DOCTOR OF PHILOSOPHY

A behavioural analysis of pre-school children's food preferences

Woolner, Janette

Award date:
2000

Awarding institution:
University of Wales, Bangor

Link to publication

A BEHAVIOURAL ANALYSIS OF PRE-SCHOOL CHILDREN'S FOOD PREFERENCES

JANETTE WOOLNER

Thesis submitted in fulfilment of the regulations for the degree of Doctor of Philosophy in the University of Wales
2000

Acknowledgements

Many people have played a part in what appears between these covers:

My thanks go firstly to my supervisors, Dr. Pauline Horne and Professor Fergus Lowe. I have learned a great deal, not least that anything is possible.

I owe a very large debt of gratitude to Tir Na N'Og nursery. Many thanks to all the children who provided me with the material to fill these pages and to the staff who lent me their time and their skills.

Thanks also to the technical department and 'the car' - Dave, Steve, Gaz and Robert Jones - always there.

To the fellow post-grads who shared tea and angst: cheers Mags, Val and Sam.

Special thanks go to David Nightingale, Alan Dowey and Simon Dymond, I have really appreciated your friendship and support.

My family have seen this piece of work to the end:

Sheila and Jack Griffiths, I can never thank you enough;

And to my wonderful husband Mike, who seems to have married me and my thesis – thank you;

I could not close the cover without paying tribute to my parents. I dedicate this work to my dear Mum and to the memory of my Dad.

SUMMARY

Four experiments were conducted to investigate methods of promoting pre-school children's consumption of fruits and vegetables, and some entirely novel foods.

In Experiment 1 a between groups design was employed to examine the effect of in vivo peer behaviour on children's consumption of a novel food. Children exposed to 'positive' peers who consumed a target novel food tended to consume that food, whilst those exposed to 'negative' peers who rejected the food tended to also reject it. The negative effects persisted despite subsequent exposure to 'positive' peers.

In Experiments 2, 3 and 4, multiple baseline designs were employed to examine the utility of video-peer modelling with rewards interventions in promoting consumption of fruits and vegetables. Target behaviour was measured in two contexts: a snack-time experimental setting and a lunchtime (generalisation) setting.

The intervention in Experiment 2 targetted individual children's consumption of fruit and vegetables that they had previously refused. Consumption increased during experimental sessions, with some evidence of the changes in behaviour being maintained, but there was little evidence of generalisation of behaviour to the lunchtime setting.

The interventions in Experiments 3 and 4 targetted children's consumption, at snack time of fruit (Experiment 3) and fruit and vegetables (Experiment 4) within the group setting of a pre-school nursery classroom. (Some procedures were modified between Experiments 3 and 4).

In Experiment 3 increases in consumption of fruit were observed in both the snack and lunch settings. Some maintenance of behaviour with half the fruits (the sweetest) was noted.

In Experiment 4, increases in consumption of target fruit and then target vegetables was observed following the intervention on each food category. The increases were in evidence at both snack and lunchtimes and were maintained in the absence of the intervention and during follow-ups.

The results showed that peer modelling alone can be effective in promoting food consumption, but is most powerful when combined with contingent rewards and is implemented in a group setting. These findings are discussed with reference to the role of rule-governed behaviour in promoting and maintaining behaviour change.

CONTENTS

CHAPTER 1

THE RELATIONSHIP BETWEEN FOOD, DIET, AND HEALTH

Chapter 1

Food, Diet, and Health

"The Challenge Now is to Increase the Consumption of Fruits and Vegetables Among Children and Adults in Western Societies."
(Gillman, 1996)

The National Diet and Nutrition Survey: Children Aged One and a Half to Four and a Half Years (1995), commissioned by the Ministry of Agriculture, Fisheries and Food, and the Department of Health, reports the following findings:

- Foods consumed by largest proportions of children were: biscuits (88%), white bread (86%), soft drinks (86%), whole milk (83%), savoury snacks (78%), potatoes (boiled/mashed/jacket) (77%), and chocolate confectionery (74%) (p. 28).
- During the recording period of four days, more than half the sample had not eaten eggs, fish, leafy green vegetables (61%) or drunk fruit juice (64%) (p. 28).
- Raw vegetables and salad were eaten by relatively small proportions of children. Peas and carrots were eaten by more than half the children; 49% had eaten baked beans. Median consumption of baked beans was significantly greater than that of either peas or carrots (p. 28).
- Half the children in the sample had eaten apples or pears and 46% had eaten bananas, but citrus fruits were only eaten by 25% (p. 28).
- 84% of children under 4 had a mean total iron intake below the UK Reference Nutrient Intakes (p. 175).

Fruit and vegetables are a valuable source of vitamins, minerals, fibre and anti-oxidants. These nutrient are found in differing quantities in each food item, so to make maximum gains, it is important to eat as wide a variety as possible. Vitamins are chemically complex substances that have many hundreds of uses within the body. Low levels can lead to ill health, serious disease and (in extreme) death. The most important combination of vitamins is thought to be A, C, and E, which act as anti-oxidants, protecting the body from the harmful effects of the free radicals that are believed to play a major role in heart disease and which are linked to diabetes, cataracts and arthritis, as well as the ageing process. Some minerals, manganese, copper, zinc and selenium, have important anti-oxidant properties and are the focus of research into both heart disease and cancer. Fibre (there are five kinds) found mostly in grains, fruits and vegetables, speeds food through the gut. In the large bowel, the function of fibre is to increase water absorption, help to prevent constipation and may also protect against colon cancer. In the stomach and small bowel, fibre binds with bile acids to decrease fat absorption, thereby lowering cholesterol levels.

There is a growing corpus of knowledge about diet and its links to health and the prevention of disease. An article by Gillman published in The British Medical Journal (September 1996) summarises the findings of recent research:

> Data from various studies strongly indicate that diets rich in fruits and vegetables reduce the incidence of several common neoplasms, especially of the respiratory and digestive tract...recent observational studies show inverse associations of intake of fruits and vegetables with cardiovascular mortality and the incidence of myocardial infarction and stroke. These studies complement cross-cultural studies which show mortality from all causes and cardiovascular diseases were lowest in those countries with traditional plant based diets. (Gillman 1996, p. 765)

Government statistics (e.g., Our Healthier Nation 1998) show that the death rate in England from coronary heart disease (CHD) has remained the highest in the world and about six times higher than Japan. CHD is one of the main causes of death in England (26% in 1989) and it is estimated that CHD related illness takes up 5,000 NHS beds every day, accounts for around 2.5% of total NHS expenditure, and results in about 35 million lost working days.

In addition to being one of the main causes of death, CHD is a major cause of *early* death, accounting for about one third of all deaths in men and one fifth of all deaths in women under 65 years old. Deaths from CHD alone account for more than a million years of life lost (through early death) each year amongst those aged 75 years and under. These illnesses were estimated to account for 12% (£3.8 billion) of total expenditure on health and social services in 1992/3. As well as the financial cost, these diseases also limit the ability of people to enjoy their lives to the full.

After CHD, cancer is the second leading cause of death in the U.K. Apart from breast and cervical cancers, the most common are of the bowel, stomach and the oesophagus.

Regional Variations in Health

Two key government reports show that in terms of health, people in Wales and Scotland fare no better than people in England.

Heart disease in Wales, is reported to be the major cause of death with mortality rates substantially higher than in many European countries; French mortality rates are approximately one third those in Wales. Wales also has the highest rate of cancer registrations in the European Union, up to 50% higher than some other countries. In addition, compared with English regions, Wales has higher numbers of people needing treatment for high blood pressure - a significant factor in many cases of heart attack and stroke (see "Better Health - Better Wales," 1998).

In Scotland, the two most common causes of death are coronary heart disease and cancer, each of which accounted for approximately one quarter of all deaths in 1996. Cancer was responsible for almost one third of deaths among people aged under 65 and CHD for just under a fifth. Stroke is reported as the third largest killer and CHD, cancer and stroke are increasingly referred to as 'Scotland's Big 3' (see "Working Together for a Healthier Scotland," 1998).

Seven years after the initial 1991 consultative paper, and in the light of the alarming mortality rates, the present government has set specific health targets:

> to reduce, by one third, deaths amongst people under 65 years from heart disease, stroke and cancer by the year 2010. (Our Healthier Nation, Ch.4, p. 4)

Achieving this target would bring the UK to a level similar to those of other countries in Europe (Italy, France and Sweden) and the "Big 3" have been identified as targets because, as well as being a major cause of death:

> in the 1990's, nearly 90,000 people die each year before their 65th birthday. Of these people, more than 25,000 die of heart disease, stroke and related illnesses and 32,000 die of cancer. *Many of these deaths could be prevented.* (italics added). (Our Healthier Nation, Ch.1, p. 4)

The government has further identified one means by which people could protect themselves and their health:

> The amount of fruit and vegetables people eat is an important influence on health. Unhealthy diets, which include too much sugar, salt and fatty foods, are linked to cancer, heart disease and stroke as well as tooth decay. (Our Healthier Nation, Ch.2. p. 4)

The links between diet and health have long been recognised by many organisations concerned with health promotion and healthy eating campaigns, such as the 5-a-day initiative in America or the "Eat Smart Eat Veg" crusade from the Cancer Research Campaign in the UK have been developed. Many major UK supermarkets have taken up the health gauntlet providing leaflets containing nutritional advice and information and urging customers to eat the five fruit and vegetables per day advocated by (amongst others) the Cancer Research Campaign, who affirm that one third of all cancers are linked to diet. Their information leaflet "Diet & Cancer: eating your way to health" has the following message:

> Diets rich in fresh fruits and vegetables help protect against several common cancers - bowel, stomach and oesophagus. Eating at least 5 portions of fruit and vegetables each day will considerably reduce your risk of getting these cancers and possibly lung and breast cancer.

Given the acknowledged links between diet and health, public knowledge and government targets, what are we to make of the findings reported in 1998 that the proportion of adults in Wales who eat fresh vegetables or salad most days is as low as 2.8% and only 44.3% eat fruit? Or in Scotland, where only 28% of adults eat fresh vegetables *once a week or less*, as few as 20% eat cooked green vegetables once a week or less and 34% eat cooked root vegetables once a week or less?

If the government is serious about tackling the poor health record by means of improving the diet of the nation, it is, as it admits, vital to develop an understanding of what factors are involved in the formation of eating habits.

> Nutritional deficiencies no longer present a major public health problem in England, and an improved diet has contributed to a longer lifespan. Nevertheless, many people still eat and drink in ways which, over time, can contribute to the risk of developing serious ill-health and of premature death (The Health of The Nation p. 68)

According to Dibb and Castell (1995) dietary habits established in childhood may be a contributory factor in the onset of CHD and stroke in later life, and sound eating habits may contribute to better long-term health. Given that food-related behaviours learned in childhood are thought to continue into adulthood (BMA 1999, p.

63; H.M. Government, 1999, Ch 3, p. 3; Birch; 1987, p. 107), it is important that good dietary behaviour is established early on in life; today's children are tomorrow's adults. Changing children's diets may also enable parents and other family members to do likewise. It is often the case that parents eat what they think their children will eat in order to minimise food waste and avoid food-related arguments at mealtimes. Thus an understanding of the development of food choice in young children is a significant and appropriate area for investigation.

CHAPTER 2

WHAT IS CURRENTLY UNDERSTOOD ABOUT HUMAN FOOD SELECTION: A REVIEW OF THE MAINSTREAM FOOD PSYCHOLOGY LITERATURE

Chapter 2

What is currently understood about human food selection?

In a biological sense, little has been established. There may be innate mechanisms for the detection of sweet substances (Crook, 1978; Steiner, 1977), bitter tastes (Nowlis, 1973) and salt (Beauchamp, Cowart & Moran, 1986). These mechanisms would be useful survival tools, sweet substances indicating a source of energy, salt for homeostasis and bitter indicating a poisonous substance.

Beyond these three, it is likely that environmental variables play a determining role in what is selected for consumption. As omnivores, humans are able to consume a wide variety of foods. However, what is actually eaten is often a small subset of what is available and subsets vary greatly from culture to culture. For example, South American Indians see insects as a delicacy, but it is unlikely that wood lice would ever be found on a meal plate in Great Britain. Such phenomena have led food researcher Paul Rozin (1982) to famously pronounce that the best way to find out about a person's food likes and dislikes is to discover first his/her ethnic background.

A corollary to the influence of culture on diet is the effect cultural practices can have on health. This can be observed by looking at the incidence of disease across different cultures. As has been previously noted, different cultures have different diets and some of these are now viewed as being healthier than others.

For example, in Mediterranean countries, where most people consume a diet rich in fresh fruits and vegetables, the incidence of CHD is relatively low. France has the same high animal fat intake as the UK and French people have similar cholesterol levels, but carry only one third the risk of heart attack. In the UK only half as much fruit and less than two thirds the amount of vegetables are consumed as in France. The Japanese diet is rich in fish and raw vegetables and the death rate in Japan from cancers and CHD is among the lowest in the world.

It seems that culture may also be a determining factor in mortality rates in such a way that Rozin's observation can be taken a step further; it may be possible to say that if one wanted to predict a person's mortality and which disease he or she is likely to die from, then find out from which culture they originate.

Culture has a greater role in food selection role than identifying edible items; it specifies rules about foods themselves, for example, methods of preparation, appropriate times for consumption, what combinations of foods are acceptable (e.g. not chocolate with chips) and appropriate times for their consumption (neither of the previously mentioned for breakfast). There is evidence (Birch, Billman & Richards, 1984) that children as young as three years of age are aware of the 'rules of cuisine' particularly with regard to which foods are appropriate to eat at which time of the day.

Within culture there are other powerful variables that influence food-related behaviour. The remainder of this chapter will be devoted to reviewing the literature on the psychology of human food intake.

Outcome Measures

Before proceeding, it should be emphasised that much of the research in the area of human food choice has been of a 'non-behavioural persuasion' and there are certain inconsistencies within it, the main one being the outcome measure used. In many cases, a measure of 'preference' is generally cited, sometimes 'choice' is the dependent measure and occasionally 'consumption' is reported. A brief discussion of these three and an example of their general usage will add clarity to the following review.

Operationally defined as idiosyncratic relative taste ranking, '*preference*' is a hypothetical construct that is linked to another hypothetical construct called 'liking' but is not equivalent to it. Preference is described by Birch (1987) as "a hedonic measure, that ranges from positive to negative"(p. 171). This 'measure' is often used to evaluate the outcome of experimental procedures so that effects are expressed in terms of a preference rating rather than actual consumption. Preferences are typically 'measured' by inviting participants to taste a food or drink (sometimes they are also asked to name the item) and then say whether they 'liked it' 'didn't like it' or it was 'just ok'. Items within each one of these three categories are then placed in rank order of preference by asking the subject to 'point to the one you like the very best', removing the selected item and repeating the question, and so on, until one food remains (Birch, 1979).

'*Choice*' is measured by asking the participant to select a food item from a range of or just a pair of foods. Choice may be the selection of a food followed by consumption or selection with no consumption. Where choice is used as a measure, actual consumption data are only occasionally reported. Although a 'preference' is implied in the 'choice' of one particular food over another, an explicit statement of 'preference' is not included in the 'choice' measure.

'Consumption' is the least frequently reported measure. Where consumption is used, it is normally as a quantifiable measure such as grammes or spoonfuls. In this case, neither a statement of 'preference' nor of 'choice' is entailed.

Unfortunately, within the psychology of food literature, the terms and measures of 'preference', 'choice' and 'consumption' are often used interchangeably, with the implicit assumption that all three are interchangeable as outcome measures. In that case, a statement by a subject of liking food X, an observation of a subject choosing food X and an observation of subject consuming food X are all assumed to be equivalent.

In general, the effects of experimental manipulations are assessed by comparing the results of statistical analyses performed on group data and then changes are expressed in terms of, for example, a median decrease of three rankings out of eight or 1.4 ranks out of seven. Statistical analyses (e.g. t-test, chi-square) are often employed in order to verify the significance of the changes in rankings. Until the question of the exact relationship between a preference and consumption has been properly addressed, it can only be concluded that changes in verbal liking or choice occur if certain techniques are employed. Whether this means that there is a concomitant increase in the likelihood that a food will be eaten remains to be resolved. The point may be one of applicability; if one was a parent trying to encourage a child to eat green beans, would it be more appropriate to encourage a child to *say* that he or she prefers green beans, or encourage a child to actually *eat* green beans?

A second consideration with regard to the literature to be reviewed, is the duration of both the experimental manipulation(s) and the outcome measure(s). In many cases both are brief, demonstrating immediate effects but failing to assess any long-term changes in behaviour.

In the following review, the outcome measure used in each study, the length of the interventions, and any follow-up phases will be clearly described so that the reader is aware of the precise nature of any behaviour change. Where the standard ‘preference’ test (Birch, 1979) is cited as a measure, the term verbal liking will be used. Where other measures (e.g., choice or consumption) are quoted, these will labelledaccordingly.

The next section will be a consideration of the main cultural variables having impact on food intake that have been subject to investigation, namely exposure, modelling (including peer influence and television) and rewards.

Exposure

The very fact of living within a particular culture will ensure regular exposure to the foods of that culture; these foods will not be all those available, but a subset that are accepted as edible. When it comes to trying new foods, it is widely thought that humans tend to show a neophobic (fear of new things) response. The neophobic response is viewed as a ‘learned safety mechanism’ that protects from the possible harm of ingesting toxic substances. Birch (1990) has suggested that it may begin at around two years of age. It has been proposed that a ‘remedy’ for neophobia may be repeated exposure to new foods (Birch & Marlin, 1982; Pliner, 1982; Sullivan & Birch, 1994).

The idea that the more often one is exposed to an item, the more preference one will have for that item has been derived from social psychological literature. Zajonc (1968) posits the view that the more familiar something becomes, the more it will be liked. The effect was demonstrated (with adult subjects) with various objects and shapes using a measure of stated preference and although food items were not included in these experiments, many of the studies that examine the effect of exposure on food choice cite Zajonc’s work.

Some experimental evidence for the efficacy of repeated experience with regard to food acceptance is presented below.

Pliner (1982) designed a study so that the number of exposures that students (n=24) had to four different unfamiliar fruit juices was manipulated. The students tasted each of the juices on 0, 5, 10 or 20 occasions within the same experimental session. Post-test stated verbal liking for the four drinks (as measured on a seven point Likert scale) increased as a direct function of the number of times the students had tasted them.

At the other end of the age spectrum, Sullivan and Birch (1994) investigated whether exposure could influence the food intake of very young infants, in particular whether pre-weaned infants' intake of a vegetable could be enhanced by prior exposure to a variety of food flavours (presumed to be) via the mother's breast milk. Thirty-six infants aged between four and six months participated; all were, at the time of the study, being weaned on cereal and fruit only; half had been exclusively fed on breast milk, half on infant formula. Each parent was given pre-weighed quantities of one of two pureed vegetables (peas or green beans) of which there was a salted or unsalted version and the parent offered the vegetable to the infant as part of the normal feeding regime at home. At the end of the ten day intervention, there followed a period of a further ten days during which there was no exposure to vegetables, followed by a two day follow-up where the infants were re-presented with the vegetable. During the 10-day exposure period, clear and significant increases in vegetable intake (measured in grammes consumed) for breast-fed infants were recorded whereas the increase in intake of the formula-fed infants was much less dramatic. Intake of both groups had increased significantly during the exposure period, regardless of the type of vegetable and whether it was salted or unsalted, but the results of an ANOVA showed that the breast-fed infants were consuming significantly more vegetable than were those infants fed on formula milk. Moreover, after the ten day delay, infants fed on breast milk increased their vegetable intake further, relative to the exposure period, whilst the intake of the formula-fed infants remained static at levels similar to those recorded during the exposure period. The authors conclude that prior exposure to breast milk provides the infant with a variety of flavours (unlike formula milk) and that this exposure facilitated acceptance of the novel vegetables.

Birch and colleagues have carried out much of the research into the food 'preferences' of children in the age range relevant to this thesis (between two and five years).

Birch and Marlin (1982) tested the 'exposure hypothesis' with two-year-olds. They gave six children differential taste exposure (2, 5, 10, 15 or 20 tastings) to five novel cheeses; food history data supplied by the parents indicated that the cheeses were initially unfamiliar to the children. Tasting was recorded if the child placed (or allowed the experimenter to place) the food sample on the tongue and/or in the mouth. The authors report that in most cases, the entire sample was ingested, but, particularly on initial presentations, some children spat out the samples. Presentations took place once daily when the children were offered and asked to taste two target foods. Tasting order and amount consumed was recorded. At the end of the experiment, each child was given a series of ten paired comparison trials comprising of all possible pairings of the cheeses. During these sessions, the children were asked to taste both foods and choose one to eat more of; the food chosen to 'eat more of' was recorded as the more preferred of the two. Any actual consumption of the foods is not reported. The children's choices of cheese were found to be an increasing function of taste exposure and the effects were in evidence for all but one child.

When novel fruits (lychees, dried apricots, kadota figs, Queen Anne cherries and dried bananas) were used as stimulus foods rather than cheese, data from a further eight children showed a significant correlation between exposure frequency and choice with choice increasing with increased taste exposure.

Thus, with adults, increased taste exposure led to an increase in verbal liking, with infants increased taste exposure led to increased consumption, and with two year olds, increased taste exposures were correlated with the children's choice of food. However, with the two-year olds it was also noted that any effects of repeated exposure might be moderated by other variables:

> The exposure effect appears to be most pronounced when the stimulus is moderately novel, unfamiliar, or unusual and *the effect does not appear with familiar material* (Birch & Marlin, 1982, p. 354 italics added).

Such a statement does beg the question of when exactly a food ceases to be novel and how to operationalise novelty. Studies of habituation to novel items reported in the infant learning literature (Fantz, 1965) show that an infant's rate of looking at a novel item gradually decreases after subsequent presentations, reaching a plateau whereupon the item is judged to be 'familiar'.

How would one advise a parent wishing to ensure a child's consumption of fruit or vegetables to proceed with this information?

In a series of studies, involving three and four year old children, Birch (1979) reported a relationship between a food's *familiarity* and a child's verbal liking for that food. 'Familiarity' of foods was inferred from the participating child's ability to name the item during a preference test and food histories supplied by the parent (information given to provide the nursery with guidance as to whether a range of 'common' foods were liked, accepted, rejected, or never served at home).

In the first study, 37 children's verbal liking for eight fruits (apple, pear, banana, peach, date, pineapple, grapefruit and orange) was tested and a subsequent multi-dimensional scaling procedure revealed that 'familiarity' and 'sweetness' (as assessed by 31 of the parents rank ordering the fruits) accounted for the greatest amount of the variance (29% and 26% respectively). Age-related differences were found in the relative importance of these criteria; sweetness was highly correlated for the four-year-olds followed by familiarity, whereas familiarity was most highly correlated for the three-year olds, followed by texture.

It must be assumed that the 'familiar' and 'unfamiliar' categories were based on relative prior exposure at home and relative ability to name each fruit, since there is no indication of what was inferred about a food's familiarity if a child could not name the food, but had been served with it at home and vice versa. Of the 37 participants, all were able to name bananas, 34 named apples, only 7 named dates correctly, and 10 correctly named canned grapefruit. Food histories showed that all the children had been served, at home, bananas and apples, only 10 had been served dates and 16 had been served grapefruit. It is not clear whether the children (n=30) who did not label dates correctly were among the same children (n=27) who had not been served dates at home or whether the (n=21) children who had never been served with grapefruit at home were among the same children (n=27) who could not label canned grapefruit. No information regarding the 'familiarity' or otherwise of the other four fruits is given and there is no indication as to how many of the four-year-olds and how many of the three-year-olds were able to correctly name the fruits.

The stability of the children's verbal liking and the salient dimensions were examined in a second assessment, carried out between 4 and 51 days (mean interval of 17 days) after the initial assessment. Sweetness and familiarity again accounted for the majority of the variance (28% and 23% respectively). For the four-year-olds more variance was accounted for by sweetness followed by familiarity, whereas for the three-year-olds the reverse was true (the texture element noted in Assessment 1 was not in evidence). In terms of stability of the children's verbal liking measures (i.e., test/re-test reliability) 16 of the 20 (80%) four-year olds rankings were unchanged between assessments, but three-year olds rankings were unstable with only 6 of the 17 (35%) children's rankings similar across both assessments. No significant relationship between the sizes of the correlation and the length of time between assessments was found.

In a third assessment of verbal liking three new foods were introduced into the procedure, raisins, lemons and figs. Food histories and the children's labelling of these three new foods indicated that raisins would be familiar and sweet, lemons familiar and tart, and figs unfamiliar and sweet. Sweetness and familiarity again accounted for the greatest of the variance (33% and 24%) along with the age differences in their relative importance. The new foods were rated as predicted; on the sweetness scale figs and raisins appeared centrally, whilst lemons were placed at the 'tart' end. On the familiarity scale, lemons and raisins appeared at the top and figs at the bottom.

A final manipulation was introduced to determine whether repeated taste exposure to an unfamiliar food, in this case dates, would cause dates to become more 'familiar'. Based on the exposure theory, any increase in familiarity should impact on the children's verbal liking for that food. During seven consecutive lunchtime meals, a plate of chopped dates was placed on the table along with the usual meal. One piece of date was placed on one child's plate and, in accordance with the established lunch procedures, the child tasted this piece. Free access to more dates was available although any extra portions requested or consumed are not reported. The verbal liking procedure began on the eighth day and showed that sweetness and familiarity again accounted for the greatest amount of the variance and that dates had become slightly more familiar. However, a concurrent increase in verbal liking for dates was not in evidence. The lack of effect of increased taste exposure on verbal liking was thought to be due to individual differences in the salience of familiarity on verbal liking, although individual data were not presented. If the child's ability to name the foods was the basis of the familiarity data, it is important that any attempts to increase this kind of familiarity are carefully documented, but in this case, there is no indication of what kind of exposure the children were given, that is, whether it consisted of sight and taste, and did or did not include naming. Moreover, it is unfortunate that the children's consumption of the 'freely available' dates is omitted from the account, as these data would have provided some indication of whether the enforced taste exposure had any effects on consumption of dates.

One further experiment (Birch, 1979) was carried out with sandwiches as the target foods to examine whether verbal liking would predict consumption. Across the four days of the study, two measures were taken, verbal liking for, and consumption of sandwiches in a snack setting. Across the four days of the experiment, the verbal liking assessments and snack sessions were alternated so that on Days 1 and 3, the sandwiches were offered first followed by the assessment procedure, and the reverse was the case on Days 2 and 4. Seventeen pre-schoolers aged between 3 years 7 months and 4 years 7 months took part and were offered open-faced sandwiches spread with either, margarine, margarine and mint jelly, peanut butter, peanut butter and grape jelly, cream cheese, cream cheese and honey, cream cheese and caviar, or cheddar cheese spread.

For the consumption measure, the children were observed in small groups of four or five at snack time when they were seated near to a table on which a dozen of each type of sandwich was displayed. Each child was given a small plate, told to help themselves to sandwiches and that further helpings were available. (It is not specified whether the members of the group were able to observe each other's choices, either at the moment of choice or at the table following choice). The number and kind of sandwiches consumed by each child was recorded. Familiarity (as measured by parental reports of foods served at home, the children's ability to name the items, and their spontaneous comments) was again found to account for much of the variance (51%). A further 23% may have been accounted for by sweetness, but a confound was identified in that the sweet and non-sweet sandwiches differed on a second dimension, the sweet sandwiches also had two toppings, e.g., cream cheese and honey, whereas the non-sweet sandwiches had a single topping, e.g., cream cheese.

