete Intervention was introduced with the vegetable category.

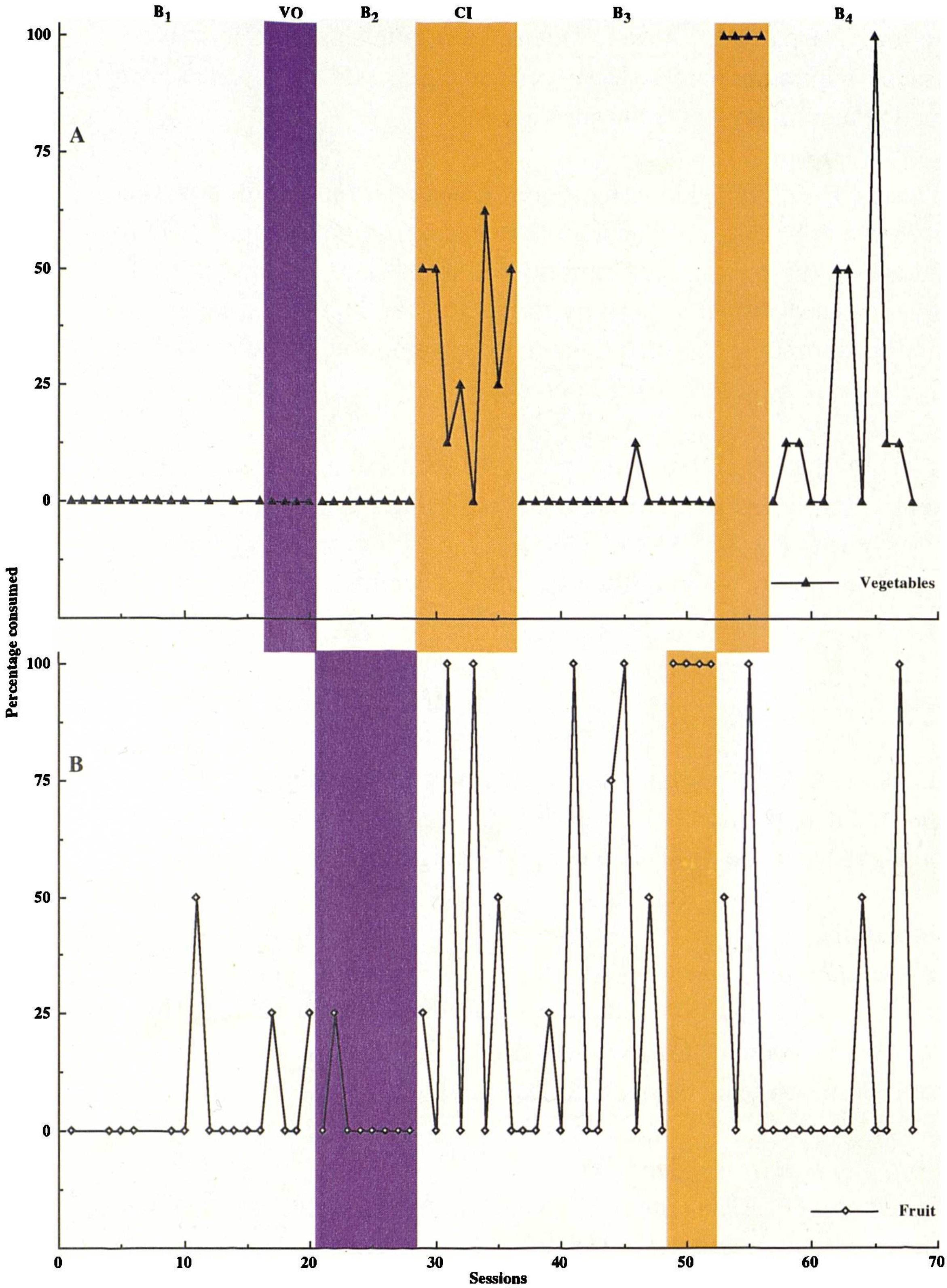

Figure 7.2: Deborah's daily consumption of the 12 experimental foods during Baseline (B1), Video Only Intervention (VO), Baseline 2 & 3 (B2 & B3), Complete Intervention (CI), and Baseline 4 (B4). Graph A displays vegetable consumption; (▲), Any two of the eight experimental vegetables. Graph B displays fruit consumption; (◇), Any one of the four experimental fruits.

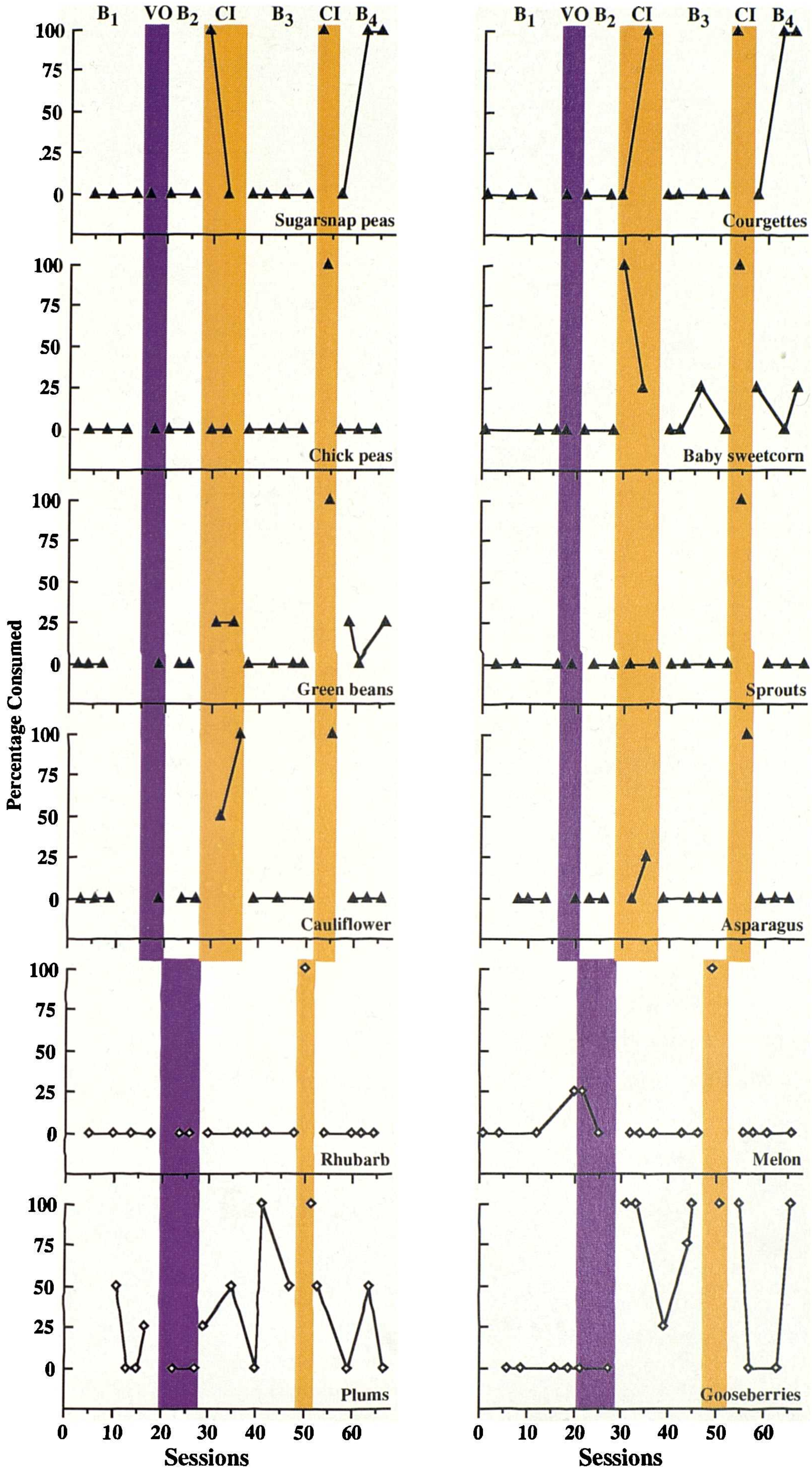

Figure 7.2.1: Deborah's daily consumption of the 12 experimental foods during Baseline (B1), Video Only Intervention (VO), Baseline 2 & 3 (B2 & B3), Complete Intervention (CI), and Baseline 4 (B4).

Complete intervention

Food category consumption: Vegetable consumption increased immediately following the introduction of the Complete Intervention package; however, this modified consumption was variable and never reached criterion when the intervention was operative. In addition, Deborah's consumption of fruit, which was being presented under baseline conditions, increased. Mean fruit consumption during Baseline 2 was 31 percent (ranging from 0% to 100%), as compared to 6 percent and 3 percent during Baseline 1 and the Video Only Intervention phase respectively.

Given that Deborah had not consumed vegetables to criterion, the Complete Intervention was withdrawn after eight sessions and both categories were presented under baseline conditions. Deborah's vegetable consumption declined to baseline levels and fruit consumption continued to vary (ranging between 0% and 100%) across the remainder of the phase.

Following a procedure similar to that reported in the case of Jeff (Experiment 3, Chapter 5) the Complete Intervention was applied to the Fruit category after completion of Baseline 2. Deborah reliably consumed 100 percent of fruit each evening the intervention was operative. A similar pattern of reliable maximum consumption was recorded when the Complete Intervention was operative with the vegetable category.

Withdrawal of the Complete Intervention resulted in a decline in consumption of fruits and vegetables. As the final baseline phase progressed some evidence of an increasing trend in vegetable consumption was recorded; however, her consumption was extremely variable from day to day and was very low (i.e., $\leq$ 12.5%) across the final three presentations of the experiment.

Some maintenance of fruit consumption was evident immediately following the withdrawal of the Complete Intervention package; however, this declined to zero levels by the fourth presentation. As was the case with the vegetable category, Deborah's fruit consumption showed some instances of increase towards the end of this Baseline phase.

Individual food consumption: Figure 7.2.1 shows that when the Complete Intervention package was first applied to the vegetable category Deborah consumed (at least some of) six of the eight vegetables. The two vegetables rejected were chick peas and sprouts; consumption of green beans and asparagus was low (not exceeding 25%). Deborah initially consumed 100 percent of sugarsnap peas and baby sweetcorn; however, consumption declined on the second occasion that these items were presented. Finally, courgette and cauliflower consumption increased across this phase, and maximum consumption was recorded on the final occasion each was presented. As noted above, little vegetable consumption was recorded during the baseline phase following the withdrawal of this intervention.

Although Deborah's consumption of fruits increased following the withdrawal of the Video Only Intervention, Figure 7.2.1 shows that only two of the four fruits, plums and gooseberries, were consumed during Baseline 2. Deborah's consumption of both fruits was variable, but mean gooseberry consumption was high (80%).

Introducing the Complete Intervention (for the second time with vegetables) resulted in all 12 experimental foods being consumed at maximum levels.

Deborah's consumption during the final Baseline phase was variable: two vegetables, sugarsnap peas and courgettes, while initially rejected, were consumed at maximum levels on the final two occasions each was presented. Little consumption was recorded with any of the other vegetables; hence, the consumption of only two vegetables accounts for the increasing trend during the final baseline phase displayed on Figure 7.2.

Regarding the consumption of fruits during the final baseline phase, two were consumed and two rejected. Neither melon nor rhubarb were consumed; plums and gooseberries were consumed, but variability was evident (means 25% and 50% respectively).

Eddie

Eddie's daily consumption of fruits and vegetables throughout the experiment is presented in Figure 7.3. His consumption of the 12 individual experimental foods is presented in Figure 7.3.1.

Baseline

Food category consumption: Eddie did not consume any of the fruit, however, vegetable consumption was more variable - some consumption was recorded on five occasions; however, on only one of these occasions did consumption exceed the 25 percent level (the last day of Baseline).

Individual food consumption: Figure 7.3.1 shows that during baseline three individual vegetables were consumed: broccoli, courgettes, and celery. The latter two were consumed on one occasion each at 25 percent. Broccoli consumption was variable and it increased to 75 percent on the final presentation of the phase.

Video only intervention

Food category consumption: The Video Only Intervention was applied to the fruit category first; however, no consumption was recorded when the intervention was operative with either category.

Complete intervention

Food category consumption: When the Complete Intervention package was applied to the fruit category, fruit consumption increased to 100 percent on the first evening of this phase. Immediately following this, however, a decline in consumption was recorded and Eddie did not consume above 25 percent on four of the following five evenings. Towards the end of the phase fruit consumption increased; consumption to criterion or above was recorded on three of the latter four presentations. Withdrawal of this Intervention resulted in Eddie's fruit consumption returning to Baseline levels.

When the Complete Intervention package was applied to the vegetable category, consumption initially increased, but not to criterion levels. On the first and fourth presentations, Eddie consumed 50 percent

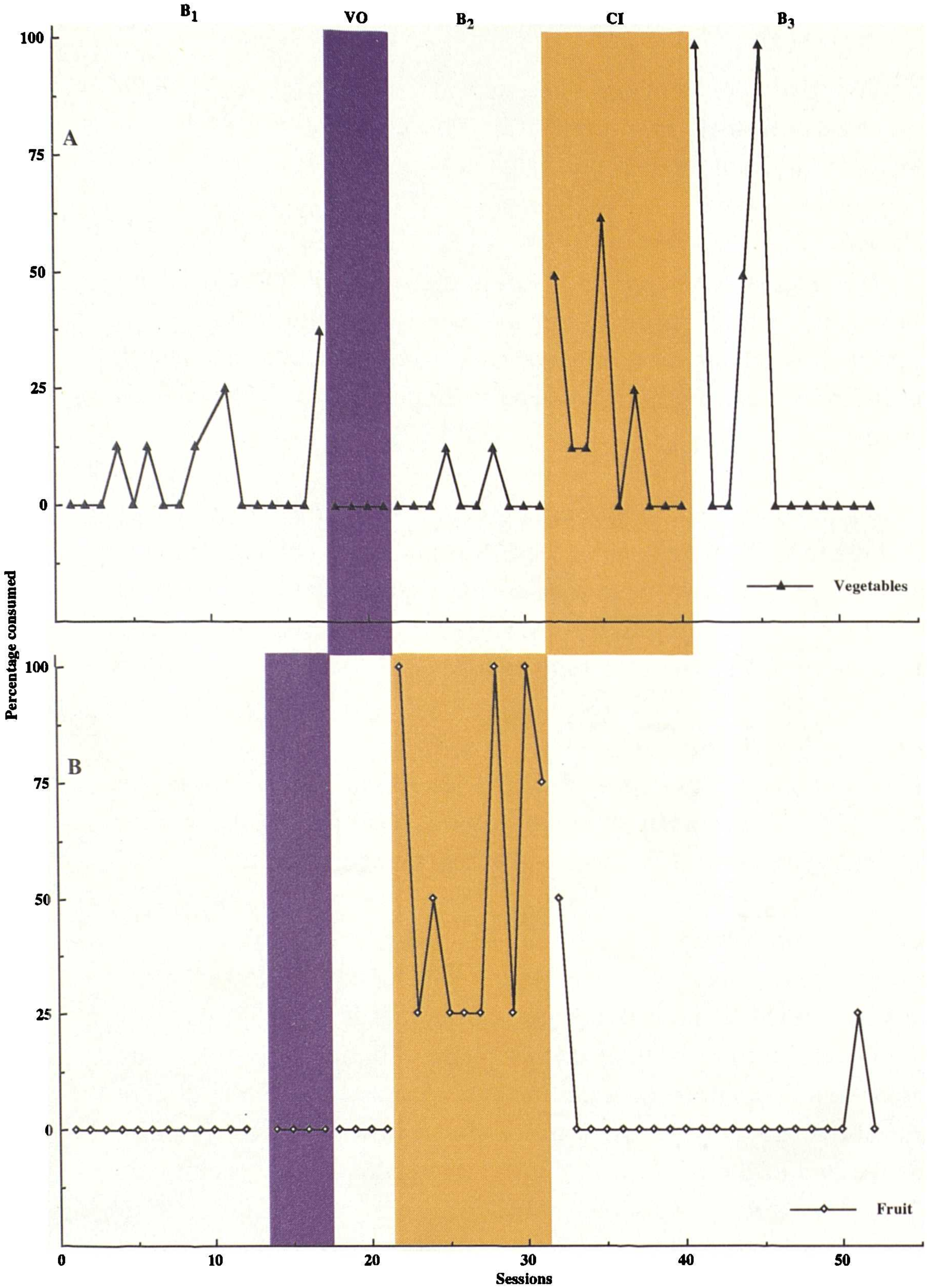

Figure 7.3: Eddie's daily consumption of the 12 experimental foods during Baseline (B1), Video Only Intervention (VO), Baseline 2 (B2), Complete Intervention (CI), and Baseline 3 (B3). Graph A displays vegetable consumption; (▲), Any two of the eight experimental vegetables. Graph B displays fruit consumption; (◇), Any one of the four experimental fruits.