Results also showed a strong relationship between verbal liking and consumption (correlation of 0.80). Sandwiches that were ranked highest in terms of verbal liking were those that were eaten in greatest quantities. Sandwiches that were ranked lowest in the verbal preference order were eaten least. Verbal liking was found to be not only linked to consumption, but was also said to *predict* it (Birch, 1979). However, this claim should be viewed with caution since correlation does not prove causation. No further investigations have been carried out to establish the conditions under which measures of verbal liking do or do not predict consumption or whether the relationship between the two is that consumption predicts preference.

To summarise, thus far, we have seen that in adults, verbal liking for fruit juices was changed following experimental manipulation of exposure to those juices (Pliner, 1982). In very young infants (Sullivan & Birch, 1994), greater post-experimental consumption of a vegetable was recorded for breast-fed infants than formula-fed infants which was presumed to be because the former had prior taste exposure to a variety of flavours via the mother's breast milk. With two-year-old children, increasing taste exposures was found to be correlated with an increase in choice for cheeses and fruit (Birch & Marlin, 1982) although the authors note that increasing taste exposures may only affect verbal liking (as measured by choice) for certain categories of foods, i.e. those that are novel or unusual.

In the experiments carried out with pre-school children (i.e. aged between three and five years) familiarity (assessed by the child's ability to name foods and information provided on foods served at home) and sweetness were both found to be important dimensions of verbal liking (certainly for fruit and sandwich toppings). However, when familiarity was increased for one food (via repeated taste exposure) there was no effect on the subsequent preference ranking of that food (Birch, 1979) even though familiarity is said to be linked to preference.

Age differences in the relative importance of familiarity and sweetness were also reported; familiarity followed by sweetness were most important for the three year-old children, whilst sweetness followed by familiarity were found to be important for the four-year-old children. The stability of verbal rankings across time was also different for children in these two age groups; four year olds were more likely than three year olds to give consistent rank orders across two assessments on the same sets of foods (Birch, 1979).

It is also noteworthy that although authors report both the existence of neophobia and the importance of familiarity in determining food preferences, none have reported any difficulty in getting children to taste any of the foods, even such items as figs and caviar.

Birch, McPhee, Shoba, Pirok, and Steinberg (1987) have noted a distinction between two different types of exposure and their effects on verbal liking, namely having seen a food on a number of occasions (visual exposure) and actually tasting a food on a number of occasions (sight and taste exposure). Children in three different age groups participated in the experiment: the youngest group consisted of 10 children aged between 1 year 11 months to 2 years 6 months; the middle group consisted of 15 children aged between 2 years 8 months and 3 years 6 months and the oldest group consisted of 18 children aged between 4 years 8 months and 5 years 9 months. Each child was given differential taste and sight exposure to seven novel fruits: fresh kiwi, dried papaya, dried peach, canned kadota figs, canned lychee, canned jack fruit and canned sugar palm. The novelty rating of these foods was estimated from parental reports. Two weeks were spent, prior to the experimental phases, familiarising the children with the procedures using familiar foods. They were taught to 'look' (visual and olfactory exposure) for ten seconds and 'taste' (olfactory, visual and taste exposure). In the case of taste, the child was required to place the food in the mouth, but did not have to swallow it, although it is reported that 'the vast majority of children did ingest the food in nearly all experimental trials and that cases in which a food was tasted and spat out were rare. For each child, three of the novel fruits were presented in the taste condition, three in the look condition and one fruit remained novel. Within each type of exposure, one fruit was presented 5 times, one 10 times and one 15 times. Sight and taste exposure occurred on different days. Two foods were presented daily, one at a time for 30 days. At the end of the exposure series, each child was presented with a series of food pairings, in which all seven foods were presented once with each of the other items (21 pairings in all). Each child was asked to "choose the one you like the best" (p. 174), firstly from looking at the foods and then by tasting them. Consumption data were not reported. In the case of 'taste', significant correlations were found between the number of taste exposures and taste judgements, but no significant correlation was found for taste judgements of foods that were looked at but never tasted. Foods tasted more frequently were chosen more frequently than items given less taste presentations. In the case of 'looking', visual judgements of both visually and taste exposed foods were significantly related to the exposure frequencies. There was no increase in taste ratings where foods were only given visual exposure. Thus, visual exposure was limited to enhanced visual preference whilst taste exposure enhanced taste and sight preference.

These findings are important because, as Birch et al. (1987) note, in reducing the neophobic response, sight exposure alone is not enough to increase verbal liking, *the food must also be tasted.* Based on the data from the (1987) experiment, Birch et al. further recommend that ten or fifteen taste exposures would significantly increase a child's 'liking' for novel foods (p. 177).

And there lies the problem with the exposure theory. The purpose of manipulating exposure to foods is to increase the probability of their being eaten in the first place. However, in order for this to occur, one must first increase the number of taste exposures. The difficulty of achieving this is acknowledged by the authors themselves, who report that whilst no differential age effects with regard to the experimental procedures were in evidence (all three groups showed increasing verbal liking with increasing exposure), the youngest subjects were the most unwilling to taste the foods. On their first exposure, eleven children from the group of seventeen two-year-olds refused to taste, only three of the sixteen three-year-olds refused, whilst none of the children in the oldest age-group failed to taste. Statistical analyses showed a significant relationship between age and taste refusal, although Birch et al. (1987)

suggest that rather than being a neophobic response to food, the unwillingness may be the "manifestation of a general developmental trend toward independence that is typical during this period, and that is often manifest in increased negativism, which peaks around the second year of life" (p. 177)

The authors acknowledge this as a problem, but give no clue as to how they overcame the unwillingness of their younger subjects to taste the experimental foods. Thus the original question remains largely unanswered:

> as far as we know, a food must be ingested or tasted in order for exposure to be effective, and little is known about factors that influence willing to try in the first place. (Pelchat & Pliner, 1995, p. 154).

It is likely that rather than being the determining factor in modifying food selection or consumption, exposure may be important in facilitating the impact of other social variables. In real life, eating generally takes place in social contexts; 'mere exposure' as such may not exist even in a laboratory setting, for even there, contextual variables may be in operation. Consider the notion of neophobia and the dearth of evidence of this in any of the experiments reported above; even though many of the foods presented during the procedures were specifically chosen for their novelty, very little subject attrition due to failure to taste the foods is reported and, even when foods are initially refused, as Dowey (1996) has observed, researchers seem able to ensure taste exposure occurs 'with apparent ease.' (p. 12).

Something approaching an acknowledgement of the role of other contextual variables is put forward by Birch et al. (1987) who state a reluctance to make too much of age differences in neophobia:

> A similar pattern of age differences in neophobia when the novel foods were presented to the children by their mothers at home, or when the children had opportunities to sample novel foods in the absence of direct adult supervision would be much more convincing evidence for age differences in neophobia *per se* (p. 177).

There is sense in this. Dowey (1996) highlighted the potential differences between parents experiences of getting their children to eat new foods (often described in terms of conflict - food fights, battleground etc) and an experimenter's experience. There are different histories between a child and an experimenter and a child and a parent. An experimenter may be perceived by the child as someone who plays games and 'gives me funny foods to eat', whereas a child may perceive interactions with a parent in food situations very differently "whenever my Mum wants me to eat a food it always tastes yucky". Thus, the characteristics of the situation and the role of the adult may play a great part in a child's willingness to consume (or otherwise) a 'novel ' food.

Zellner (1991) has hit the nail on the head when she says that eating is a social activity and exposure itself may not be the cause of increased liking, but it may allow the operation of other variables, so that the more often one is exposed to a food, the greater is the possibility that liking will develop through other mechanisms. Birch et al. (1987) support this view noting that "mere exposure is not an accurate description of children's eating experiences" (p. 177). Rozin (1981) is certain that cultural factors such as social pressure combine to ensure regular taste exposures and these combinations must be the means by which consumption of initially unpleasant tasting substances, such as alcohol, coffee and chilli is established. If this view is correct, then social pressure would indeed be a powerful weapon to wield in the battle for children's diets. If social pressure can ensure that initially noxious tasting substances are ingested, not just once, but repeatedly and even come to be highly desired, how might it be: i) operationally defined and ii) systematically manipulated in order to ensure that many innocuous and even pleasant tasting substances, in the form of fruit and vegetables are also repeatedly ingested?

The next section of this chapter will be an examination of how some forms of social pressure have been manipulated to influence what is eaten (and what is not).

Modelling and Peer Influence

As well as exposure to foods, the very fact of living within a culture also entails exposure to other members of that culture. Both appropriate and inappropriate behaviours are learned by individuals from other members of their culture, and behaviour with regard to food may be no exception. The impact that modelling and peer influence can have on food acceptance and rejection has been widely documented in the literature.

Harper and Sanders (1975) showed that young children could be susceptible to modelling influences. In two similar experiments (the second differed only in the addition of a male experimenter) unfamiliar foods (familiarity was inferred from parental reports) were presented to 164 children aged 14 to 20 months or 42 to 48 months, in their own homes. Target foods were a blue coloured tortilla filled with ham and cheese followed by either a date or a macadamia nut. The dependent variable of 'acceptance' was defined as the child putting the food in the mouth within one minute of grasping it. Half the subjects in each age group were offered the foods by the adult (half by the mother and half by an experimenter) whilst the other half of the group were offered the foods when the adult had begun eating. More children (80%) accepted the first item (tortilla) when the adult modelled eating than when the adult merely offered the food (47.5%) and they were more willing to try a food if their mothers offered the food than if a stranger did (77% compared to 50%). Of the second food (the nut or date) the older children were more likely to accept it if the adult had modelled consumption of the first food, whilst more (73%) of the younger children than older children (28%) accepted the second food when it was merely offered. According to the authors, the majority of those sampling the food ate appreciable amounts, i.e. 80% ate half or more.

Duncker (1938) and Marhino (1942) used two means to manipulate children's food choices, by 'in vivo' peers and a hero in a story.

In the first of Duncker's three studies, children aged between 2 years 8 months and 5 years 2 months were presented with six foods: carrots, bananas, nuts, apples, bread and grapes, and instructed to choose and eat the food (choice followed by taste) they liked the best until all six were ranked. In the experimental manipulation, the children repeated the task, but this time in the presence of another child (or children) whose choices were very different. Results were calculated by comparing how many of the choices of the target child were identical to those of the peer when they were initially made in the absence of the peer and how many were identical when made in the presence of the peer. The target child's choices were found to be consistent with those of the peer on 81% of occasions, as opposed to 25.6% when rankings were made alone.

In the second study, Duncker investigated the effects of the age of the model on the observer's food choices. Twelve children were split into two age groups, two and a half to three and a half years and three and a half to five years. In half the experimental conditions, an older child acted as the model with the younger child observing and in the other half, the younger child modelled and the older child observed. In all cases, the model and the target child's pre-manipulation rankings were different to each other. 81% of the younger children imitated the older peer compared to 58% when the model was younger, although compared to the initial choice situation when no peer was present, older children exposed to younger models did alter their choices in the direction of the model. It was also noted that children of less than 2 years 8 months were not influenced by other children.

To determine whether the effects of the experimental manipulation would last beyond the experimental context, the children ranked the six foods again, but this time in the absence of any peers. Since effects of the peers were not in evidence beyond the experimental situation, the intervention was re-introduced with four pairs of children 'several times'. Following these further interventions, in some instances, the alteration in choice made in the presence of peer models was maintained in their absence.

Three important findings emerged from these studies. First, more than one exposure to peers was necessary before any lasting changes in food choice were observed. Secondly, the effectiveness of the model's behaviour may be limited by the age of the model; i.e. older peers are more effective than younger ones, although younger peers are more effective than no peer. Thirdly, there may be an age limit under which peer modelling is not effective (2 years 8 months).

In Duncker's final experiment, 33 children (average age of four and a half years) were told a story that featured two 'novel' foods, one bitter, the other sweet-tasting and a fictional hero who showed a strong preference for the bitter-tasting food. After listening to the story, the children acted it out in pairs. During the 'performance' both foods featured in the story were available and the children were instructed to try each one and say which they liked better. Despite the fact that the sweet food was very like chocolate, 67% of the 15 children in the experimental group chose the same food as the hero in the story, i.e. bitter-tasting. Of a group of 15 children who had not heard the story, only 13% chose the bitter food. The children's choices were monitored for five successive trials over a twelve day period when both foods were available. They were instructed to help themselves to the food they liked best and then to try some of the other food. They were subsequently asked which food they would like to have more of (more was never given). Compared to the control group, choice of the bitter tasting food by children in the experimental group remained elevated for three or four trials across twelve days, but the trend was downward. When the story was re-told, the number of children choosing the bitter tasting food increased. In both control and experimental groups, similar numbers of children were consistent in their rejection of the bitter tasting food (6.3 and 6.7), thus indicating that the fluctuation in choice was much greater in the experimental group (recall that 67% initially chose the bitter food). Interestingly, of the children who rejected the food, most (40%-60%) were found to be unable to remember the story, whilst of the children who liked the food, most did remember the story (60% - 90%).

As the author acknowledges, these studies do not address the effects of short term conformity to peer choices on long term food choices and food consumption:

> For the most part, the children gave some evidence of being in a conflict situation, hesitating, looking back and forth, or even making a wry face before the very object they chose. From this, we got the distinct impression that the influence issuing from the story did not affect the dimension of taste valences proper – in short, that it was not transformed into sensory terms. It looked rather as if the two valences, the sensory and the social, remained separate and caused the child to waver between them. (Duncker, 1938, p. 504)

This observation attests to the power of social influence, but raises the question of how many exposures might be required to convert conformity to peer modelled food choices into permanent behaviour change and it is by no means certain that the procedures would be as effective with foods with which children have had previous experience.

Marinho's 1942 study looked at the effects of peer-modelled food choices on the food choices of children aged between four and six years who attended a kindergarten in Rio de Janeiro. The initial stage of the experiment involved one hundred children whose choice of six different kinds of fruit paste was assessed over a three-month period. The extended period was included to ensure stability of the children's choices. Based on the accumulated choice data, the children were sub-divided into three different categories: *predominant* - those whose choices were consistent in all trials, *temporary* – those who chose the same foods across successive trials and then changed, and *indefinite* – those whose choices changed across trials. The children in the predominant and indefinite groups (n=66) were selected to take part in the experimental phases of the study and each group was sub-divided to form an experimental and control group within each category. It was hypothesised that differences would be apparent between the predominant group and the indefinite group that would be observed in their responses to the experimental manipulations, and that it might be easier to change the choices of the indefinite group in comparison to the predominant group. Longer-term maintenance of change may also be different in both groups.

Whilst children in the control groups continued to have their food choices monitored as in the baseline phase, children in the experimental groups were each exposed to a peer (carefully chosen from observation of social interactions and teacher advice) with whom they played a game in which the peer modelled choice of a pre-instructed food. If the target child was from the predominant group, the peer modelled choice of one the former's less preferred foods; if the target child was from the indefinite group, the peer would model exactly the same choice of food on every trial. Target child's choice of food and 'attitude' towards the peer were recorded. It is not clear whether the children actually ate the food after making their choice. Each child's last ten choices during baseline were compared to their first ten choices during the experimental sessions. Half of the choices of children in the predominant group who were exposed to the peer changed in favour of the peers choice, whilst only 5% of choices of their control group had changed. In the indefinite group, *all* the children exposed to a peer changed their choice in favour of the peer's choice, whilst less than 1% of choices in their control condition changed in favour of the peer. Thus, it was easier to change the choice behaviour of the indefinite group than it was the predominant group.

Trials carried out a year later showed that the long-term effects of the manipulation were in evidence for all four remaining children whose choices were indefinite at the beginning of the study, whilst five out of the six remaining children from the predominant group reverted to their pre-experimental choices.

Along with analysing the effects of the peer influence, Marhino also noted the 'style' of the peers during the experimental manipulation and found a relationship between this and the effectiveness of the peer in influencing the target child's food choices. Socially agreeable peers had many more positive effects on choice than negative (20-2), whilst peers who were 'socially domineering' had more negative effects on food choice than positive effects (7-1). Thus the peers' behaviour in relation to the target child were an important factor; peer's whose behaviour was described as domineering tended not to be imitated.

Birch (1980) extended both Marinho and Duncker's work by investigating the immediate and longer term effects of real life peers on three measures, verbal liking, choice (either A or B), and consumption of vegetables. Thirty-nine pre-schoolers aged between 2 years 11 months and 4 years 10 months rank ordered, in terms of verbal liking, a set of nine vegetables (corn, carrots, peas, celery, beans, cauliflower, broccoli, beets and mushrooms). During the intervention, a target child was seated for lunch with a group of four peers whose preferred vegetable was opposite to those of the target child, so that the target child's preferred vegetable might be peas and least preferred carrots and the peer's preferred vegetable might be carrot and least preferred peas. These two vegetables were presented to the group along with the lunchtime meal for four consecutive days. On Day 1, the target child chose his or her vegetables first, whilst on Days 2, 3 and 4, the peers chose first. Further helpings of vegetables were available. Each child's choice and consumption (measured in tablespoons) of vegetables was recorded and at the end of the intervention period, verbal liking was re-assessed.

The effects of the intervention were evaluated by i) comparing the results of the pre-intervention verbal liking assessment with post-intervention assessment, ii) comparing choice of vegetable on Day 1 with that of subsequent days, and iii) comparing relative quantities of each vegetable consumed across the four interventions.

On the verbal liking measure, there was a median increase for the target food of 2.5 positions relative to it's initial ranking, which represented a change in preference for the initially non-preferred foods for 12 out of 17 target subjects. Age differences were found in the effects, with all eight of the younger children showing an increase (median of seven points) and only four of the nine older children showing an increase (median of one point).

An inevitable outcome of any movement of an item in a closed ranking is that all other foods that are ranked within that scale will also change position. In this case, the reported increase in verbal liking for the target food was accompanied by a median decrease of three positions for the target children's initially preferred food; seven of the eight younger children showed a decrease (median of two) and seven of the nine older children (median of three points). Thus, although age differences were found in the increases in verbal liking, with the younger children more likely to change, all but three children, regardless of age, showed decreases in verbal liking for their initially preferred vegetable at the end of the experimental manipulation.

No change in the peer children's verbal rank ordering for vegetables was observed.

The post-intervention verbal liking assessments were carried out, in some cases many weeks after the intervention and were considered to be evidence that the procedures had long-term effects on the verbal rank orderings of the target children.

The daily *choice* data showed that out of the 15 target children who chose their highly ranked vegetable on Day 1, 10 chose the vegetable ranked highly by the peers sitting at the same table on Day 4, and the target children made significantly more choices of their initially lower-ranked vegetable than did the peers. All seven of the younger children chose their lower-ranked vegetable on Day 4, whilst only three of the eight older children did so. Thus, choice data indicated differences of the effectiveness of the intervention between older and younger participants.

With regard to consumption, changes are more difficult to assess. Consumption is reported as a proportion, i.e., relative amount of preferred and non-preferred food consumed as a proportion of the total amount of vegetables eaten. The group data for both target children and peers showed that across the course of the study overall consumption of vegetables decreased. In the peer group, the proportions of both vegetables remained unchanged across the study. For the target children, changes were recorded, so that a larger proportion of target vegetable was eaten on the final day of the study than at the beginning. However, an equal decrease in consumption of the initially higher ranked vegetable was also recorded. As the authors claim, this is evidence that the intervention had a significant positive effect on the initially lower ranked vegetable; yet the intervention also had a negative effect since an equal decrease in consumption of the initially higher ranked food was recorded. It should also be noted that the target children's consumption of the target vegetable was relatively stable across the first 3 days of the intervention and increased only on the fourth day, indicating that the peer intervention was not effective until Day 4. Since there are no consumption data beyond Day 4, it is not known whether the increase was temporary or whether it would have persisted in the absence of the peers.

The results of the 1980 experiment show that exposure to peer models changed subjects *verbal rankings* in the absence of those peers and when the peers were present *choice* of vegetable was changed (there is no measure of choice in the absence of the peers), but these changes also impacted negatively on verbal ranking and choice of the initially higher ranked vegetable. It is less clear what effect there was on actual consumption and whether this was a desirable outcome.

The age differences found in effects of the intervention on verbal liking and choice are worthy of further discussion. As noted previously, there was a difference between the older and younger children in terms of increase on measures of choice and verbal preference and these age-related differences were found to be significant. Decreases in verbal preference for the initially higher ranked vegetable were found across both younger and older age groups.

Dowey (1996) has observed that the difference in effects may not be due to age per se, but may be the result of the age of some of the peers. In the study, children acted both as target child and peer and so it is likely that the younger children were always exposed to similar age or older peers whilst the older subjects would have been exposed to similar age peers or younger. Brody and Stoneman (1981) and Duncker (1938) all found that children were less likely to imitate younger models than those of similar age or older and thus, the age difference in verbal liking reported by Birch may be due, at least in part to the younger children's exposure to the older peers.

Dowey (1996) developed the Birch (1980) findings. Children aged between 5 and 7 years old took part in an experiment in which two invented 'foods' (quorn and potato bread) were coloured blue (to ensure that none of the participants had any prior exposure to them). The 35 children were split into three groups, A, B and C, and, across the course of an 'activity day' were individually offered the novel foods, along with other snack foods, in a variety of different contexts. Each child's consumption of the novel foods was recorded throughout each experimental phase and was measured from plate waste using a percentage consumed score of 0%, 25%, 50%, 75% or 100%.

In Phase 1, children in Group A were each presented with either one of the novel foods in the presence of a group of peers who expressed a liking for and ate it, whilst children in Group B were each presented with either one of the blue foods in the presence of peers who expressed a strong dislike for and refused to eat it. Children in Group C were each presented with one of the blue foods with no peers present. Phase 2 was a test for maintenance of behaviour and generalisation to a second novel food of a similar colour and each child was presented with the both the target blue food and the second blue food in the absence of peers. In Phase 3, children in Groups A and B were each presented with the target food in the presence of peers who expressed a liking for, and ate that food. Children in group C were again each presented with the target food with no peers present. Phase 4 was a repeat of Phase 2, in which each child was presented with the both the target blue food and the second blue food when in the absence of peers.

Both types of peer influence (positive, 'liking' and negative, 'disliking' behaviours) impacted on consumption of the blue food, in the presence and absence of the peers and also on the choice to consume (or not) a second novel (but perceptually similar) food. Group A, the group initially exposed to the food in the positive context showed increased consumption compared to controls (Group C), an effect which was maintained in the absence of the peers and generalised to the second blue food. Group B, the group first exposed to the food in the negative context, showed decreased levels of consumption compared to the control group, an effect which was also maintained in the absence of peers and generalised to the second blue food. Group A's consumption of target food increased further when exposed to positive peer influence a second time and this behaviour was again reflected in both consumption of the target food in the absence of the peers and in consumption of the second food. When Group B were exposed to positive peer influence in Phase 3, consumption of the target food increased to levels similar to those observed in Group A, and was maintained in the absence of the peers, although this behaviour did not generalise to the second blue food.

The Dowey study provides evidence for the impact of positive peer influence on consumption (as opposed to verbal liking or choice measures) of a novel food. It also demonstrated the power of negative peer influence on consumption, showing that it may be more powerful than positive influence and that negative influence can, to some extent, be overridden by subsequent positive influence. Data recorded in the absence of peers demonstrate that the effects on consumption in the presence of peers were not dependent on the continued presence of those peers.

Greer, Dorow, Williams, McCorkle and Asnes (1991) showed that peer behaviour could be useful as an intervention in an applied setting. An 18 month old child learned to swallow by observing his older sibling feeding herself and obtaining token reinforcement. When the sibling had swallowed a bolus of food, the target child was given the opportunity to feed himself. Praise and token reinforcement was given for each bolus swallowed. Food swallowing was established after seven days and liquid swallowing was then successfully targetted. At the one month follow-up the child continued to swallow both liquids and solids.

The child in a second study was aged 2 years 5 months, drank only from a bottle and his parents reported that he ate very little. Experimental procedures took place in a pre-school lunch-time setting. The number of food presentations eaten by the child during lunch was recorded as were the number of refused presentations, the number of calories consumed, duration of the meal, and weekly height and weight measures were recorded. During baseline, the child was presented with a teaspoon size piece of food placed on a plate (liquids were spooned into a cup) in front of him. The food was removed after five seconds if it was not eaten and replaced with another food. Praise was given for any food consumed, which was then replaced with another type of food. Foods were alternated throughout the session. A session ended after ten consecutive refusals or when one item of food was totally consumed. During Baseline, only 33% of food presentations were accepted whereas in the first intervention phase (peer mediation) a peer (1 of 3 different children aged 2-4 years) sat opposite the target child and the experimenter placed a bite of food on a plate in front of the peer. The peer was praised for eating the food and the target child was then offered a bite of the same type of food. If he ate the food, praise was given; uneaten food was removed after five seconds. Food presentations were alternated between the target child and the peer across the session. During this intervention phase, the target child ate 72% of all food presentations, but when baseline conditions were re-established, this was reduced to 38%. On the return of the peer, the target child's consumption increased to 70%. A peer modelling phase was then implemented wherein the target child and the peer were given food at the same time and both were given praise for food consumption. During this phase, the target child consumed 50% of the foods presented (a quantity somewhere between baseline and peer mediation). In the final phase, peer-mediation was re-introduced, so that food presentations were again alternated between target child and peer. At this time, the target child was consuming 75% of all food presentations, the highest of the study. Thus, the peer mediation intervention, wherein food presentations were alternated, was more effective in this case, than the peer modelling. There are no follow up data given and so the long term effect of the procedures is not known.

The literature reviewed in this section indicates that real-life peers can be a powerful influence on the food-related behaviours of young children. All of the studies demonstrated a conformity effect, impacting on acceptance (Harper & Sanders, 1975), choice (Birch, 1980; Duncker, 1938; Marhino, 1942;) and consumption (Birch, 1980; Dowey, 1996; Greer et al. 1991) in the presence of peers. The impact of the influence was moderated by the age of the peer relative to the age of the target child and the age of the target child.

Dowey (1996) demonstrated that peer influence could increase consumption of novel foods at the time of the intervention and when the peer intervention was withdrawn. The study also emphasised the power of negative influence and showed that its effects could, to some extent be over-ridden by subsequent exposure to positive influence, an important finding if one wishes to increase consumption of foods that may have negative histories attached to them.

The utility of real-life peer modelling in applied settings was shown by Greer et al. (1991) wherein an 18 month old child learned to swallow solid foods and liquids after observing the consequences of similar actions performed by other children. A second study with a 29-month-old child also indicated a difference between the effects of *peer modelling* and those of *peer mediation,* with the former having greater impact than the latter.

Television

Television is another potential means through which children may be exposed to models. Does television have any influence over children's eating behaviours? This is a relevant question given estimates that even pre-school children may watch up to 28 hours of television a week (Leung, Fagan, Cho, Lim & Robson, 1994) and given the likely content of much of this viewing.

There are two aspects of television, namely, the programmes themselves and the advertisements broadcast in between. Evidence of the effects of television advertising will be considered first followed by evidence of the effectiveness of television programmes to increase healthier food choices.

Television Advertising

According to the National Food Alliance Advertising Project (1995) food advertising was the single largest category of advertising aimed at children, accounting for approximately seven out of ten advertisements on children's weekday ITV and five out of ten on Saturday mornings and The Big Breakfast. Breakfast cereals (the majority highly sweetened) and confectionery were generally the most intensively advertised foods.

Children watching children's weekday ITV or Saturday morning TV view three to four times as much advertising for fatty, sugary and salty foods per hour than adults viewing after 9pm in the evening. The survey found that out of the 549 adverts monitored, only *two* were for fruit and vegetables and that fatty and sugary foods (which should make up no more than 7% of the total diet) were the most heavily advertised.