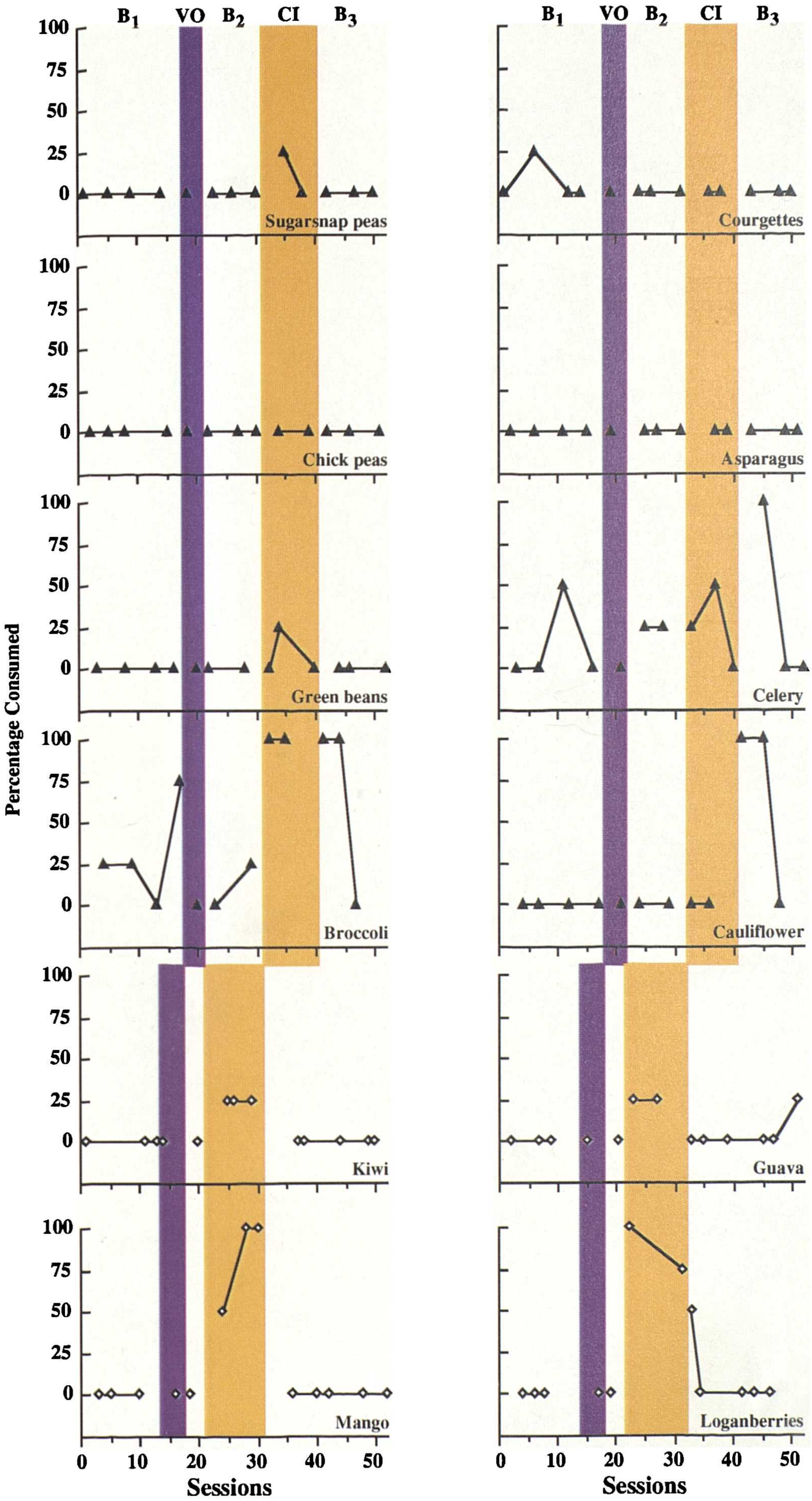

Figure 7.3.1: Eddie's daily consumption of the 12 experimental foods during Baseline (B1), Video Only Intervention (VO), Baseline 2 (B2), Complete Intervention (CI), and Baseline 3 (B3).

or above, of the vegetables presented. However, this was followed by a decline, and vegetables were rejected on the last three presentations of this phase.

Immediately following withdrawal of the Complete Intervention, consumption initially increased, with maximum consumption recorded on first and fourth presentation of Baseline 3. Eddie's father (who was mainly responsible for the implementation of experimental procedures) reported that Eddie had been told by his mother on the first day of this phase that if he consumed his vegetables the Food Dudes would "come back". This contravened experimental procedures. Further, the Experimenter was unaware of this event until some time after it had occurred and was thus unable to respond to it effectively.

Individual food consumption: Figure 7.3.1 shows that the Complete Intervention was successful in promoting high consumption of two fruits. Eddie consumed *mango and loganberries, to criterion or* above, on two occasions each during this phase. Kiwi and guava were reliably consumed at the 25 percent level.

While the Complete Intervention was operative Eddie reliably consumed one vegetable, broccoli, at maximum levels. The only other vegetable to be consumed above the 25 percent level during this phase was celery; this was consumed once at 50 percent. During Baseline 3 Eddie consumed three vegetables at maximum levels on at least one occasion: broccoli, cauliflower, and celery. Celery and Broccoli were presented on the first session of Baseline 3, the day Eddie's mother contravened experimental procedures, and celery and cauliflower were presented on the fourth day following the withdrawal of the Complete Intervention. The consumption of all these foods declined to zero levels by the final presentation of the experiment.

George

George's daily consumption of fruits and vegetables throughout the experiment is presented in Figure 7.4. His consumption of the 12 individual experimental foods is presented in Figure 7.4.1. Due to unforeseen parental circumstances it was only possible to implement the Video Only Intervention (following baseline). (Part way through the experiment George's mother gained full-time employment and consequently George was not presented with an evening meal at home on a regular basis.)

Baseline

With the exception of one evening (baby sweetcorn 25%) no fruits or vegetables were consumed.

Video only intervention

Food category consumption: The Video Only Intervention was applied to the fruit category first but consumption did not increase. Following the application of the intervention to the vegetable category a small increase in vegetable consumption was recorded. However, consumption in excess of 25 percent did not occur.

During the final Baseline phase George reliably rejected all fruits and vegetables presented.

Individual food consumption: Figure 7.4.1 shows that when the Video Only Intervention was operative three vegetables were consumed, but usually at low levels. George's consumption of sugarsnap peas accounts for most of the increase displayed on Figure 7.4; this vegetable was reliably consumed at the 25 percent level. Green beans and baby sweetcorn were consumed once at the 25 percent and 50 percent level respectively.

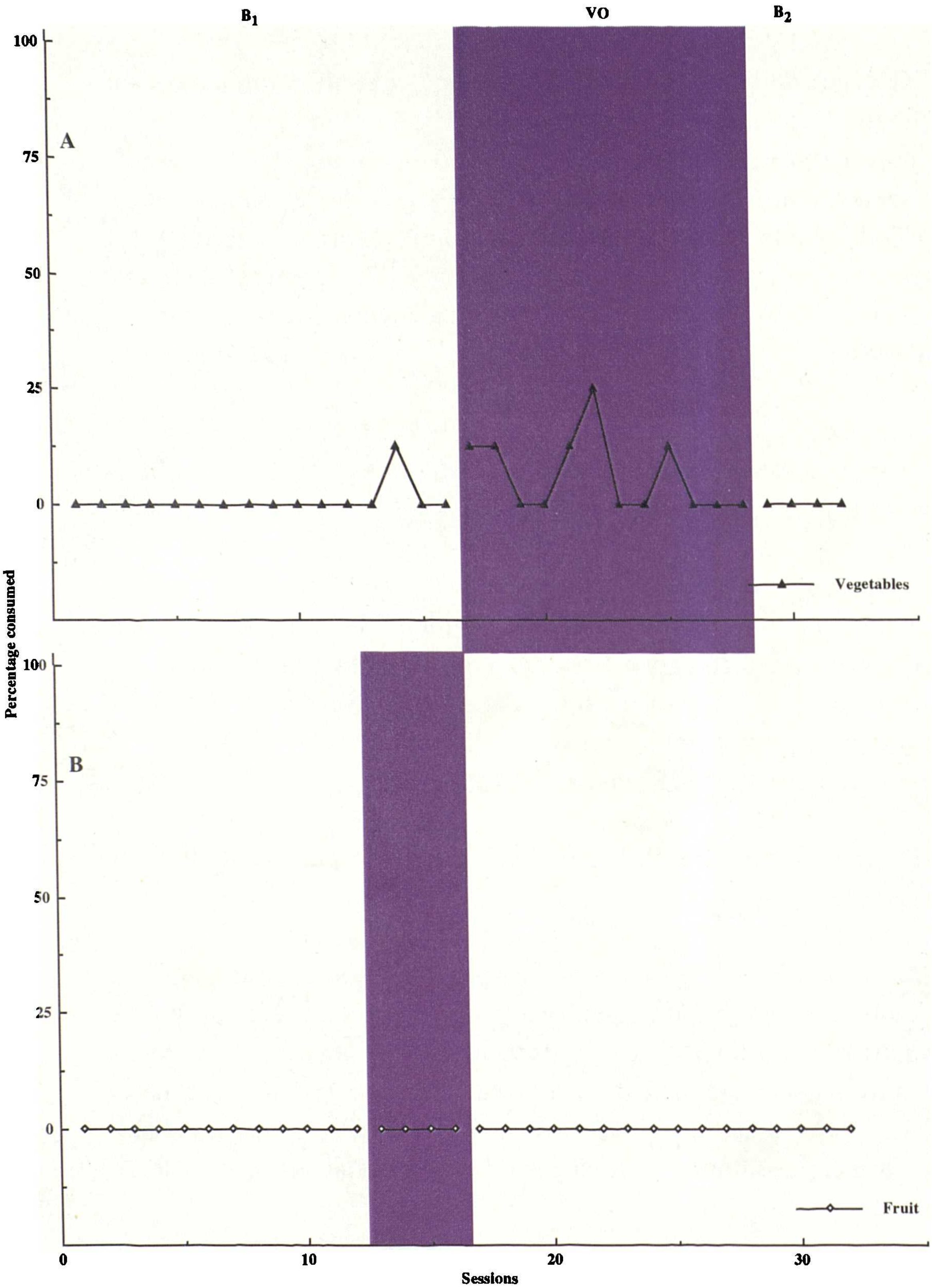

Figure 7.4: George's daily consumption of the 12 experimental foods during Baseline (B_1), Video Only Intervention (VO), and Baseline 2 (B_2). Graph A displays vegetable consumption; (▲), Any two of the eight experimental vegetables. Graph B displays fruit consumption; (◆), Any one of the four experimental fruits.

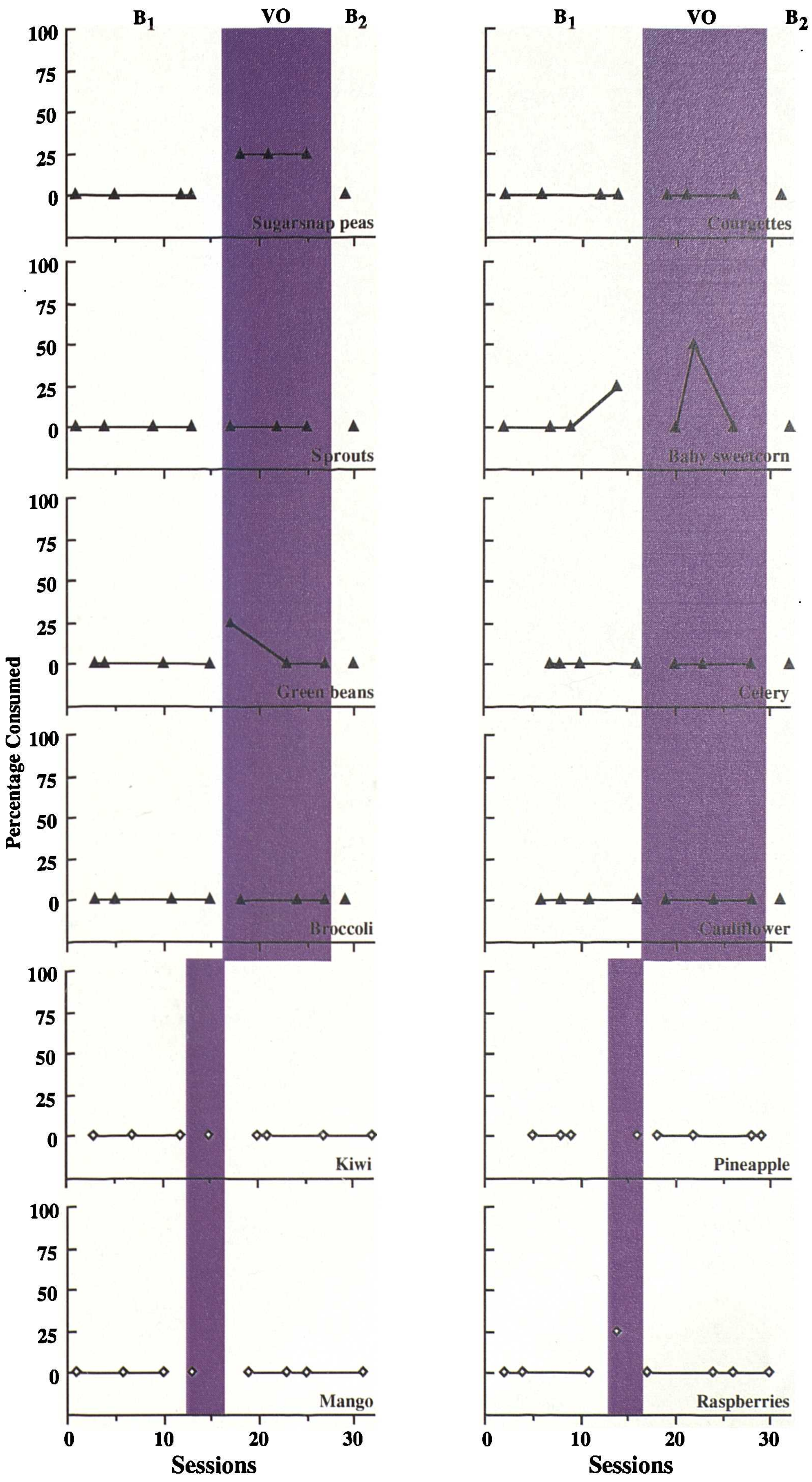

Figure 7.4.1: George's daily consumption of the 12 experimental foods during Baseline (B1), Video Only Intervention (VO), and Baseline 2 (B2).

6.3.3: Discussion

This was the second of two experiments designed to examine the relative effectiveness of modified versions of the Complete Intervention package employed in Experiment 3. The present results demonstrate clearly that an intervention which uses the Food Dude intervention films and category based instructions, in the absence of a reward contingency does little to promote the consumption of previously rejected fruits and vegetables. None of the subjects participating in the present experiment consumed much, if any, of the experimental foods when the Video Only Intervention was operative.

An examination of the consumption recorded during Baseline 2, the phase immediately following the withdrawal of the Video Only Intervention, highlights an issue warranting further investigation. During Baseline 2 Deborah's fruit consumption and Ian's consumption of both fruits and vegetables increased. Ian's increase in vegetable consumption may be due to the delayed effects of the Video Only Intervention. If this is the case, such effects appear weak and variable and may be observed only with specific children and/or specific foods.

However, a different account for the observed increase in fruit consumption may be proposed. With both children, the increase in fruit consumption emerged immediately following the introduction of the Complete Intervention with the vegetable category; hence, rewards were on offer for the consumption of vegetables. Prior to this, during the Video Only Intervention the subject had already been instructed to consume both categories. Hence, when offered reward for vegetable consumption the children were already likely to be aware that another way to protect the Life Force, help the Food Dudes, and so on, was to eat fruit. The increase in fruit consumption may be the result of generalised consumption. Although such claims are tentative, they would appear to warrant further investigation.

Another striking feature of the present results is the lack of differential effects arising from exposure to the Video Only Intervention. In the three previously reported home-based experiments, category differences have been a feature of each one. For example, in Experiment

4, the Reward Only Intervention was relatively successful in promoting fruit, but not vegetable, consumption. No such category differences are apparent, in the short term at least, in the present experiment - the Video Only Intervention had virtually no effect on the consumption of fruits or vegetables while it was operative.

Finally, although not directly comparable, the results of Experiment 5 appear to contradict previous research on the impact of television on food preferences. It was reported in Section 1.2.3 that exposure to televised information appeared to impact on children's food preferences. However, a number of observations suggest that the present results are in fact generally consistant with this body of literature. First, research on television and food preferences has generally relied upon stated preference as an outcome measure. In experiments where actual consumption is reported (e.g., Petterson et al, 1984), no positive effects are evident. Second, many of the significant findings reported in relation to television and food preference are for *decreases* in stated preferences. For example, choice or stated preference for a snack high in sugar decreases following exposure to a pronutritional programme. Subjects in the present experiments were never provoked to provide data regarding stated preferences.

Furthermore, the present results (and some experiments reviewed in Chpater 1) question the utility of television advertisements/ programmes as an effective means of improving children's diets. Such a result is consistent with research questioning the effectiveness of traditional health promotion campaigns (Gatherer, Parfit, Porter, & Vessey, 1979). Health promotion campaigns may be relatively effective in changing what people say, they may not be very effective in changing what people do (see also, Goldberg, 1992).

6:4: MODIFIED INTERVENTIONS. GENERAL DISCUSSION

A comparison of the effectiveness of the three intervention packages is presented in Figure 8. This figure compares fruit and vegetable consumption during the first Baseline phase and the first intervention phase of Experiments 3 (Complete Intervention), 4 (Reward Only), and, 5 (Video Only). During Baseline, overall consumption (i.e., the consumption of the four subjects within each experiment combined) of fruits and vegetables was similar across the three experiments. The greater effectiveness of the Complete Intervention package as used in Experiment 3 is clear. In addition, the differential effectiveness of the Reward Only Intervention in promoting consumption of fruits and vegetables can be seen. During Experiment 4 when the Reward Only Intervention was operative mean vegetable consumption was 9 percent compared to 57 percent with fruit.

The lack of effect (in the short term at least) of the Video Only Intervention is also clear. During Experiment 5, mean fruit and vegetable consumption during Baseline 1 was two percent. Little change was recorded during the Video Only Intervention phase where mean fruit and vegetable consumption was three percent in each case.

Investigations similar to those carried out in Experiments 4 and 5 can be of particular applied significance, providing the researcher/clinician with information regarding variables important for behaviour change (cf., Cooper et al, 1995). However, from the present results it is not clear if any components of the Complete Intervention package are superfluous to its success. Hence, the results of Experiments 4 and 5 do not immediatly aid the development of more economical intervention procedures.

In Experiment 4 and 5 the modified interventions were introduced following baseline, and in cases where modified consumption was not recorded, the Complete Intervention was then introduced. This procedure of *sequential introduction* may be contrasted with the procedure of initially introducing the powerful multi-component behaviour change package, and then sequentially *withdrawing* certain components (e.g., Hoch, Babbitt, Coe, Krell, & Hackbert, 1994). The strategy of sequential

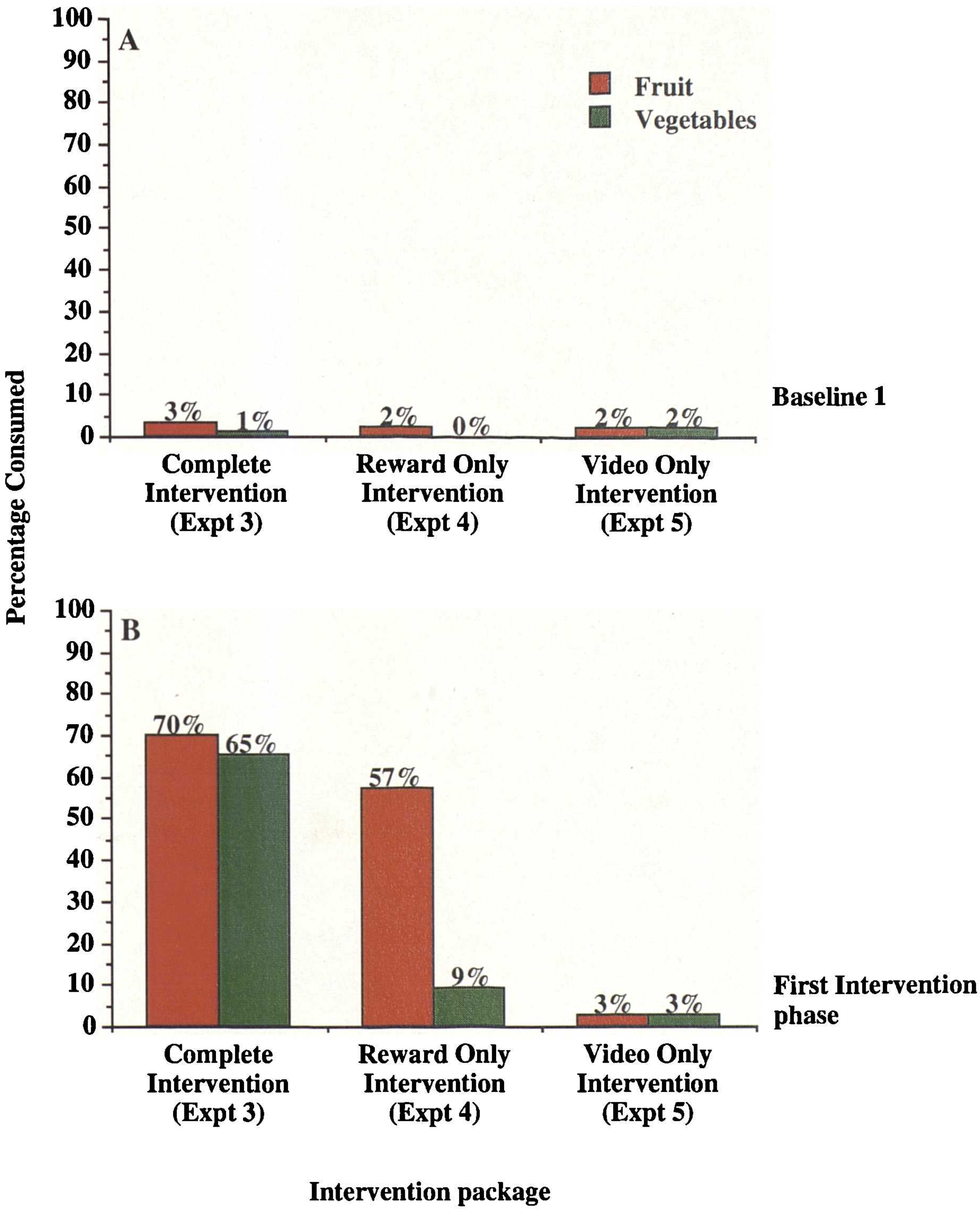

Figure 7: A comparison of overall (i.e., 4 subjects in each experiment combined) mean consumption during Experiments 2, 3 and 4. Graph A compares Baseline 1 levels of consumption, prior to the introduction of interventions. Graph B compares the effects of the Complete Intervention (Experiment 3) with the effects of the Reward Only Intervention (Experiment 4) and the Video Only Intervention (Experiment 5).

introduction may be deemed to be a more suitable design for the present experiments. The particular strategy adopted (i.e., sequential introduction or sequential withdrawal) will depend upon the interest of the experimenter (Cooper et al, 1995). Sequential withdrawal is more suited to identifying variables which will *maintain* target behaviour, however, sequential introduction is more likely to identify variables critical for the *promotion* of initial behaviour change - this was the intention in the present experiments. Information regarding the maintenance of target behaviour was already provided when discussing the results of Experiments 2 and 3 (i.e., during Intervention 2).

Nevertheless, the strategy of sequential withdrawal (i.e., initially introducing the Complete Intervention and then withdrawing certain components) represents a possible avenue for future research. For example, although it appeared relatively ineffective in promoting behaviour change initially, the Video Only Intervention may have been effective in *maintaining* consumption (once modified consumption has been achieved).

Given the complex nature of the Complete Intervention package, the modified interventions used in Experiments 4 and 5 represent only a fraction of the available options for modification. For example, during Experiment 3 (and in some cases in Experiment 4) none of the subjects consumed their target food above criterion on the first evening of the first intervention phase. All subjects required at least one letter of feedback from the Food Dudes before increases in consumption (to criterion) were observed. Thus, feedback appears to have played a central role in the effectiveness of the Complete Intervention. In addition to specifying the target behaviour and the reward contingency, the feedback letters may have made the intervention more "real" for the subjects. The reader is reminded of the earlier cited comments of Sally, a child who participated in Experiment 3. After watching the Food Dudes film on the first intervention evening Sally asked her mother if it was real. Presumably receiving a letter from the Food Dudes on the following evening confirmed this. In light of this, feedback could be incorporated in the Video Only Intervention. This may also introduce apparent social consequences for consumption (e.g., written praise from the Food Dudes), and thus increase the efficacy of the modified package. If successful, such a modified intervention would have numerous advantages over the Complete Intervention (e.g., ease of implementation, cost effectiveness).

The present modified packages were designed to examine particular theoretical issues (e.g., the debate concerning the role of rewards and food preferences) and applied issues (the development of more economical interventions). Thus the particular modifications incorporated in future research will depend upon the particular questions one wishes to address. For example, the proposed modification discussed above (incorporating feedback with the Video Only Intervention) would address both applied and theoretical issues. In particular this modification would provide information regarding the impact of different types of reward (i.e., social consequences versus material rewards) on consumption.

The different effects of the two modified interventions were also observed when the Complete Intervention package was introduced in each experiment. However, it is necessary to note that given the present data, firm conclusions are not permitted. For example, with two subjects in Experiment 4 (Bob & Carol) the Complete Intervention was not introduced with the fruit category. Further, in Experiment 5 the Complete Intervention was introduced with only three of the four subjects, and Eddie's vegetable consumption was not modified to a level comparable with that recorded during Intervention 1 in Experiment 3. Nevertheless, there is some evidence to suggest that the Reward Only Intervention compromised the effectiveness of the Complete Intervention package. None of the subjects in Experiment 4 evidenced modified vegetable consumption to a level comparable with that recorded in Experiment 3 - all of these subjects were exposed to the Complete Intervention following the Reward Only Intervention. Further, although the Reward Only Interveniton modified Rory's consumption of fruits, no consumption of this category was recorded when the Complete Intervention was later introduced with this category.

The reduced effectiveness of the Complete Intervention when introduced following the Reward Only Intervention appears to reflect a sequence effect (Johnson & Pennypacker, 1993) - the immediate history of exposure to the Reward Only Intervention interferes with the impact of the Complete Package. Sequence effects were also evident during Experiment 3 (Chapter 5): an increase in Jeff's consumption of vegetables was evident only after the Complete Intervention had been applied to the fruit category. This may be explained relatively easily. Because fruits are sweeter than vegetables, increases in fruit consumption may be achieved more readily than vegetable consumption (this is supported by the results of the home-based experiment). Thus, targetting the fruits allowed Jeff to contact the imposed contingency more easily than was the case with vegetables; once contacted, the contrived consequences were sufficiently powerful to modify consumption of both categories.

However, it may be less straight forward to account for the apparent detrimental effects resulting from the Reward Only Intervention. A number of alternative explanations will be discussed in the following chapter during which an overview and discussion of the present results will be presented.

CHAPTER 7

OVERVIEW AND DISCUSSION

7.1: OVERVIEW OF RESULTS

The present series of experiments investigated food choice and consumption in five to seven year old children. The aim of the series was to promote consumption of novel and previously refused foods; this was to be achieved through the manipulation of cultural variables.

Experiment 1 examined the impact of peer behaviour on the consumption of a novel food. The results indicated that the behaviour of peers could be a powerful determinant of (short term) acceptability of a novel food. In the presence of confederates, subjects tended to reject or accept a novel food in accordance with the food related behaviour of the confederates. Further, similar trends in consumption were recorded when subjects were subsequently presented the food in the absence of confederates. The impact of negative peer influence was particularly apparent: little novel food consumption was recorded in the presence of negative models, or when subsequently presented in their absence. Nevertheless, the data indicate that such induced "aversions" could be largely overridden through subsequent exposure to positive peer modelling.

The design of Experiment 1 prohibited any firm conclusions about such effects in the long term; in particular, little could be concluded about the development of consumption patterns across time. In light of this, Experiments 2 and 3 utilised single case methodology in order to allow for an investigation into daily changes of consumption patterns across a number of months. In addition to the changes in methodology and design, the focus of Experiments 2 and 3 altered slightly. These experiments were conducted within the context of home evening meals (with other family members present), and subjects were presented with previously refused target foods. Also, in an attempt to promote consumption of these foods, subjects were exposed to a multi-component intervention package. This incorporated: (i) video peer modelling of target food consumption; (ii) instructions about the benefits that would follow from target food consumption; and (iii) rewards contingent upon target food consumption.

During Experiment 2, the multi-component intervention package (i.e., the Complete Intervention) was used to target three specific foods (a fruit, a vegetable, and a pulse) with each subject. Although little consumption was recorded during Baseline, immediately following the introduction of the Complete Intervention (i.e., during Intervention 1), consumption of each target food increased, often to maximum levels. Withdrawal of the intervention resulted in a decline in consumption of the target foods. However, target fruits were an exception, and consumption of these tended to remain high during Baseline 2. Intervention 2, which utilised food specific instructions and token rewards, was designed to promote consumption in the long term by maintaining target food consumption across a further seven presentations. Hence, by the end of Intervention 2, each subject had consumed each of the three target foods on at least 10 occasions across the nine weeks of interventions.

Long term maintenance of consumption was evident during follow-up. During the first follow-up phase, mean target food consumption (for all subjects combined) was 54 percent, compared to 3 percent during Baseline 1. And, although target vegetable and pulse consumption was lower during the second follow-up phase (relative to the first), target fruit consumption was high and stable across both follow-up phases. Three of the four subjects continued to consume their target fruit, to criterion or above, on every presentation during both follow-up phases.

Little consumption of the control foods was recorded during Experiment 2. This was to be expected as these foods, although presented with their experimental counterparts, were never the subject of an intervention. Although the food-specific intervention was extremely effective in promoting target food consumption, there was little evidence of generalisation to other previously refused foods. The promotion of generalisation was the focus of Experiment 3.

During Experiment 3 the focus of the multi-component package (i.e., the Complete Intervention) was changed so that food categories, rather than specific foods, were targeted. Hence, during this intervention subjects were instructed to "*eat all fruits/vegetables*". This category-based intervention was successful in promoting consumption across a range of previously refused fruits and vegetables. The second intervention (token reward) employed in Experiment 3 was designed to maintain consumption of some of the experimental foods (the high exposure group) on up to 15 occasions. This was successful with three of the four subjects. Intervention 2 also appeared to promote generalisation; during the Generalisation phase that immediately followed Intervention 2, there was an increase in the consumption of the low exposure foods relative to Baseline 2.

Long term effects were evident during follow-up, with many foods being consumed at high or maximum levels. In general, the high exposure foods (i.e., those presented during Intervention 2) were consumed in greater amounts than the low exposure foods. However, as a similar trend in consumption was evident during Baseline 2 (i.e., prior to the differential taste exposure), it could not be concluded that the increased exposure to the high exposure foods led to the greater consumption during follow-up.

Together, the results of Experiments 2 and 3 demonstrate that children's consumption of previously refused foods can be effectively modified in an applied setting. Experiment 3 shows that young children can be persuaded to consume up to 12 previously refused foods, and, that many of these foods will be reliably consumed (often at high levels) six months after the interventions.

Although effective, it was unclear which components of the interventions used during Experiment 2 and 3 were necessary to promote consumption. To inform this issue, Experiments 4 and 5 (see Chapter 6), were designed to examine the effectiveness of two modified intervention packages. During Experiment 4, subjects were exposed to a Reward Only Intervention which was similar to the Complete Intervention package used during Experiment 3, but excluded the Food Dude intervention film component. Subjects were issued with category based instructions (*eat all vegetables/fruits*), and offered contingent rewards for the consumption of previously refused foods. This modified intervention package was almost as successful as the Complete Intervention package in increasing consumption of fruits, but was markedly less successful in promoting vegetable consumption. Further, this modified intervention also appeared to compromise the effectiveness of the Complete Intervention for those subjects for whom it was subsequently introduced.

The Video Only Intervention used during Experiment 5 exposed subjects to the series of Food Dude intervention films, and this was done in the absence of an imposed reward contingency. Hence subjects were: (i) told about the Food Dudes' struggle to save the Life Force of the earth; (ii) exposed to video models consuming the target foods; and (iii) issued with instructions to consume the foods. They were not, however, offered any tangible material reward for consuming the target foods. This intervention had a negligible impact on the subjects' consumption of previously refused vegetables and fruits.

Taken together, the results of the five experiments reported in the present thesis highlight the importance of cultural variables in determining the foods that five to seven year old children will and will not eat. A particular strength of the home-based experiments is their ecological validity. Further, in all five experiments the amount of target food consumed by the subjects was recorded. Consequently, these experiments do not suffer from the limitations of much of the research reported in Chapter 1 (Section 1.2) in which only measures of stated preference are typically reported.

From the present results, it can be concluded that it is indeed possible to empower children to choose and consume a healthier diet. This is of particular applied significance given: (i) the increasing evidence linking diet and health (see Chapter 1, Section 1.4); and, (ii) the failure of previous research to focus on establishing changes in *consumption*.

7.2: GENERAL DISCUSSION

The purpose of this final section is to discuss the present results in relation to the four areas of literature reviewed in Chapter 1, namely: (i) the role of taste and sight exposure; (ii) peer modelling/influence; (iii) rule-governed behaviour; and (iv) the role of rewards in promoting consumption. Throughout this discussion issues of applied significance will be noted, but, in addition, Section 7.2.5 will discuss the generality of behaviour change; an issue of central importance to Applied Behaviour Analysis. Finally, it should have become apparent to the reader that difficulties emerge when comparing the present results to much previous research. Often these problems arise because of the different outcome measures used (i.e., consumption versus stated preference). In Section 7.2.6, the issue of how best to measure preference within the context of applied research will be examined; particular emphasis will be placed on the problems surrounding measures of stated preference.

7.2.1: Exposure

Promoting Taste Exposure: In Chapter 1 it was argued that in order to enhance taste preferences for novel foods, taste exposure was necessary; furthermore, if these foods are consumed "for 10 or 15 exposures, significant increases in liking could be obtained" (Birch et al, 1987, p. 177). Although this may indeed be the case, the low and stable consumption characteristic of the initial Baseline phases in the home-based experiments suggests that it is necessary to implement procedures which will *induce* tasting. It was argued in Chapter 1 that Birch and colleagues (Birch et al, 1982, 1987) utilised instructions to promote taste exposure. However, because the success of such an intervention is dependant upon the subject's speaker/listener history, instructions issued by parents are likely to be of little use in promoting taste exposure.

In recognition of this, the effectiveness of parental instructions in promoting taste exposure was not examined in the present experiments (in fact, parents were requested not to instruct their children to consume). However, it was clear from baseline data that "mere exposure" to previously refused foods (i.e., simply presenting foods at family mealtimes), some of which were novel prior to the experiment, will do little to increase children's taste exposure to these foods. The extent to which this is acknowledged by Birch and colleagues is unclear.

Maintenance of Exposure: In Experiments 2 and 3 the implementation of Intervention 2, which maintained target food consumption across several weeks, appeared to be important in the promotion of long-term consumption. Cases were noted previously (e.g., Chapter 3) where consumption was low immediately following the withdrawal of Intervention 1 (i.e., prior to Intervention 2), but high during follow-up (i.e., after Intervention 2). However, it has been also noted previously that the present results preclude any firm conclusions regarding the importance of differential levels of taste exposure and the promotion of long term maintenance.

Nevertheless, establishing the importance of taste exposure within a maintenance package such as Intervention 2 would be particularly useful for future applied work. For example, the duration of Intervention 2 (i.e., number of taste exposures) could be systematically increased within a series of ABA reversals. This would establish whether certain foods (e.g., sweet fruits) require relatively few exposures (i.e., a very short maintenance intervention) to establish high stable consumption. Conversely, other foods (e.g., vegetables) may require longer interventions incorporating more taste exposures. Such research would allow the researcher to target interventions more effectively at specific foods and specific children, implementing long interventions only where necessary. This may begin to allow the researcher to establish the amount of exposure *sufficient* to maintain consumption of particular foods (with particular children). Put simply, why continue an intervention with a food if that food will be reliably consumed in the absence of the intervention?

7.2.2: Modelling

Characteristics of the models: Subjects in every experiment reported in Chapters 2 to 6 were exposed to models consuming the target foods. During the home-based experiments, children were exposed to adult models (i.e., parents) consuming the experimental foods throughout the entire experiment. Baseline 1 data suggests that this adult modelling had no impact upon subjects' consumption of the target foods.

Subjects were also exposed to other children (either confederates or the Food Dudes) consuming target foods. Interestingly, the results of Experiments 1 and 5, which investigated peer modelling/behaviour most directly, appear contradictory. The Video Only Intervention used in Experiment 5, produced a negligible effect on consumption whereas the peer based intervention in Experiment 1 produced a substantial effect on novel food consumption. Although not directly comparable, these two studies were similar in that subjects were exposed to peer models (televised or *in vivo*) in the absence of an imposed reward contingency. It may be useful to discuss some possible accounts of these different results.

The Medium of Modelling: The medium through which the modelling was delivered in each experiment may be important. Stoneman and Brody (1981; see Section 1.2.3) suggested that peer behaviour could override the effects of televised information (in the form of an advertisement). In their study, subjects exposed to a peer whose choices were inconsistent with a televised advertisement showed lower stated preferences for the advertised foods than did subjects exposed to the advertisement alone. This is consistent with the proposal that *in vivo* modelling is more powerful than televised modelling. The effectiveness of televised peers may also depend upon the nature of the particular task (Bandura, 1971). The consumption of previously refused foods may be a task which is affected little by exposure to televised peers. To test this, Experiment 1 could be replicated, with the blue foods replaced with previously refused foods, and the addition of another condition in which the confederates are presented on television.

Modelling and Rule-following: Behavioural accounts of modelling/ imitation and observational learning highlight the role of direct reinforcement on the occurrence behaviour (see Section 1.3.3). Although no explicit reinforcement was scheduled in either Experiment 1 or 5 (during the Video Only Intervention), it is likely that implicit reinforcement interacted with the modelling interventions employed in the experiments. However, the implicit reinforcement differed across the two experiments and, as such, may have resulted in the observed differences in consumption in the *in vivo* and televised modelling scenarios.

Modelling and Pliance: First, it was suggested in Chapter 2 (Section 2.1.3) that the confederate verbalisations in Experiment 1 may have implied the operation of social contingencies during the modelling scenario. Subjects may have perceived the possibility of certain social consequences (e.g., social rejection/acceptance) for engagement in the target activity. This is very similar to the example provided by Zettle and Hayes (1982) in which a person is told to fast for a day. Although fasting may be punishing, the instruction is followed because of the implicit social contingencies (and the listener's history of reinforcement with respect to instruction following).