The authors submit that advertising on television, particularly on children's TV:

> presents a grossly imbalanced nutritional message which is undermining progress towards a healthy diet (p. 2)

And that the imbalance

> creates a conflict between food advertising and dietary recommendations which not only encourages and reinforces children's consumption of foods that do little to contribute to a healthy diet, but which also undermines the efforts of parents and others, to encourage healthier eating (p. 2).

What is the evidence that advertising on television can influence children's food choices?

An early study by Galst and White (1976) reported a high degree of correspondence between 3-6 year old children's 'purchase influence attempts' during supermarket shopping and foods that were heavily advertised on television. The children did request foods such as meat, fruit and vegetables which are not generally advertised on television, but to a much lesser degree than they made requests for cereals and confectionery products that are very heavily advertised. The older the child, the more requests were made, whether or not the requests were rewarded.

Gorn and Goldberg (1982) attempted to assess the causal link between exposure to varying types of televised food messages and children's food selection and consumption. Seventy-two children aged between five and eight years, who were attending a summer camp for two weeks watched half an hour of cartoons each day just prior to a scheduled snack session. The children were assigned to one of four viewing conditions in which the cartoons were interspersed with either: 4.5 minutes of confectionery commercials that included a sugary drink (Kool-Aid), 4.5 minutes of public service announcements stressing the importance of a balanced diet, or 4.5 minutes of fruit commercials that included orange juice. A control group saw just the cartoons. In the snack period that followed, the children were required (alone so as to reduce peer influence) to choose one of two drinks (orange juice or Kool Aid) and two out of four snack foods (two fruits and two types of confectionery). Food and drink choices were recorded. All the foods on offer had been featured in that day's TV programming and for the preceding three days. On the final day of the study, children were asked about the health values of all the foods.

A major effect was found on choice of drink. Children who were exposed to orange juice commercials chose most orange juice (45%) whilst those exposed to confectionery commercials chose the least orange juice (25%). In the cartoon only and the public service group, choice of orange juice was at a level between the confectionery commercial group and the fruit commercial group (35% and 40% respectively). The cartoon only and the public service announcement groups were not significantly different from the confectionery commercial group in their choice of drink. With regard to choice of snack food, the confectionery commercial group picked 21% less fruit than the other three groups (significantly different). The number of children choosing fruit in all other conditions was between 33% and 36%. No difference was found in the health awareness measure across groups; all the children were aware of what they 'should' be choosing.

In this study, the children's choice of drink was affected by exposure to TV messages; the most orange juice was selected by those in the fruit commercial condition whilst those in the candy commercial condition selected the least. The children exposed to confectionery advertising seemed to be *encouraged* to choose confectionery over fruit, given that choice of fruit in all the other conditions was similar. At the same time, the inference can be made that the children's fruit eating and/or healthy eating was not in any way affected by being promoted in the commercials. The authors suggest that this may be due to the familiarity of the advertisements for confectionery relative to the advertisements for fruit. If their hypothesis is correct, the paucity of commercials for fruit and vegetables on TV in general, let alone during children's broadcasting must surely be a major cause for concern to agencies attempting to influence children's food choices towards healthier options.

There is some evidence within the study for the view that a longer period of exposure to the fruit commercials may have had more influence on fruit choices. In the study, commercials for the orange juice or Kool Aid were shown on each of the 14 days, whereas commercials for each of the fruits were less frequent. Familiarity with the advertisements for sugary snacks was likely to be elevated, given that the experimenters incorporated advertisements from every-day television programming. Prior to the experiment, it is likely that subjects would have had little exposure to orange juice promotion and much exposure to the promotion of Kool Aid. The more frequent exposure to the orange juice commercial in the study seems to have been enough to influence choice given that the choice of orange juice was differential across groups.

Goldberg, Gorn, and Gibson (1978) tested the hypothesis that exposure to commercials for one product might lead children to prefer other similar products. Eighty children aged between five and six years were assigned to one of five conditions in which they watched 24 minutes of an animated cartoon programme. In Condition 1, along with the cartoon, there were four and a half minutes of advertising for sugared snacks and breakfast cereals and Condition 2 was identical except that it contained nine minutes of advertising of the latter products. Condition 3 contained four and a half minutes of public service announcements for 'more wholesome' snack and breakfast foods, and Condition 4 had nine minutes of these same announcements. In a control condition, children were not exposed to any film or advertisement. Following the intervention, children were asked to indicate on a display of six that were mounted on a board, which three snack foods they would ask for if a baby-sitter were looking after them. Three of the snacks were sugared, the other three were not and two of each had been featured in the advertising. On a second board, six breakfast cereals were displayed and children were asked to choose three of these. Again, three were sugared and three were more nutritious and two of each had been featured in the advertising. Following the choice scenario, children were asked which of the displayed snacks were healthy and which not so healthy. No significant differences between groups were found on this measure, however, choice measures showed a main effect for message type with the groups exposed to sugared food commercials choosing significantly more sugared foods compared to both controls and those exposed to public service announcements. Again, the advertising seemed to affect choice for sugared products, but not non-sugared products.

Stoneman and Brody (1981) looked at the impact of peer-modelled food preference combined with television food advertisements on the food selections of nine year old children. They predicted that: i) children exposed to food advertisements would select the advertised products more often than children in the control condition, ii) children who were exposed to peers of the same age selecting the same products as those advertised would show an even greater preference for those foods than children exposed only to the televised commercial and iii) children exposed to peers of the same age who had different preferences than the advertised foods would show less preference for those items than children who had been exposed to the televised commercial. Eighty children were randomly assigned to one of four experimental conditions whilst forty others served as peer models. At the end of each experimental manipulation, each child was shown a series of ten slides, each consisting of pictures of one salty snack and one other common food. Five of the salty snacks were those that featured in the television commercials. Children were asked to point to their favourite food on each slide. They were then tested for their recognition of which products had appeared in the advertisements.

In the control condition, subjects watched a four-minute educational feature with no advertisements. In the advertisement alone condition, children were shown four advertisements depicting eight different salty snacks. In the television plus modelling condition, children either watched television advertisements and then observed peer choices, or observed peer choices and then watched the televised advertisements, before indicating their favourite foods on the slides. The model either pointed to the products that had been featured in the advertisements (peer-similar) or pointed to products that were not featured in the advertisements (peer-dissimilar). The children in the peer model conditions were also tested for their recognition of the products that had been identified by the peer model, as well as those that were featured on the television.

In the advertisement alone condition, children selected salty snacks more often than those in the control condition did. In the advertisement plus similar peer choice condition, children selected salty snacks more often than those in the advertisement only condition, while children in the condition wherein the peer chose snacks that were at odds with the advertisement chose salty snacks less frequently than did the children in the advertisement alone condition. Memory for the featured products and peer choices was high in all conditions (90%-100% and 92%-100% respectively).

The finding that the most powerful manipulation was in evidence when the model's food selections were in accordance with the advertisements led the authors to conclude that peer behaviour coupled with concordant advertising may function in an additive or complementary way. It is likely that children of similar ages are exposed to the same advertisements as well as to peers who may model preferences for the advertised products. When a food is the subject of an advertising campaign, the advertisements might directly affect the behaviour of children within a peer group, but there may also be the additional effect that some of the children within the peer group will display preferences for advertised foods in the presence of their friends.

It is worthy of note that the children in the condition where the peer made dissimilar food choices to the foods advertised chose less salty foods than those in the advertising only condition, showing that peers may also moderate the effects of television advertising. A useful comparison could have been between the choices of the control group and those of the group exposed to the peer who chose items from the range of non-advertised products to gain insight into how much the dissimilar choices of the peers had affected choice of salty foods.

Stoneman and Brody (1981) suggest that there may be differences between the influence of advertising and the influence of peers. Television provides information but does not provide feedback regarding the acceptability of the product, whereas exchanges between peers are a powerful source of feedback regarding the group's acceptability of the message. In the 1981 study, the food selections of the peer may have been interpreted by the observer as reflecting the group norm. It might be the case that even though advertisers try to create significant role models to endorse their products, the technique is less powerful than it might be if coupled with exposure to the preferences of a real life peer.

It would seem a simple procedure for a product manufacturer; devise an advertising campaign and sit back and wait for the effects of the peers to do their work. The question is how does one ensure that members of the peer group model the desired behaviour in the first place?

The studies reviewed above that included a measure of knowledge of healthy eating, demonstrate that children take in information about foods, but that information alone may not translate into changes in either verbal liking ratings or food choice. Since none of these studies report any measure of consumption, any effects of the manipulations on this measure are unknown.

Television Programming

Peterson, Jeffrey, Bridgewater and Dawson (1984) designed a study in which 78 children aged between 5 and 6 years were exposed to videotapes that were presented in the classroom over a ten-day period. Each twenty minute videotape consisted of pro-nutritional excerpts from popular children's programmes, at the end of which were either ten 30 second commercials or ten 30 second public service announcements that gave out health messages. Attention to the videos was recorded, as was recall of the content. The children were assigned to either one of the video presentations or the control group who were not exposed to any of the videotapes. Three tests were carried out before and after the experimental manipulations; in the Behavioural Eating Test, a child was left alone with six foods (3 low in nutritional value, 3 higher in nutritional value) and instructed to 'eat as much you like'. Consumption of each food was weighed at the end of the session. The Pretend Eating Test was devised to measure each child's food 'preferences'. Three sets of six foods, half rated as high in nutritional value and half rated as low in nutritional value were presented to the children who were asked to name all the foods (experimenter supplied the name if necessary) and then instructed to choose one of the foods that they would ask for if a babysitter were looking after them. This food was removed from the array and the question repeated until all foods had been rank ordered. The test for nutritional knowledge contained a range of questions regarding food categories and the nutritive values of foods.

Post-test scores on the Nutritional Knowledge Test for the experimental groups were 'appreciably' higher than those at pre-test and were higher than those in the control group. On the second Pretend Eating Test, children in all groups ranked the 'pronutrition' foods higher than they did on the pre-test of this measure, indicating that these changes were due to the variables other than the intervention. Despite the significant change in both nutritional knowledge and in verbal liking, significant changes were not noted on the consumption measure, i.e., performance on the Behavioural Eating Test.

This study illustrates the danger in assuming that knowledge of healthy eating, statements of verbal liking and consumption are equivalent. The authors went to a great deal of trouble to cover as many aspects of children's eating behaviour as possible, but one very useful calculation was omitted from the report - a comparison between rankings obtained for foods presented in the Pretend Eating Test which was a measure of verbal liking and the consumption measures of those same foods obtained in Behavioural Eating Test. Such a comparison would have shed light on the comparability or otherwise of data collected on measures of verbal liking and those collected on the measures of consumption at the beginning of the study.

Goldberg, Gorn and Gibson (1978) showed 5 to 6 year old children an episode of a popular children's television programme in which a character had to visit the dentist, lost a football game, and lost esteem from friends as a result of eating too much junk food. The message in the programme suggested that eating wholesome foods could help to avoid negative outcomes. Forty-two children took part in one of three experimental conditions: the film interspersed with either advertisements for nutritious foods; sugared snack and breakfast cereal commercials; or no commercials at all. The control group data from the previous study (described earlier in the section) were utilised. Following the intervention, children were asked to indicate, on a display of six that were mounted on a board, which three snack foods they would ask for if a baby-sitter were looking after them. Three of the snacks were sugared, the other three were not and two of each had been featured in the advertising. On a second board, six breakfast cereals were displayed and the children were asked to choose three of these. Again, three were sugared and three were more nutritious and two of each had been featured in the advertising. Following the choice scenario, the children were asked which of the displayed snacks were healthy and which not so healthy. Regardless of condition, all children chose significantly fewer sugared snack and cereals compared to the control group and the programme by itself appeared to be significantly more effective than the public service advertising (used in their first study reported earlier) in reducing the number of sugared foods selected. It is interesting to note that the programme was more effective by itself than when it was paired with public service announcements and that the advertisements for unhealthy foods had no detrimental effects on the effects of the message of the film. As in the first (1978) study, the authors note that all the children were aware of the nutritional values of all foods.

The above study is a further demonstration of the influence of television peer modelling on young children's visual choice of foods. What it does not tell us is whether these would have been reflected in consumption.

Of the research reviewed in this section, only Peterson et al. (1984) give measures of food consumption, the others cite choice measures, that by definition are not the same behaviours. Given that in the Peterson et al. study verbal liking changed and nutritional knowledge increased whilst consumption did not, there does not seem to be a straightforward relationship between these different behaviours.

As a point of the general applicability of these findings, if appealing advertising methods were used with items such as fruit and vegetables, and demand for these foods was increased, how likely is it that they will actually be consumed?

There may be many factors in British society that work against children and healthy eating. Children's television includes a great deal of advertising, much of which is for snack foods or sugary breakfast cereals specifically aimed at children. Given the evidence that humans are born with a biological predisposition to prefer sweet foods, there is a great deal of encouragement, both environmental and biological for children to eat foods that are nutritionally less desirable.

Moreover, most breakfast cereals and confectionery are designed to be perceived as fun - these products are generally packaged in bright and colourful ways so that they appeal to young children. They may also contain free gifts, such as toys etc. Healthier alternatives (apples, bananas, swede or green beans) are rarely promoted in this way.

Another important difference between sweet foods and fruit and vegetables is the way they are used in British and American cultures. Sweet tasting foods are generally used as rewards rather than more nutritious items. It is hard to imagine a situation in British and American cultures in which a parent rewards a child with a juicy carrot. Sweet foods tend to be highly featured in cultural celebrations, for example at birthday parties, at Christmas or Easter. The issue of the cultural use of food as rewards and rewarding food consumption will be discussed in the next section.

Rewards

A third cultural variable that has received much attention in the food literature is that of rewarding food consumption - either with another food or with a non-food item. Results of these investigations suggest that rewarding consumption leads to a decrease in verbal liking of the rewarded food whilst using a food as a reward enhances verbal liking of the reward food but decreases verbal liking for the target food.

Much of the work in this field has been either instigated by Birch and colleagues or has been inspired by the same.

Birch, Zimmerman and Hind (1980) set out to examine how verbal liking for foods can be affected according to the context within which they are presented. In the experiment, 64 children aged between 3 and 6 years verbally taste ranked 8 snack foods (dry-roasted peanuts, raw carrot slices, animal crackers, seedless raisins, dried apples, Wheat-thins, vanilla wafers and cheese goldfish crackers). The children were then assigned to one of four presentation conditions: a reward condition where a food reward was given contingent on the performance of a specified behaviour, a non-contingent attention condition wherein a food was given at random during a play session, a non-social condition in which a food was placed in a child's locker, and a control condition where a food was presented as a snack during the scheduled snack session. The food presented to each child throughout the 21 days of the experiment was the one that had been given neutral rankings by that child. Half the participants were given sweet foods, half non-sweet foods.

The results of the first post-experimental assessments showed that verbal liking was enhanced for foods in the reward and non-contingent attention conditions but not the control.

A second post-experimental assessment, carried out six weeks after the experimental manipulations, showed that the increase in rank order for verbal liking of foods in both reward and non-contingent attention conditions were inflated further than they were in the initial post-experimental assessment. Eight weeks after the end of the experimental phase, rankings for foods in the reward and non-contingent conditions were still elevated whilst those in the non-social group had returned to pre-intervention levels. The control group remained unchanged throughout.

Since the effects of the experimental manipulations were as strong with the non-sweet foods as with the sweet ones, the authors suggest that "positive contexts could be used to increase preference for foods that are not initially highly preferred but are nutritionally more desirable" (p. 861).

In this study, rankings for verbal liking of foods increased and remained elevated when those foods were presented in apparently different contexts, as a 'reward' versus paired with adult attention. A closer examination of these 'different contexts' is warranted. In the 'reward' condition, teachers were trained to present the food to children 'contingent' on the child performing one of a number of behaviours: responding to a verbal request, performing an activity adequately, sustained attention to an activity and co-operative play. Twice each day, when the teacher saw a child perform one of these types of behaviour, she gave the child the food and praised him or her for their performance. In the non-contingent attention condition, teachers approached a child and merely gave him or her the snack food. Is there any real difference between these two conditions since children in both received foods paired with attention from a teacher? There are no data presented to show whether performance of any of the behaviours in the 'reward' condition increased during the experimental phase, thus there is no evidence that the snack foods were reinforcers.

These findings were replicated and extended in a subsequent experiment (Birch, 1981) which was designed to elucidate whether the context effects found in the 1980 experiment were specific to the food presented or whether they would generalise to similar foods in the same category. Twenty-three children aged between three and five years were initially trained to sort pictures of household items. In this procedure, three pictures were placed on a table, two of them depicted items from one semantic category, one from another and the child was asked to "put the ones that are the same kind of thing together". When the child had complied with the instruction, the experimenter then asked how the child knew the two pictures went together. Following the sorting task, the child was presented with eight snack foods: canned peaches; canned pineapple; two types of cheese; peanuts; cashew nuts; goldfish crackers and wheat crackers. The child tasted and named the foods and was then presented with a series of twelve 'triads' that consisted of two foods from one category and one from another (e.g. two nuts and one fruit) with the instruction to "put the same kind of thing together". Verbal liking assessments were then carried out. Pineapple and cashew nuts were selected to be paired with adult attention; as a control for exposure effects the other foods were presented at snack time. The children were formed into two groups that had equal collective rankings (6 from an 8-point scale) for both target foods and for 20 days, an adult presented each child with two pieces of one of the target foods. Rankings of the target foods increased as did the rankings of the non-targetted item in each category *for those children who were able to correctly* *categorise the foods*. Of the children who used food categories as a basis for sorting, 75% generalised the enhanced ranking to the other food in the same category. Only 20% of children who did not use the food categories consistently when sorting showed any evidence of a generalised food preference. Further examination of the data showed that children who used categories as a basis for their sorting performance were significantly older than the non-category sorters with the former having a mean age of 4 years 3 months and the latter a mean age of 3 years 11 months.

Thus, when a food becomes the target of experimental or social intervention, the effects, for children who use categories, may not be limited to the target food. Some support for this view is provided by Dowey (1996) who demonstrated changes in consumption of one novel food that generalised to a second novel food that was similar (in colour) to the first but had not been the subject of the experimental procedures.

In our culture, the consuming of a particular food is often used as the response component of a contingency as well as the reward component. For example, a parent may want a child to eat more vegetables and will instruct him or her to "eat your vegetables and then you can play."

Birch, Birch, Marlin, and Kramer (1982) refer to the eating response as the instrumental component and the reward as the contingent activity and designed an experiment to test the effects of such contingencies on verbal liking of foods that are used as the instrumental component. Twelve children aged between 3 years 6 months and 4 years 5 months took part in the study wherein fruit juice consumption was the instrumental activity and access to play activities the contingent reward. A verbal liking assessment was used to determine each child's centrally 'preferred' juice (i.e. that fell in the middle of the rank orderings) which was then used as the target drink. Verbal liking for the reward activity was determined by allowing the children to engage in the activities during two 30 minute sessions following which each child rank ordered photographs of those activities. The centrally ranked activity for each child was used as the reward component. Baseline levels of juice consumption and time spent in the target activity were then measured. Across the course of the experimental sessions, the volume of juice the child was required to drink in order to gain access to the play activity was increased (in order that the juice was consumed 'instrumentally' i.e. more than the child would consume independently, in the same way that vegetables might be). In order to control for exposure effects, during the course of the experiment children were served with pairs of the other fruit juices at snack time and access to all other play activities was available. Following six experimental sessions during which the contingency was administered twice per session, the verbal liking assessment was re-administered. As predicted, the children's ranking of their target juice had decreased (by 1.4 ranks) whilst there was slight positive shift in ranking for juices that had been given similar exposure and were consumed in similar amounts. No effect on verbal liking for the target activity was found.

A further experiment carried out by Birch, Marlin, and Rotter (1984) was designed to replicate the above findings 'in a more natural environment'. Forty-five children aged between 3 and 5 years were assessed for verbal liking for 7 flavoured milk drinks; the most neutral choice (i.e. the middle ranked drink) became the target drink for each child. There were four experimental conditions and two control conditions. Children in the non-contingent condition consumed as much drink as they wanted and were given praise for doing so. One contingent group were praised when they consumed more drink than in baseline. In a second contingent condition, children gained access to a ten-minute film when they consumed baseline amounts of the target drink, whilst a third contingent group were required to consume more than they had in baseline to gain access to the film. In the control conditions, children were simply either given the drink before being given access to the film or were given access to the film prior to being given the drink with no contingencies imposed. Eight experimental sessions took place, after which verbal liking for the target drink decreased (mean of 1.13 ranks) in all four experimental conditions, whilst there was a slight increase in verbal liking (.43 ranks) in the control groups. Measures of verbal liking for the reward activity were not recorded.

The conditions in this and the 1982 study were designed to mirror parental practices in which foods are employed in the instrumental component of a contingency such as "eat your vegetables and then you can play". The authors conclude that such practices may increase consumption whilst the contingency is in effect, but may actually produce negative shifts so that once the contingency is removed, the probability of consumption is reduced.

Some caveats to both the 1982 and 1984 experiments should be given. Firstly, the purpose of the experiment was to test the hypothesis that 'having children eat foods to obtain rewards might reduce preference for the foods eaten' (Birch et al., 1982 p.

126). What is the evidence that any of the reward activities were actually rewarding to the children involved? All the 'reward' activities in the 1982 experiment were rated by the children themselves as being only moderately preferable prior to the experimental procedures, indeed they were chosen by the experimenters for that reason. In the 1984 study, no measure of preference was taken, either for film watching or for verbal praise; in fact, the experimenters were surprised to find that the verbal praise condition seemed to elicit the same results as the other contingent conditions.

In the control condition in the 1982 experiment, the children were given two of the drinks at snack time that were not presented during the experimental sessions and they were not required to consume any more of these drinks than they normally would. In the 1984 experiment, a separate group served as a control group; children in these groups were also not required to drink any more than they normally would and so meaningful comparison of these data with those from the experimental conditions is not possible.

Perhaps at best what this study demonstrates is that in an experimental situation, encouraging children to consume a drink that they neither like nor dislike in order to gain access to an activity (or possibly to escape from the experimental situation) that they neither like nor dislike, may have detrimental effects on what children say about those drinks.

Moreover, being required to drink beyond satiation is aversive. Feelings of aversion will then be paired with the target drink and the child will quite literally become 'sick of it'. It would not be surprising if their verbal liking for such a drink decreased.

There are also issues of extrapolation and applicability to real life. Since all the target items placed in the instrumental part of the contingency were those ranked as moderately preferred, can these findings be generalised to other foods that a child might rate as highly preferred or disliked? Further, in real life, children don't have to eat beyond satiation; they may be asked to eat foods that are different from those in their current diet, but not more food in total.

Finally, Birch et al. (1984) claim that the procedures employed in the experiment mirror those used by parents when they offer rewards (watching television etc.) in return for a child's compliance with the instruction to "eat vegetables". Is this really the case? Surely the parent is offering a *potent* reward (e.g. television watching or extra pocket money) in return for what is likely to be a disliked activity.

Foods are also used within our culture as 'rewards' for consuming other foods. Consider for example the instruction, "if you eat your vegetables then you can have some pudding." Mikula (1989) devised a series of experiments to investigate the effects of "if-then" instructions on young children's preference for and choice of foods. The taste followed by verbal ranking procedure developed by Birch (1979) was utilised as a dependent measure. Fifty-two children, aged between four and seven years, were assessed on their verbal liking for six foods: yoghurt; zwieback (a kind of sweet biscuit); carrot; apple; cheese; and hazelnut. The two foods ranked in the middle of a child's rank order (3rd and 4th position) were selected for use with that child. The order of presentation of foods was counterbalanced within each group. During three sessions, children in the experimental group were told that they could have the second food after they had eaten the first. In the control group, children were given the second food once they had eaten the first. Verbal liking measures were re-taken at the end of the experimental phase and again six weeks later. Following these assessments, children were offered a choice (this measure was not taken prior to the experimental treatments) between the two target foods and asked to select one to 'have more of'. It is not clear whether the food was actually presented for consumption. Pre- and post-treatment changes in verbal liking were significant for the 'then' food; both post-treatment assessments showed an increase compared to the initial assessment (1.7 and 1.6 respectively). For the 'if' food, a small, non-significant decrease in verbal liking (.5) was noted that did not continue into the final assessment. Verbal liking in the control group remained unchanged for both foods. *Choice* data showed that children in the experimental condition chose the second food more frequently than the first food (compared to controls) and the first food less frequently (compared to controls) but these differences were significant only in the final choice test. However, there are no pre-intervention data to compare the post-treatment choices with and it has not been established that choice data and preference data are equivalent.

Contrary to the experimental hypothesis, no negative effects on verbal liking were found for foods when they were placed as the 'if' component in the 'if-then' contingency whilst positive effects were noted for foods placed in the 'then' position.

Mikula's second experiment was designed to test the effects of using a 'relatively disliked' food in the 'then' part of the contingency with a 'neutral' food as the 'if' part. This is said to be similar to the instruction 'eat your pudding and then you can have some vegetables'. Thirty-seven children aged between 3 and 6 years were assessed on their verbal liking of seven foods: bread roll spread with either cheese, liver sausage, or cottage cheese with herbs; a piece of green pepper; tomato; apple or yoghurt. The foods that each child ranked fourth were used as the 'if' food and those ranked sixth the 'then' food. Dependent measures were verbal liking data collected prior to and a few days after the experimental manipulations and again five weeks after the end of the experiment. Choice data (children were shown the two foods and asked to choose one to have more of) were collected midway between the experimental manipulations, and also at the same times as the second and third verbal liking assessments. In the experimental condition, children were presented with the foods in the contingency with the least preferred as the 'then' food, whilst those in one control group were presented with the foods in the same order, but non-contingently. In a second control group, children were presented with both foods simultaneously to control for possible sequencing effects. The only significant effect found was an enhanced verbal liking for the lowest ranked food in all conditions (including the controls). Choice data showed that the second food was chosen first more often *only when data for both control groups were combined and the assessment time* (whether data were collected at time 2 or time 3*) was disregarded.* The authors note that since the choice data for the two foods are not independent, it would be impossible to say whether any effects were due to an enhancement in liking for the 'then' food or a decrease in liking for the 'if' food.

In this case, employing foods in an 'if-then' contingency "turned out to be ineffective not only with regard to the evaluation of the foods in the 'then' position, but also with those addressed in the 'if' part" and this was true even though the number of exposures to the contingency had been increased from three in the first experiment to six in the second experiment. This finding led Mikula to comment that

> one has to conclude that there is not much evidence supporting the idea that repeated implementations of 'if-then' contingencies....may be able to weaken children's dislike of foods" (Mikula, 1989, p. 234).

It is difficult to see how the above experiment is related to the "eat your pudding and then you can have your vegetables" scenario, when presumably, pudding is a highly preferred food. In the experiment outlined, the 'if' food was ranked as fourth out of seven foods – hardly a rating of 'highly preferred'.

In a final experiment, the experimenter turned his attention to a slightly different issue – that of ensuring consumption of a 'new' food. Would it be more effective to introduce the new food as a reward (i.e. second food) for eating a familiar food, rather than as an 'if' food with the reward for eating it being a familiar food?