Similar social consequences may have been operative with the subjects in Experiment 5 (e.g., the children may have believed that the Food Dudes would be pleased with any children who help them to beat the Junta). However, such implicit social contingencies are less likely to influence the children's behaviour when models are televised (compared to being *in vivo*), because the models cannot deliver peer mediated consequences directly. Consistent with this account, Zettle and Hayes (1982) argue that pliance is controlled by speaker mediated consequences. If the speaker is deemed to be unable to mediate the apparent consequences (as may have been the case in Experiment 5), counterpliance is likely.

The addition of the imposed reward contingency in the Complete Intervention may have been functionally equivalent to the implicit social consequences which may have been operative in Experiment 1. Consistent with this is the observation that, during Experiment 3, none of the children complied with the instructions from the Food Dudes on the first evening of the intervention. Subjects required at least one feedback letter before modified consumption was evident. The letters may have demonstrated to the subjects that the Food Dudes were, (i) reactive to participants' food consumption, and (ii) were able to administer the described consequences.

To further investigate the importance of implicit social contingencies, at least two modifications could be made to Experiments 1 and 5. First, the social contingencies operative in Experiment 1 could be reduced. Similar to the modification proposed above, subjects could view the confederates through a one way mirror (or on television). This would allow exposure to modelling, confederate verbalisations, and so forth, but reduce the directness of the social contingencies.

Second, a more direct social contingency could be introduced as part of the Video Only Intervention (Experiment 5). For example, the subject could be told that the Food Dudes would visit the subject at home later in the evening to record how much of the experimental food he or she had consumed. Similar contingencies might be operative were the subject to be required to write to the Food Dudes stating the amount of experimental food consumed. The Food Dudes could then reply via letters, providing contingent social praise or punishment (and performance related feedback). In these modifications the apparent social consequences would still be more indirect, especially in the latter, than was the case in Experiment 1.

Modelling and Tracking: Confederate/Food Dude verbalisations, in addition to implying the operation of social contingencies, described the natural consequences of target food consumption and as such may have promoted tracking by the subjects: "If it tastes that good I had better try it!". However, descriptions of natural consequences may operate differently with respect to the consumption of novel and previously refused foods. For example, a statement (from a model) that a previously refused food tastes good may lead a subject to say, "no it's not, I know it's yukky because I've had it before". Such definite and explicit rules may be less likely when the food is novel; in the case of Experiment 1, it is very unlikely that any of the subjects had ever been presented with any blue foods prior to the experiment.

In order to test the importance of the different status of the food used in Experiments 1 and 5 (i.e., novel versus previously refused), procedural modifications could be incorporated into future research, namely: (i) replicate Experiment 1 using previously refused foods; or (ii) produce a series of video films in which the Food Dudes eat entirely novel foods (e.g., gwark, fodrick, and other blue foods) in order to save the Life Force.

To conclude: In order to account for the results of Experiments 1 and 5 the concept of rule-governed behaviour was invoked. Although further research is required, the accounts proposed are consistent with the notions of rule-governed behaviour as outlined in Chapter 1. The discussion of the role of rule-governance and the results of Experiments 1 to 5 will be expanded upon in the following section.

7.2.3: Rule-Governed Behaviour

A number of observations concerning the present results support a rule-governed account of the changes in behaviour; this evidence, which has been reported in previous chapters, will be reviewed briefly below:

1. During the home-based experiments, the time delay between the performance of the target behaviour and presentation of the contrived consequence (i.e., reward) was too great for the contrived consequence to directly control the target behaviour. Some form of verbal mediation must have bridged these gaps between response and consequence (Lowe & Higson, 1983; Lowe, Horne & Higson, 1987; Michael, 1980; see also Hayes & Hayes, 1993). Further, Experiment 5 demonstrated the importance of the delivery of contrived consequences in promoting behaviour change.

2. The children who participated in the experiments were verbal, and they were repeatedly provided with numerous verbal antecedents describing the imposed, and some natural contingencies. Opportunities for earning rewards were described in the Food Dude intervention films, feedback letters, instruction cards, and sticker charts. Natural consequences (e.g., taste) were described when the Food Dudes modelled consumption of the target foods. During Experiment 1, the confederates provided descriptions of the consequences of consuming the novel blue foods. (The presence, and possible role of such verbal antecedents in promoting behaviour change, can often be overlooked in behavioural programmes designed to modify behaviour; see Lowe & Higson, 1983; Lowe, Horne & Higson, 1987).

3. In many cases, the subjects' consumption corresponded more closely to the instruction than the actual imposed contingency. Although not directly applicable, such "insensitivity" to imposed schedules has been reported in laboratory based examinations of human schedule performance (e.g., Catania, Matthews, & Shimoff, 1990; see also Chapter 1, Section 1.3.1).

4. During Experiments 3 and 5 not all of the additional foods consumed by the subjects were featured pictorially in the Food Dude intervention films (see Chapter 5 for a list of cases in Experiment 3). However, as subjects were instructed to "eat all fruits/vegetables" it is likely that consumption came under verbal regulation. Owing to the absence of pictorial representation for these foods, consumption could not be guided by visual similarity. Hence, it is likely that appropriate responding required the subjects to utilise the verbal categories (e.g., fruit or vegetables), in order to select additional foods to consume.

The present results are also consistent with accounts of rule-governed behaviour proposed in Chapter 1 (e.g., Baum, 1995; Hayes et al, 1989; Malott, 1989; Skinner 1969; Zettle & Hayes, 1982). In order to promote initial behaviour change it was necessary to introduce the Complete Intervention package. This included the provision of a contrived consequence (or proximal reinforcer) for rule following (see for example, Skinner, 1969, p. 169). Although effective, in many cases consumption returned to baseline levels when the intervention was withdrawn (with the exception of some target fruits). Such a pattern of consumption is consistent with Zettle and Hayes (1982) concept of *pliance* - once the speaker mediated consequences are withdrawn, or the speaker is no longer perceived to be able to mediate consequences, rule following ceases.

The second intervention, which also utilised proximal consequences (in the form of token rewards), maintained consumption over an extended period. This may have facilitated a transition from pliance to tracking.

The Development of Tracking: Maintaining consumption during Intervention 2 may have demonstrated to the children that they could consume the foods in the absence of negative consequences. Children are often aware of the health properties of fruits and vegetables and this knowledge may promote the self instruction: "I should continue to eat these foods because they are good for me; I want to grow big and strong." Other possible tracks may relate to the content of the video film; the children may continue to consume the foods in an attempt to keep the Life Force strong. Finally, subjects may guide their behaviour with rules such as "these vegetables are not as yukky as I thought they were, they taste quite nice!".

This shift from pliance to tracking may be closely linked to the development of self control, with the subjects' self-instructions becoming more effective in controlling consumption. It was noted in Chapter 1 that people respond to their own responding (e.g., Lowe, 1979, 1983, 1988; Skinner, 1953, 1957), or a speaker and listener may be in the same skin (Skinner 1953). For example, Poppen (1989) has argued:

> Rules are also derived from one's own observations of and interactions with environmental contingencies. The verbal community provides us with a kind of metarule: 'Extract rules'. That is, we are taught to tact contingent relationships that affect our own and others' behaviour ....These rules then serve to guide one's own behaviour in similar situations. (p. 339)

In a final analysis, it is likely that the account outlined above will be more or less accurate with different children, different foods, and different foods within the same child. For example, the transition from pliance to tracking may occur readily in some cases; in other cases tracking may develop very slowly (if at all). Likewise, control by natural consequences may be achieved readily with some foods (e.g., sweet fruits), whereas with other foods control may never pass directly to natural contingencies (cf., Baum, 1995). Further research is required to determine the validity of the proposed account of the present results and the development of children's consumption patterns more generally. However, it is important to note that it was not the purpose of the present experiments to identify the particular variables controlling long term consumption. The aim of Experiments 2 and 3 was to develop an intervention which was effective in promoting and maintaining the subjects' consumption of previously refused foods.

An initial investigation of the variables responsible for the *promotion* of consumption was undertaken in Experiments 4 and 5, during which the modified interventions were implemented. In the following section, the results of Experiments 4 and 5 will be discussed within the framework of rule-governed behaviour.

Modified Interventions

It was reported in Chapter 6 that the modified intervention employed in Experiments 4 and 5 represented only a subset of the possible options for modification. Although the Complete Intervention (used in Experiment 3) comprised of three *major* components (see Section 7.1), a closer examination reveals numerous smaller components, only some of which were present in the modified intervention packages. These smaller components included :

1. Video modelling: Subjects observed the Food Dudes modelling the target behaviour.

2. Vicarious reinforcement: The Food Dudes were seen enjoying the consequences of consuming the target foods, and the consequences of beating General Junk.

3. Peer pressure from the Food Dudes to consume the target foods (see Section 7.2.2 during which the importance of implicit social contingencies in the modelling scenario was discussed).

4. Verbal specification (by the Food Dudes) of the consequences of target food consumption: This included the natural consequences of target food consumption (e.g., "kiwi fruit is lovely"), and consequences concerning the Life Force and the defeat of General Junk.

5. Instruction to consume the targeted food/category and verbal specification of the imposed contingency.

6. Contingent presentation of the material rewards.

The reduced effectiveness of the modified intervention packages may be due to the fact that each contained fewer of the above components than was the case with the Complete Intervention package.

In relative terms, the Reward Only Intervention (Experiment 4) was more effective than the Video Only Intervention (Experiment 5). Given the demonstrated importance of the reward contingency (see Experiment 5), future research could establish if the addition of a modelling component to the Reward Only Intervention might yield a successful intervention. Such a modelling component may not necessarily need to be an elaborate series of intervention films like that employed in the Complete Intervention. A relatively "simple" video could be produced showing little more than other children consuming the target foods. The extent to which other components or variables of the Complete Intervention are featured (e.g., peer pressure, vicarious reinforcement) would depend upon the behaviour of the videoed models. For example, the models could be seen to consume the food but not refer (either verbally or non verbally) to the consequences of this act, thus reducing vicarious reinforcement. Further research would be necessary to establish the validity of this proposal, but if effective such an intervention would have practical advantages (e.g., in terms of production cost and effort) over the Complete Intervention package.

Essentially, the Food Dude intervention films represent numerous (possibly functional) components of the Complete Intervention, many of which may be conceptualised as contingencies which are social/verbal in nature. For example, it was suggested earlier that the advice by the Food Dudes may function as tracks for the viewer to follow. Similar information may be provided by models non-verbal behaviour such as facial expressions. Likewise, the behaviour of the Food Dudes may have implied the existence of social contingencies for consuming certain foods (see Sections 2.1.3, & 7.2.2 for related comments).

Tacts, Mands, and the Reward Only Intervention: The results of Experiment 4 suggest that exposure to the Reward Only Intervention may have compromised the effectiveness of the Complete Intervention (in cases where the latter was subsequently introduced). In accounting for such effects, it may be useful to examine the particular form of instruction (and other verbal behaviour) prominent in the two intervention packages. Different instructions are likely to alter the "overall tone" of a particular intervention, and consequently the way the subjects interpret the intervention.

Presumably, all of the home-based interventions rely heavily upon verbal behaviour in mand form, more specifically "commands" (when subjects were instructed to consume the target foods). Statements in tact-form, describing the relationship between target behaviour and imposed consequences were also featured. However, as these tact-form statements described imposed contingencies, they may have been perceived in a similar light to the commands. This verbal behaviour accounts for the majority of the Reward Only Intervention. However, in addition to such mand-like content, the Complete Intervention also contained tact-like statements which included:

1. A description of some of the "natural" consequences of eating the target foods (e.g., "kiwi fruit is lovely").

2. A description of the relationship between target food consumption and the consequences for the Life Force and for General Junk.

The differential tact-like and mand-like content of the Reward Only and Complete Intervention may promote very different behaviours on the part of the subjects. Skinner (1957) argues, "...since verbal behaviour in the form of a mand operates primarily for the benefit of the speaker, repeated mands are likely to move the listener to revolt." (p.41). In order to avoid such revolt, Skinner argues that "...it is customary to soften or conceal the mand character" (p.41). To illustrate, Skinner provides the following example: If one is thirsty one is less likely to successfully obtain a drink by demanding "Water!". More successful alternatives include, "I'm thirsty", "may I have some water?", or "would you mind getting me a drink?".

It is possible that the Reward Only Intervention was functionally similar to "Water!" in Skinner's example, while the Complete Intervention corresponded to "would you mind getting me a drink?" (or one of the other softened mands).

Zettle and Hayes (1982) raise a similar issue when discussing the "Trojan tact", which is defined as a mand in tact form. To illustrate, Zettle and Hayes provide the example of a father saying to his child, "if you make that much noise the neighbours will be angry". Although this statement is in tact form (i.e., it describes a relationship between a behaviour and its consequences), it is in effect a mand (by the parent) that the child should stop engaging in noisy behaviour. Such forms of verbal behaviour are extremely common because "Hard mands ('I demand this') are very likely to generate counterpliance if the contingencies allow it." (Zettle & Hayes, 1982, p.84).

Applying such analyses to the present series of experiments, the speaker is ultimately the present author who is speaking to the subjects via the Food Dudes. The Reward Only Intervention may constitute the repeated or hard mand, and as such may have resulted in the subject formulating rules such as: "those Food Dudes want me to eat that food!" Further, because rewards were being presented, again in a blatant way, the subjects may have framed rules such as, "those Food Dudes are trying to bribe me, just like mum/dad does when she/he wants me to eat something horrible". The Complete Intervention, on the other hand, may correspond to the softened mand, and be perceived in less coercive terms: "the Food Dudes would like me to help them to beat the Junta and save the Life Force of the earth."

Such an analysis, if correct, may begin to explain why the Reward Only Intervention may compromise the effectiveness of the Complete Intervention. The Reward Only Intervention provides the subject with a history of repeated mands, which may increase the likelihood of revolt (to use Skinner's term), or counterpliance (Zettle & Hayes, 1982). Further, a history of repeated mands may lead subjects to continue to focus on the mand-like content of the Complete Intervention package, perceiving the Food Dudes as, "those guys who try to force me to eat horrible food!". As Zettle and Hayes (1982) note, rule following will be dependant upon the listeners' history with respect to the rule provider - we are less likely to fall foul of the same conman twice.

To investigate the validity of the analysis presented above, future research could examine the impact of a Reward Only Intervention with a softened-mand content. For example, the Food Dudes scenario could be presented in written form, in a series of letters; this would present the appropriate "commands" within the context of the story. This modification may increase the effectiveness of the Reward Only Intervention. However, given the continued absence of some components of the Complete Intervention (e.g. video modelling), such a modified intervention may not be any more effective than the Reward Only Intervention. Instead, such a modification may only prevent the Reward Only Intervention compromising the effectiveness of the Complete Intervention (and consequently may be of little applied value).

The negative history resulting from exposure to the Reward Only Intervention (used in Experiment 4) may be compounded further by the intervention's reduced effectiveness (when compared to the Complete Intervention). The imposition of a reward contingency, within the context of a relatively ineffective intervention, produces a condition whereby failure to meet the contingency requirement is likely. This may lead to a history of (perceived) failure on the part of the subjects, and this may impact negatively on the effectiveness of the Complete Intervention when subsequently introduced. To compensate for this, the requirement of the contingency employed in the intervention could initially be reduced, thus reducing the likelihood of perceived failure on the part of the subject. If successful, the contingency requirement could be systematically increased.

Little consideration has been given to the Video Only Intervention during the above discussion, there are two reasons for this:

First, although the Video Only Intervention produced a negligible effect on consumption, this intervention did not appear to compromise the effectiveness of the Complete Intervention when subsequently introduced in Experiment 5. However, it should be noted that: during Experiment 5 the Complete Intervention was introduced with only three of the four subjects. Furthermore, with one of these subjects, the Complete Intervention did not modify vegetable consumption on a par with that recorded in Experiment 3 (during which only the Complete Intervention was used).

Second, the results of Experiment 5 are broadly consistent with previous findings. For example, in Ayllon and Azrin's (1964) experiment (often cited as an important experiment in the development of research into rule-governed behaviour) instructions specifying token rewards were successful in promoting target behaviour in psychiatric patients. However, instruction in the absence of reward was not effective in promoting behaviour change.

Given the present results one can only speculate about the validity of the accounts of the modified intervention provided above. Further, regardless of how the components are conceptualised, it may be that the Complete Intervention is not reducible. The success of this intervention may be due to its complex mix of tact-like and mand-like verbal behaviour, in addition to the numerous other components. Put simply, the whole may be greater than the sum of its parts, with the effect arising from the interaction of the various components.

7.2.4: Use of Rewards

The present results directly contradict the widely held view within the mainstream human food preference literature that using rewards to promote consumption will impact negatively on preference (see Chapter 1, Section 1.2.4). Instead, the present results, consistent with previous behavioural research, suggest that reward use can be a very effective means through which to empower children to consume a more varied and healthy diet.

In Chapter 1 (Section 1.3.4) behavioural literature was reviewed which highlighted the shortcomings of the research purported to demonstrate negative effects resulting from reward use. Many of the issues raised in this behavioural literature are of direct relevance to the present experiments, but there are a number of additional points which should be noted.

The Context of Reward Use: (The issue of context and reward use is related to the earlier discussion concerning the prominence of mand-like and tact -like statements in the Reward Only and Complete Intervention.) A major difference between the present experiments and those conducted by researchers claiming negative effects of rewards concerns the context in which the rewards were used. For example, in the study by Newman and Taylor (1992), food A was designated as a reward for eating food B. This was emphasised by the experimenter, and the subjects were required to verbalise the contingency. This may well indicate to the child that food B *is considered by the experimenter* as being less good than food A. Hence, it is of little surprise that food B is ranked lower during the post-experimental test. This may constitute a form of audience control (Skinner, 1957). As Poppen (1989) notes, a report of a past event will be determined by the event and the "...contingencies wielded by his/her current audience" (p.328). Thus, when a child is asked to rank a food in an experiment, the ranking position will be determined by: (i) the child's response to consuming the food; (ii) the "commands" by the experimenter; and (iii) the audience present during the post ranking test, who may be perceived by the child to be "connected" with the experimenter.

Contrast these procedures with those employed in Experiments 2 and 3, where the intrinsic virtues and enjoyment of eating the target foods (or categories of foods) were described by the Food Dudes. The children were provided a rationale for consuming the targeted items, that of beating the Junk Food Junta and strengthening the Life Force. The reward contingency was "buried" in this context so that the Food Dudes, who provided the instruction, "also just happened" to offer rewards and membership to the Food Dudes club. It may be difficult for a child to construe such a contingency negatively.