Papaya was used as the unfamiliar food and apple as the familiar one. Familiarity was based on a survey of fifteen children (similar age to those taking part in the experiment) who did not participate in the experiment itself and both apple and papaya were ranked by these children as 3rd or 4th in a set of foods that also included banana, strawberry, kiwi and mango. All 56 children who participated in the experiment were aged between 3 and 6 years. In one experimental group, children were told that they would be given the apple if they ate the papaya, whilst in the second experimental group, children were told that they would get the papaya if they ate the apple. In the two control groups, children were given either the apple or papaya followed by the second fruit. Following a single trial, children rated their preference for each fruit using a rating scale of five faces and were asked to choose one fruit to have more of. Mean preference data showed that regardless of type, the food presented as the 'if' component was rated significantly lower in the experimental group than by the controls. Significant enhancement effects were found with the food presented as the 'then' component, when the food was papaya, but not for apple. The choice data showed that the control group tended to choose the apple regardless of whether it had been presented as the first or second food, whilst those in the experimental group tended to choose the food that had been presented as the second food regardless of whether it was the apple or papaya.

In this case, the 'if-then' contingency had a significant effect on both preference ratings and choice *in one single trial*, whereas no effect had been noted in the previous two experiments even though there were (three and six respectively) more trials in the first two. Thus, the effects of the manipulations may well be transient and quite possibly would disappear if further trials had been included in the study. It is just as possible that if the first two studies had consisted of only one trial, similar effects to those in this final study would have been noted. Once a food is no longer novel or unfamiliar, presumably after one trial, history effects may then come to the fore.

Newman and Taylor (1992) carried out a similar experiment to that of Mikula. A total of 86 children took part: 18 pre-schoolers with a mean age of 4 years 6 months; 28 kindergarteners with a mean age of 5 years 5 months and 40 first graders with a mean age of 6 years 5 months. All were assessed for their verbal liking of eight snack foods that included: sweet animal crackers; dried apples; raw carrot; Cheerios; Melba Rounds; popcorn; raisins and Wheat Thins. In this version of the Birch (1979) preference procedure, children were purposely not asked to name each food, nor did the experimenter provide a name in order to 'eliminate any possible influence from previously being told positive or negative things' (p. 206) about any food. Target snacks for each child were the fourth and fifth ranked foods from his/her stated preference order with the presentation order of foods counterbalanced across each experimental group. In the means-end contingency condition ('if-then') the second food was placed on a table and the child was told that he/she could 'win' some of that food by eating the first snack. In the temporal order condition, no contingency was placed on consuming the foods, which were presented one after the other. In the mere exposure condition, the two snacks were left for the subject to consume (simultaneous presentation of both). In a post-treatment condition, following the single intervention, subjects could choose one of the snacks and was encouraged to eat it. He/she was then asked which was the nicer snack and why. A post-intervention verbal liking assessment involving all eight snack foods was also carried out. The data were first analysed to show whether subjects in each group had changed their relative rankings between the two foods, i.e. their relative 'attractiveness'. Prior to the intervention, children in all groups rated both foods equally. Following the intervention, the mere exposure group continued to rate the two foods fairly equally, whilst there was a small change in the temporal order group so that the first snack became slightly more preferred than the second snack (although not significantly). In the means-end condition however, the divergence was much greater; the first snack was significantly less preferred and the second snack significantly more preferred. The difference was found to be due to treatment effects on the first snack; changes in rankings of the second snack were in the same direction for all groups. Interestingly, the children's responses to the questions of which was the nicer snack and why, were not related to treatment groups. Unfortunately, choices of additional snack at post-treatment are not presented and thus it is not possible to make any comparisons between post-intervention choice, post-intervention ranking on the verbal liking assessment and responses to the experimenter's post-intervention questions.

In this experiment, the effect of placing foods in a contingency was that the 'if' food comes to be devalued, and so when this practice is used by a parent at home, the authors propose that

> the effect of this procedure is counter to the spirit of the parent's goals in that it has it's effects by depressing the perceived value of the very thing which the procedure was aimed to enhance in value. (Newman & Taylor, 1992, p. 213).

Despite the lack of correspondence between children's post-intervention verbal reports of why they chose a particular food over another 'to have more of', Newman and Taylor suggest that children are

> able to construct scripts which would enable them to attribute meaning to the order in which adults present activities, foods, etc. to them. (Newman & Taylor, 1992, p. 214)

and further that

> the more valuable the reward is made to appear, relative to the means, then the more likely it is that the procedures will encourage devaluing the means. (Newman & Taylor, 1992, p. 214)

There are four points to be made regarding the Newman and Taylor study. Firstly, their intervention consisted of only one trial and it is possible that if further interventions had been introduced, the effects may have disappeared, as may have been the case in the Mikula study. Secondly, the foods used in the study were selected to be of 'medium appeal' (Newman & Taylor, 1992, (p. 205) (based on parental reports) and from within those eight foods, those that were ranked fourth and fifth by each child were presented in the treatment conditions; neither ranking can be said to be 'highly preferred' let alone 'rewarding', yet, the authors are able to claim that the more valuable a reward, the more devalued will be the target food. Thirdly, when Newman and Taylor talk about significant changes in preference for the 'if' food, the actual obtained decrease in ranking for the first food from 4.4 in the initial assessment to 5.23 in the post-treatment assessment is a difference of .83 of a rank. This may be experimentally significant, but how meaningful is it outside of the experimental situation? The figure of .83 is based on mean scores of the group of children; individual rankings are not given, and so it is not possible to say how many children changed their rating of the means food or the direction of the change.

In this section, the experimental evidence for the usefulness of rewarding food consumption has been reviewed. The two types of reward procedure investigated were the use of foods as rewards and the rewarding of food consumption either with another food or with access to an activity. With regard to the former, verbal liking of foods both sweet and non-sweet was found to be enhanced, at least when paired with adult attention (Birch, Zimmerman & Hind, 1980). These effects were found up to eight weeks after the experimental procedures were concluded. There was also evidence of generalisation of the enhanced preference to other foods in the same category as the targetted food. Whether the foods used in these experiments actually functioned as rewards is open to question.

With regard to the issue of rewarding food (or drink) consumption, the evidence is less clear. Some researchers found a decreased preference for the food or drink consumed instrumentally (e.g. Birch et al., 1982 & 1984; Mikula, 1989 experiment 3; Newman & Taylor, 1992) others have found no effect on the instrumental food, but an increase in preference for the food used as a reward (Mikula, 1989). Further, some authors (Mikula, 1989; Newman & Taylor, 1992) have found differences between stated preferences and choice measures. Thus, the picture is one of confusion.

It is likely that the differences in findings lie in the methodology employed by the experimenters, namely use of short-term treatments, poor/improper interpretation of what constitutes an experimental contingency, using activities or food items as 'rewards' when they have not been shown to be rewarding to the participants.

CHAPTER 3

BEHAVIOUR ANALYSIS

Chapter 3
Behaviour Analysis

The research presented so far has been concentrated on culture and the variables within culture that impact on eating behaviour; culture itself defines which substances are edible, whilst various cultural practices (exposure, modelling, rewards) largely determine which of those substances are consumed or rejected.

The concept of culture and its power to shape the behaviour of its members is central to the theory of Behaviour Analysis, in particular to Radical Behaviourism, which holds the view that verbal behaviour is the key to the development, maintenance and transmission of a particular culture and its practices.

It is this theoretical standpoint that has informed the experimental work to be presented in this thesis and from which the research presented in Chapter 2 will be re-examined.

Language and Culture

For Skinner (1971) a culture can be defined as the practices, both verbal and non-verbal that people share. These practices are acquired as the result of membership of a group; the group arranges consequences for the behaviour of its members. Children growing up in British society learn the customs of that culture and in turn, pass them onto others. One very important means of maintaining and transmitting cultural practices is through language, and it is the acquisition and use of language that is central to the Radical Behaviourist account of human learning.

> 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).

According to Skinner (1989) verbal behaviour demarcates animal and human behaviour and allows humans to benefit from much cultural knowledge via the "exclusively human" usage of contingencies.

> The so-called intellectual life of the mind underwent an important change with the advent of verbal behaviour. People began to talk about what they were doing and why they were doing it. They described their behaviour, the setting in which it occurred and the consequences. (Skinner, 1974, p. 132).

Prior to the acquisition of language, the behaviour of a human infant, like that of other animals, is directly affected by the environment. With the advent of verbal behaviour, a child is freed from the "spatial, temporal and mechanical relations" (Skinner, 1974, p. 99) that exist between operant behaviour and non-social consequences; the child is able to talk about the environment and her relationship to it, using the labels that are generated, taught and maintained by the other members of the same verbal community. The fundamental difference in psychological functioning between animals and verbal infants is that animals respond only to events in the environment, whilst the infant can also respond to her own words about those events (see Lowe, 1983, also Luria, 1961; Vygotsky, 1934/1987).

Verbal behaviour comes to control not only one's own behaviour but also the behaviour of others and its effects on other people reinforce the verbal behaviour itself. Skinner (1974, p. 99) gives the example of opening a door wherein one can turn the handle and push and thereby be rewarded by the consequence of opening the door. Alternatively, one may ask another person to open the door to achieve the same objective.

The following section will outline the essential characteristics of verbal behaviour; naming and categorisation, rule-governed behaviour and the relationship between saying and doing.

Naming and Categorisation

All humans use the ability to put objects and labels into categories. For example, anyone who has learned the category of 'bird' will respond appropriately to all birds whether or not each one has been encountered before. This behaviour is puzzling since in many cases, stimuli in categories do not bear any physical resemblance to each other. Horne and Lowe (1996) propose a way that physically different objects can be functionally interrelated, i.e. as a named category; the earliest form of rule-governed behaviour. The emergence of categorisation behaviour can be best understood within the context of the development of verbal behaviour.

In the initial stages of language development, a child learns listener behaviours, firstly to orient towards an object on hearing an auditory stimulus, for example on hearing the word 'dog', look at a dog. After many repetitions in a wide variety of settings, with different dogs, on hearing the name dog, the child will orient herself not only to one dog, but also to any other dog in the environment. She may also perform dog-related behaviours, stroking, or patting, in response to the auditory stimulus, 'dog' regardless of whether a dog is actually present. Conditioned seeing of dogs (Skinner, 1953) may also occur. According to Horne and Lowe, it is in the course of learning these listener relations that the child begins to move away from 'a perceptual world to a conceptual world' (in press). Continued responding to auditory stimuli results in the child's orientating to an ever-widening set of objects that although diverse in appearance, have one common feature - the same name.

Following the establishment of these listener relations, the child learns the echoic response, whereby the auditory stimulus 'dog' serves as a discriminative stimulus for the child's own verbalisation 'dog' in the presence of a dog.

From the above, it can be seen that an auditory stimulus (e.g. 'dog') sets the occasion for both listener behaviour (orienting towards dogs, dog-related behaviour, conditioned seeing) *and* the echoic response (child's own verbalisation) 'dog'. When, in the presence of one or more dogs, the auditory stimulus 'dog' is spoken, the child orients to towards a dog (or dogs) and, *at the same time* utters the echoic response 'dog'. According to Horne and Lowe (1996; in press), after these behaviours have been frequently repeated, the object itself may come to occasion the child's own verbalisation of 'dog' and such tacting once established, completes the 'name relation' that is:

> a functional union of speaking and listening that draws together tact, echoic, and listener relations – is the basic unit of verbal behaviour, upon which all of the complexities of human language are founded. (Horne & Lowe, in press)

The Horne and Lowe account can usefully explain how categorisation comes about. When the name-relation has been established with one exemplar from a class of objects then it can be extended, through generalisation, to include other stimuli that are physically similar. Objects that are physically dissimilar to one another come to be functionally interrelated through the name itself. The caregiver supplies a common name to a range of exemplars, the child echoes the common name in the presence of those exemplars and thereby incorporates those objects into her own common name relation.

Foods are generally categorised into classes such as fruit and vegetables and these verbal classifications may impact on the way a child responds to a particular food. Suppose, a child eats a spinach leaf on one occasion and for some reason finds its taste aversive. That same child may subsequently learn that spinach is also a vegetable; this one experience may cause the child to form a rule such as 'vegetables are horrible' and will be less likely to try a new food that has been labelled as a vegetable than a child who has not formed such a rule.

Using this same logic, it may also be possible to use categories to increase the likelihood of consumption of a *range* of foods by giving them a common label, for example presenting cucumber, or sweet potato (or other vegetables that are most acceptable) and labelling these as vegetables. Once consumption of these foods is established, consumption of other members of the class 'vegetable' will be more likely.

In addition, it may be possible to effect changes in consumption of categories of foods by attaching other labels to the category label for example, 'vegetables are cool' or 'vegetables taste great.'

These possibilities serve to illustrate Horne and Lowe's assertion that in the case of categories, "a name relation of this kind is a functional unit with extraordinary generative power". (in press)

Rule-governed behaviour

Once verbal behaviour is established, it comes to control other behaviour, and then behaviour diverges and may be either *contingency-shaped* or *rule-governed,* with contingency-shaped behaviour being behaviour controlled or shaped directly by it's consequences, and rule-governed behaviour being behaviour under the control of a rule; the latter being defined as "a contingency specifying discriminative stimulus" Skinner (1969, p. 133-171).

The topography of both rule-governed and contingency shaped behaviours may be similar, but the controlling variables are different. A person following directions or instructions may not behave *exactly* as a person who is directly exposed to the contingencies because verbal descriptions themselves are never complete or exact. To illustrate the difference between contingency-shaped and rule-governed behaviour, Skinner provides the example of a novice and professional snooker player. A professional player takes shots based on 'instinct' whereas a physicist may rely on working out angles and distances. The difference can be thought of as *knowledge by description and knowledge by acquaintance* (Russell, 1912/1961) where rule-governed behaviour is the former and contingency-shaped behaviour the latter; or *knowing that* and *knowing how* (Ryle, 1949) where rule-governed behaviour is the former and contingency-shaped behaviour the latter.

Skinner (1969) provides a further distinction; contingency-shaped behaviour is based on what has happened in the past (previously reinforced) whilst rule-governed behaviour is based on what will happen in the future (an expectation that a certain consequence will follow an action).

It is not always easy to make clear distinctions between behaviours that are rule-governed and those which are contingency-shaped. Often, behaviour that begins as rule-governed develops into contingency-shaped behaviour. Take for example, driving a car. At first, one takes lessons and learns all the 'rules' of the car and the road. Eventually, as one becomes an experienced driver, the driving behaviour that began on the basis of rules becomes increasingly contingency shaped. As Skinner (1974) points out, "to learn to drive simply through exposure to the contingencies would take a very long time." (p. 134). Following rules makes it possible for the learner to come under the control of the natural contingencies quickly and safely. Thus, rule following allows behaviours to be learned quickly.

According to Baum (1994) when biologists and anthropologists talk about beliefs, ideas and values of a culture, they are probably referring to the culture's tradition of verbal behaviour. The particular rules that are used in a culture may also distinguish that culture from others. Recall the discussion in Chapter 2 regarding the subset of foods that are defined as edible in different societies around the world. Jewish people do not eat pork and Hindus do not eat cows, both are examples of how the rules of a culture distinguish that particular culture from others.

Rules are of particular importance to a culture and appear in different forms; as laws, instructions or knowledge of the environment. Examples of rules and rule following pervade our culture. Skinner (1974, p. 133) lists three different kinds:

Commands, advice and warnings are examples of verbal behaviour that describe actions and imply a consequence. For example, as a command, "Go home" tells the listener not only how to behave, but also that the speaker has arranged aversive consequences for non-compliance. As a warning or advice, "Go home!" tells the listener how to behave and that there are non-speaker related positive consequences for doing so. Go home and avoid trouble or go home and you'll find a meal waiting for you.

Directions and instructions describe behaviour that will lead to a consequence, for example following a recipe in a book leads to the consequence of a nutritious meal, or following road signs leads to a geographical destination.

Folklore, maxims and proverbs can be transmitted from generation to generation because the contingencies they describe are long lasting. Proverbs such as "an apple a day keeps the doctor away" may be particularly effective because the advantages of the behaviour they specify are often long deferred and do not function well as reinforcers.

Rules in the form of laws can be used to control the behaviour of great numbers of people and thus save them from directly contacting the contingencies. For example, observing laws regarding drinking and driving or driving at excessive speed can save many accidents on the road; however, most people don't drink and drive or drive too fast because there are rules and consequences that prohibit those behaviours, rather than because they have directly experienced the consequences of doing so (i.e. have not been involved in a road traffic accident).

Rules can also serve to make it easier to profit from similarities between contingencies. For example when instructing a person in the use of a particular computer software package, it may hasten the learning if the student is told that the package operates in a similar way to one he is already familiar with.

Rule-following may enable people to achieve long term goals when direct reinforcement is non-direct acting or delayed:

> human beings optimise outcomes by following instructions or rules that specify the outcomes of their actions; it is not the delayed outcomes but rather the rules stating those delayed outcomes that more directly control the actions. (Malott, 1989, p. 283)

Dowey (1996) describes how direct acting and non-direct acting contingencies might affect choosing to consume a healthy diet. The physical consequences of a healthy diet, such as being fitter, healthier and living longer are outcomes that are delayed and may even be improbable. Of those people who do eat healthily, many suffer ill-health and some die prematurely. In addition, there are very few immediate health benefits to consuming a single portion of any particular food - the consequences are generally additive. Similarly, the outcome of an unhealthy diet is also delayed and may also be improbable; not everyone who consumes a diet high in saturated fat and sugar will suffer from CHD. The immediate consequences of eating fatty sugary foods (taste) may even function to reinforce that very behaviour. Thus, in the first scenario, the ultimate consequences are delayed, and there are only weak direct-acting consequences. In the second scenario, the ultimate consequences are also delayed, but there are strong direct acting consequences at work. In order to persist in following a healthy eating plan, a person must be able to state the delayed outcome of their behaviour.

In a similar vein, Baum (1995) suggests that following a rule that points to long term consequences may also engender contact with short-term consequences, and he gives the following (appropriate) illustration of such a process:

> the speaker (e.g., a parent) says something like 'eat your vegetables,' which is equivalent to 'If you eat your 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. (Baum, 1995, p. 6)

Zettle and Hayes (1982), propose that rule-governed behaviour involves two sets of contingencies; one relating to the natural consequences of the activity, the second being verbal or social in nature. In their example, a person is instructed to fast for one day. This might be for medical or religious reasons, so that even though not eating food is aversive, the rule of fasting is followed in order to avoid any negative social (or medical) consequences.

In addition to different types of *rules*, different types of *rule-following* may exist. Hayes, Zettle and Rosenfarb (1989) have identified three different conditions under which rules might be followed: pliance, tracking and augmenting.

Pliance is said to be the fundamental unit of rule-governed behaviour. In this case a rule is followed because of who is providing the rule and the perceived consequences that the speaker could deliver. Hayes et al. (1989) give the example of a child being told by her parent to wear a sweater when going outside. If the child wears the sweater because of the consequences involved from the parent, then this is pliance. If the child refuses to wear a sweater precisely because she has been told to by the parent and failing to follow parental rules is reinforcing, then this is still pliance, but may be known as *counterpliance* since the form of the rule and the behaviour do not match. Wearing the sweater for any other reason, for example, to show to a friend or to keep warm, is not pliance.

Tracking occurs when a person follows a set of directions in order to achieve a particular consequence. It is rule-governed behaviour under the control of the apparent correspondence between the rule and the way the world is arranged. Unlike the case of pliance, in tracking, the speaker does not mediate compliance, rather, it is the listener's history with regard to following other rule-givers, or making contact with the consequences that ensures that rule following occurs. Thus, no actual speaker is required; rules can be followed from a book, for example.

Augmenting is said to be rule-governed behaviour 'under the control of apparent changes in the capacity of events to function as reinforcers or punishers.'(p. 206). It is a verbal stimulus that functions as an establishing stimulus. In an advertisement for a fast-food chain a picture of a large burger with a verbal description such as 'aren't you hungry?' may establish the consequences of eating as desirable, even though this wasn't the case prior to seeing the advertisement.

Dowey (1996) provides a useful illustration of the different types of rule following discussed above. A child may be reluctant to eat vegetables and refuses to consume them when they are presented during a family meal. The parent (who is aware of the health benefits of vegetable consumption) instructs the child to eat the vegetable. Such instruction may include a consequence, such as the promise of a sweet for compliance or a punishment for non-compliance such as no television. The child may follow the instruction as a ply and eat the vegetable to contact or avoid the speaker-mediated consequences. (The rule will not be followed however, if the child perceives the parent as being unable to mediate the consequences, for example, in the past the parent has not carried out the television ban of has not given the promised reward.)

The child may continue to eat vegetables via pliance, but then may begin to think of eating vegetables as a good thing to do for health reasons. Perhaps a television programme has had a feature on the benefits of eating a balanced diet, or a favourite magazine has a similar feature. In this case, the child may start to track his own self-formulated rule such as "I eat vegetables because they are good for me" rather than eating as a ply as before. In this way, the difference between pliance and tracking becomes blurred.

Pliance or tracking may lead to contact with natural consequences of eating a food. The child may be reluctant to consume vegetables because he has been following his own self-generated rule that all vegetables taste disgusting. When he complies with his parents instruction to eat a vegetable, the natural taste of the vegetable may be enough to maintain the behaviour, so that the rule becomes 'some vegetables taste nice' and control has passed from the speaker mediated consequences to the natural consequences of eating. Prolonged pliance or tracking may eventually lead the child to contact the long-term natural consequences.

Augmenting might occur if the child sees an advertisement during a television programme that suggests the reader may be hungry and in need of an apple to satisfy that hunger.

Experimental evidence

Rule-governed behaviour has been investigated experimentally, in the context of performance on reinforcement schedules once,

> It quickly became clear that humans often would not show the same kinds of effects of behavioural manipulations even though these effects were nearly ubiquitous in the rest of the animal kingdom (Hayes, 1989, p. 192)

Differences between humans and animals have been found in performances on schedules of reinforcement, both on fixed interval and fixed ratio schedules and

> is evident both in response patterning and in sensitivity to the schedule parameters. The evidence also suggests that the occurrence of rule-governed behaviour in humans may also give rise to some of these differences. (Horne & Lowe, 1993, p. 29)

Possessing a verbal repertoire enables humans to generate their own rules about what is required of them in the experimental situation. In responding to a schedule, humans may formulate their own description of the contingency, or the experimenter may provide the description. However they are generated, these 'verbal antecedents' seem to control responding rather than the actual contingency of reinforcement.

Evidence to support the view that subjects in experiments formulate their own rules and these rules control their behaviour rather than the imposed contingencies has been documented by Lowe (1979). It was found that attenuating subject's own verbal descriptions (by providing a response clock to measure the schedule interval) resulted in responses that were sensitive to the schedule parameters and much more animal-like in their patterning.

A series of experiments by Lowe and colleagues (Bentall, Lowe & Beasty, 1985; Bentall & Lowe, 1987; Lowe, Beasty & Bentall, 1983) showed that the development of verbal behaviour greatly affects performance on reinforcement schedules. On fixed interval schedules, children's performances differed depending on their linguistic abilities. Five year olds responded in a similar way to adults, whereas pre-verbal infants response patterns were indistinguishable from those of animals. Children between these two age ranges, (the subject matter of this thesis) showed irregular responding, somewhere between that of animals and that of adult humans,

> which appears to mark a transitional stage between animal and human adult-like behaviour (Bentall et al., 1985, p. 177).

When the experimenters gave instructions to this group of children (e.g. "press faster") the children subsequently showed patterns of responding that were like those of the adults.

The results of experiments examining human performance on reinforcement schedules have prompted some suggestion that rule-governed behaviour may in some cases, be insensitive to its consequences. It may be, as Catania, Shimoff and Matthews (1990) argue, that such insensitivity is an advantage and makes rule-governed behaviour useful. The issue of sensitivity has not yet been resolved and it is not in the remit of this thesis to further the debate. Suffice it to say that there are three positions on the matter; according to Grant and Evans (1994) rules may increase sensitivity in responding. They can establish control over behaviour very quickly and rule control can in some cases, allow humans to respond quickly to changes in contingencies. Insensitivity may only persist where contingencies support it and will be extinguished when responding is punished: see Vaughan 1989, p. 109). Finally, Catania, Shimoff and Matthews (1989) note that rule-governed behaviour is sensitive to contingencies only to the extent that the rules are consistent with those contingencies and when this is not the case, "the contingencies that maintain rule-following, even though often remote, may override the other consequences of the behaviour." (p.120). In this way maladaptive rules may continue to be followed despite any aversive consequences. Thus, providing a person with inaccurate rules regarding a contingency can lead to inappropriate or inefficient performances. This view is consonant with the suggestion that behaviour must be considered in terms of the *two* contingencies with which it may be in contact; the natural and the social. Whether or not a rule is followed will depend upon the person's history of rule-following.

Saying and Doing

There exists a wide body of literature (Baer, Detrich & Weninger, 1988; Deacon & Konarski, 1987; Israel, 1978; Risley & Hart, 1968) showing the results of investigations into the relationship between verbal and non-verbal behaviour, or what a person says he will do and what he actually does. This literature is of import to this thesis because it has been shown that reinforcing verbal behaviour doesn't always impact on the actual carrying out of that behaviour; the verbal behaviour will increase, but the physical behaviour may not. Some of the experiments reviewed in the television modelling section highlighted the anomaly that exists between a child's knowledge of what to eat for health and the same child's actual food choices. The message from the correspondence training literature is that in order to ensure that a person will do what he says he is going to, it is important that he is rewarded for carrying out the promised behaviour. It follows from this that reinforcing a child for saying he will eat his vegetables does not necessarily mean that he will do so. If he does, it is important that the promised eating behaviour is rewarded too.

Summary

This chapter introduced the field of Behaviour Analysis and Radical Behaviourism. It was shown that verbal behaviour is central to the radical behaviourist view of culture and how developing verbal behaviour transforms functioning.

The essential characteristics of verbal behaviour and how they might impact on eating behaviour were discussed; naming and categorisation, rule-governed behaviour and the relationship between saying and doing.

When children categorise foods, they may use their knowledge of existing exemplars to respond to new ones, so that having previously eaten other vegetables with relish, a child may do the same with vegetables that they have not previously encountered. Alternatively, if a child has previously refused to eat other vegetables, they may refuse to consume new exemplars. Adding positive descriptions to food categories (vegetables taste great) may increase the likelihood of their being eaten.

Given that more than one type of rule-following may exist, it may be more desirable in applied settings to promote tracking rather than pliance. Tracking is not dependent on speaker mediated consequences, and thus does not require that the person issuing the instructions be available to monitor performance. Tracking may also be more likely to continue beyond the experimental context, and so it may be useful to focus on the natural consequences of behaviour (e.g. 'these foods taste great') rather than any reward. In cases where the natural consequences are not likely to be sufficient (at first) to promote the desired behaviour, then promoting pliance before shifting to tracking would be a useful strategy.

Rule-following may be the framework within which to best understand the behaviour of people who attempt to modify their diet to eat more healthily; their attempts may be seen in terms of short and long term consequences, with little of the former and no guarantee of the latter. It may be useful, from an applied perspective, to programme short term consequences for those people who would like to change their diet – perhaps by offering rewards to vegetable or fruit eaters. Other, longer-term consequences may then follow, for example the dieter may begin to enjoy the taste of the healthier foods, or may lose weight.

The next section will examine, from a radical behavioural perspective, the cultural variables that were the focus of the general literature on the psychology of human food intake in Chapter 2

CHAPTER 4

EXPOSURE, MODELLING AND REWARDS: A RADICAL BEHAVIOURIST PERSPECTIVE

Chapter 4

Exposure, Modelling and Rewards from a Radical Behaviourist Perspective

Exposure

The focus of the research presented at the beginning of Chapter 2 was the role of exposure in decreasing taste refusal and increasing verbal liking for foods. In Chapter 2 it was noted that taste exposure was necessary to reduce neophobia and increase preference for foods. It was further noted that contrary to many parent's experiences (as well as being contrary to the notion that children are neophobic) experimenters report little difficulty in getting children to try experimental foods.

Perhaps a more useful way to view food acceptance is that the likelihood of a food being eaten will vary with the context within which it is presented; situations parents describe when their child will eat foods at a friend's house that they won't eat at home, and an experimenter achieving consumption in the experimental situation are examples of different contexts with different variables at work in each. Neither the experimental context nor the home environment can accurately be referred to as 'mere' exposure, but involve social or speaker-mediated contingencies, or both.

If food consumption is the desired outcome, then contingencies operating within a given context must be identified and manipulated to both induce initial tasting and also ensure repeated consumption. Then the child will have the opportunity to contact the natural contingencies of ingesting a particular food, the result of which may be, as Rozin (1982) says, "forced exposure is eventually internalised and the individual develops a liking for the food".

Modelling and Imitation

Culture would probably be impossible without imitation. (Baum, 1994, p. 217)

Modelling is a term that covers imitation and observational learning. When one person performs a behaviour that prompts imitation of that behaviour by an observer, imitation is said to have occurred. Imitation is one of the most efficient means by which cultural practices can be transmitted. Once an imitative repertoire has been acquired, rapid learning can occur, in many cases after only a single trial. Imitation provides a base for operant learning – an action induced by imitation can be reinforced and shaped into other forms.

Skinner's (1959) position on the phenomena of imitation is that it is not instinctual, but develops as the result of discriminative reinforcements:

> When we see people looking into a shop window, we are likely to look too – not because there is an instinct of imitation, but because windows into which other people are looking are likely to reinforce such behaviour. (Skinner, 1953, p. 120)

Thus, behaving in the same way as other people is likely to be reinforcing.

It is generally agreed (e.g., Baer & Deguchi, 1985; Gewirtz & Stingle, 1968) that generalised imitation emerges as a response class; the first imitative responses occur by chance, perhaps via direct physical assistance or by training and these are strengthened and maintained by direct reinforcement from the environment. When several imitative responses become established (by similar means) a class of diverse but functionally equivalent behaviours is acquired that is maintained by reinforcement on an intermittent schedule. Variations in the content of these responses are not important; the responses are part of the imitative response class that is defined functionally by reinforcing agents.

Baer, Peterson and Sherman (1967) demonstrated, in a study involving three severely retarded children aged between 9 and 12 years, that generalised imitation can be learned. Initially, the experimenters had to train one simple imitative response (arm raising) through shaping and physical prompts. Other simple imitations were then trained with less and less prompting and at the end of the study, participants were able to produce untrained imitations following the verbal prompt "do this".

Gewirtz and Stingle (1968) suggest that imitative responses can occur in the absence of reinforcement because the entire response class is maintained by intermittent reinforcement, whilst Baer and Deguchi (1985) argue that intermittent reinforcement can account for the maintenance of existing imitations, but not for new imitative responses that are acquired without shaping or direct reinforcement. They posit the view that conditioned reinforcement accounts for new imitative responses. Once the response class of imitation is established through direct reinforcement, the similarity of the model's behaviour and the observer's imitative responses become a conditioned reinforcer for new imitations. Providing some members of the response class are reinforced, generalised imitations will be maintained.

Whatever the underlying processes involved there is little doubt that imitation is an important means of acquiring behaviours and can be established at a very early age. Poulson, Kymissis, Reeve, Andreatos and Reeve (1991) demonstrated generalised imitation in infants aged between 9 and 12 months. In their study, the parents of three infants modelled vocalisation of sounds, classed as either 'training' or 'test' sounds. The parents reinforced the infants' vocalisation of the 'training' but not the 'test' sounds. After several sessions, each child was able to vocalise the sounds that had not been reinforced.

Observational Learning

In imitation, the observer's behaviour corresponds to the observed behaviour of the model; i.e. the topography is the same. This may also be a feature of observational learning, but it is possible for other relationships to exist between a model's behaviour and that of an observer. For example, an observer can learn when or how *not* to do something. Whitehurst (1978) suggests that there are three characteristics of a model's behaviour that can control the response of an observer: it's topography, the discriminative context, and it's function.

Topography, (as in the behaviour of the observer matching that of the model) has already been discussed and includes examples of behaviour such as a model producing a new word and an observer imitating it.

A *discriminative context* is the cue for the observer to make a response (and can also be the cue for the model to perform). For example, a model *points* to a preferred toy amongst a box full of other toys. The model picks up all the toys and asks the observer to *say* which toy was the model's favourite. No relation exists between the model's pointing response and the observer's verbal response, but the same stimulus is controlling the responses. In the presence of the toys, the model pointed and the observer made a verbal response. Likewise, a child may say 'shoe' in the presence of shoes and boots. Following a person modelling the correct labels, the stimulus boot will control the child's future verbal response 'boot'.

Function – the outcome of an observer's response may be the same as the outcome of the modelled behaviour, but the topography of both behaviours is different. One person can clean a car using a bucket and a cloth, whereas an observer might use a hosepipe and brush. The outcome is the same, both have clean cars, but the responses themselves are not topographically related.

One other feature of observational learning sets it apart from imitation - the observer can observe the consequences of a model's actions, i.e. the observer can see if the behaviour of the model is rewarded or punished and the effects of this 'vicarious learning' impact on the behaviour of an observer.

A modelled response that is followed by positive consequences for the model is more likely to be imitated than one that is followed by punishing consequence (Kazdin 1973; Ollendick, Shapiro & Barrett, 1982; Thelen & Rennie, 1972). From a behaviourist viewpoint, a modelled consequence probably functions as a discriminative cue for extrinsic reinforcement of the observer's later imitation. If this is so, then its effects should decrease over time if no direct reinforcement is given to the observer's imitations. In an applied setting, one would not expect reliable maintenance or generalisation of behaviour that has been modified with the use of vicarious reinforcement.

Studies that investigate the role of vicarious reinforcement in observational learning have been criticised for the short-term nature of the measures used, often only one or two brief experimental sessions (Deguchi, 1984, Whitehurst, 1978). One study by Ollendick, Dailey and Shapiro (1983) was designed to assess longer-term effects of vicarious reinforcement on the behaviour of children. Across the course of the study, performance of a task that was directly reinforced improved, whilst the performance of a task that was vicariously reinforced improved initially but then decreased (perhaps because the vicarious reinforcement became punishing to those children – watching others being praised whilst not receiving praise themselves). The children whose performances were vicariously and then directly reinforced on an intermittent basis performed as well as the directly reinforced children over time.

The message from Ollendick et al. (1983) is that vicarious reinforcement sets the occasion for imitation, but in order to be maintained the behaviour must be directly reinforced, at least intermittently.

Vicarious reinforcement may allow individuals to 'contact' reinforcement more frequently than they normally would. For example, Mansdorf (1977) trained an institutionalised woman to perform low frequency behaviours in return for tokens that could be exchanged for consumables. The woman then became a model for the other residents and a token economy was rapidly established. Darch, Carnine, and Gersten (1984) showed that students attentive behaviour could be improved. When a student wasn't paying attention to the teacher, the teacher gave reinforcers to students who were. Immediately the target student re-attended, he too was given a reinforcer.

The research reviewed in Chapter 2 highlighted the potential of manipulating peer influence to alter children's food related behaviours. However, with the exception of Dowey (1996) and Birch (1980a) none of the experimenters reported change in consumption, changes were observed in measures such as choice and preference. Birch (1980a), reported changes in consumption when peers were present, increases were reported for initially non-preferred vegetables and decreases for initially preferred vegetables but no measure of consumption was taken in the absence of peers. Dowey (1996) reported that changes in consumption observed when peers were also observed in their absence, but no measures were taken beyond the experimental context. Only Greer et al. (1991) utilised direct reinforcement in combination with modelling.

Evidence presented in this section suggests that if modelling is used as a behaviour change technique then direct reinforcement should be utilised where possible, via instructions specifying the natural consequences of behaviour, describing the taste or flavour of a food for example. Where the natural consequences may not be immediately reinforcing, contrived consequences could be useful.

Rewards and Food

The prevailing view in the mainstream food literature that rewarding food consumption has a negative effect on verbal liking for that food is somewhat at odds with behavioural practice. One of the main tools in the behaviour analyst's armoury is the use of rewards and there exists a vast literature documenting the role of rewards in successfully promoting learning and behaviour change in a myriad of settings. A number of published studies have used reward procedures to change children's food consumption.

Cooper, Wacker, Brown, McComas, Peck, Drew, Asmus and Kayser (1999) affirm that treatment for chronic food refusal nearly always includes a positive reinforcement component, in the form of preferred activities or foods, or attention and that the availability of a positive reinforcer may facilitate long-term treatment success. They report the results of three experiments, all of which utilised different schedules of reinforcement in the treatment of four children aged between 2 and 3 years nine months with severe food refusal. All children increased their intake of food as a function of the quantity and quality of reinforcement available for ingesting food.

Riordan, Iwata, Finney, Wohl and Stanley (1984) increased self-feeding and food consumption in four children with learning difficulties (aged between 16 and 40 months). The increases were the result of making access to reinforcers contingent upon target food consumption. Once the behaviour was established, it was maintained using intermittent rewarding procedures. Target food consumption and self-feeding at follow-up exceeded baseline levels.

A number of other studies have included reward procedures as part of a treatment package for lack of self-feeding (Bernal, 1972), food refusal (Siegal, 1972), lack of solid food consumption (Handen, Mandell & Russo, 1986; Hatcher, 1979).

Beneficial effects of reward procedures with no consequent deleterious effect have also been reported in studies conducted in non-clinical populations with 'normal' subjects.

Stark, Collins, Osnes and Stokes (1986) designed a study to increase healthy snack food choices using nutrition training and contingent rewards with children aged between 3 years 3 months and 6 years 6 months. Without rewards, nutrition training alone was found to be ineffective and the combined nutrition training and reward procedures were further utilised to promote generalisation of behaviour to the home setting.

Baer, Blount, Detrich and Stokes (1987) used correspondence training techniques to promote consumption of healthy snacks over less nutritious alternatives. Nutritious snack choice increased only when reinforcers were contingent on choice behaviour, little change was noted when reinforcement was contingent upon participants saying they would make more nutritious choices. The positive changes in snack food choice were maintained over several weeks using intermittent reinforcement.

The above studies demonstrate that placing contingencies upon food consumption, rather than having the negative outcome predicted in the mainstream food psychology literature, can have the effect of *promoting* consumption of those foods. Moreover, the studies reported in this section measured behaviour over a period of weeks or months, rather than across a few days as was generally the case with the experiments that were reported in Chapter 2.

Two series of experiments most pertinent to this thesis utilised rewards together with video peer-modelling to promote fruit and vegetable consumption in children aged between five and seven years. The first series was conducted with children in their own homes (Dowey, 1996) and the second series was carried out with children in a school setting (Horne, Lowe, Bowdery & Egerton, 1998). All the studies incorporated multiple baseline procedures and all used food consumption as the outcome measure.

The children involved in the home-based studies all had a history of consistently refusing to eat the fruits and vegetables that were selected for use. During the studies, these foods were presented along with the normal family evening meal.

In the first study, four children were presented with two vegetables with the main course and two fruits between the main course and dessert. One food in each pair served as the target food, the other as a control. The target behaviour (consumption of foods) was measured as a percentage of plate waste.

On each day of the intervention phase, prior to the evening meal, the child was shown one of a series of short video films in which a group of older children, the 'Food Dudes', in the context of an adventure, ate a named target food and encouraged the viewer to do likewise. In return for consuming the target foods, the viewer was promised rewards.

The intervention had the effect of increasing consumption across all four children and across all food categories from 15% to almost 100%. When the intervention was removed, fruit consumption remained high (almost 70%) whilst vegetable consumption had almost returned to baseline levels. A second intervention was introduced during which the food pairs were presented only once a week and the children were told that if they ate the target foods over a specified number of weeks, they could earn a family prize. This had the effect of increasing target food consumption to almost 100% where it remained for the duration of the phase.

A follow–up phase carried out after two months showed consumption of target foods to be above that recorded in baseline, fruit was highest at 79% with pulses at 50% and vegetables at 33%. At a six month follow-up, fruit consumption was still high at 75%, whilst pulses and vegetables had declined to 31% and 10% respectively.

The video peer-modelling with reward interventions employed in this study resulted in foods that had been systematically refused over many weeks being consumed at close to maximum levels.

A second study confirmed the findings of the first and extended them to show that consumption of whole categories of foods could be affected simultaneously by the same intervention. General food categories (i.e. 'fruit' and 'vegetables') were targetted rather than specifically named foods. The intervention phase was lengthened and the number of foods presented per child per meal was increased to three, either two vegetables and one fruit, or three vegetables (to allow for the examination of generalisation to non targetted food items within the same category). For two of the children fruit was targetted first followed by vegetables whilst for the other two children, the reverse was true.

During the first intervention, fruit consumption across all subjects increased to 70% from less than 5% and vegetable consumption increased to 65% from 0%. A second intervention, when only half the foods were presented under a token reward system (as in the previous experiment) had the effect of increasing consumption of these 'high exposure' fruits to maximum levels and this was maintained into both two month and six month follow up phases. High exposure vegetable consumption increased further to 83% and at follow up's carried out two and six months later, vegetables were being consumed at 48% and 58% respectively.

In a follow-up phase two months after the end of the experiment, fruit consumption was at 75% and vegetable consumption at 40%. Six months later, fruit consumption remained at 75% whilst vegetable consumption was recorded at 50%.

In the series of home-based experiments, all children who experienced the combined video modelling and rewards intervention showed substantial increases in consumption of foods that previously that they had refused to eat. The effects were immediate, continued over a number of weeks, and to a large extent were maintained up to six months after the interventions were withdrawn. Only increased experience with the **taste** of a food (rather than sight presentations) brought about contact with the natural (and rewarding) consequences of ingestion.

A study to 'unpack' the important features of the intervention package showed that the video by itself had negligible effects on the fruit and vegetable consumption of four children. Four children who were given rewards without the video peer-modelling increased their consumption of fruit but not vegetables. Thus, to obtain the greatest impact, the two elements (video modelling with rewards) need to be combined.

The first series of experiments was carried out with individual children in their own homes; the second series was conducted with groups of children in a school setting. A similar intervention to that used in the home based studies was employed to increase healthy food choice during the mid-morning snack break. Food consumption was measured by weighing portions of food before and after selection.

In the first study, a class of 26 children were presented daily with a choice of snack foods that ranged from fruit and vegetables to crisps and chocolate. Measures were taken of the children's stated intentions to eat certain foods, their food choices and their actual consumption of the foods they chose.

The class was randomly split into three teams and each child could win tokens and prizes for themselves and their team by eating fruit or vegetables (depending on which category of foods was targetted). Consumption of target fruit rose from 28% in Baseline 1 to 55% during the six-day fruit intervention and, at the same time, consumption of the sweet and savoury snacks decreased. This was maintained into the four and six month follow up phases. Target vegetable consumption increased from 8% during Baseline 1 to 39% during the six-day vegetable intervention. Again, this was largely maintained into the two follow-up phases at four and six months. Some generalisation to non-targetted fruits and vegetables was noted.

A second study (carried out in a different school) was designed to examine whether the same effects would be repeated and improved and whether the effects of the intervention would generalise to a second context of the home. The same intervention package described above was utilised and fruit and vegetables only were presented (no sweet or savoury snacks). The intervention phases were of 16 days duration. In addition, five of the children were presented with the experimental foods at home as well as at school; experimental phases at home mirrored those at school. Cues to aid generalisation at home were given to the five children.

Fruit consumption at school increased substantially from 37% in baseline to 70% during the intervention phase. Likewise, vegetable consumption increased from 39% in baseline to 84% during the intervention phase. Increases in consumption were recorded for every single fruit and vegetable presented and these elevated levels were recorded during follow-up phases at two months and six months. Generalisation effects of the intervention were noted with the non-target foods so that there was an increase in every single non-target fruit and non-target vegetable presented.

Results for children at home showed an overall increase in fruit consumption from 18% to 61%. When token rewards were on offer for consumption in that context, fruit consumption increased further to 89%. At follow-up, eight months later, 77% fruit continued to be eaten. Following the vegetable intervention at school, home consumption for three children increased to 100% and, at final follow-up, was recorded at 98%. Two of the children increased their consumption of vegetables from 30% to 59% with cues, and this increased to 88% when token rewards were offered. These children continued to eat 64% of the vegetables in the final follow-up.

Consistent differences in the three outcome measures in both studies were also observed; measures of intent to consume were always greater than the consumption they purported to predict. i.e. the children always claimed they were going to eat more target foods than they actually did.

The results of the school-based studies reaffirmed what was found in the home based experiments. Children's consumption of fruit and vegetables could be increased with the use of the video peer-modelling with rewards intervention and the effects of the intervention lasted long after the procedures were withdrawn. In addition, the school studies showed that the intervention could enable large groups of children to improve their eating behaviour and the changes generalised to the home environment with very little extra input. Many children had learned to eat many more foods.

THE PRESENT EXPERIMENTS

The series of home-based and school-based studies reported above were carried out with children aged between five and seven years. Experiments 2, 3 and 4 in the present thesis were conducted at the same time as those above and were designed to investigate whether similar effects in fruit and vegetable consumption could be obtained with younger children aged between two and five years in a pre-school nursery setting.

Children in Experiment 2 participated on an individual basis, in a similar way to children in the home-based experiments, whilst those in Experiments 3 & 4 participated as a group, in a similar way to the school based experiments.

Experiment 1 was a replication of a study carried out by Dowey (1996), that examined the effects of peer influence on consumption of a novel food. The purpose of Experiment 1 was to investigate whether similar effects would be observed with children of a younger age.

All the present experiments utilise the outcome measure of consumption. Since the purpose of the interventions employed was to effect change in actual eating behaviour, rather than to affect the frequency of statements of liking or disliking, the amount of food consumed was the measure considered to be most fitting and relevant.

CHAPTER 5

EXPERIMENT 1:

PEER BEHAVIOUR AND NOVEL FOOD CONSUMPTION

INTRODUCTION

The literature reported in Chapter 2 suggested that children's food-related behaviour could be affected by observing the behaviour of other children, thus indicating that peer behaviour may be one important means of influencing children's eating behaviour. Statements of verbal liking for a novel food were shown to change in accordance with those of a peer (Birch, 1980; Duncker, 1938; Marhino, 1942). Dowey (1996) demonstrated that both positive and negative peer behaviours impacted on five to seven year old children's consumption of a novel food in the presence of the peers and also when they were absent. Generalisation of the effects to a second novel food was also observed.

The purpose of the present experiment was to replicate the Dowey (1996) study and extend its findings by observing the effects of real life peer behaviour on younger (three and four year old) children's consumption of a novel food. Participants 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. The results will show the effects of positive and negative peer influence both when peers are present and also when peers are withdrawn. Results will also demonstrate whether any aversions established by the negative peer modelling can be reversed by exposure to positive peer modelling.

METHOD

Participants

Participants

Forty-nine pre-school children aged 3 and 4 years took part. Table 1.1 below shows the distribution of age and sex:

Table 1.1. Age and sex of all participants in Experiment 1.

	Age and Number of Participants	
Sex	3 years	4 years
Male	11	18
Female	10	10

Data from five children who did not complete all the experimental procedures were discarded. Participants were recruited from day care nurseries and children's interest groups in the Bangor area.

Letters were circulated, inviting children to a 'Funday' organised by the School of Psychology to be held at their Centre for Child Development. Posters with response forms advertising the 'Funday' were also put up in public buildings (libraries, swimming pools, doctor's surgeries etc.). Parents who responded to the letters or posters were contacted by telephone or were visited at home. They were given a general outline of the purpose of the study and asked for information regarding any food allergies that their child/ren might have (in order to ensure that child was not exposed to any such food during the experiment). Arrangements were then made for each child to arrive at one of the three weekend 'Fundays'. Transport was provided if requested. Confirmation slips and consent forms were sent to each parent.

Two months after completion, all the parents were sent a letter that explained the purpose of the study and outlined the results

Ethics

Ethical approval for the study was sought and obtained from the University of Wales Bangor Ethics Committee.

Confederates

The confederates were recruited from a local primary school. There were eleven in total, five males and six females, their ages ranging between six and nine years. Confederates and participants were recruited from different areas of Bangor in order to minimise the likelihood of contact between the two groups prior to the study.

Parents of confederates were contacted through the school via a letter that set out the general purpose of the study and requested permission for their child's participation. The headmaster of the school allowed confederate training to be carried out during school hours.

There were six training sessions in all; five took place in the school and a sixth at the experimental site to familiarise the confederates with the setting and the monitoring equipment.

During the study, the confederates acted in two groups of four, each group consisting of two males and two females. All were trained to respond positively and negatively to two target foods.

Setting

The experiment took place at Tir Na n'Og day care nursery, the Centre of Child Development funded by the School of Psychology at Bangor. The layout of the nursery is shown in Figure 1 overleaf.

Nursery Staff

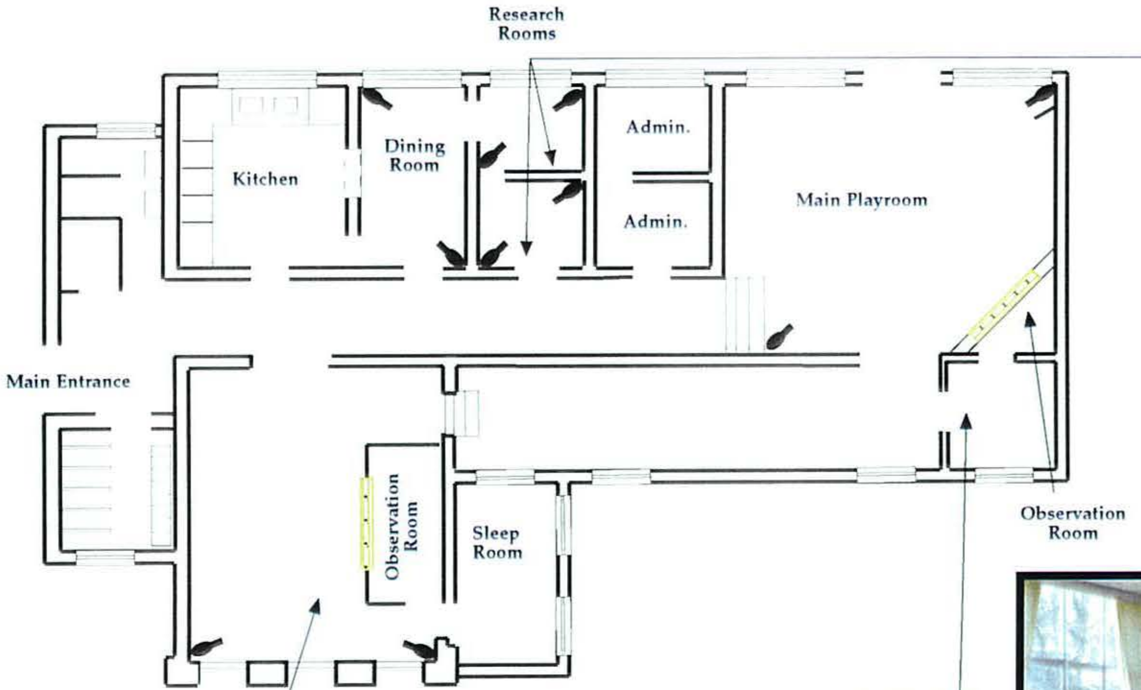
Four nursery nurses assisted in the experiment. They took responsibility for organising group and individual games as well as supervision and care of participants throughout the sessions.

Foods

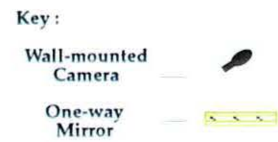
The two target foods were quorn and potato bread, both of which were coloured blue and named 'teclu' and 'marsop', respectively. (Recipes for these appear in Appendix 1). Quorn was presented in cube 1cm^3 approximately. Potato bread was presented as a disc approximately 1cm in diameter and .5cm thick. The names and blue colourings were chosen to ensure that they would be novel. Novelty was of importance to control for differential exposure histories across participants and to limit the chances

Figure 1. Shows the layout of the nursery building.

Tir Na N'Og - Main Building



Research Room



Baby Room

One-way Mirror

Video Control Room

Main Playroom

One-way Mirror

of creating an aversion to other foods that may be encountered outside of the experimental situation.

Six other foods namely, grapes, small cubes of cheese, crisps, corn sticks, prawn crackers and cheese tubes were presented with the targets. Foods were presented on paper plates approximately six inches in diameter. Each plate was marked so that the individual recipient of the food could be identified.

Foods including crisps, sandwiches, small cakes, biscuits and drinks were available at a post-session party that all the children attended. Party bags containing small toys, crayons and sweets, were given to participants and peers at the end of each session.

Target Behaviour and Measurement

The dependent variable was the amount of target and second blue food consumed. Scales were used to weigh each portion of target food before and after presentation.

An experimenter was always present during food presentations to ensure that uneaten target foods remained on the plate.

Experimental Design

In the independent subjects repeated measures design, two independent groups each received different treatments, with a third group serving as the control. Participants were randomly allocated to one of the three groups; each group consisted of similar numbers of three and four year olds and of males and females. Half the participants in each group were presented with quorn as the target food, the other half were presented with potato bread. Both foods were presented to all subjects in a subsequent test phase. Thus, it was possible to a) identify food specific effects and b) test for generalisation to a second novel blue food. Participants in each group were individually presented with the target foods in four separate phases. Table 1.2 below illustrates the sequence of food presentations.

Table 1.2. Schedule of food presentations during Experiment 1.

Presentation Context

Presentation	Group A	Group B	Group C
1	Positive peer influence	Negative peer influence	Alone
2	Alone (test)	Alone (test)	Alone
3	Positive peer influence	Positive peer influence	Alone
4	Alone (test)	Alone (test)	Alone

For participants in Group A, all intervention phases were designed to show the effects of positive peer modelling. Intervention 1 for participants in Group B was designed to show the effects of negative peer modelling and Intervention 2 was designed to observe whether effects of the negative intervention could be reversed by a subsequent positive one. It was also an attempt to counteract any aversion to blue foodstuffs that may have carried over beyond the experimental situation.

Participants in Group C were not exposed to peer influence; data from this group would show the 'normal' consumption levels of novel foods in this population.

Test phases occurred in the absence of peers and were designed to monitor both maintenance and generalisation of the effects of the interventions.

Participants in all groups were given equal exposures to the target and test foods, thus controlling for any effects of repeated presentations.

The children in the confederate groups were counterbalanced across sessions so that each group gave an equal number of positive and negative first interventions; in this way any differences in the effectiveness of each confederate group would be equal across participants.

Procedure

The study took place over four weekend days. Each day was divided into two sessions in which a maximum of twelve participants could be accommodated. The morning session lasted from 9.15 am to 1 pm and an afternoon session lasted from 1.15 pm to 5 pm.

On arrival at the nursery, each participant was given a name badge and taken to join the other participants and confederates in the play scheme building which was a separate building in the grounds of the nursery. For the first 30 minutes of the session, participants and confederates engaged in group games that were designed to establish the confederates as role models (e.g. running, catching etc.)

Participants were then escorted to the main nursery building where they played individual games (under the supervision of a nursery nurse) for the rest of the session. At pre-determined times, on four separate occasions (corresponding to the four presentations) each participant was presented with a snack consisting of either one (the target food) or both blue foods along with the other (non target) food items previously described.

Verbal contact between participants during the individual games sessions was kept to a minimum. One of six different experimenters was present during each of the four food presentations; each one was naïve as to the participant's previous consumption. On no occasion did any experimenter encourage or discourage consumption of any food.

Figure 1.1 overleaf is a schematic representation of the scheduled four food presentations on each day of the experiment.