Heavy reliance upon hard mands, and overtly coercive (short term) reward based interventions (e.g., Birch et al, 1982, 1984; Mikula, 1989; Newman & Taylor, 1992) are very likely to promote counter control and perceptions of bribery on the part of the experimenter. Consider again the procedure employed by Birch et al (1982): a child is required to consume an increasing amount of juice to gain access to something which may have little rewarding value. Negative effects arising from such procedures would be predicted by behavioural researchers; consider the following:

> Used unskilfully, positive reinforcement can strengthen conduct that is just as unwanted as any of coercion's side effects.
>
> Positive reinforcers given unskilfully can cause problems. Handing out reinforcers independently of anything [e.g., participation based contingencies?] a child does will teach the child that anything goes.
>
> The secret is to set up realistic contingencies that the child can meet....Also, provide real reinforcers, consequences that satisfy the child and not just the parent. Sometimes a pat on the head is not enough; a real hug may be needed. (Sidman, 1989, pp. 215-216)

Rule-governance and Overjustification: The above discussion raises a further issue: what is overjustification other than rule-governed behaviour? To recap, overjustification is highlighted as a process through which rewards impact negatively upon behaviour (see Chapter 1, Section 1.2.4). Overjustification results from a child's attributions regarding his or her environment: "If I have to be rewarded to eat this food it can't be much good!". As Lepper et al (1982) note, children probably have an extensive history of being offered rewards for the consumption of certain foods. However, parents (or anyone else) do not need to impose reward contingencies to promote the consumption of foods already reliably eaten (e.g., ice cream). Hence, rules of the type, "if mum has offered me a reward for consuming this food, it must be yukky" probably reflect quite accurately, many children's experiences. Depending upon history, and the present contingencies, the generation of self-rules leading to negative outcomes will be more or less likely. Rule-governed behaviour is behaviour, and therefore it is altered by its consequences:

> In the traditional behavior-analytic account, most psychologically significant behaviour (i.e., that of whole organisms in and with a context) is thought ultimately to be contingency shaped. An important subset of this is rule-governed. (Hayes & Hayes, 1989, p. 153)

In light of this, surely a more fruitful approach than that adopted by researchers such as Birch et al (1982, 1984), Mikula (1989), and Newman and Taylor (1992), would be to investigate the conditions under which rewards will, and will not, be effective. Such an analysis was embarked upon in the present thesis - rewards were less effective in modifying behaviour when used in the context of the Reward Only Intervention.

Rewards and Consumption, not Stated Preference: Those researchers arguing that rewards impact negatively upon preference have relied exclusively upon verbal measures of preferences (i.e., stated preferences). Hence, no empirical evidence has been provided to show that rewards impact negatively upon *consumption.* It was noted in Chapter 1 that in the study by Newman and Taylor (1992), after each subject was presented with food A and B in a contingency, the subjects were asked to choose one of the foods to eat - these choice data were not consistent with the trends recorded in stated preferences. Hence, Newman and Taylor may have changed what the subjects said (in the presence of an experimenter) regarding the foods, but what the subjects did was quite another matter. Given that this criticism can be levelled at the majority of research cited in Section 1.2 (i.e., research from the mainstream human food preference literature), this issue will be discussed in the final section of this thesis.

7.2.5: Applied Issues

A central issue within Applied Behaviour Analysis is that of "generality of behaviour change" (Cooper, Heron & Heyward, 1987), or, behaviour maintenance and generalisation as it has been labelled (e.g., Cullen, 1988b; Kazdin, 1989; Stokes & Osnes, 1989;). For example, Cooper et al note:

> A behavior change with generality is one that continues over time after the contingencies that produced it are no longer operating, appears in environments other than those in which the instructional program was conducted, and/or spreads to other related behaviors that were not taught directly. (p. 551)

Further, it is generally assumed that researchers should *actively* seek generality, as opposed to adopting a "train and hope" attitude to behaviour change (e.g., Stokes & Baer, 1977). Hence, behaviour change interventions should contain elements which are designed to promote generality of the effects. Such a strategy was adopted in the present home-based experiments; this will be discussed in addition to highlighting a number of possible avenues for future research which may enhance generality.

The change in strategy from targeting specific foods (as in Experiment 2) to targeting categories of food (Experiment 3), appears to be a procedure which results in generalisation. Although the interventions in Experiments 2 and 3 required a similar amount of effort in the training of target behaviours, the category based procedures resulted in a much greater effect (i.e., more foods consumed). The greater spread of effect observed in Experiment 3 would appear to be consistent with Stokes and Baer's (1977) "pragmatic" definition of generalisation:

> ...generalisation may be claimed when no extratraining manipulations are needed for extratarining changes; or may be claimed when some extra manipulations are necessary, but their cost or extent is clearly less than that of the direct intervention. Generalisation will not be claimed when similar events are necessary for similar effects across conditions. (p. 350)

Consumption patterns during the Generalisation phase of Experiment 3 provide additional evidence that the category procedures promoted generalisation (see Chapter 5).

Generality encompasses the issue of maintenance of effects, that is, the extent to which behaviour change is evident following the withdrawal of an intervention. The second intervention phase in Experiments 2 and 3 was designed to promote maintenance of consumption, and long term effects were evident in both of these experiments. The long term effects in Experiment 3 were particularly striking, with many foods being consumed at high levels six months after the intervention phases had ended. A strategy discussed in the literature for promoting long term effects is to bring the target behaviour under the control of its natural consequences. For example, Stokes and Osnes (1989) have argued: "If the existing consequences that follow certain behaviours may be contacted in a functional way, then a powerful entrapment for that behaviour may occur" (pp.340-341). Although the present results preclude firm conclusions regarding the variables controlling the observed long term effects, Intervention 2 appeared important in developing long term consumption (see Section 7.2.3, above).

Generality and Future Research: A number of avenues for future research can also be identified. One immediate natural consequence of consumption is taste, and it was proposed earlier that this variable may be responsible for the differential consumption often recorded across the fruit and vegetable categories. In the present home-based experiments the foods were presented in a "basic" form, with no dressing or other flavour enhancement. With such basic presentation there is much scope for enhancing the taste of the foods, thus making control by natural consequences more likely. For example, parents could be provided with recipes which incorporate the target foods (e.g., bean salads, vegetable casseroles, or other recipes which the child already accepts). This would allow the subjects to be presented with the foods in a more palatable form. The presentation of the recipes containing the target foods could be phased in across Intervention 2 to encourage the subjects to eat the target foods in any form.

Such an approach, if successful, could be adapted to promote generalisation. In addition to containing the target foods, the recipes could contain other vegetables; thus, by consuming the dish the subject consumes other vegetables not directly targeted. For example, kidney beans could be presented in a "kidney bean salad" which could also contain chickpeas and blackeye beans. Contrived consequences could be delivered contingent upon the consumption of the "kidney bean salad".

Target behaviour can potentially be controlled by natural contingencies beyond those relating directly to the target foods. Eating tends to be a social occasion and consequently, powerful social consequences can be used to "trap" the target behaviour (cf. Kazdin, 1989; Stokes & Baer, 1977). For example, parent mediated consequences could be used to maintain the target behaviour (e.g., praise and attention). Although parents implemented the experimental procedures in the home-based experiments, parental behaviour was not manipulated as an independent variable (see Chapter 3 for rationale). Thus, the integration of parental managed contingencies with the home-based intervention programmes may be a fruitful area for future research. Such contingencies are well established (if not necessarily well managed) in the normal home environment. Hence, the maintenance of consumption could be tied to these naturally occurring contingencies.

It is likely that many parents are not well practised in effective contingency management. In fact, it is possible that much food refusal results from parents unwittingly reinforcing such behaviour with, for example, contingent attention. Hence, to utilise parental contingencies in the promotion of maintenance, it may be necessary to train parents in behaviour management techniques; recent research has reported that this may indeed be a successful approach (cf., Werle, Murphy, & Budd, 1993).

Trapping target behaviour with social contingencies will be particularly attractive if implementing behaviour change packages in a group setting (e.g., school classrooms). However, a problem with such an environment is that the contingencies may be likely to maintain undesirable behaviour, perhaps by exposure to "negative" models (the issue of selecting appropriate peer models was discussed briefly in Chapter 2). A procedure which may circumvent such problems is to utilise the Food Dude based intervention in a group setting. For example, all the members of a primary school class could be exposed to the Food Dude video intervention, and presented fruits and vegetables as snacks. To further enhance the effectiveness of the intervention, the children could be divided into teams which then compete against each other, with points/tokens awarded contingent upon target food consumption (see for example, Barrish, Saunders, & Wolf, 1969; Kazdin, 1989, pp 201-202; Swain, Allard, & Holborn, 1982). Such a strategy would be likely to introduce many social consequences (e.g., peer pressure from other team members to consume the foods) which may have been absent, or ineffective, during in Experiments 2 and 3.

Finally, much of the General Discussion has focused on the role of rule-governance in the promotion of behaviour change. If the arguments proposed are correct, the applied researcher/clinician who has the task of improving the diets of children would do well to acknowledge the potential role of rule-governance in the modification of consumption patterns.

> If rule-governed behaviour is as pervasive and potent variable in human learning as the evidence from basic research and applied work now suggests then it must surely be folly for applied behaviour analysts to ignore it. (p160. Lowe, Horne, & Higson, 1987)

7.2.6: Measures of Food Preference

Chapter 1 identified three categories of outcome measure commonly used in human food preference research, namely: (i) stated preferences, (ii) choice, and (iii) consumption. Throughout this thesis, the term *food preference* has been used to refer to these measures collectively, but where possible the actual measure used has been reported. This has resulted in a continual need to qualify the findings of many authors who, for example, report stated preference data and then extrapolate their findings to actual consumption (e.g., Birch et al, 1982, 1984; Newman & Taylor, 1992). Failure to recognise the important differences between these measures may lead to unjustified extrapolation of findings. Hence a central, albeit implicit issue in the present thesis concerns this question: within the context of applied research, what is the best way to measure food preferences?

The choice of measure used in a given study may depend on many factors, not least, the purpose of the research. If the purpose of the project is to examine how people talk about food (e.g., consumer research examining how people describe and classify certain brands of products), then verbal measures are appropriate. Practical constraints represent another factor which will influence choice of measure. For example, when conducting experiments with a large group of subjects, it is likely that one will have to rely upon retrospective, or predictive verbal reports of consumption. Likewise, it may be very difficult, if not impossible to measure consumption in an applied setting, especially if dealing with groups of subjects (e.g., in school). Consequently, choice may be recorded, and the assumption made that choice is a reliable predictor of consumption.

Choice of measure will also be informed by a researcher's theoretical/philosophical perspective. Hence, a researcher may be in a position where actual consumption can be recorded, but another measure is recorded instead. As will have become apparent reading the present thesis, stated preferences are the favoured outcome variable for many authors within the mainstream food preference literature. It appears that this measure is assumed to be the most appropriate for use in many experiments. A number of quotations from two influential authors will illustrate.

Rozin (1990a) claims that "preference implies choice. To prefer a food is to choose it over another designated food" (p 106). However, Rozin (1988) defines *liking* thus:

> ...an affective response to foods. Liking is usually indexed by self report, but can also be measured using facial expressions (e.g., Ekman and Friesen, 1975). Liking can be used in a comparative sense, "I like X better than Y".... the like statement describes a motivation or a mental state.... *Because liking is a powerful determinant of preference*, likes and preferences are often congruent. The liking-preference distinction is easy to measure in humans, but more difficult in animals, *because of the absence of self report*. (p. 167. Emphasis added)

Birch (1987) comments in a review paper:

> Throughout this review, the term *preference* is used to refer to (1) a continuum of hedonic reactions from positive to negative, and to (2) the relatively positive end of this continuum of hedonic responses, while the term *aversion* applies to the negative end of this continuum of hedonic responses. This terminology is at variance with a strictly behavioural operational definition in which preference is indicated only by the choice of one item over another. But such a definition seems most appropriate given that this review focuses on the literature on humans, who can provide direct evidence on their affective reactions, in contrast to research on food preferences in other animals, where a behavioural definition of preference must be used. (pp. 171-172)

Birch (1987) ascribes causal status to such hedonic responses when she notes:

> Consumption of adequate variety and quantity of food is essential if the childs is to maintain growth and health. Food preferences are of interest *because they are primary determinants of food intake* (p. 171. Emphasis added).

Finally, when justifying the use of stated preference as an outcome measure Birch (1979b) argues:

> Despite their [i.e., preferences] assumed importance, most researchers have not studied young children's preferences directly. Rather than asking children about their preferences, researchers have described children's consumption patterns or relied on maternal report, and these data have formed the basis of inferences regarding preferences. (p. 77).

From a behavioural perspective, the problem with the approach adopted by Birch, Rozin, and others, is the failure to conceptualise measures of stated preference as verbal behaviour, or "saying" (which can be contrasted with "doing"). Verbal behaviour, like any other behaviour, is modified by its consequences. In the present section, the shortcomings of measures of stated preference will be examined. In particular, four issues will be discussed, namely: (i) ecological validity; (ii) establishing causation from correlations; (iii) issues relating to saying and doing; and (iv) failing to acknowledge the practices of the verbal community. But first, the procedure by which verbal reports are often obtained will be discussed.

Measuring Stated Preference: Birch (e.g., Birch, 1980a) has developed a verbal ranking procedure which she claims can measure food preferences, and this test is often used in food preference research. For example, this outcome measure is reported by the authors who argue that rewards impact negatively on food preferences (see Section 1.2.4). The procedure, labelled the "food preference test"(*sic*) is described in detail below (see also, Birch, 1980a).

Each child is tested alone and presented with a number of foods (e.g., nine vegetables; Birch, 1980a). In a self-selected order, the child tastes each food. As each food is tasted an experimenter asks the child "does that taste 'good', 'bad', or 'just OK?'". On a table in front of the subject are three pictures of androgynous cartoon faces corresponding to three categories of response: a smiling face for the "good" category, a frowning face for the "bad", and a neutral face for the "just OK" category. The child is required to place the food on the cartoon face which corresponds to their response to the question. The child is then asked to name the food. When all the foods have been tasted and categorised, the child is required to rank order the items in each category. To achieve this the experimenter focuses the child's attention on the items in the "good" category and says, "point to the item you like the very best". This item is removed from the category, and the question repeated until all the items in the "good" category have been ranked. This procedure is repeated with the items in the two remaining categories, thus yielding a complete ranking of all the items presented to the child during the test.

Ecological Validity: The first problem regarding the verbal ranking measure concerns its ecological validity. In cases where changes are recorded, little can be concluded beyond the observation that a shift in verbal ranking has been observed. Interpreting the magnitude of the shift is difficult, if not impossible. The data yielded are at best ordinal; if an increase of three ranking positions is recorded, is this a greater effect than a shift of one position? Thus, the tests may have high internal validity in that changes can attributed, with little ambiguity, to the manipulation of the independent variable. However, the tests may suffer low external validity in that little can be said about what the changes mean in contexts beyond the experimental situation (see Kazdin, 1982).

This observation leads to the examination of another issue, and one which has received little attention in the mainstream food preference literature: by how much do we need to change preference? For example, will an increase of one ranking position result in the child *actually consuming* more of the target food? It may be that a greater shift in ranking is required for foods which are initially less preferred, relative to foods which are moderately preferred prior to experimental interventions. Although many experiments have reported statistically significant changes in ranking positions, there is no guarantee that such changes will be reflected in changes in actual consumption of the target foods (in a context of applied significance, e.g., during regular meals at home). Moreover, consumption data are rarely, if ever, reported in such experiments.

This is similar to the issue of "clinical versus statistical significance" discussed by many authors, including Dickinson (1989; see Chapter 1, Section 1.3.4) and Barlow and Hersen (1984, p. 35). Barlow and Hersen note that often treatments which are statistically significant will also be *assumed* to be clinically significant (see also, Kazdin, 1982, pp. 251-252). Consider the following:

> One of the problems lies in the word *significant.* A statistically significant result can be very trivial indeed and be very far from the usual meaning of the word *significant.* And yet, once one achieves statistical significance, typically it is simply reported in a journal or book, with most consumers of research assuming that the result is truly significant or clinically important. (Barlow, Hayes, & Nelson, 1986, p. 28)

The comparison of pre- and post-experimental rankings and their interpretation is hindered further because of the relative nature of the measure yielded by verbal ranking tests. With ranking procedures, if at post-test one food has been ranked differently (than at pre-test), *at least one other food* will also change ranking position. Thus, some changes may be active in that they are caused by the experimental intervention, while other changes will be passive, resulting from the changing ranks of other foods. The problem then is determining what is responsible for a shift in preference (see Birch 1980a, p. 496 for a related comment).

Correlation and Causation: Birch has claimed that verbal ranking procedures are both reliable (Birch 1979b), and predictive of consumption in a free choice situation (Birch 1979a). Data regarding reliability were obtained from 37 children (aged 3-4) verbally ranking eight fruits on two occasions (median gap between occasions was 17 days, range 4 to 51 days). Mean correlation for the two tests was 0.58 (range 0.14 to 0.86). Higher correlation's were recorded with the four year-old subjects.

Data regarding the correspondence between consumption and verbal rankings is reported in Birch (1979a). On four consecutive days children's (N=17; age 3-4 years) verbal rankings for eight different open faced sandwiches were assessed. In addition, consumption measures for the same eight sandwiches were recorded during the children's snack time on each of the four days. Subjects were told to "take the sandwiches they wanted" from a serving table, and at the end of the snack session consumption was estimated from plate waste. The results indicated that those sandwiches ranked higher in the ranking order, were also those which were eaten in significantly greater amounts during the snack session.

However, these data fail to establish the causal status of whatever is purported to be measured by verbal ranking procedures. It was noted earlier that Birch argues: (i) "food preferences...are primary determinants of food intake" (Birch, 1987, p.171); and, (ii) verbal ranking procedures measure food preferences. However, Birch provides data regarding the correlation of stated measures and consumption; she then argues, *with no additional data*, that what is purported to be measured by the "preference test" has a determining role. On the basis of such correlative data it could just as easily be argued that consumption determines the performance on the ranking test.

To add further problems, the data provided by Birch regarding stated preferences and consumption were collected in a free choice situation. How similar is a free choice situation to the contexts in which children normally consume foods? This is related to the issue of ecological validity discussed above.

In addition to the problems discussed above, stated preferences (as outcome measures) are problematic at the conceptual level. What does performance on a preference test (i.e., verbal ranking procedures) actually measure beyond a verbal report? As noted previously, failure to conceptualise a verbal report as operant behaviour which is altered by its consequences, and which may or may not correspond to other overt behaviour, is a serious limitation of the position adopted by authors such as Birch and Rozin. This will be the focus of the next section, during which the issues of correspondence between saying and doing, and the practices of the verbal community will be discussed.

Saying and Doing: The issue of the correspondence between saying and doing was introduced in Chapter 1 (Section 1.3.1). Depending upon the contingencies, verbal behaviour may change independently of the behaviour it describes. The correspondence training literature has repeatedly demonstrated that the frequency of a verbal report (usually a statement of intent to engage in a particular activity) may be increased by manipulating contingent consequences. The behaviour specified in the verbal report will not increase, however, if the consequences are contingent upon saying alone. Applying this to preference and liking, it may be relatively easy to change a subject's verbal ranking of a food (e.g., saying "I now like this one more than the other one"). Such statements will often be reinforced by adult praise (e.g., "That's good, carrots are very good for you"). However, depending upon the function of such statements, an increase in the doing (i.e., consumption) may or may not be recorded. Thus, obtaining an increase in liking or preference may be little more than recording an increase in the frequency of such statements. Typically if reinforcement is delivered contingent upon saying, and no consequences are provided for doing, saying will increase, doing will not. It is only when contingencies support a *correspondence* between saying and doing that doing will increase.

Two experiments examining this issue are particularly important with respect to the issue of measuring stated preferences. The reader is reminded of the data reported by Birch (1979a) which is cited as evidence that verbal ranking procedures are predictive of consumption (in a free choice situation). Baer and Detrich (1990) and de Freitas Ribeiro (1989) have argued that in a "free choice" situation, children often display a high correspondence between saying and doing. Children will accurately tact past (or future) behaviour. However, when a restriction is placed upon saying, or the experimenter supplies the child with the target verbalisation, and consequences are placed upon saying alone, correspondence decreases. Baer and Detrich argue that the child's verbalisation is now functioning as a mand. The child produces the verbalisation not as a tact of past or future behaviour, but as a means of being able to leave the experimenter's company and continue with other activities (e.g. attending playtime).

Applying this to Birch (1979a) highlights the problems with her account. Birch's data (regarding stated preferences and consumption) were collected in the free choice situation, a situation where correspondence may be high. Introducing an intervention (e.g., the reward based interventions reported in Birch et al, 1982; 1984) may alter the saying, but not the doing, as is reported by Baer and Detrich (1990). Unfortunately, Birch et al do not report the subjects' saying *and* doing (i.e., stated preferences and consumption). Instead, pre- and post-experimental stated preference data are reported; the *assumption* is made that because the stated preference changed, a corresponding change in consumption will occur.

It is also important to note when discussing saying and doing in the context of tacts and mands, a statement such as "I prefer this one" does not tact some mental state (this would be an impure tact, see Zettle & Hayes, 1982; Skinner, 1957) - preferences and likes are not things. Instead, such statements are likely to have multiple determinants, which will vary across biological and social contexts. Such a statement may represent a shorthand way to refer to actual behaviour (tacting past or future behaviour). For example, when people report that they like or prefer a certain food item they may be referring to the fact that they will work harder to obtain that particular item, or that they will consume it rather than another if given a choice. Likewise these statements may tact sensations; for example, the classically conditioned salivatory response of the hungry individual when they hear their "favourite food" is about to be served to them. Statements of liking/preference may reflect the sensory properties of foods - the statement, "I love ice cream" may be a tact of the experience of eating ice cream (e.g., its sweet taste). Statements of like/preference can be a function of covert as much as overt behaviour. When a function of covert behaviour, the covert behaviour is behaviour nonetheless; the verbalisation is not a reflection or manifestation of some hypothetical inner structure which has been labelled preference or liking. (Reports and observations of one's covert behaviour are not precluded from a behaviour analysis because of the small audience size. Covert behaviours are behaviours and are, in principle, observable - see Skinner, 1953, 1957).

Statements of liking or preference are extremely shorthand ways of referring to a complex behavioural history. A person may say that he or she like sprouts; however, it is possible that sprouts will only be consumed in very specific contexts (e.g., with a roast dinner). The statement "I like sprouts" could translate into: "I will eat sprouts in a limited number of contexts. With a roast dinner, but on few other occasions. I would not like/eat sprouts if they were presented to me with a burger and fries, or with some sweets. Also, when someone mentions the word 'sprouts' my mouth will begin to water, especially if I'm hungry. However, my mouth will water more if someone mentions 'chips' or 'chocolate'". The practices of the verbal community mean that detailed descriptions of behaviour in context (such as the one presented) are punished, while shorthand statements are reinforced (see Guerin 1994, p 156).

Practices of the Verbal Community: To further understand the nature of stated preferences, it will be useful to briefly examine the practices of the verbal community in shaping such statements. It appears that authors such as Birch and Rozin have taken the terms of "preference" and "liking", as used in everyday language, and failed to see the problems with the everyday usage. This results in these authors using the terms inappropriately as nouns - a common mistake within psychology in general (for discussions on this point see, for example, Lee, 1988; Miles, 1994).

Deitz (1986) comments on a similar issue when he discusses idioms. Everyday mentalistic terms are idioms, and as such their use is either grammatically odd, or they do not mean what they appear to mean. Idioms are often used in noun form, but are not "things" in the way other nouns are. As Deitz notes, changing your mind and changing your shirt are grammatically similar, but differ greatly in their meaning. Confusion arises because the former is an idiom (a grammatical idiom). Rather than referring to something "inside the head" (or anywhere else), changing your mind means no more than someone saying that they are not going to do what they had previously said they would. Deitz states the following:

> When such expressions are recognised as idioms, we can easily see that they have very clear, precise, and behavioural meanings. They are shortcut ways of saying something about actions or changes in actions. They are not expressions about some peculiar mentalistic concept but clearly expressions about behaviour in context (p. 163)

The practices of the verbal community are of particular importance. Deitz (1986) provides the following useful example. His son was being naughty, pushing his younger sister over as she was sitting down. Dietz reports that when he asked his son "why do you keep doing that?" his son failed to reply. Deitz continues:

> ...of course he did not know. He had not yet been taught what reasons to give for his actions. The reasons parents teach, however, are often phrased as causes. (p. 164)

To use Dietz's (1986) analysis, if someone is asked why they ate a particular food he or she may respond, "because I like it". The use of "like" is phrased as a cause, but it is a verbal report shaped by the verbal community, and probably does not reflect accurately all of the causes of the behaviour. As suggested above, these statements may tact numerous overt and covert behaviours, both past and present. However, to say that the food is eaten because it is liked is not an adequate explanation. Self reports are socially reinforced for plausibility and not accuracy (Street, 1994, p.147).

Language can perform a regulatory function, and verbal behaviour can control non-verbal behaviour (this has been developed as a central issue in the present thesis). It does not follow from this, however, that statements of liking or preferences are manifestations of underlying mental processes. Unfortunately, a failure to recognise this has led many authors to overemphasise the importance of stated preferences (as both outcome measure and determinant of consumption). These researchers may better spend their time investigating the contexts in which statements of preference do and do not correspond with consumption. If authors (e.g., Birch and Rozin) insist on dealing with statements concerning likes and dislikes, maybe they should concentrate their efforts on developing procedures whereby such statements can function as effective verbal antecedents (i.e., rules) which will consequently regulate children's consumption.

The reliance upon stated preferences has led to numerous problems in the human food preference literature, and this is particularly well illustrated in literature examining the effects of rewards on consumption. It was noted earlier that the authors of this body of literature have relied exclusively on stated preferences as outcome measures. Hence, in the light of the preceding discussion, the validity of the literature examining the negative impact of rewards on preference can be further questioned. Unfortunately, given the failure to acknowledge the problems associated with measures of stated preference, many authors have extrapolated these results to consumption, and discussed its applied value. Consider the following extract from Shatter's (1987) *How to get your kid to eat...but not too much.* which is aimed at a general audience:

> If you do anything with feeding that even remotely feels to them [children] like forcing, most children will do the exact opposite of what you want. Leann Birch [Birch, Marlin & Rotter 1984]...tried it, in the nicest possible way. In her pre-school laboratory, she rewarded children for trying a new food. *Rewarded* them: gave them something nice. Another group she did not reward, but simply let them approach the food in their own way; no comment, no facial expressions. The children who were rewarded were less likely to go back to the new food than children who were left alone. (pp. 44-45).

Leaving aside the inaccurate description of the Birch et al (1984) experiment, this quotation illustrates how widespread is this belief about detrimental effects of rewards - a belief which is based on data which may have serious limitations.

Conclusion

The purpose of Section 7.2.5 was to discuss the most appropriate measure of food preference, within the context of applied research. A major weakness of the approach of authors such as Birch and Rozin (as outlined above) is the failure to recognise that different food related behaviours - choice, consumption, verbal preference ranking, verbal prediction of consumption - are simply different behaviours. These different behaviours will correspond only to the extent that correspondence is determined by contingencies. A contingency which results in an increase in statements of the form "I like X" will not promote an increase in consumption if consequences are not functionally related to consumption of the food included in the statement.

Measures of stated preference do not, contrary to the views of Birch and Rozin, represent manifestation of some underlying determinant of consumption. However, the failure to recognise this has resulted in unjustified extrapolation of many of the findings based upon measures of stated preference - this was highlighted in the quotation from Shatter (1987).

Instead, many of the authors carrying out research into human food preferences, and relying upon measures of stated preference would do well to take heed of Cullen's (1988a) advice to counsellors (who have to rely upon clients verbal reports as data):

> Behaviour is not of interest because it is a manifestation of underlying processes, but because it is an important subject in its own right. This is not to deny that there are processes going on within the body, but the legitimate concern of radical behaviourists...is behaviour and its relation with the environment. In order to help clients, we have to suggest what they might do in order to change how they feel, and usually what they might do is to alter some aspects of their relationship with the world around them. (p.276)

In the final analysis, what one chooses as the best measure of preference may depend on the particular research objective. Measures of actual consumption must be paramount if the aim is to understand why people eat what they do and how to alter what they eat. This was the aim of the current set of experiments and should also be, of course, the main objective for applied researchers, and other agents, concerned with empowering children and adults to eat healthier diets.

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APPENDIX 1

EXPERIMENT 1: STATISTICAL ANALYSIS

APPENDIX 1A
EXPERIMENT 1 STATISTICAL ANALYSIS: INITIAL RANDOMISATION TESTS.

It was reported in Chapter 2 that an initial statistical analysis suggested no main effect for type of food; this initial analysis will be discussed in the present appendix. Also presented here are the appropriate distributions generated by the randomisation tests concerning the series of mean comparisons reported in Chapter 2.

It was reported in Chapter 2 that in order to examine the impact of positive and negative peer influence on subjects' consumption of the target (and second) food, the data were initially analysed using a repeated measures mixed design ANOVA. However, subsequent analysis revealed that the raw data were not parametric (the spread of values was actually bi-modal); therefore an initial randomisation test was performed on the data. In effect this procedure generated new (data-appropriate) F values with which to compare the obtained F values calculated by the ANOVA.

The Randomisation test generates data appropriate critical values by:

1. Initially examining the raw data using the desired statistical test - in the present case this is a mixed design ANOVA. This test will generate observed F ratios relating to the main factors and interactions.

2. The original data set is then randomised. In the present case the randomisation is carried out in two steps: (i) values recorded across the four presentations are randomised *within* subject; (ii) subjects are then randomly assigned to groups (i.e., either Group A, B or C). This yields a data set different to the original.

3. The same statistical test (i.e., mixed design ANOVA), is performed on this new randomised data set, thus yielding another F ratio.

4. Steps 2 and 3 are performed on 999 further occasions, thus yielding a distribution of observed values each calculated on a randomised data set generated from the original data set.

5. The 95th and 99th percentiles of the generated distribution of F ratios are calculated. If the observed F ratio calculated with the original data set (prior to any randomisation) exceeds the value at either percentile, it is deemed significant at either the 0.05 or 0.01 level respectively. Essentially, these procedures generate the equivalent of the F tables with which the normal observed F ratio is usually compared.

Following this calculation a series of contrasts was carried out: (i) Food (i.e., quorn v's potato bread); (ii) Group (Gp A v's Gp B, and Gp A + GpB v's GpC); and (iii) Presentation (Presentation 1 versus 3, Presentation 2 versus 4, and Presentations 1+3 versus 2+4). It was necessary to combine the data in this way in order to perform the test. The observed F ratios and F ratios generated by the randomisation procedures, at the 90th, 95th and 99th percentile of the distribution, are presented in Table 1A1.

Type of food was not significant (*F 4.003, p<0.10*). Hence this was not examined in the analysis reported in Chapter 2 (although this value approaches significance; see Table 1A1). The analysis revealed an effect for Group A (positive peers) versus Group B (negative peers) (*F 8.723, p<0.05*). However, a number of Group by Presentation interactions were revealed, suggesting that the difference between Groups A and B was not constant across the four presentations.

This analysis of contrasts isolates where the variance is occurring. It does not, however, permit a direct comparison of mean values. In order to investigate these interactions the randomisation test which allowed a post-hoc comparison of means was implemented - the results of this are reported in Chapter 2. The distributions generated by the randomisation test for each post-hoc comparison are presented in the remainder of this appendix.

Table 1A1: The observed and generated F ratios resulting from the randomisation procedures.

	Observed F	90th percentile p<0.10	95th percentile p<0.05	99th percentile p<0.01
F	4.003	3.718	4.817	18.881
G1	8.723*	2.956	3.742	10.129
G2	0.835	5.064	6.133	20.939
FG1	0.033	3.782	4.831	7.786
FG2	0.243	1.994	2.588	6.590
P1	12.087**	2.015	3.383	12.087
P2	11.513**	2.844	4.664	11.513
P3	0.514	2.435	3.446	8.908

* Significant at p<0.05
** Significant at p<0.01

F Comparison of type of food
G1 Comparison of Group A versus Group B
G2 Comparison of Group A + Group B versus Group C
P1 Comparison of Presentation 2 versus Presentation 4
P2 Comparison of Presentation 1 versus Presentation 3
P3 Comparison of Presentations 1+3 versus Presentations 2+4

APPENDIX 1B

EXPERIMENT 1 STATISTICAL ANALYSIS: MEAN COMPARISON TESTS

Q value distributions generated by the mean comparison randomisation tests.

COMPARISON
Presentation 1: Group A versus Group B - Target Food

Mean Group A: 70.8%

Mean Group B: 2.08%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = 2.825

Quantile	Distribution
0.00	-2.560
0.005	-2.052
0.025	-1.718
0.25	-0.595
0.5	-0.047
0.75	0.466
0.975	1.439
0.995	1.836
1.00	2.825

95% confidence interval

99% confidence interval

COMPARISON
Presentation 1: Group B versus Group C - Target Food

Mean Group B: 2.08%

Mean Group C: 40.91%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = -1.595

Quantile	Distribution
0.00	-2.087
0.005	-1.854
0.025	-1.425
0.25	-0.392
0.5	0.054
0.75	0.608
0.975	1.824
0.995	2.165
1.00	2.436

95% confidence interval

99% confidence interval

Comparison
Presentation 1: Group A versus Group C - Target Food

Mean Group A: 70.8%

Mean Group C: 40.91%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = 1.230

Quantile	Distribution
0.00	-2.300
0.005	-1.950
0.025	-1.495
0.25	-0.448
0.5	0.073
0.75	0.520
0.975	1.545
0.995	1.959
1.00	2.346

95% confidence interval

99% confidence interval

COMPARISON
Presentation 2: Group A versus Group B - Target Food

Mean Group A: 58.33%

Mean Group C: 0%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = 2.397

Quantile	Distribution
0.00	-2.478
0.005	-2.118
0.025	-1.724
0.25	-0.584
0.5	-0.036
0.75	0.475
0.975	1.261
0.995	1.684
1.00	2.397

95% confidence interval

99% confidence interval

COMPARISON
Presentation 2: Group C versus Group B - Target Food

Mean Group B: 0%

Mean Group C: 45.45%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = -1.868

Quantile	Distribution
0.00	-1.868
0.005	-1.601
0.025	-1.313
0.25	-0.509
0.5	0.000
0.75	0.662
0.975	1.897
0.995	2.206
1.00	2.689

95% confidence interval

99% confidence interval

COMPARISON
Presentation 2: Group A versus Group C - Target Food

Mean Group A: 58.33%

Mean Group C: 45.45%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = 0.529

Quantile	Distribution
0.00	-2.579
0.005	-2.000
0.025	-1.459
0.25	-0.475
0.5	0.058
0.75	0.500
0.975	1.537
0.995	1.985
1.00	2.383

95% confidence interval

99% confidence interval

COMPARISON
Presentation 2 : Group A versus Group B - 2nd food

Mean Group A: 64.58%

Mean Group C: 4.167%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = 2.482

Quantile	Distribution
0.00	-3.002
0.005	-2.256
0.025	-1.607
0.25	-0.563
0.5	-0.059
0.75	0.473
0.975	1.589
0.995	2.065
1.00	2.482

95% confidence interval

99% confidence interval

COMPARISON

Presentation 2 : Group A - Target food versus 2nd Food

Mean Group A - Target food: 58.33%

Mean Group B - 2nd food: 64.58%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = -0.3894

Quantile	Distribution
0.00	-1.973
0.005	-1.673
0.025	-1.299
0.25	-0.492
0.5	0.000
0.75	0.435
0.975	1.404
0.995	2.148
1.00	2.521

95% confidence interval

99% confidence interval

COMPARISON
Presentation 2 : Group C - Target food versus 2nd Food

Mean Group C - Target food: 45.45%

Mean Group C - 2nd food: 36.36%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = 0.558

Quantile	Distribution
0.00	-2.068
0.005	-1.758
0.025	-1.264
0.25	-0.444
0.5	0.000
0.75	0.440
0.975	1.229
0.995	1.806
1.00	2.078

95% confidence interval

99% confidence interval

COMPARISON
Presentation 2 : Group A versus Group B - 2nd food

Mean Group A: 64.58%

Mean Group C: 4.167%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = 2.482

Quantile	Distribution
0.00	-3.002
0.005	-2.256
0.025	-1.607
0.25	-0.563
0.5	-0.059
0.75	0.473
0.975	1.589
0.995	2.065
1.00	2.482

95% confidence interval

99% confidence interval

COMPARISON
Presentation 3 : Group A versus Group C - Target food

Mean Group A: 83.33%

Mean Group C: 40.91%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = 1.743

Quantile	Distribution
0.00	-2.115
0.005	-1.927
0.025	-1.441
0.25	-0.449
0.5	0.074
0.75	0.568
0.975	1.413
0.995	1.653
1.00	1.839