Presentation 1

Whilst the other participants played individual games in the baby room or playroom (see Figure 1 for layout) three of the participants were invited to have a snack. Each child was taken to a separate room and snacks were presented to the three in parallel.

Group A, *positive peer influence:* participants assigned to Group A were taken to an experimental room where four confederates were seated round a table. The participant was shown to a fifth chair. A supervisor sat on a chair away from the table. A tray of five plates, each containing a target food plus six snack foods, was brought in. The plates were given to each of the confederates and then to the participant. On receipt of a plate, each confederate began to make comments about the target food:

"This is Quorn/Potato bread"
"Wow, this food's blue"
"Mm, it's really nice"
"I'm definitely going to eat this"

There was a period of five minutes during which the confederates consumed the foods and the participant ate those that he or she wished to consume. The plates were then collected and the participant returned to resume individual activities.

Group B, *negative peer influence:* Participants assigned to Group B followed the same procedure as did Group A participants except that confederate statements were as follows:

"This is Potato bread/Quorn"
"Ugh, this food's blue"
"Ugh, it's really horrible"
"There's no way I'm eating this"

There was a five-minute period during which the confederates ate all the foods on the plate with the exception of the target food. The participant ate the foods that he or she wished to.

Group C, *control*: The participants allocated to Group C entered the experimental room where there was one chair at a table. He or she was seated and then presented with a plate of food that included a target food. After five minutes, the plate was collected and the participant returned to resume individual activities.

This procedure was repeated with remaining participants in turn depending on the Group to which each was allocated. In the event that any child was reluctant to go into an experimental room, a nursery nurse would accompany him or her.

When all participants had been exposed to the first intervention, the first test session began with the first participants from each group. The procedure was identical across the three conditions.

Presentation 2

The participant entered the experimental room where there was one chair at a table. An experimenter sat on a separate chair. The participant was shown to the table and then presented with a plate of food that included the six snack foods and **both** target foods. After five minutes, the plate was collected and the participant returned to the playroom to resume individual activities.

Presentations 3 and 4

Following the second food presentation, the second intervention phase began, followed by a second test session starting with the first participants from each group.

The procedure used for presentations 1 and 2 was repeated so that each participant was presented with the target food on two further occasions and the second blue food on one further occasion. Thus, each participant was presented with a blue target food on a total of four occasions and a second blue food on a total of two occasions.

During the final two presentations, the procedure was modified so that participants in Group B were exposed to a different peer group who provided *positive* rather than negative influence. Participants in Group A were exposed to a different group of confederates who again provided positive peer influence.

Following participation in the second test phase, participants were taken to the play scheme building for a post-experimental party and presents.

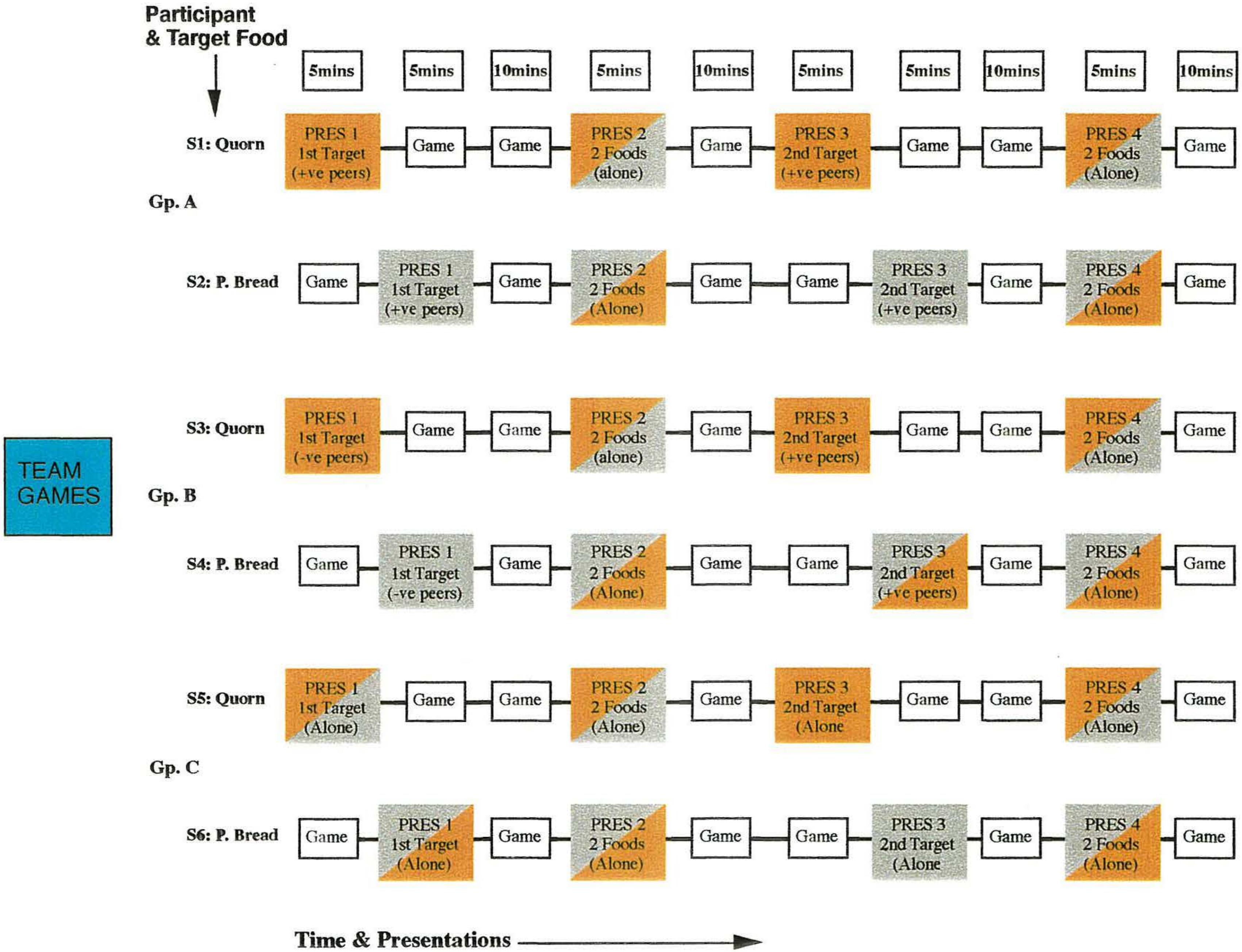
Figure 1.1: A schematic representation of the four food presentations on any one day during Experiment 1. This shows subject allocation to Group A (Gp. A), Group B (Gp. B) and Group C (Gp. C), and the target food (i.e. quorn or potato bread) presented to each of the participating subjects.

Key:

Quorn Presentation

Potato Bread Presentation

P Bread	Potato Bread
1st & 2nd Target	The first and second presentation in the 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


Participant & Target Food
5mins
5mins
10mins
5mins
10mins
5mins
5mins
10mins
5mins
10mins
S1: Quorn
PRES 1 1st Target (+ve peers)
Game
Game
PRES 2 2 Foods (alone)
Game
PRES 3 2nd Target (+ve peers)
Game
Game
PRES 4 2 Foods (Alone)
Game
Gp. A
S2: P. Bread
Game
PRES 1 1st Target (+ve peers)
Game
PRES 2 2 Foods (Alone)
Game
Game
PRES 3 2nd Target (+ve peers)
Game
PRES 4 2 Foods (Alone)
Game
TEAM GAMES
S3: Quorn
PRES 1 1st Target (-ve peers)
Game
Game
PRES 2 2 Foods (alone)
Game
PRES 3 2nd Target (+ve peers)
Game
Game
PRES 4 2 Foods (Alone)
Game
Gp. B
S4: P. Bread
Game
PRES 1 1st Target (-ve peers)
Game
PRES 2 2 Foods (Alone)
Game
Game
PRES 3 2nd Target (+ve peers)
Game
PRES 4 2 Foods (Alone)
Game
S5: Quorn
PRES 1 1st Target (Alone)
Game
Game
PRES 2 2 Foods (Alone)
Game
PRES 3 2nd Target (Alone
Game
Game
PRES 4 2 Foods (Alone)
Game
Gp. C
S6: P. Bread
Game
PRES 1 1st Target (Alone)
Game
PRES 2 2 Foods (Alone)
Game
Game
PRES 3 2nd Target (Alone
Game
PRES 4 2 Foods (Alone)
Game
Time & Presentations

RESULTS

Target and test foods were weighed before and after presentation and measurements were converted to a percentage consumed score. The data consisted of extremes of either 100% consumed or 0% consumed and so results are presented in terms of the percentage of participants who chose to consume each target/test food, rather than a percentage consumed per group score. No differences in consumption were observed that related to either the age or gender of the participants.

Group Analysis

Target Food Consumption

The mean percentage of participants who consumed the target food during each of the four presentations is shown in Table 1.3 below. Figure 1.2 (overleaf) is a graphical representation of these data.

Table 1.3. Mean percentage of participants who consumed the target food (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 in Experiment 1. The table also shows the mean consumption of quorn and potato bread when presented as a target food within each group.

Group and Food	Presentation 1	Presentation 2	Presentation 3	Presentation 4
	% participants	% participants	% participants	% participants
Gp. A Quorn	89	100	100	89
Gp. A P Bread	29	43	57	43
Gp. A Total	59	72	79	66
Gp. B Quorn	14	0	14	14
Gp. B P Bread	13	13	13	13
Gp. B Total	13	7	13	0
Gp. C Quorn	43	43	43	29
Gp. C P Bread	71	71	71	71
Gp. C Total	57	57	57	50

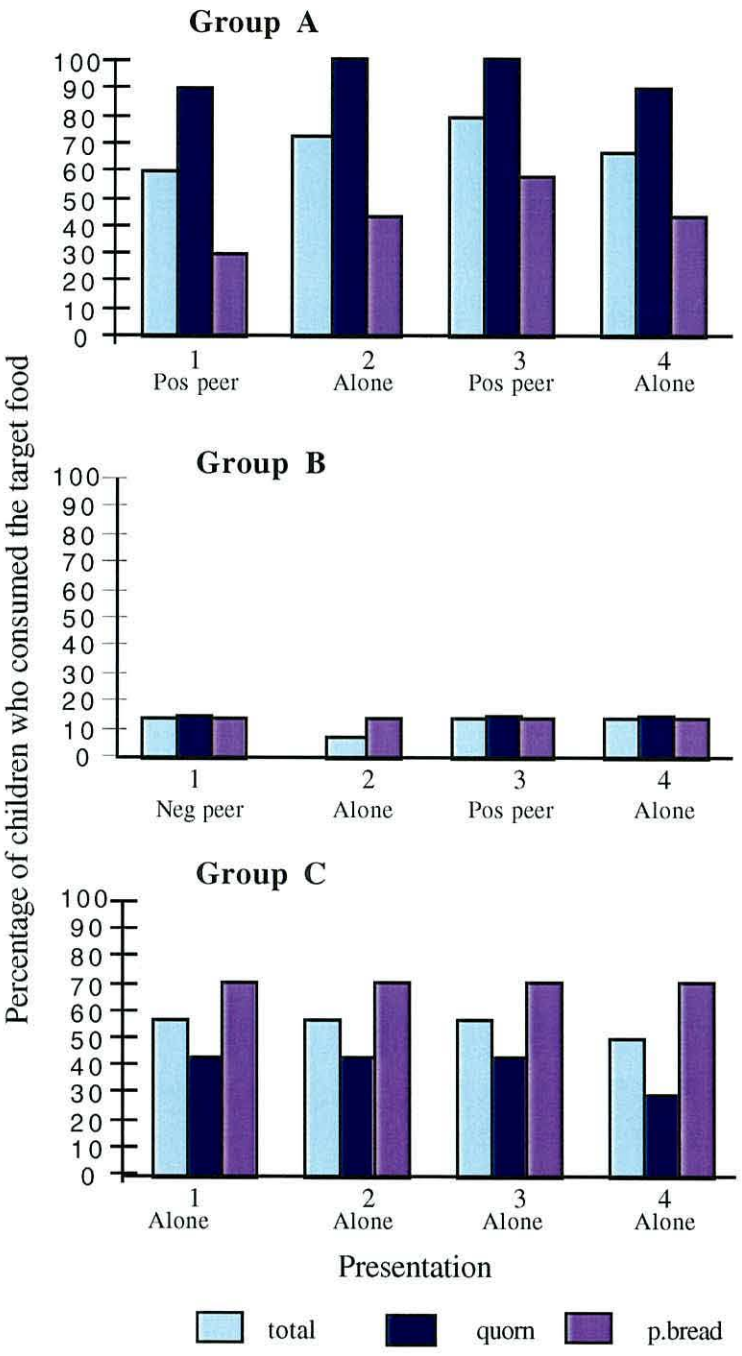


Figure 1.2. Percentage of children who consumed the target foods in each presentation during positive influence conditions (pos peer), negative influence condition (neg peer) and control conditions (alone). Overall group mean of target food eaten (total) is illustrated as well as group mean consumption for p.bread and quorn when presented as target foods.

Table 1.3 and Figure 1.2 show that overall food consumption (i.e. mean target food consumption) in Group A was upward. The highest level of consumption was recorded with Group A in Presentation 3, at 72% in the presence of positive peers. Consumption was greater at the end of the study in Phase 4 than in Phase 1.

With regard to consumption of individual foods, Fig 1.2 shows that within Group A, quorn was more popular than potato bread. Quorn was immediately eaten at 89% whereas initial potato bread consumption was poor at 29%. Quorn consumption reached maximum levels in Phase 2 and remained there for the subsequent positive intervention before reverting to Phase 1 levels in Phase 4. Consumption of potato bread increased steadily across the course of the study reaching its highest level during the second positive intervention (57%). Although consumption of potato bread dropped during Phase 4, more participants were consuming it than were doing so during Phase 1.

Group B showed stable, low levels of target food consumption, 13% in Phase 1 in the presence of the negative peers and 7% when alone in Phase 2. When the group was subsequently exposed to the positive peers in Phase 3, there was little change in consumption, which remained low at 13% and continued at that level in Phase 4. Consumption in Phase 4 was equal to that of Phase 1. Consumption of each of the two target foods was similar across the course of the study.

Target food consumption in Group C was stable with levels across the first three phases at 57%. The only change recorded was in Phase 4 when consumption was reduced by 7% to 50%. Of the individual foods, potato bread was more popular than quorn. Consumption of both foods remained stable across the study until the final presentation when quorn consumption dropped from 43% to 29%.

Second Food Consumption

Table 1.4 below shows the percentage of participants in each group who consumed the target and second blue food during Phases 2 and 4 when the foods were presented in the absence of the confederates. The table also shows group consumption of target food quorn and potato bread when presented as a second blue food or vice versa.

Table 1.4. Percentage of participants in each group who consumed the target and second novel food during Phases 2 and 4.

Group	Food		Phase 2		Phase 4	
	Target	2nd	Target	2nd	Target	2nd
A	quorn	p.bread	100	100	89	88
A	p.bread	quorn	43	43	43	43
A	**Total**		**72**	**72**	**66**	**66**
	Target	**2nd**				
B	quorn	p.bread	0	13	14	13
B	p.bread	quorn	13	13	13	13
B	**Total**		**7**	**13**	**13**	**13**
	Target	**2nd**				
C	quorn	p.bread	43	43	29	29
C	p.bread	quorn	71	71	71	71
C	**Total**		**57**	**57**	**50**	**50**

For Group A, in Phase 2, 72% of participants chose to consume the target food in the absence of peers and the same number ate the second blue food. Likewise in Phase 4, 66% of children ate the target food and 66% ate the second novel food.

For Group B in Phase 2, consumption of the second blue food was marginally increased compared to consumption of the target food, 13% as opposed to 7%. In Phase 4, consumption of both foods was the same at 13%.

In Group C, during Phase 2, consumption of the second and target blue foods was the same at 57%. During Phase 4, consumption of target food was 50% and consumption of the second novel food also 50%.

Overall, the trend in all groups was that those who consumed the target food tended also to consume the second novel food.

Statistical Analysis

In order to examine the impact of peer influence on participant's consumption of the target and second blue food, a mixed design ANOVA was implemented. Since the raw data (as noted above) was made up of extreme scores giving a bi-modal distribution, a randomisation procedure was introduced. This procedure allowed a post-hoc comparison between two selected mean values, either within or across groups, similar to the Tukeys multiple comparison test. Comparisons are achieved through the generation of data-appropriate values (gen Q) with which to compare the observed value corresponding to the difference between the two selected mean values (obs Q). The distribution of the generated values (i.e. the gen Q) is shown in Appendix 1.

In the following analysis, the comparisons calculated were chosen to address specific questions in relation to the experimental hypotheses and it is not presented as an exhaustive investigation of every possible comparison within the data set.

***Phase 1*:** A between-group comparison of mean consumption of target food during the first presentation showed that Group B's (negative influence) consumption differed significantly from that of Group A (Obs Q, 2.216, $p < 0.01$) and Group C (Obs Q 2.080, $p < 0.01$). There was no significant difference between mean consumption in Groups A and C (positive influence and control) (Obs Q .1357).

***Phase 2*:** A within group comparison of Group A's mean consumption of target food in the first 'test' phase (i.e. in the absence of peers) showed that although consumption of the target food increased, this was not significant (Obs Q, -1.052). Group B's mean consumption of target food decreased in comparison to that observed during Presentation1, although not significantly (Obs Q, 2101). Consumption in Group C remained unchanged.

A between groups comparison showed that during Presentation 2, Group B's consumption was significantly different from that of Group A (Obs Q, 3.166 $p < 0.01$) and Group C (Obs Q, -2.397 $p < 0.01$). Mean consumption scores of Groups A and C were not significantly different (Obs Q, 0.7688).

Second food consumption: Target and second blue food consumption did not differ significantly within each group. There was no significant difference between the mean consumption of the second blue food in Groups A and C (Obs Q, 0.7688).

***Phase 3* :** In Phase 3, participants in Group A were exposed to positive peer influence for a second time. Compared to that of the control group and consumption during Phase 1, consumption at this point approached significance (Obs Q, 1.085).

In this phase, Group B were exposed to positive peer influence. It can be seen that there was no change in consumption across Presentations 1 and 3; mean consumption remained unchanged at 13.3%.

Phase 4: This was the final 'test' phase, during which each participant was presented with the target and second blue food. No peers were present.

The difference in mean consumption of target food between Group A and Group B was not significant (Obs Q, 0.7914). There were significant differences between mean consumption of target food in Group A and Group B (Obs Q, 3.166 $p < 0.01$) and Group B and Group C (Obs Q, -2.397 $p < 0.01$.

Second food consumption: In Phase 4, Group A's consumption of the second blue food was greater than that of Group C although not significantly so (Obs Q, .7914).

Food Specific Effects: The statistical analysis indicated a main effect of food type in the positive and negative groups ($F = 4.936$, $p < 05$) and in the positive and negative versus control groups. These effects were discussed earlier in the section when it was noted that most of the participants in Group A initially consumed quorn rather than potato bread, whilst most participants in Group C initially consumed potato bread rather than quorn. These 'preferences' influenced consumption or rejection of the second blue food presented in the absence of peers.

Individual Participant Consumption

The above analysis was a comparison of means across presentations and groups. In this experiment, group mean data are representative of how individuals performed across the experiment as each participant either consumed the blue food, or did not consume it, there were no measures in between. Thus consumption means are representative of the spread of effect.

However, group means do not show individual responses across the course of the study. It is important to examine these data since it is possible that different children were differentially affected across the experimental procedures. In Group A for example, it is possible that child X ate the target food in Phase 1 and not in Phase 2, whilst the reverse is true for child Y. These performances would not affect the overall group mean, but do have differing implications for the effectiveness of the intervention.

Raw data are presented in Appendix 1, but it is appropriate to make some observations on individual performances within each group.

Table 1.5 below shows the pattern of responses for each participant in Group across all four presentations.

Table 1.5. Individual responses across each phase of the experiment for the participants in Group A. X denotes consumption, O denotes non-consumption.

Number of Participants	Phase 1	Phase 2		Phase 3	Phase 4	
		Target	2nd		Target	2nd
7	X	X	X	X	X	X
3	O	X	X	X	X	X
3	O	O	O	O	O	O
1	X	X	X	X	O	O
1	X	O	O	X	O	O

Within Group A, the greatest number (seven) of participants in the group consumed the target food in Phase 1 and continued to do so through all other phases. These participants also consumed the second novel food. Six of the seven were presented with quorn as the target food.

Three participants refused the target food on the first presentation but did consume it in the second and thereafter ate both the target and second blue foods.

Three participants refused all foods throughout.

One participant consumed both target and second foods in Phases 1, 2 and 3, but failed to consume either one in Phase 4.

One participant ate the target food in the presence of the peers only.

Table 1.6 below shows the pattern of responses for each participant in Group B across all four presentations.

Table 1.6. Individual responses across each phase of the experiment for the participants in Group B. X denotes consumption, O denotes non-consumption.

No. of Participants	Phase 1	Phase 2 Target	Phase 2 2nd	Phase 3	Phase 4 Target	Phase 4 2nd
11	O	O	O	O	O	O
1	X	O	O	O	O	O
1	O	O	O	X	X	X
1	O	O	X	O	O	O
1	X	X	X	X	X	X

Within Group B, the majority (eleven) of participants ate neither the target nor second novel blue foods.

One participant consumed the target food in Phase 1 and thereafter refused all target and second novel foods.

One participant began consuming the target food in Phase 3 and in Phase 4 also ate the second blue food.

One participant refused the target food on all occasions and consumed the 2nd blue food only in Phase 2.

One participant consumed 100% of the target foods in all four phases *and* consumed the second target food during Phase 4.

Table 1.7 below shows the pattern of responses for each participant in Group C across all four presentations.

Table 1.7. Individual responses across each phase of the experiment for the participants in Group C. X denotes consumption, O denotes non-consumption.

No. of Participants	Phase 1	Phase 2 Target	Phase 2 2nd	Phase 3	Phase 4 Target	Phase 4 2nd
5	X	X	X	X	X	X
4	O	O	O	O	O	O
2	O	X	X	X	X	X
2	X	O	O	O	O	O
1	X	X	X	X	O	O

In Group C, five participants consumed the target food in all four phases and also consumed the second blue food. Four of the five were in the group that were presented with Potato bread as the target food.

Four participants consumed neither food.

Two participants did not consume the target foods in Phase 1, but began to do so in Phase 2 and continued throughout the course of the experiment. These participants also consumed the second novel food.

Two participants ate the target food in Phase 1, but never consumed them again.

One participant consumed the target food in Phases 1, 2 and 3 and ate the second novel food in Phase 2. In Phase 4, this participant refused the target and second novel food.

Table 1.8 overleaf is a summary of the patterns of individual consumption within all groups. It compares the number of participants in each group who showed the same pattern of responses to the target and second blue foods

Table 1.8. Summary of the patterns of consumption recorded within Groups A, B and C. X denotes consumption, O denotes non-consumption.

	Phase 1	Phase 2 Target	Phase 2 2nd	Phase 3	Phase 4 Target	Phase 4 2nd
A 7 B 1 C 5	X	X	X	X	X	X
A 3 B 11 C 4	O	O	O	O	O	O
A 3 B 0 C 2	O	X	X	X	X	X
A 3 B 1 C 2	X	O	O	O	O	O
A 1 B 0 C 1	X	X	X	X	O	O
A 1 B 0 C 0	X	O	O	X	O	O
A 0 B 1 C 0	O	O	O	X	X	X
A 0 B 1 C 0	O	O	X	O	O	O

Most participants in Group A showed the first pattern of responding, consuming the target foods in all presentations and also consuming the second novel food. Most participants in Group B refused the target foods in all presentations and likewise refused the second novel food. Participants in Group C showed more varied responses with the majority split between acceptance and refusal of both target and second novel foods.

This analysis shows how different children can respond in different ways to the same intervention and that in applied settings individual performance as well as that of the group should be constantly monitored to ensure optimum efficacy of the intervention.

DISCUSSION

The results of Experiment 1 support the notion that children's consumption of a novel food can be affected by peer behaviour, particularly if the peer's model 'dislike' of that food. Participants who were initially exposed to the negative intervention ate significantly less target food than the participants who were presented with the food in the absence of any peers. Moreover, the differences between the consumption scores of the negative peer influence group and the controls were greater than the differences between the positive intervention group and controls, suggesting that the negative intervention was the more powerful.

The effects of the initial negative intervention were not reversed by the subsequent positive intervention, indicating that initial experiences with foods are important and, with children in this age group, not easily overridden.

Compared to the control condition, consumption of the target food was greater (although not significantly so) for those participants who were exposed to the positive peer intervention. The overall trend in consumption across the course of the study was upward in the positive intervention group but remained static in the control group. At the end of the study (Presentation 4), novel food consumption in Group A was increased compared to Presentation 1, whereas Group C's consumption showed a decline. It is possible that any decreases in consumption observed during Phase 4 may have been due to satiation. This would have been easily identified had consumption of the accompanying foods been measured.

The influence of the peers is substantiated when one looks at the consumption of each target food in Groups A and C, where the most highly consumed food in each group were the opposite of the other. Given that Group C was the non-intervention group this result demonstrates that the peer influence in A was powerful enough to reverse an apparent natural preference for potato bread. During training sessions, the confederates expressed a preference for quorn and professed to not liking the potato bread. It may be that during the early positive intervention sessions, the confederates found it difficult to overcome this natural preference/dislike of the foods and although positive statements were made about potato bread, these were not convincing, at least with the first two or three participants. The raw data bear this assumption out. Thus, in order to avoid unwanted or even negative outcomes, care must be taken to ensure that the physical behaviour (facial expressions etc.) of the model(s) has a high correspondence to their verbal behaviour. Ambiguity may give the observer conflicting or even negative information about the target stimulus. Group A's consumption of potato bread increased during the second positive intervention, but did not reach the levels recorded in the control group. In an applied setting, a first intervention may be crucial and any ambiguity on the part of the models may have the effect of a child deriving negative information about a target food. As demonstrated in the present experiment, these negative effects may not be easy to reverse.

The effects of the interventions were observed when participants were presented with the novel foods away from the peers, demonstrating that the effects on behaviour generalised to a different context *and* to a second blue food. These changes in behaviour cannot be explained in terms of conformity alone, although conformity may explain the initial behaviour in the context of the intervention. It is possible that as Skinner (1989) suggests, imitating the model (confederates) brought the observer's behaviour under the control of the same contingency as the model's behaviour. Thus in the positive intervention group, the natural consequences of eating the target food may have driven its consumption, while in the negative intervention group, the natural consequences would be the avoidance of the negative consequences of consumption. The natural consequences of consumption could be applied to the pattern of generalisation found in Groups A and C where consumption data for the second blue food mirrored that of the target food.

Generalisation of consumption to the second novel food appeared to be determined by the individual's response to the target blue food; those who consumed the target food were more likely to consume the second food. It might be possible to promote consumption of other foods that are linked in some way, e.g. yellow fruits, green vegetables etc., but since the foods used in Experiment 1 were novel, the findings cannot be directly extrapolated to the more common foods that children encounter.

The present study was a replication with children of a younger age group, of that reported by Dowey (1996). In both experiments, the overall trends in consumption of target foods in Groups A and C were similar, the former showing a generally increasing pattern of consumption, with a slight increase in Presentation 4 and the latter showing a static pattern that decreased slightly in Presentation 4. Patterns of generalisation of consumption to the second presentation context (in the absence of any peers) and to a second novel food were similar across groups in both the studies. Differences in consumption between Group A and Group C were shown to be statistically significantly different in the Dowey study, whilst in the present study they were not (although during Presentation 3, the differences approached significance).

The consumption patterns observed in Group B (the negative intervention) were also similar in both studies; very little target food consumption was recorded. However, in the Dowey study the reversal was effected during Phase 3, with consumption levels observed in Group B resembling those of the initial positive intervention with Group A (although the second novel food continued to be refused). In the present study, the positive intervention in Phase 3 failed to increase consumption of the target food, thus indicating that there may be developmental differences in overriding negative reactions to food through the medium of social pressure. Garcia, Hankins and Coil (1977) have documented the rapidity with which animals learn to avoid foodstuffs and these aversions once learned may be difficult to alter.

The stability of consumption of Group C, compared with the increase in consumption of Group A across Phases 1 and 3 suggests that effects of positive interventions may be cumulative. It is possible that one more positive intervention with Group B would have effected the reversal.

The results of the present study concur with those of previous research where peer influence was manipulated to increase children's verbal liking of target foods (e.g. Birch, 1980a; Duncker, 1938; Marhino, 1942), although it is difficult to make direct comparisons with previous research because of the different outcome measures used. Also, in the Birch study, vegetables were used as target foods, whilst the foods used in the present study were designed to be novel, in part to avoid any history effects. It may be more difficult to effect changes with foods that have had previous exposure.

A finding of particular interest was the surprisingly high consumption levels of target food consumption recorded for Group C during Presentation 1. Fifty-seven percent of participants in this group consumed the target food at first sight, with no intervention. This does not accord with those studies reported in Chapter 2 (Birch & Marlin, 1982; Birch, 1990; Pliner, 1982; Sullivan & Birch, 1994) which claim that children tend to be unwilling to try novel foods.

Modelling techniques were employed here as a means of increasing food consumption. It was not intended as a means of investigating variables involved in the modelling process and how they might operate. The context of this study would however be a useful one for future research, as the experimental situation involved is less contrived than that of many of the modelling studies. Further, there is a hard measure of behaviour - food consumption rather than some of the more subjective measures often reported in the literature. The findings of any future research using this paradigm would be of direct use in the applied field.

For example, a future study might examine the effect on the observer's behaviour if models were seen to be rewarded for making positive statements about a target food, or were seen to be rewarded for consumption of the target food. It may be that this latter manipulation would be more effective in reversing the consumption of participants in the negative intervention group.

Similarly, a future study could be designed to examine the effects of the models who were not actually in the same room as the participant, but were viewed through a one way mirror, or were on television. This would be similar to children viewing televised advertisements.

It is also important to explore the effects of repeated positive peer interventions in those cases where initial negative peer interventions had had the effect of creating aversions.

One of the limitations of this study is the lack of follow-up data; it is not known whether behaviour of the participants would have continued outside of the experimental situation or what the effects of the interventions on longer-term consumption might be. It might be possible to incorporate more phases into the design that are carried out at home or in venues where young children congregate, play groups, nurseries etc. Novel foods could be presented within the normal routines of these organisations, for example at snack times. This would allow for behaviour to be measured over longer time periods.

The present experiment was an attempt to demonstrate the effects of peer modelling on the food choices of three and four year old children. The interventions and measurement of effects were brief and it is thus not possible to comment on what would happen to any changes in behaviour across time. As the foods presented were novel, it is perhaps not applicable to generalise the findings to normal social environments and foods.

The experiments that follow represent a more intensive and long term analysis of behaviour change across time and in different contexts using poorly consumed or previously rejected food items (fruit and vegetables).

CHAPTER 6

EXPERIMENT 2:

USING A VIDEO PEER-MODELLING WITH REWARDS INTERVENTION TO PROMOTE CONSUMPTION OF PREVIOUSLY REFUSED FOODS

INTRODUCTION

In Experiment 1, young children's acceptance of a novel food was influenced by the behaviour of peers to some extent in a positive way and to a great extent in a negative way. When consumption had been negatively affected, it was not changed by a positive intervention. All peer interventions applied to one target food had consequences for acceptance of a second food.

The design of Experiment 1 allowed for only short term investigations of the effects of the interventions and so it is not possible to say what, for example, the effects of continued exposure to positive peer influence might be on consumption of novel foods. Moreover, it was not possible to examine any effects the interventions may have had beyond the context of the experimental situation. The applied value of the interventions was unclear since the foods used in Experiment 2 were novel with no history of refusal.

Experiment 2 was designed to examine whether changes in consumption of 'real' foods could be achieved and whether these changes would be long lasting. An interactive video and rewards intervention was devised to promote and maintain consumption of specific fruits and vegetables that had been consistently refused by the participants. There were three purposes to the experiment: (i) to examine the possibility, using behavioural techniques, of modifying children's consumption of previously refused fruits and vegetables, ii) to achieve maintenance of any changes over a number of presentations and iii) to look for generalisation effects across time and contexts.

The experiment was conducted at Tir Na n'Og nursery over a period of several months. Target behaviour was recorded in two settings, once during a morning experimental session and, as a generalisation measure, during the midday meal. Single case methodology was used to examine the impact of the intervention.

METHOD

Participants

Four children took part, three males and one female. Their ages were 44, 47, 48 and 52 months at the start of the study. Participation was based on parental consent, attendance at the nursery (participants were required to attend morning sessions) and (to some extent) each child's food choices.

Letters were sent to parents of children aged between three and five years who attended the pre-school playroom of the nursery, giving general information about the nature of the study and asking if parents were interested in having their child participate in it.

Those parents who responded positively were contacted and an appointment was made to visit them either at work or at home, at a time when the child would not be present. At the visit, the experimenter explained the nature of the study and the parent(s) were asked to respond to a food questionnaire which was designed to ascertain the kinds of foods that the child consumed at home. A copy of the questionnaire appears in the Appendix 2. Following the visit, parents indicated whether or not they were willing for their child to participate in the study.

One child was said by the parents not to eat fruit. Another child was described as being "stubborn about green foods" - his mother remarked that the child would painstakingly remove all traces of lettuce and greens from burgers in McDonalds. Another child was said by parents to have phases of eating and refusing particular foods.

Setting

Three of the rooms in the nursery were used in the experiment, Research Room 1, the playroom and the kitchen. Figure 1 (see Experiment 1) shows the layout of the nursery.

Research Room 1

This room measured 3.25m x 3.6m. It was equipped with two Colossus CCTV cameras mounted on pan and tilt heads. These were sited in opposite corners at different heights; one at 1.7m above floor level; the other at 1.3m above floor level. The angle of the cameras could be adjusted from the central console room located behind the playroom. Audio input was made via a Panasonic radio microphone. Video and audio inputs were transmitted from the experimental room to the console room which was equipped with pan and tilt control units, vision and audio mixer, multiple stack VCR's and patch panels. Recordings were made on to VHS videotapes.

The Playroom

This room measured approximately 11m x 9.15m. Two video cameras, Hitachi KP-C50, 240v ac PAL with 8-80mm zoom lens and long range microphones were wall-mounted at a height of 4.5m on Molnyx pan and tilt heads. One camera was sited above the main door, the other above the one-way mirror. These were controlled from the central console room using purpose - built pan and tilt controllers.

The room was vacant between 11.45 and 1.00 pm when lunch was served in the dining room. A small section of the room measuring 3.5m x 2m was utilised during these times for the purpose of serving lunch to those children participating in the study.

The Kitchen

The kitchen measured 3m x 10m and was in general use by the nursery staff. All the experimental food preparation was carried out in the kitchen under the supervision of the nursery cook.

Foods

Six foods, two fruits and four vegetables that were reliably rejected by each participant during pre-baseline presentations were used in the study. Table 2.1 below shows the approximate weight in grammes of each food portion along with a brief description of each food as it was presented.

Table 2.1. Foods presented in Experiment 2, indicating weight and dimensions of each portion

Food	**Weight** (per portion)	**Presentation**
Lettuce (Iceberg)	3g	2 strips 2.5cm x 1.25 cm
Celery	4g	4 slices .5cm thick
Mange-tout	5g	2 beans sliced in half
Spinach	5g	1 teaspoon
Guava	6g	1/4 of one guava half
Lychee	6g	1 whole fruit
Banana	22g	2 slices 2.5cm thick
Satsuma Orange	11g	2 segments

Celery, lettuce and mange-tout were fresh, spinach was frozen, guava and lychees were canned. Mange-tout and spinach were cooked in a microwave for about one minute. All other foods were served uncooked.

Oranges and bananas were presented once, as an introduction to the experimental procedures.

For the morning experimental sessions, each of the three foods was placed in a round plastic food bowl with a lid measuring $10cm^3$. Cooked foods were wrapped in silver foil to keep them warm. A specially designed wooden box measuring 45cm x 15cm x 7cm was used to present the food bowls. The box was divided into three separate compartments each with a lid that was hinged and secured by means of a wing nut.

At lunchtime, the experimental vegetables were served on a plate along with the midday meal. The experimental fruit was served on a small plate (in general use at the nursery) separate from the main meal.

Equipment

Recording equipment.

The recording facilities in place at the nursery (as described above) were used to record the target behaviour of each participant in both the morning experimental session and at lunchtime.

Intervention Videos

There were three intervention videos. All were produced in-house by the School of Psychology Technical Department. The main intervention film targetted food consumption during the morning experimental session, a second film was produced as a primer to the main intervention film and a third film was designed to target lunchtime food consumption.

Main Intervention Video. This featured a 'gang' of children (two girls and two boys aged between 6 and 8 years) called 'The Taste Buddies'. Within the context of a series of adventures that culminated in the finding of a hoard of 'treasure', the Taste Buddies ate small amounts of target foods marvelling at their taste and energy-giving properties and requested that the viewer (i.e. the participant) do likewise. In return for consuming the target foods, the participant was promised a share in the treasure that the gang was seeking.

The video was of an interactive nature in that when the participant was asked to consume a food, a 'magic energy panel' (a picture of the target food) appeared on the TV screen and could be held there (by means of the experimenter covertly switching the video into pause mode). In the event that the participant consumed the food they then placed a hand on this panel and the video continued (by means of the experimenter covertly switching the video to play mode). If the participant refused to consume the food, the experimenter stopped the film and gave the participant the option to "try again tomorrow." A maximum of three foods could be targetted in any one session.

The intervention films had 18 separate episodes which were sequential and showed the Taste Buddies beginning their journey at point A and finishing at point B having found the sought after treasure. Each episode, recorded on VHS format videotapes, featured a different target food and three episodes were recorded on to one tape. Each episode lasted approximately five minutes. In the final episode (i.e. the last intervention) the treasure appeared on the screen and the Taste Buddies informed the viewer that he or she was to be given a share in it as a reward for helping out.

Primer video. The primer video was devised to 'train' each participant in the experimental procedures. In this film, a narrator outlined the purpose of the Taste Buddies journey and asked if the viewer (i.e. the participant) would be willing to help out the gang if necessary. Foods that the participants were known to consume were featured in this film.

Video to target lunchtime consumption. A second intervention video, designed to increase target food consumption at lunchtime, showed two of the Taste Buddies alongside the treasure box that was said to contain the participant's reward. To gain access to the contents of the box, the participant was instructed to eat the target foods in the morning experimental session and at lunchtime (or indeed any other time they were available).

Each time the participant complied with the instruction to consume the target foods at both times, (i.e. during experimental sessions and at lunchtime) the Buddies were shown to lift the lid of the treasure box. The design of the video was such that the lid of the box was opened further each time the participant ate all target foods at lunchtime. If the participant had failed to comply with the instruction to eat the target foods at lunchtime, the Buddies would appear to be unable to lift the lid of the box (or unable to lift it any higher if it had been lifted at all). In that case, the participant was instructed to try again by eating the target foods that same day.

Presentation Media

A Panasonic 14inch television and VHS video recorder were used to show the intervention films.

Rewards

A number of items were used as rewards. These were varied to suit individual children and included stickers and small plastic toys. The toys were presented in a cardboard box that was covered in silver foil and ornamented with Taste Buddies logos. In addition, a Polaroid camera was used to take instant photographs of the children.

Each participant was given a map that corresponded to one that was used in the video by the Taste Buddies. A copy of the map appears in Appendix 2. Small coloured stickers were used to mark the participant's progress on the map.

A 'treasure box', given to each participant at the end of the study was a plastic storage box of a 'pirates chest' design with a lid. It was covered in brown and gold paper to enhance its appeal. Inside, the 'treasure' consisted of small trinkets; bags of marbles, crayons, plasticine and so on, plus one larger item that had been specifically requested by the participant during the study, for example, a plastic sword or a Barbie doll.

Dependent Variables and Recording

Target behaviour

The dependent variable was the quantity consumed, by each participant, of the particular experimental foods presented during the morning experimental session and lunchtime meal sessions. Consumption was defined as food being taken into the mouth and ingested; food placed in the mouth and spat out did not qualify as consumption.

Data collection

Data collected were the amount of target food each child had consumed in the experimental and lunchtime settings. This was calculated by a visual assessment of residual food, subtracting the latter from the quantity presented and using the following scale:

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

Weighing each food was not considered a viable option given the lightness of some of the foods (lettuce for example). Also, in the lunchtime context, the experimental vegetables were presented on the same plate as the midday meal, leaving open the possibility that they could be mixed in with the lunchtime food items.

The experimenter assessed each child's consumption during the morning experimental session and a research assistant verified the assessments by estimating the amount of food left in each plastic bowl at the end of each session.

Consumption at lunchtime was assessed by a research assistant and verified by a kitchen assistant from plate waste. 100% agreement was reached throughout the study. To confirm that plate waste was a valid measure, floors were checked after lunch for any discarded experimental food.

Experimental Design

The effects of the intervention(s) were evaluated in a multiple baseline across foods design. This design was chosen so that any effects of an intervention on eating behaviour could be clearly observed. Repeated observations over time show whether an intervention is effective immediately, or whether it's effects are more gradual. It can also be clearly seen whether the effects are short-lived or are maintained across time and/or settings. Additionally it can be observed whether the effects of an intervention are limited to the target food(s) or if the effects generalise to others.

Since the multiple baseline design does not require a control group, the effects of interventions could be observed without the need for great numbers of participants in each experiment. The design also allows the evaluation of a number of different interventions within the same experiment and the same participant, thus reducing the number of participants required. Behaviour need not return to baseline levels between interventions; this is useful in cases where it is not in the participant's interests to reverse or stop a treatment or intervention. For example, the purpose of this study was to promote consumption of foods. If this goal is achieved it would be counter-productive to reduce consumption to baseline levels at the end of the intervention period.

In the experiment, six foods were used as target foods, all of which had been reliably refused by each participant during both pre-baseline exposures and baseline trials. The six foods were split into two sets, each set comprising two vegetables and one fruit and each set was presented on alternate days throughout each phase of the experiment. So, for example, on Day One of the baseline phase, Set 1 foods were presented, on Day 2, Set 2 foods were presented and on Day 3 Set 1 foods were presented again, and so on. In the intervention phase, on Day 1, Set 1 foods were intervened upon and on Day 2 Set 2 foods were presented under baseline conditions, and so on. During Intervention 1, when three data points for each food had been collected for foods in Set 1, Set 2 foods were then targetted with the intervention.

This design conferred three advantages: firstly it could be observed whether the intervention had an effect on the consumption of the first set of foods only, or whether the behaviour generalised to foods in the second set which were presented on alternate days but not directly targetted. Secondly, if the effects produced with Set 2 foods occurred only when the intervention was introduced to Set 1 foods, then it could be concluded that the change was due to the experimental manipulation, rather than the passage of time and/or increased exposure. Finally, continued presentation of Set 1 foods under baseline conditions whilst Set 2 foods were targetted, would show whether any behaviour change for Set 1 foods was maintained.

The order of presentation of foods within each set was varied in every session to avoid possible order effects. So for example, when foods within Set 1 were targetted, the presentation order on the first day was celery, lettuce and guava and on the second day the presentation order was lettuce guava and celery.

In addition to measuring behaviour in the morning experimental session, the design of the experiment included a second measure of behaviour, consumption during the lunchtime meal. In this way, any effects of the intervention in a second context, later in the day, could be recorded.

One other feature of the design of this experiment was the use of the Taste Buddies as contingency managers. All rewards and performance feedback were delivered to the participants 'from the Taste Buddies' independently of the experimenter, which served to eliminate any source of potential conflict between the participant and experimenter.

Following a baseline phase, two interventions were programmed; first an intervention that specifically targetted food consumption in the morning experimental session; and then a second intervention that targetted food consumption in both morning experimental sessions *and* at lunchtime.

Procedure

Throughout the course of the study, the experimenter spent each morning at the nursery preparing experimental foods and carrying out experimental procedures. A research assistant monitored experimental sessions from the console room, helped to instigate reward procedures and assisted in assessing food consumption.

Pre-baseline

For several weeks prior to the start of baseline, the children whose parents had given permission for their participation (eight in number) were served lunch in the playroom, away from the rest of the children in the nursery. They were seated four to a table and were presented with, in addition to the normal lunch, one extra vegetable and one extra fruit. Each child's consumption of the extra food was noted. Foods were generally presented three times during prebaseline and included a range of beans (broad beans, kidney beans, flageolet beans, borlotti beans, etc) vegetables (swede, parsnip, carrot, green beans, baby sweetcorn, mushroom, etc) and fruit (oranges, banana, guava, lychee, prune, apricot, pear, apple, etc).

The prebaseline procedure served two purposes; first to give an idea of the foods that were eaten and refused by the children; and second to discover which children would and would not eat those foods.

Morning Session

Every morning, between 9am and 11 am, a participant was escorted from the playroom to the experimental room. Depending on the phase of the experiment, participants either engaged in a play activity or were exposed to the intervention. During each session, which lasted between fifteen minutes and half an hour, up to three experimental foods were presented. At the end of each session, participants were returned to the playroom. Food containers were taken to the kitchen where consumption was assessed.

Lunchtime

The participating children were served their midday meal in the playroom rather than in the dining room with the other playroom attendees. They were seated at individual tables that were placed in a line and separated from each other by means of wooden partitions. A nursery nurse supervised the meal. She was instructed to carry out normal lunchtime procedures and asked to not draw attention to any particular foods.

All foods were brought on a tray from the kitchen to the playroom. Experimental vegetables were placed on a plate along with the normal lunchtime meal. Experimental fruit was served in between the main course and the dessert and was left in front of the child until eaten or it became obvious that the child was not going to eat it. The normal nursery dessert was then served. Experimental fruit and dessert were served separately so as not to be in competition with each other.

At the end of the meal, plates were collected and taken to the kitchen where the kitchen assistant and a research assistant (independently) assessed consumption of the experimental foods.

Baseline Phases

Morning experimental session

Participants entered the experimental room where games and play activities were set out on a table. These were items such as crayons, drawing and colouring books, plasticine, and reading books. The child was asked to choose one activity to carry out during the session. The experimenter and the child sat at a second table and engaged in the chosen activity. The food presentation box was placed on the table near to the experimenter. After an interval of approximately five minutes, the experimenter asked the child if he or she would like to "see what's in the box today". The child was invited to open one compartment of the box and take out the plastic bowl containing one of the experimental foods. If the child was reluctant to open the box, the experimenter offered to do it. When the container was opened, the experimenter asked the child to name the food and named it for them if necessary. The child was then invited to try the food. The container was returned to the box with any remaining contents. The child and experimenter returned to the play activity.

This procedure was repeated with the other two foods at approximately five-minute intervals. At the end of the session, the experimenter returned the child to the playroom.

Lunchtime

The general lunchtime procedure outlined above was followed. The foods presented were those that had been presented in the morning experimental session.

Intervention 1

The participant entered the experimental room where the television and video were set up on a table. Two chairs were placed at an adjacent table so as to give a good view of the television screen. Also on the table were the food presentation box, containing the experimental foods and the participant's own map of the Taste Buddies' journey to the treasure.

The experimenter sat down next to the participant and explained that "today we are going to watch television. This is a very special programme so we need to look and listen carefully." The experimenter then initiated the video presentation. At the appropriate time in the film (see Method section) the experimenter paused the videotape and directed the child to the food presentation box. After having consumed some or all of the food, the participant was directed to place his/her right hand on the panel that was showing on the TV screen. The experimenter allowed the video to move forward and the tape continued with the children in the film thanking the participant for helping out and reiterating the promise of a share in the treasure when it was found. A map then appeared on the screen that showed current progress towards the treasure. The experimenter gave the child a sticker to attach on their map and a sticker to wear. Progress along the route of the map was discussed and encouragement to continue towards the treasure given.

When each new location on the map had been reached, the child was given the choice to continue with the session (a maximum of 3 foods per session) or to stop and continue on another day.

If the participant was reluctant to consume a particular food, some verbal encouragement was given. The criteria for continuing with the video was different for individual participants and particular foods with each child encouraged to consume as much as possible of each target food before moving on.

Within the Intervention phase, different reward procedures were implemented for each participant. In the case of two participants, at the end of each session they were given a sticker to wear. A third participant was rewarded, on an intermittent basis with small, inexpensive toys after she had consumed a target food. The fourth participant was rewarded with small plastic dinosaurs after consuming each food.

When individual rewards were used, a research assistant or member of the nursery staff who watched the session from the central console room effected the procedure. She left the reward at the door of the experimental room, knocked and left as quickly as possible. After hearing the knock, the experimenter asked the child to see who was at the door whereupon he or she retrieved the reward.

At the end of each session, the experimenter took a photograph of the participant using the Polaroid camera.

All sessions began with the experimenter reminding the participant of what had happened on previous intervention days, with particular emphasis placed on the child's progress on the map.

On the final day of Intervention 1, the participant was told (via the video film) that he or she had earned a share in the treasure and was asked to request a special item that they would like to find in their treasure box.

Intervention 2

Morning Experimental session

The lunchtime intervention film was introduced. During the course of the film, participants were presented with the three experimental foods that were featured in the film and were instructed (via the characters in the film) to consume those foods at lunchtime in order to gain access to their share of the treasure. At the end of the video presentation, the experimenter asked the participant to verbalise the instructions and contingency.

Lunchtime

The experimenter visited the nursery just before lunch was served, to remind the participant of the contingency in operation. The participant was asked to verbalise that contingency.

Lunchtime Only

Participants did not attend the morning experimental sessions, but were presented with the target foods along with the normal nursery meal at lunchtime. Lunch continued to be served in the playroom. In this phase, no instructions were given regarding the target foods.

Baselines 2 & 3

The procedures for Baselines 2 and 3 were identical to that of Baseline 1 with foods presented in a morning experimental session and with the midday meal in the absence of any intervention.

RESULTS

Results for each participant will be presented and discussed separately. A general discussion will be presented at the end of the section. Data from the morning experimental session will be considered first, followed by data from the lunchtime setting.

RN

Figure 2.1 (overleaf) shows RN's consumption of the six experimental foods in each morning experimental session and in the lunchtime context across all phases of the experiment.

Baseline 1

During baseline, RN did not consume any of the experimental foods even after three presentations of each for Set 1 and five presentations each for Set 2.

Intervention 1

Immediately that Intervention 1 was applied to consumption of foods in Set 1, RN's consumption of all the foods in that set increased. He began eating lettuce and celery at 100% and continued to do so for the duration of the phase. Guava was consumed more gradually, starting at 25% and reaching 100% on the final presentation.

When the intervention was applied to Set 2 foods, an increase in consumption of all foods in that set was also recorded. Spinach and mange-tout were eaten immediately at 100% and remained at that level throughout the phase. Fruit consumption (as was the case with Set 1 foods) began hesitantly; lychee was initially refused but on the second presentation it was consumed at 100% and remained there for the duration of the phase.

Baseline 2

When Intervention 1 was withdrawn from Set 1 foods, consumption of vegetables in Set 1 was maintained at 100% across all three presentations whilst guava consumption reverted to zero.

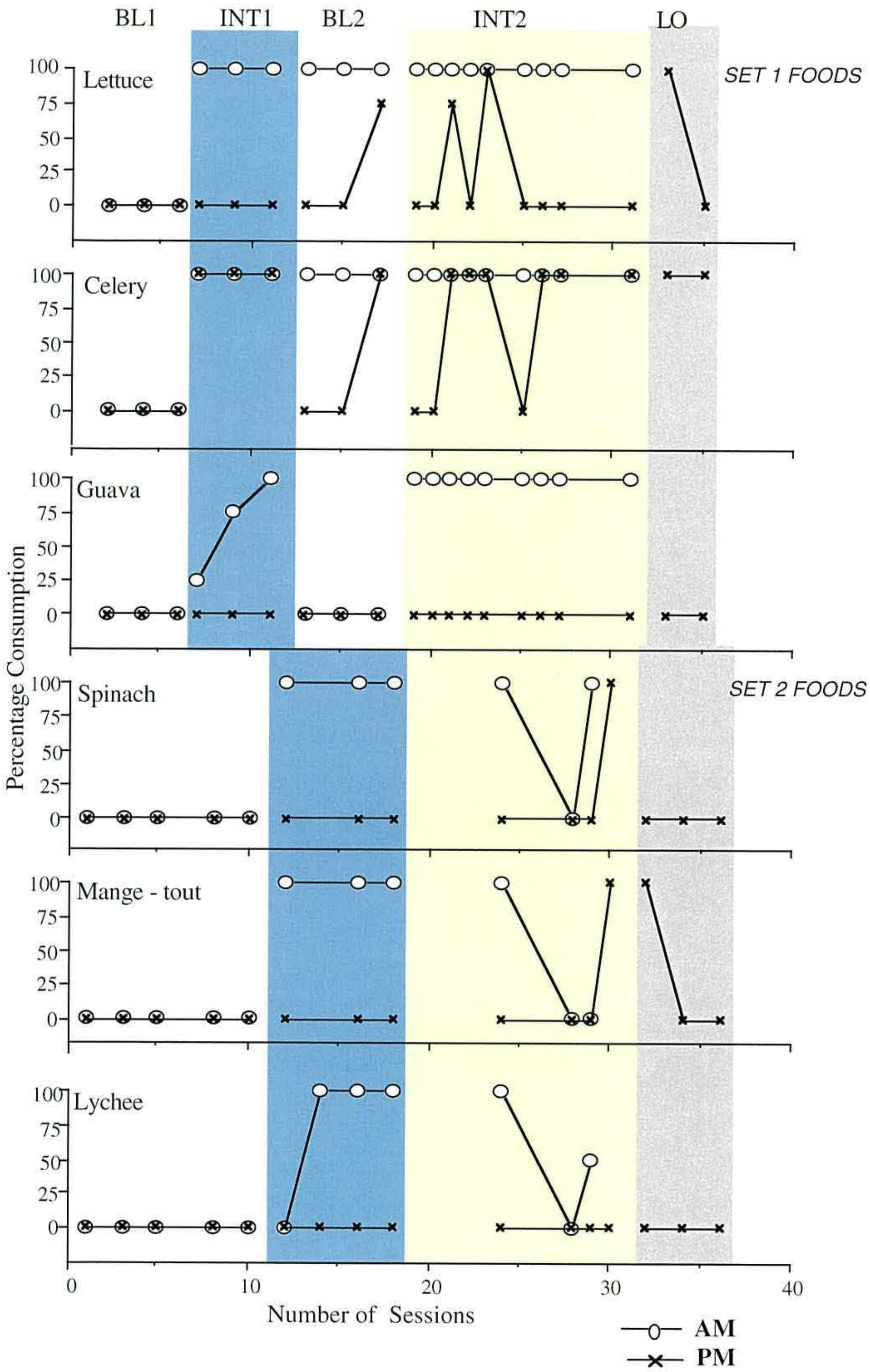


Figure 2.1. RN's consumption of each experimental food in the mid-morning experimental session (AM) and at lunchtime (PM) during Baseline 1 (BL1), Intervention 1 (INT1), Baseline 2 (BL2), Intervention 2 (INT2) and Lunchtime Only (LO) phases of Experiment 2

Intervention 2

When the 2nd intervention was introduced, RN not only continued to eat all vegetables in Set 1, but also resumed eating guava at maximum levels.