95% confidence interval

99% confidence interval

COMPARISON
Presentation 4: Group A versus Group C - Target Food

Mean Group A: 75%

Mean Group C: 36.36%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = 1.587

Quantile	Distribution
0.00	-1.706
0.005	-1.706
0.025	-1.451
0.25	-0.517
0.5	-0.073
0.75	0.386
0.975	1.439
0.995	2.276
1.00	2.462

95% confidence interval

99% confidence interval

COMPARISON
Presentation 3 versus Presentation 1: Group B - Target Food

Mean Group B - Pres 3: 56.25%

Mean Group B - Pres 1: 2.083%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = 3.326

Quantile	Distribution
0.00	-2.684
0.005	-2.400
0.025	-1.805
0.25	-0.606
0.5	0.000
0.75	0.560
0.975	1.788
0.995	2.588
1.00	3.326

95% confidence interval

99% confidence interval

COMPARISON
Presentation 2 versus Presentation 4: Group B - Target Food

Mean Group B - Pres 2: 0%

Mean Group B - Pres 4: 60.42%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = -3.710

Quantile	Distribution
0.00	-3.710
0.005	-2.020
0.025	-1.466
0.25	-0.476
0.5	0.000
0.75	0.470
0.975	1.338
0.995	1.816
1.00	2.246

95% confidence interval

99% confidence interval

COMPARISON
Presentation 3 versus Presentation 4: Group B - Target food

Mean Group B: 56.25%

Mean Group B: 60.42%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = -0.2558

Quantile	Distribution
0.00	-2.362
0.005	-2.123
0.025	-1.445
0.25	-0.486
0.5	0.000
0.75	0.457
0.975	1.403
0.995	2.074
1.00	2.748

95% confidence interval

99% confidence interval

COMPARISON
Presentation 4: Group A versus Group C - 2nd food

Mean Group A: 66.7%

Mean Group B: 22.7%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = 1.805

Quantile	Distribution
0.00	-2.307
0.005	-1.808
0.025	-1.445
0.25	-0.449
0.5	0.000
0.75	0.568
0.975	1.630
0.995	2.007
1.00	2.199

95% confidence interval

99% confidence interval

COMPARISON
Presentation 2 versus Presentation 4: Group B - 2nd Food

Mean Group B - Pres 2: 4.167%

Mean Group B - Pres 4: 18.75%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = -0.895

Quantile	Distribution
0.00	-2.451
0.005	-1.721
0.025	-1.416
0.25	-0.544
0.5	-0.110
0.75	0.436
0.975	1.603
0.995	1.978
1.00	2.221

95% confidence interval

99% confidence interval

COMPARISON

Presentation 4: Group B - Target Food versus 2nd food

Mean Group B - target food: 60.42%

Mean Group B - 2nd food: 18.75%

Subjects: 36
Rep measure per individual: 6
Number of foods: 2
Number of groups: 3

Critical Value:
Observed Q = 2.558

Quantile	Distribution
0.00	-2.371
0.005	-1.924
0.025	-1.494
0.25	-0.500
0.5	0.000
0.75	0.465
0.975	1.565
0.995	2.326
1.00	3.122

95% confidence interval

99% confidence interval

APPENDIX 2

EXPERIMENT 1: INDIVIDUAL CONSUMPTION PATTERNS

EXPERIMENT 1: INDIVIDUAL CONSUMPTION PATTERNS

The analysis presented in Chapter 2 demonstrated that the behaviour of confederates could be a powerful (short term) determinant of novel food consumption. However, experiments utilising the present design (i.e., between groups comparison) typically report considerable within-group variability in responding (Kazdin, 1982; Barlow & Hersen, 1984; Barlow, Hayes & Nelson, 1986; see also Austad, Sininger, Daugherty, Geary, & Stange, 1984) - the present results are no exception. Within group variability was briefly examined in Chapter 2, and it was suggested that the mean value of each group was representative of acceptability (i.e., number of subjects who ate any food) within that group. The purpose of the present appendix is to provide a more detailed account of the individual consumption patterns evident within each group. This will allow an examination of the differential (short term) impact of the interventions.

The amount of target, and second food consumed by each subject across each of the four presentations is presented in Table 2A1. This table indicates that with some subjects, exposure to the confederates had an immediate and substantial effect, with others the effect increased across presentations, and with some subjects there was no evidence of peer influence.

Group A

Within Group A a number of individual consumption patterns were evident.

No impact: Two subjects (S3 & S7) consumed little or no target or second blue food throughout the experiment.

Compliance: One subject (S5) only ever consumed the target food when peers were present.

Increasing consumption: With some subjects in this group, the impact of the intervention appeared to increase across the presentations. For example, two subjects (S2 and S6) consumed the target food during

Presentation 1, with peers present, and rejected it during Presentation 2 (when presented in the peers' absence). When exposed to the peers during Presentation 3 the target food was again consumed, and this consumption was maintained during Presentation 4 (peer absent).

Delayed Impact: A delayed impact of the intervention was evident with subject 10 who did not consume any target food during the first occasion it was presented with peers. However, during the following presentation with peers absent (Presentation 2) maximum consumption of the target food was recorded.

High Consumption: The remaining six subjects consumed the target food on every occasion it was presented.

Group B

Virtually no consumption was recorded across the first two presentations within Group B. Negative peer influence appeared to have a uniform effect on the subjects; only one subject (S21) ate any food during Presentation 1, and no target food consumption was evident during Presentation 2. However, within group variability was evident across Presentations 3 and 4.

No impact: Two subjects (S15 & S18) did not consume any target food during Presentation 3 in the presence of positive peers, or during the subsequent presentation (Presentation 4).

Compliance: Two subjects (S14 & S16) only consumed when the positive peers were present, but not when the peers were absent.

Delayed Impact of Positive Peers: Two subjects (S17 & S20) rejected the target food in the presence of peers, but consumed it in the absence of peers.

Reliable acceptance: The remaining six subjects in this group consistently accepted the target food when peers were both present and absent; however, the amount consumed by Subject 23 was lower than that recorded with the other subjects (i.e., 25% versus 100%). Finally, three of these subjects (S13, S19, & S24) also consumed the second blue food during the final food presentation.

Group C

In Group C no (or little) consumption was recorded with four subjects, S26, S28, S29, and S34. Two other subjects (S31 and S32) consumed the target food on only one occasion. Reliable maximum consumption was recorded with Subjects 27, 30, and 35. Subject 33 also accepted the target food on each occasion; however, only 25 percent was consumed during the first presentation while maximum consumption was recorded on each of the remaining three presentations.

This analysis, although descriptive, indicates the diverse effects which may result from exposure to the same peer intervention. The within group variability may suggest that when attempting to modify consumption in an applied setting, a peer based intervention may be more or less effective with certain children. For example, with two children in Group A, exposure to positive peers did little to promote consumption of a novel food. In cases such as these, the addition of an imposed reward contingency may be necessary before the package is effective.

Table 2A1

Table showing the consumption of all 35 subjects, who participated in Experiment 1, across the Presentations 1 to 4. Each subjects group allocation and target food (i.e., quorn versus potato bread) is presented in the left column. During presentations 2 and 4 consumption of the second blue food is also shown.

Key:

Gp.A	Group A - positive peer influence
Gp.B	Group B - negative and positive peer influence
Gp. C	Group C - control group
Quorn	Presented quorn as a target food
Potat B	Presented potato bread as a target food
Target	Target food consumption
2nd food	Second blue food consumption

	Presentation 1	Presentation 2		Presentation 3	Presentation 4	
Group & Subject	Target	Target	2nd food	Target	Target	2nd food
Gp A S1 quorn	100%	100%	100%	100%	100%	100%
Gp A S2 quorn	100%	0%	0%	100%	100%	100%
Gp A S3 quorn	0%	0%	0%	0%	0%	0%
Gp A S4 quorn	100%	100%	100%	100%	100%	100%
Gp A S5 quorn	25%	0%	25%	100%	0%	0%
Gp A S6 quorn	100%	0%	100%	100%	100%	100%
Gp A S7 Potat B	25%	0%	0%	0%	0%	0%
Gp A S8 Potat B	100%	100%	100%	100%	100%	100%
Gp A S9 Potat B	100%	100%	100%	100%	100%	100%
Gp A S10 Potat B	0%	100%	100%	100%	100%	100%
Gp A S11 Potat B	100%	100%	50%	100%	100%	0%
Gp A S12 Potat B	100%	100%	100%	100%	100%	100%
Gp B S13 quorn	0%	0%	25%	100%	100%	100%
Gp B S14 quorn	0%	0%	0%	100%	0%	0%
Gp B S15 quorn	0%	0%	0%	0%	0%	0%
Gp B S16 quorn	0%	0%	0%	50%	0%	0%
Gp B S17 quorn	0%	0%	0%	0%	100%	0%
Gp B S18 quorn	0%	0%	0%	0%	0%	0%
Gp B S19 Potat B	0%	0%	0%	100%	100%	100%
Gp B S20 Potat B	0%	0%	0%	0%	100%	0%
Gp B S21 Potat B	25%	0%	25%	100%	100%	0%
Gp B S22 Potat B	0%	0%	0%	100%	100%	0%
Gp B S23 Potat B	0%	0%	0%	25%	25%	0%
Gp B S24 Potat B	0%	0%	0%	100%	100%	25%
Gp C S25 quorn	25%	0%	0%	50%	0%	0%
Gp C S26 quorn	0%	0%	0%	0%	0%	0%
Gp C S27 quorn	•	•	•	•	•	•
Gp C S28 quorn	100%	100%	100%	100%	100%	25%
Gp C S29 quorn	0%	0%	0%	0%	0%	0%
Gp C S30 quorn	0%	0%	0%	0%	0%	25%
Gp C S31 Potat B	100%	100%	100%	100%	100%	100%
Gp C S32 Potat B	0%	100%	100%	0%	0%	0%
Gp C S33 Potat B	100%	0%	0%	0%	0%	0%
Gp C S34 Potat B	25%	100%	25%	100%	100%	100%
Gp C S35 Potat B	0%	0%	0%	0%	0%	0%
Gp C S36 Potat B	100%	100%	75%	100%	100%	0%

APPENDIX 3

EXPERIMENTS 2 - 5

APPENDIX 3A - Food Dude sticker charts and letters

APPENDIX 3B - Transcription of message sections in intervention films.

APPENDIX 3A
(Sticker chart used during Intervention 1, Experiment 2)

Food Dudes

Progress Card

NAME: ....

FOOD: ....

STICKER 1.

Confirmed by: ....
(Food Dude)

Date: ....

STICKER 2.

Confirmed by: ....
(Food Dude)

Date: ....

STICKER 3.

Confirmed by: ....
(Food Dude)

Date: ....

APPENDIX 3A

Example of letter presented to subjects who attained the complete programme of reward during Intervention 1 (Complete Intervention), Experiments 2 and 3.

Food Dudes

Thursday April 22nd, 1996.

Dear James,

Hey man, good going! You've passed the test and made the grade. You have eaten the vital foods, so you are now a full member of the Food Dude Gang.

It's now up to you to keep the Life Force strong in this area, because we have to defend other parts of the world that are being attacked by the Junk Food Junta.

We will be writing to you again soon, so don't forget what you have to do to be a Dude. With you on our side, the Junta haven't got a chance!

Keep eating,

....

Food Dude Zak.
(Force Fielder)

APPENDIX 3A

Example of the sticker collection chart as used in Intervention 2, Experiment 2.

DUDE OF THE YEAR PROGRESS CARD **NAME...**

WEEK ONE			WEEK TWO			WEEK THREE			WEEK FOUR			WEEK FIVE			WEEK SIX			WEEK SEVEN		
BE BEANS	GUAVA	BROCCOLI	BE BEANS	GUAVA	BROCCOLI	BE BEANS	GUAVA	BROCCOLI	BE BEANS	GUAVA	BROCCOLI	BE BEANS	GUAVA	BROCCOLI	BE BEANS	GUAVA	BROCCOLI	BE BEANS	GUAVA	BROCCOLI
I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate	I ate ....
Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign	Sign ....

Remember, you get a **yellow** sticker every time you eat **all** of the vital food. You get a **green** sticker every time you eat **nearly all** of the food. You get a **red** sticker if **you don't eat enough**. **REDS ARE NO GOOD !**

Once you have filled in all the boxes, send this card back to us here at the Magno-Monitoring Station, and you could be a winner!

APPENDIX 3A

Example of the letter sent to subjects at the beginning of Intervention 2 during Experiments 2 & 3

Food Dudes

Dude of the year Grand Lottery

Win a day out for all the family at Rhyl Sun Centre, Alton Towers, Chester Zoo, Butlins Star Coast World, or Knowsley Safari Park, or, somewhere else ?!!!?

What do you have to do to be a Dude?

Simple

ALWAYS EAT THE VITAL FOODS !

Keep up your good work and help us to continue the struggle against the evil Junk Food Junta.

Fill this new Progress Card with yellow or green stickers and you could gain promotion to the next level. When the card is full, send it back to us, and you could win first prize in the Dude of the year Lottery.

You get a yellow sticker every time you eat all of the vital food

You get a green sticker every time you eat nearly all of the food

You get a red sticker if you don't eat enough. Reds are no good !

APPENDIX 3A
Example of membership certificate presented at the end of Intervention 1, Experiment 2

Food Dudes

Having fulfilled all the required conditions to the satisfaction of the Instructors

John Smith
....

has achieved status and is awarded this

Membership Certificate

in witness whereof the seal of the Dudes and the signatures of its officers are hereunder affixed.

GIVEN AT OSAZOS ON THIS .... DAY OF

.... NINETEEN HUNDRED AND ....

.... FORCE FIELDER

.... ENERGIZER

The Coolest Gang Around
Food Dudes

Appendix 3B

Transcript of an ending message featured during one of the Food Dude Intervention films used during Experiment 2.

1st. Dude (Female)	Now, let me tell you how *you* [points into camera] can be a Food Dude.
2nd. Dude (Male)	Help us to protect the Life Force from General Junk and his evil Junta.
1st Dude	Eat ***broccoli*** because it is today's Vital Life Force food. If you do eat ***broccoli*** and all other healthy foods then you can join the gang.
2nd Dude	Ask you mum or dad to show you this special card we have sent [shows a question card to the camera]. Follow the instructions on the card and answer all the questions.
1st Dude	Get your parents to post the card to us here at the Magno Monitoring station, and we will send you a Food Dude sticker and a junior membership pack [holds up a sticker and a box wrapped in brightly coloured paper to illustrate the membership pack].
2nd Dude	Every time you collect three stickers [holds up a sticker chart containing three stickers] we will send you a promotion pack with some ultra cool surprises [hold up a box, slightly bigger to that representing the junior membership pack, to represent the promotion pack].
1st Dude	That's really cool! But, if you collect *nine* stickers [holding up three sticker charts, each containing three stickers], we'll make you a life time member of the Food Dudes club, and you get to choose one of these mega dude fantabulistic super box's [pointing to a

number of large box's wrapped in brightly coloured paper].

The second dude walks over to one of the box's, looks inside, looks at the camera and says "amazing!".

1st Dude — But remember what you have to do to be a Dude, always eat ***broccoli*** and all other healthy foods.

Appendix 3B

Transcript of an ending message featured during one of the Food Dude Intervention films used during Experiment 3.

1st. Dude (Female)	Now, let me tell you how *you* [points into camera] can be a Food Dude.
2nd. Dude (Male)	Help us to protect the Life Force from General Junk and his evil Junta.
1st Dude	Eat ***vegetables*** because it is today's Vital Life Force food. If you do eat all your ***vegetables*** then you can join the gang.
2nd Dude	Ask you mum or dad to show you this special card we have sent [shows a question card to the camera]. Follow the instructions on the card and answer all the questions.
1st Dude	Get your parents to post the card to us here at the Magno Monitoring station, and we will send you a Food Dude sticker and a junior membership pack [holds up a sticker and a box wrapped in brightly coloured paper to illustrate the membership pack].
2nd Dude	Every time you collect four stickers [holds up a sticker chart containing four stickers] we will send you a promotion pack with some ultra cool surprises [hold up a box, slightly bigger to that representing the junior membership pack, to represent the promotion pack].
1st Dude	That's really cool! But, if you collect *eight* stickers [holding up two sticker charts, each containing four stickers], we'll make you a life time member of the Food Dudes club, and you get to choose one of these mega dude fantabulistic super box's [pointing to a

number of large box's wrapped in brightly coloured paper].

The second dude walks over to one of the box's, looks inside, looks at the camera and says "amazing!".

1st Dude	But remember what you have to do to be a Dude, always eat all ***vegetables*** because they are vital foods.

Appendix 3B
Example of the instruction card used during the Reward Only Intervention, Experiment 4

Food Dudes

Now we are going to tell you how YOU can be a Food Dude! All you have to do is eat VEGETABLES - eat all your VEGETABLES tonight and you can join the gang! Fill in this card, telling us how much VEGETABLES you have eaten. Ask your parents to post it back to us here at the Magno-Monitoring Station and we will send you a Food Dude sticker and a Junior membership pack.

If you can collect FOUR STICKERS, we will send you a promotion pack with SOME ULTRA-COOL SURPRIZES! If you collect EIGHT STICKERS, we will make you a Full Life Time Member of the Food Dude Gang, and we will send you a FANTABULISTIC SUPER PRIZE!

But remember what you have to do to be a Dude - ALWAYS EAT ALL VEGETABLES!

Questions

1) What food do we want you to eat today? ....

....

2) How much of today's food did you eat? ....

NAME: ....

PARENT: .... DATE: ....

APPENDIX 4

RELIABILITY: HOME-BASED EXPERIMENTS

APPENDIX 4A	Experiment 2
APPENDIX 4B	Experiment 3
APPENDIX 4C	Experiment 4
APPENDIX 4D	Experiment 5

APPENDIX 4A

Experiment 2: Reliability

The Standard and Modified PAI's calculated for each subject's six individual experimental foods are presented in Tables A.1 (Rachel), A.2 (John), A.3 (Brenda), and A.4 (Susan).

Agreement between parents' and the second observers' reports of consumption are high, thus suggesting parental consumption measures were reliable. In virtually every case the Standard PAI for target food consumption is 75 percent or above. In addition, of the 12 Modified PAI's calculated for target food consumption (across the four subjects), the majority (10) yield 100 percent agreement.

Figure A.1 shows the distribution of the size (i.e., the number of categories between observations) of the difference in cases where disagreement was recorded between observers. This figure shows that the vast majority of differences were of one category (22 of the 27 cases of disagreement). Further, *all* the differences with respect to the subjects' target food consumption were of one category only. As stated in Chapter 3, a difference of one category may reflect the different conditions under which the two observers estimate consumption. Parents are very close to the subject and plate when recording consumption, the second observer is estimating consumption from a video recording where, in some cases, the ability to discriminate foods may be reduced.

The data presented in Figure A.1 suggest that in cases where the Standard PAI is lower than the Modified PAI, this is the result of small differences in consumption estimations between the two observers. This supports the use of the Modified PAI calculation. Collapsing the estimations of consumption into one of two categories (i.e., above or below 75%), eliminates most one category differences. Because few differences above one category were recorded (see Figure A.1), the Modified PAI is not being spuriously inflated by ignoring larger differences.

Tables A.1 - A.4

Percentage agreement indices (PAI) for the two observers estimations of each subject's consumption of the six individual experimental foods. Standard and Modified (i.e., estimations of consumption either above or below criterion only) PAI's are presented in each case.

Table A.1	Rachel
Table A.2	John
Table A.3	Brenda
Table A.4	Susan

Table A.1 Rachel	**Standard Agreement Index**		**Modified Agreement Index**	
	Target	Control	Target	Control
Vegetable	88%	100%	100%	100%
Pulse	75%	100%	100%	100%
Fruit	100%	100%	100%	100%
Total	**88%**	**100%**	**100%**	**100%**

Table A.2 John	**Standard Agreement Index**		**Modified Agreement Index**	
	Target	Control	Target	Control
Vegetable	71%	71%	100%	71%
Pulse	100%	71%	100%	100%
Fruit	100%	100%	100%	100%
Total	**90%**	**85%**	**100%**	**90%**

Table A.3 Brenda	**Standard Agreement Index**		**Modified Agreement Index**	
	Target	Control	Target	Control
Vegetable	89%	100%	100%	100%
Pulse	78%	89%	89%	100%
Fruit	89%	89%	100%	100%
Total	**85%**	**92%**	**96%**	**100%**

Table A.4 Susan	**Standard Agreement Index**		**Modified Agreement Index**	
	Target	Control	Target	Control
Vegetable	75%	63%	100%	88%
Pulse	75%	63%	100%	88%
Fruit	88%	75%	88%	88%
Total	**79%**	**66%**	**96%**	**88%**

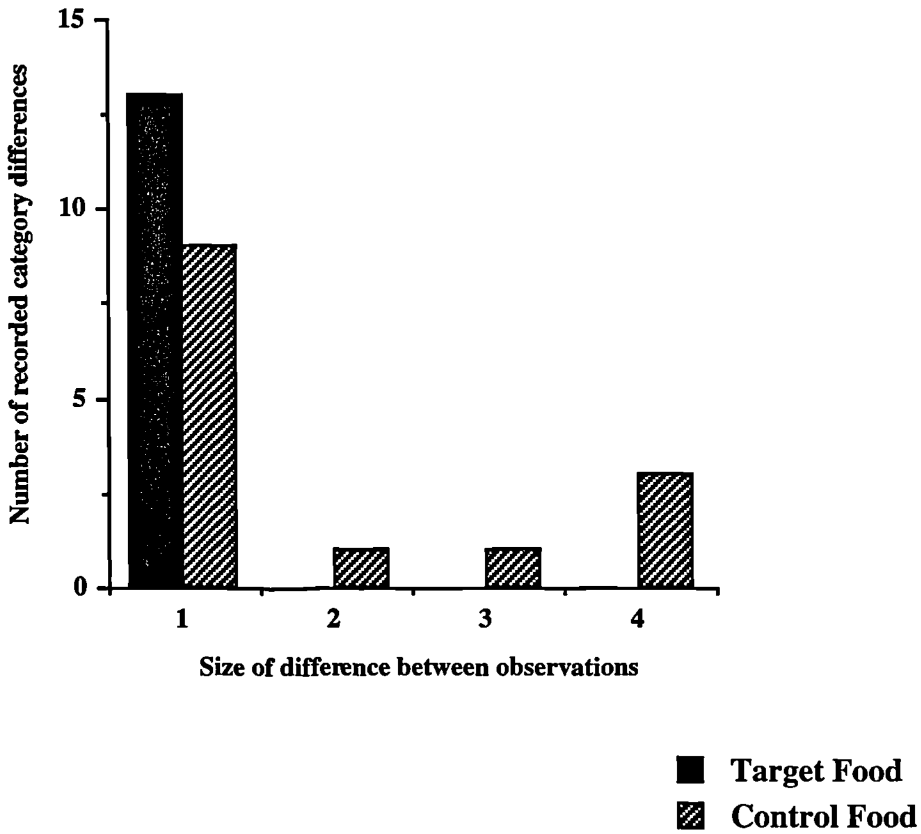

Figure A.1

Data for Experiment 2. The distribution of the size of differences (i.e., the number of categories between observations) in cases where the estimations of consumption by the two observers (i.e., each subject's parent and a second observer) disagree.

APPENDIX 4B
EXPERIMENT 3: RELIABILITY

The Standard and Modified PAI's calculated for each subject's 12 individual experimental foods are presented in Tables B.1 (Jeff), B.2 (Kirsty), B.3 (Alison), and B.4 (Susan).

Consistent with Experiment 2, agreement between parents' and the second observers' reports of consumption are high, thus suggesting parental consumption measures were reliable.

As expected, the Modified PAI (where observers estimations of consumption are collapsed into above or below 75% consumption categories) yields higher agreements when compared to the Standard PAI. Of the 48 individual Modified PAIs calculated, only three are below 80%.

Figure B.1 shows the distribution of the size (i.e., the number of categories between observations) of the difference in cases where disagreement was recorded between observers. This figure shows that, consistent with Experiment 2, the vast majority of differences were of one category (31 of the 38 cases of disagreement).

Tables B.1 - B.4

Percentage agreement indices (PAI) for the two observers' estimations of each subject's consumption of the 12 individual experimental foods. Standard and Modified (i.e., estimations of consumption either above or below 75% only) PAI's are presented in each case.

Table B.1	Jeff
Table B.2	Kirsty
Table B.3	Alison
Table B.4	Sally

Table B.1: Jeff Food	Standard Agreement Index	Modified Agreement Index
Green beans	71%	100%
Butter beans	85%	100%
Sprouts	100%	100%
Blackeye beans	85%	100%
Celery	75%	100%
Beetroot	60%	80%
Kidney beans	100%	100%
Courgette	75%	100%
Guava	100%	100%
Lychee	100%	100%
Gooseberries	100%	100%
Blackberries	100%	100%
Total	**87%**	**99%**

Table B.2: Kirsty Food	Standard Agreement Index	Modified Agreement Index
Cauliflower	71%	86%
Courgette	100%	100%
Green beans	100%	100%
Sprouts	75%	88%
Baby sweetcorn	60%	100%
Sugarsnap peas	100%	100%
Chick peas	66%	100%
Kidney beans	100%	100%
Guava	100%	100%
Loganberries	100%	100%
Kiwi	100%	100%
Prunes	60%	100%
Total	**88%**	**97%**

Table B.3: Alison Food	Standard Agreement Index	Modified Agreement Index
Asparagus	100%	100%
Courgette	100%	100%
Red pepper	90%	100%
Borlotti beans	100%	100%
Celery	89%	100%
Coleslaw	80%	100%
Chick peas	90%	100%
Kidney beans	100%	100%
Raspberries	100%	100%
Loganberries	100%	100%
Blackberries	67%	100%
Prunes	100%	100%
Total	**93%**	**100%**

Table B.4: Sally Food	Standard Agreement Index	Modified Agreement Index
Beansprouts	100%	100%
Coleslaw	100%	100%
Chick peas	71%	100%
Kidney beans	88%	100%
Water chestnut	86%	100%
Celery	86%	86%
Asparagus	75%	75%
Borlotti beans	50%	75%
Flageolet	100%	100%
Butter beans	50%	100%
Blackeye beans	50%	75%
Courgette	100%	100%
Total	**82%**	**97%**

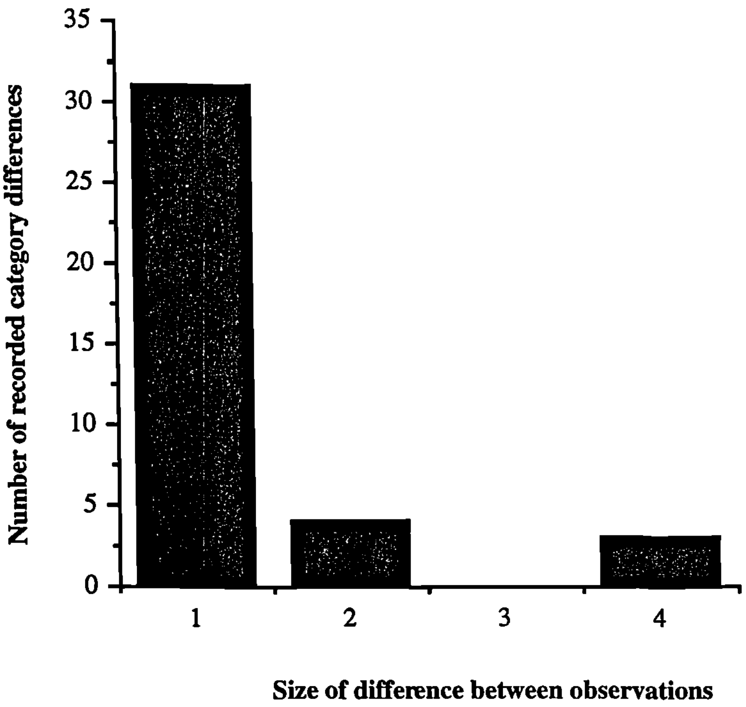

Figure B.1

Data for Experiment 3. The distribution of the size of differences (i.e., the number of categories between observations) in cases where the estimations of consumption by the two observers (i.e., each subject's parent and a second observer) disagree.

APPENDIX 4C
EXPERIMENT 4: RELIABILITY

The Standard and Modified PAI's calculated for each subject's 12 individual experimental foods are presented in Tables C.1 (Carol), C.2 (Bob), C.3 (Rory), and C.4 (James).

Consistent with Experiments 2 and 3, agreement between parents' and the second observers' reports of consumption are high, thus suggesting parental consumption measures were reliable. The lowest Standard PAI is 75 percent, however, the majority of calculations yielded 100 percent agreement. Further, when the Modified PAI is calculated, 100 percent agreement is reported in every case.

Figure C.1 shows the distribution of the size (i.e., the number of categories between observations) of the difference in cases where disagreement was recorded between observers. This figure shows that of the 19 differences recorded, 17 were of one category.

The data presented in Figure C.1 supports the claims made in Appendix 4A regarding the validity of the Modified PAI calculation.

Tables C.1 - C.4

Percentage agreement indices (PAI) for the two observers' estimations of each subject's consumption of the 12 individual experimental foods. Standard and Modified (i.e., estimations of consumption either above or below 75% only) PAI's are presented in each case.

Table C.1	Carol
Table C.2	Bob
Table C.3	Rory
Table C.4	James

Table C.1: Carol		
Food	Standard Agreement Index	Modified Agreement Index
Broccoli	100%	100%
Sprouts	100%	100%
Baby sweetcorn	100%	100%
Cauliflower	100%	100%
Sugarsnap peas	75%	100%
Chick peas	100%	100%
Peas	100%	100%
Beansprouts	75%	100%
Guava	100%	100%
Melon	75%	100%
Peaches	100%	100%
Raspberries	75%	100%
Total	**92%**	**100%**

Table C.2: Bob		
Food	Standard Agreement Index	Modified Agreement Index
Baby sweetcorn	83%	100%
Courgette	100%	100%
Green beans	100%	100%
Broccoli	100%	100%
Sprouts	80%	100%
Chick peas	100%	100%
Celery	83%	100%
Cauliflower	100%	100%
Guava	83%	100%
Pineapple	100%	100%
Kiwi	100%	100%
Loganberries	86%	100%
Total	**93%**	**100%**

Table C.3: Rory		
Food	Standard Agreement Index	Modified Agreement Index
Baby sweetcorn	83%	100%
Broccoli	83%	100%
Coleslaw	83%	100%
Chick peas	100%	100%
Sugarsnap peas	100%	100%
Kidney beans	100%	100%
Cauliflower	100%	100%
Beetroot	83%	100%
Guava	100%	100%
Kiwi	100%	100%
Mango	80%	100%
Prunes	100%	100%
Total	**92%**	**100%**

Table C.4: James		
Food	Standard Agreement Index	Modified Agreement Index
Asparagus	100%	100%
Chick peas	88%	100%
Blackeye beans	88%	100%
Spinach	100%	100%
Avocado	100%	100%
Mushrooms	100%	100%
Beansprouts	80%	100%
Haricot beans	75%	100%
Gooseberries	100%	100%
Lychee	80%	100%
Grapefruit	100%	100%
Prunes	100%	100%
Total	**93%**	**100%**

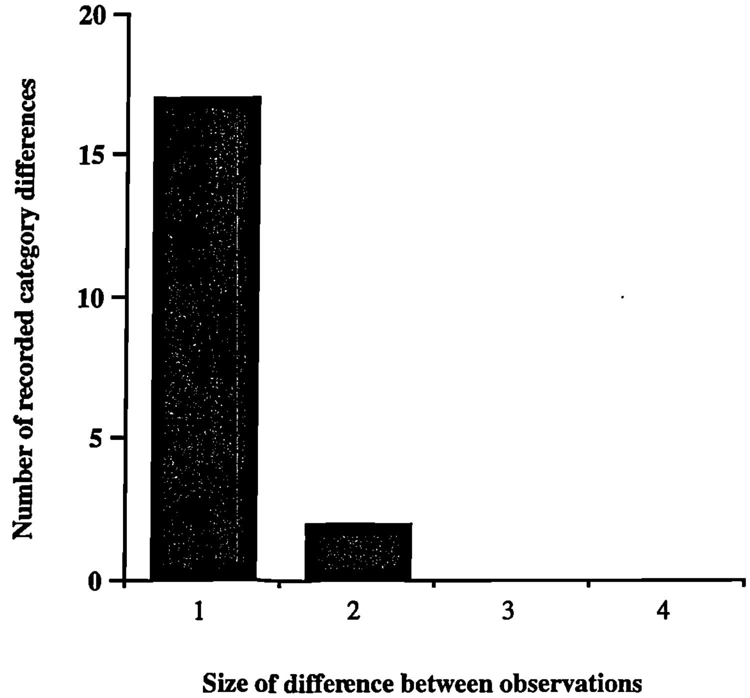

Figure C.1

Data for Experiment 4. The distribution of the size of differences (i.e., the number of categories between observations) in cases where the estimations of consumption by the two observers (i.e., each subject's parent and a second observer) disagree.

APPENDIX 4D
EXPERIMENT 5: RELIABILITY

The Standard and Modified PAI's calculated for the three subject's 12 individual experimental foods are presented in Tables D1 (Ian), D2 (Deborah), and D3 (Eddie). Because of practical constraints no reliability indices were calculated for George - see Chapter 6.

Consistent with the reliability calculations reported previously, agreement is generally high.

Figure D.1 shows the distribution of the size of the differences in cases where disagreement was recorded between observers. This figure shows that, consistent with the previous home-based experiments, the majority of differences were of one category (27 of the 31 cases of disagreement).

Tables D1 - D3

Percentage agreement indices (PAI) for the two observers' estimations of each subject's consumption of the 12 individual experimental foods. Standard and Modified (i.e., estimations of consumption either above or below 75% only) PAIs are presented in each case.

Table D1	Ian
Table D2	Deborah
Table D3	Eddie

Table D.1: Ian		
Food	Standard Agreement Index	Modified Agreement Index
Chick peas	71%	88%
Courgettes	100%	100%
Beansprouts	86%	100%
Kidney beans	100%	100%
Sugarsnap peas	71%	100%
Red Pepper	83%	83%
Asparagus	100%	100%
Celery	100%	100%
Kiwi	83%	100%
Guava	67%	100%
Lychee	71%	100%
Blackberries	100%	100%
Total	**86%**	**97%**

Table D.2: Deborah		
Food	Standard Agreement Index	Modified Agreement Index
Sprouts	100%	100%
Courgettes	86%	100%
Greenbeans	86%	100%
Cauliflower	88%	100%
Sugarsnap peas	86%	100%
Chick peas	100%	100%
Asparagus	89%	100%
Baby sweetcorn	71%	100%
Rhubarb	86%	100%
Melon	88%	100%
Plums	67%	100%
Gooseberries	71%	86%
Total	**85%**	**99%**

Table D.3: Eddie Food	Standard Agreement Index	Modified Agreement Index
Broccoli	60%	80%
Courgettes	100%	100%
Greenbeans	83%	100%
Cauliflower	80%	100%
Sugarsnap peas	100%	100%
Chick peas	83%	100%
Asparagus	100%	100%
Celery	60%	100%
Kiwi	83%	100%
Guava	83%	100%
Mango	100%	100%
Loganberries	83%	100%
Total	**85%**	**99%**

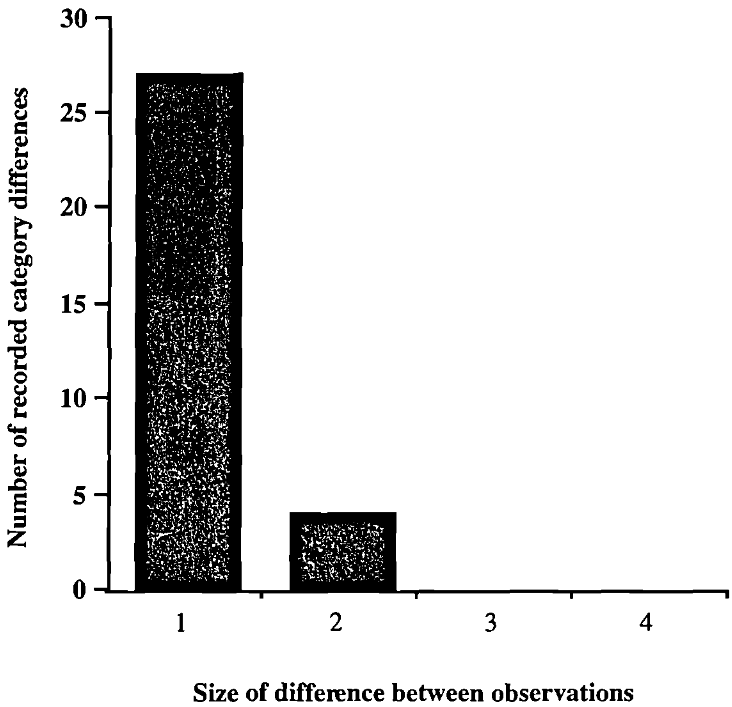

Figure D.1

Data for Experiment 5. The distribution of the size of differences (i.e., the number of categories between observations) in cases where the estimations of consumption by the two observers (i.e., each subject's parent and a second observer) disagree.