Consumption of foods in Set 2 was less stable than it had been during Intervention 1. Spinach was consumed most (100% on two out of three presentations) whilst mange-tout was eaten once (at 100%) out of three presentations. Lychee was eaten on two out of three occasions, but the trend was downward (100% and 50% respectively).

Figure 2.1.1 below shows the average (mean) number of times RN consumed the target foods during the morning experimental session throughout each phase of Experiment 2.

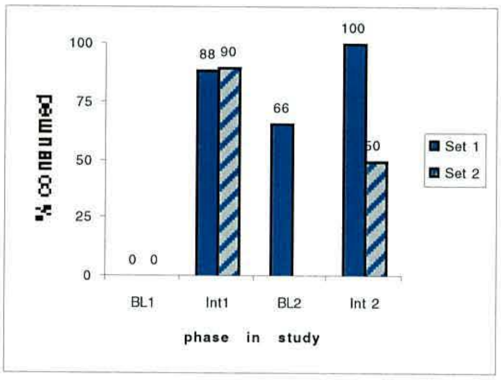


Figure 2.1.1 Changes in RN's consumption of foods during the experimental session across all phases of the experiment, Baseline 1 (BL1), Intervention 1 (INT1), Baseline 2 (BL2) and Intervention 2 (INT2).

Figure 2.1.1 shows that when Intervention 1 was applied to Set 1 foods, consumption of those foods increased to 88% from zero and this increase was maintained at 66% when Intervention 1 was withdrawn from Set 1 foods. When Intervention 2 was applied, consumption rose to 100%.

Similarly, when Intervention 1 was applied to foods in Set 2, consumption increased from 0% in Baseline to 91%. When Intervention 2 was applied to foods in Set 2, consumption fell to 50%; 50% more than was recorded during Baseline 1.

Overall, Figure 2.1.1 shows that there was a substantial increase in RN's consumption of foods in Sets 1 and 2 following the application of Intervention 1.

This increase was largely maintained when the intervention was withdrawn at Baseline 2 and during Intervention 2. Maintenance was greater with Set 1 foods. Consumption of foods in Set 1 was at maximum throughout Intervention 2.

Lunchtime context

Baseline 1

RN ate none of the foods in Set 1 or Set 2 at lunchtime during Baseline even after three presentations of each for Set 1 and five presentations each for Set 2.

Intervention 1

When Intervention 1 was applied in the morning experimental session to Set 1 foods, RN immediately began to consume celery at 100% and continued to do so across the phase. There was no change in guava or lettuce consumption, which remained at zero in the lunchtime setting.

Baseline 2

When the Intervention was removed from Set 1 foods in the morning session, RN's celery consumption was reduced to one out of three presentations. During this phase, RN ate lettuce for the first time in this context, once at 75%. He continued to refuse guava.

Intervention 2

When foods in Set 1 were targetted in the lunchtime context, RN's consumption of celery returned to being relatively stable, he consumed it maximally on six occasions out of a possible nine. His consumption of lettuce was low and variable, eaten twice out of nine presentations, at 75% and 100% respectively. There was no change in guava, which was not consumed.

Of Set 2 foods, there was a small effect on spinach and mange-tout which were each consumed once (at 100%) out of three presentations, both on the last presentation of the phase. Lychee remained consistently refused across the phase.

Lunchtime Only

Of those foods in Set 1, only celery was consistently eaten and consumed at 100% on both presentations. Lettuce was consumed maximally on the first presentation but refused on the second and guava continued to be refused.

Of foods in Set 2, only mange-tout was eaten and this on the first presentation and refused thereafter. Spinach and lychee were never eaten in this phase.

Figure 2.1.2 below shows the average (mean) number of times RN consumed the target foods in the lunchtime session throughout each phase of Experiment 2.

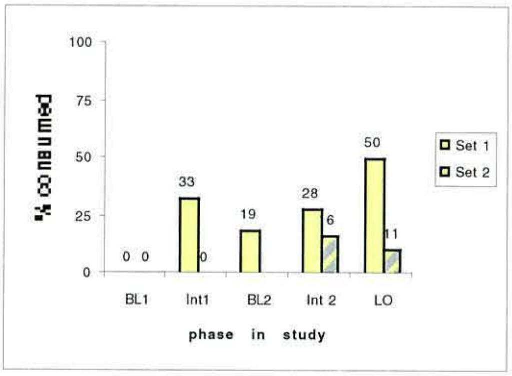


Figure 2.1.2. Changes in RN's consumption of foods at lunchtime across the phases of the experiment, Baseline 1 (BL1), Intervention 1 (INT1), Baseline 2 (BL2), Intervention 2 (INT2) and Lunchtime Only (LO).

Figure 2.1.2 shows that when Intervention 1 was applied to Set 1 foods during the morning experimental session, consumption of those foods at lunchtime rose from zero to 33%. This dropped to 19% when Intervention 1 was withdrawn, but recovered to 28% when Intervention 2 (specifically targetting lunchtime consumption) was implemented.

When Intervention 1 was applied to Set 2 foods during the morning experimental session, consumption of those foods at lunchtime was unaffected and remained at zero, but when Intervention 2 (specifically targetting lunchtime consumption) was introduced, consumption at lunchtime rose to 16%. In the final phase, when foods were presented only at lunchtime and in the absence of any intervention, RN's consumption of foods in Set 1 was at 50%, 50% greater than it had been during Baseline 1. Set 2 foods during the same phase were consumed at 11%, marginally greater than during Baseline 1.

Discussion

The main purpose of Experiment 2 was to examine the possibility of promoting consumption of previously refused fruits and vegetables using an interactive video peer-modelling with rewards intervention.

During Baseline 1, RN consistently refused all of the experimental foods. When Intervention 1 was applied to Set 1 foods in the morning experimental session, his consumption of those foods increased immediately. Since there was no change in consumption of Set 2 foods, it can be concluded that the intervention was responsible for the increased consumption.

When the Intervention 1 was applied to consumption of foods in Set 2, RN's consumption of those foods increased, providing further support for the intervention as the effective variable rather than other factors such as exposure or time.

Baseline 2 measures on Set 1 foods show that the increase in vegetable consumption recorded during Intervention 1 was maintained when that intervention was withdrawn, but fruit consumption reverted to pre-intervention levels as soon as it's consumption was no longer subject to the intervention procedures. Since there were no Baseline 2 data for Set 2 foods, it is not known whether a similar pattern of consumption would have been observed with the foods in that set.

During Intervention 2, when instructed to consumed the experimental foods in both contexts, but rewards were offered only for lunchtime consumption, RN continued to eat all foods in Set 1 and some of the foods in Set 2. He also began to consume maximum amounts of guava during this phase.

An important feature of the design of Experiment 2 was the use of the lunchtime context to look for any generalisation effects of the intervention. RN did not consume any of the experimental foods at lunchtime during Baseline 1. When the intervention was applied in the morning experimental session, RN ate celery at lunchtime, but no other food. His consumption of celery decreased when Intervention 1 was withdrawn.

When consumption at lunchtime was specifically targetted, during Intervention 2, some consumption of all vegetables was recorded. Some of these were being eaten for the first time in this context (spinach and mange-tout) and consumption was more variable and less stable than was the case when Intervention 1 was applied to foods in the morning experimental session. No increase in fruit consumption at lunchtime was recorded during any phase of the study.

It is interesting to note that whilst Intervention 2 was in operation, RN's consumption of vegetables in Set 1 during the morning experimental session was maintained at 100% for the duration of the phase although this consumption was not observed at lunchtime. Curiously, given his reliable consumption of guava in the experimental session during this phase, RN never ate guava at lunchtime.

Increasing consumption of the experimental foods in the lunchtime context was not as straightforward as had been planned for. RN was instructed via the video in Intervention 2 to "eat the special foods whenever you see them." During the morning experimental session, with the exception of presentation of spinach, he consumed all the target foods each time they were presented, but consumption at lunchtime remained variable. It was envisaged that during this lunchtime consumption of Set 1 foods would be targetted first and, when all three foods had been eaten on the same occasion, Set 2 foods would be targetted. The phase was planned to end when all foods in each set had been consumed three times at lunchtime.

Figure 2.1 shows that with Set 1 foods, of the five initial presentations, RN never consumed all three foods within the same presentation. He consumed celery and lettuce variably, but consistently refused guava. In order that RN might experience some measure of success, after five consecutive presentations of Set 1 foods, foods in Set 2 were targetted. The result of this was that all three foods in Set 2 were refused.

A further three presentations of Set 1 foods elicited little success, with only celery being eaten. On the second of two final presentations of Set 2 foods, spinach and mange-tout were eaten, but not guava. One final attempt was made to increase consumption of Set 1 foods, but success was not forthcoming and at this point it was decided to end the phase and award RN his treasure.

The evidence for any long-term effects on consumption at lunchtime in the absence of any intervention is scant. It was not possible to conduct further trials during the mornings (RN had begun to attend school for two hours each morning) and so the foods were presented at lunchtime only. RN did continue to eat celery reliably during the Lunchtime Only phase, but any consumption of other foods ceased beyond the first presentation. RN's celery consumption is interesting given that during baseline he was always particularly vociferous about celery, on one occasion shouting, "why do you bring that stuff when you know I don't like it?" Not only was celery eaten maximally during the Intervention period but it was also the only food ever consumed at lunchtime prior to Intervention 2.

Anecdotal evidence points to the actors descriptions of the experimental foods as a factor in behaviour change. On the first occasion that lettuce was targetted, RN asked the experimenter if lettuce "really is nice" as had been asserted by the characters in the video and promptly consumed it

In summary, RN's consumption of previously refused fruits and vegetables increased when the intervention was introduced. Vegetable consumption was affected more quickly and the effects longer lasting than was the case with fruit. This is somewhat surprising, since it might be expected that consumption of sweet fruits would increase and maintain as least as well, if not better than vegetables.

The intervention was effective in the experimental context and the changes in eating behaviour were maintained with some foods in the absence of rewards. Consumption of the target foods increased from the beginning of the study through to the end of the final phase. There was evidence of generalisation of behaviour change to a second context with only one food. Specific procedures to target consumption in a second context were introduced, but consumption at that time remained sporadic and unstable.

WD

Figure 2.2 (overleaf) shows WD's consumption of all six experimental foods across all phases of the experiment in both the morning experimental session and at lunchtime.

Morning Experimental Session

Baseline 1

WD consumed none of the experimental foods during Baseline 1, even after 5 presentations each of Set 1 foods and 11 presentations each of Set 2 foods.

Intervention 1

Immediately Set 1 foods were intervened upon, WD's consumption of those foods increased. He ate lettuce on its first presentation at 25% and increased this to 100% on the two subsequent presentations. Celery consumption rose more gradually, starting at 25%, to 75% to finally 100%. His consumption of guava was more variable, eaten on the first presentation at 100%, then refused, but was back to 100% on the third and fourth presentations.

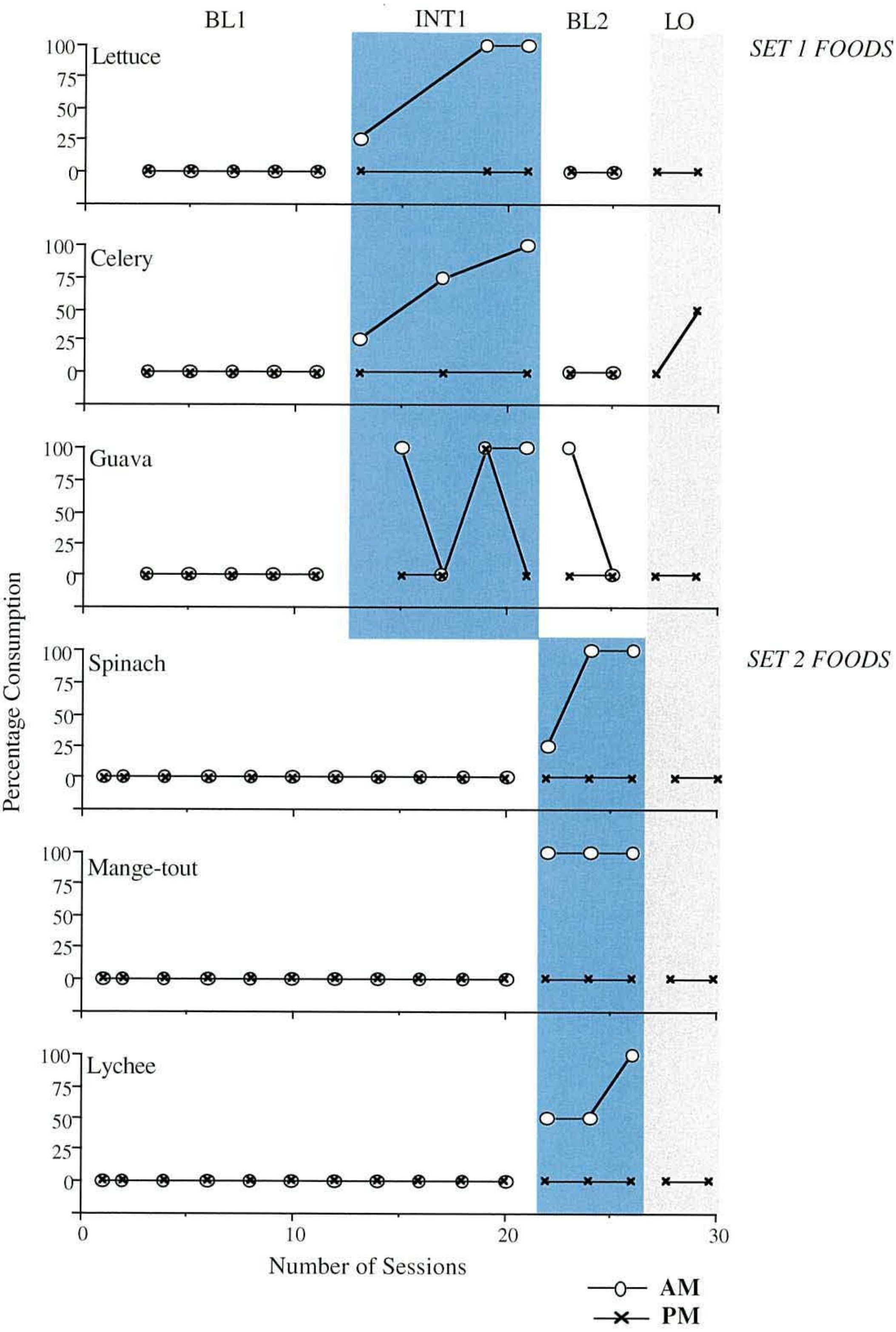


Figure 2.2. WD's consumption of each experimental food in the mid-morning experimental session (AM) and at lunchtime (PM) during Baseline 1 (BL1). Intervention 1 (INT1), Baseline 2 (BL2) and Lunchtime Only (LO) phases of Experiment 2.

Similarly, when the intervention was applied to Set 2, WD's consumption of foods in that set also increased. He immediately ate mange-tout at 100% and continued to do so throughout the phase. Spinach consumption rose more gradually, starting at 25% and reaching 100% on both subsequent presentations. Lychees were eaten at 50% for the first two presentations and then at 100% by the third and final presentation.

Baseline 2

When Intervention 1 was removed from Set 1 foods, WD ate guava on one occasion only (at 100%) and refused both lettuce and celery.

Figure 2.2.1 below shows the average (mean) number of times WD consumed the target foods during the morning experimental session throughout each phase of Experiment 2.

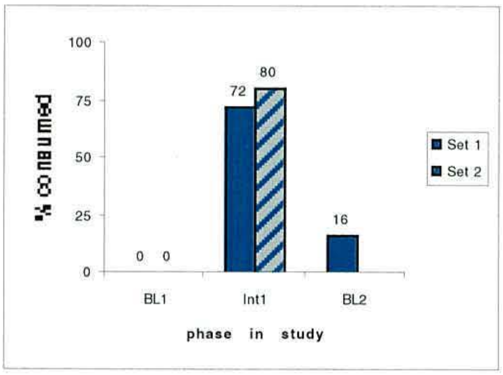


Figure 2.2.1. Changes in WD's consumption of foods during the experimental session across the phases of the experiment, Baseline 1 (BL1), Intervention 1 (INT1) and Baseline 2 (BL2).

Figure 2.2.1 shows that when Intervention 1 was applied, WD's consumption of Set 1 foods increased immediately from 0% to 72%. Some consumption (16%) was maintained into second baseline.

When Intervention 1 was introduced with Set 2 foods, WD's consumption of those foods increased substantially from 0% to 80%.

No further data were collected during the morning experimental session as WD left the nursery.

Lunchtime Context

Baseline 1

As was the case during the morning experimental sessions, WD ate none of the foods in either Set 1 or Set 2 at lunchtime even after 5 presentations each of Set 1 foods and 11 presentations each of Set 2 foods.

Intervention 1

When Intervention 1 was applied in the morning experimental session, there was little effect on WD's consumption at lunchtime. The only food he ate at this time was guava and then just once.

Baseline 2

WD continued to refuse the experimental foods.

Lunchtime only

WD's consumption of all foods remained poor. Except for celery, which was eaten once at 50%, he refused all foods.

Figure 2.2.2 below shows the average (mean) number of times WD consumed the target foods during the lunchtime session throughout each phase of Experiment 2.

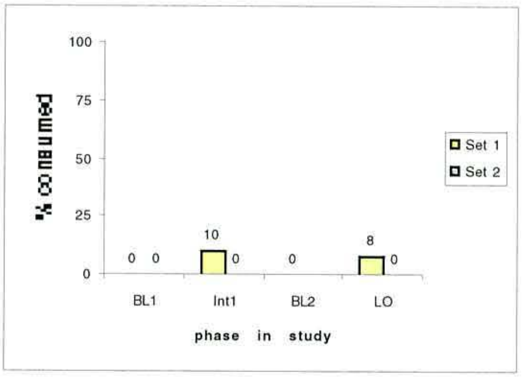


Figure 2.2.2. Changes in WD's consumption of foods in each set across all the phases of the experiment, (Baseline 1 (BL1), Intervention 1 (INT1), and Baseline 2 (BL2).

There was no consumption of any food at lunchtime during Baseline 1. During Intervention 1, WD's consumption of Set 1 foods increased to 10%, but dropped back to zero during Baseline 2. He never consumed foods in Set 2 at lunchtime.

Discussion

WD consistently refused all six foods during Baseline in the morning experimental session. When Intervention 1 was applied to Set 1 foods, consumption of those foods increased immediately, supporting the notion that the intervention was responsible for changes in eating behaviour. Consumption of foods in Set 2 was not affected until those foods were specifically targetted, further suggesting that the intervention was the effective variable rather than other factors such as time or increased exposure.

Baseline 2 data show little evidence of maintenance of the behaviour change recorded during Intervention 1 when that intervention was removed.

The changes in consumption observed during the morning experimental session did not generalise to the lunchtime context. WD ate none of the target foods at lunchtime. Data from the Lunchtime Only phase also show that he continued to refuse foods at lunchtime in the absence of any intervention. Time limitations (WD left the nursery) meant that he was not exposed to Intervention 2 and so further means of increasing lunchtime consumption were not explored.

In summary, WD did increase his consumption of previously refused fruits and vegetables, but the changes were in evidence only when the intervention was applied and were confined to the experimental context; changes in consumption did not generalise to the lunchtime context and did not last beyond the experimental procedures.

HI

Figure 2.3 shows HI's consumption of the six target foods, both in the morning experimental session and at lunchtime across all phases of the experiment.

Morning Experimental Session

Baseline 1

Figure 2.3 (overleaf) shows that HI ate none of the experimental foods across 5 presentations of each of Set 1 foods and 18 presentations of foods in Set 2.

Intervention 1

When foods in Set 1 were targetted, HI increased his consumption of those foods. He immediately consumed celery at 50% and continued to do so, increasing his intake to 100% for the last two presentations. He began eating lettuce and guava more hesitantly; three presentations were necessary before either were consumed.

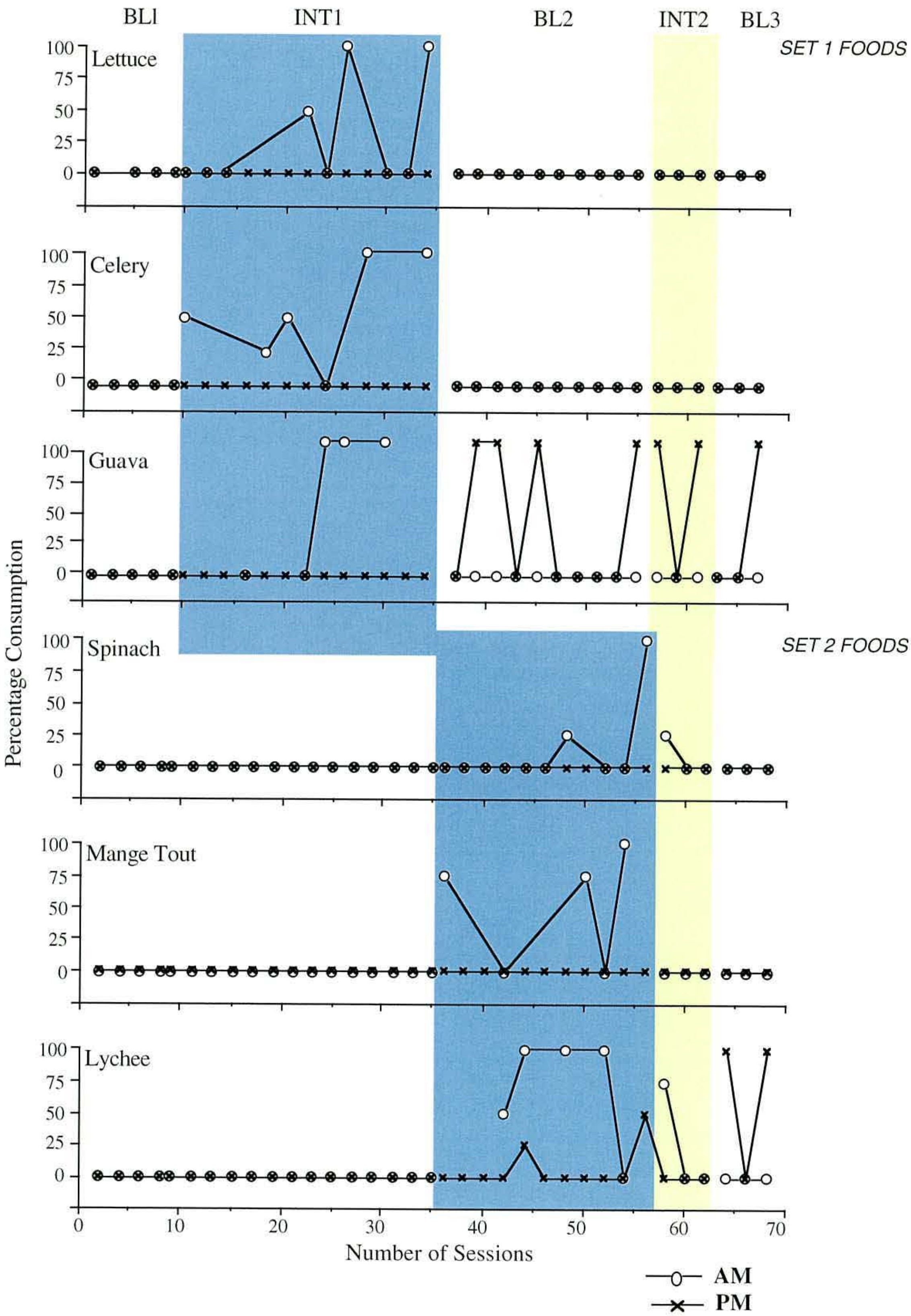


Figure 2.3. HI's consumption of each experimental food in the mid-morning session (AM) and at lunchtime (PM) during Baseline 1 (BL1), Intervention 1 (INT1), Baseline 2 (BL2), Intervention 2 (INT2) and Baseline 3 (BL3) phases of Experiment 2.

Consumption of guava was the most stable at 100% across the phase. Lettuce consumption was variable, with one data point at 50% and two at 100% recorded out of six presentations.

When the intervention was applied to Set 2 foods, HI's consumption of those foods also increased. He ate mange-tout and lychee immediately at 75% and 50% respectively.

Lychee consumption across the phase was the highest and most stable of the three foods in the set, being eaten four out of five times, only once at less than maximum. Mange tout was eaten three out of five times, once at 100%. Spinach was the least accepted food, eaten only (at 25%) on the seventh and (at 100%) the tenth and final presentations.

Baseline 2

When Intervention 1 was removed from Set 1, HI's consumption of all three foods reverted to zero.

Intervention 2

Foods in Set 1 were consistently refused across the phase.

Of the foods in Set 2, consumption was low; spinach and lychee were eaten once (on the same occasion) at levels of 25% and 75% respectively. Mange-tout was never eaten in this phase.

Baseline 3

When all interventions were withdrawn, HI did not consume any of the experimental foods.

Figure 2.3.1 below shows the average (mean) number of times HI consumed the target foods during the morning experimental session throughout each phase of Experiment 2.

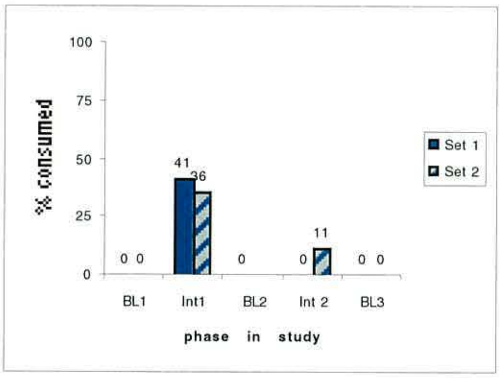


Figure 2.3.1. Changes in HI's consumption during the morning experimental session across all phases of the experiment, Baseline 1 (BL1), Intervention 1 (INT1), Baseline 2 (BL2), Intervention 2 (INT2), and Baseline 3 (BL3).

As Figure 2.3.1 illustrates, when Intervention 1 was applied to Set 1 foods, HI's consumption of those foods increased to 41% from zero. No other consumption of these foods was recorded throughout the duration of the study.

Similarly, consumption of Set 2 foods also increased to 36% during Intervention 1 dropping to 11% during Baseline 2. No further consumption was recorded for the remainder of the study.

Lunchtime Context

Baseline 1

HI ate none of the experimental foods during Baseline 1, despite 5 presentations of Set 1 foods and 18 presentations of Set 2 foods.

Intervention 1

When Intervention 1 was applied to foods in Set 1 during the morning experimental session, there was no change in HI's consumption of those foods at lunchtime. When Intervention 1 was applied to Set 2 foods, he ate small amounts of lychee (25% and 50% respectively) on 2 out of 11 occasions. Neither of the vegetables was eaten on any of the 11 occasions on which they were presented.

Baseline 2

HI's consumption of guava increased from zero in the previous two phases to being eaten on 4 out of 10 presentations during Baseline 2. He continued to refuse lettuce and celery.

Intervention 2

When the Intervention was applied to consumption at lunchtime, HI continued to eat guava whilst refusing lettuce and celery.

He ate none of the foods in Set 2.

Baseline 3

When the interventions were withdrawn, HI continued to eat fruit, lychee more often than guava. He consistently refused all vegetables.

Figure 2.3.2 below shows the average (mean) number of times HI consumed the target foods during the lunchtime session throughout each phase of Experiment 2.

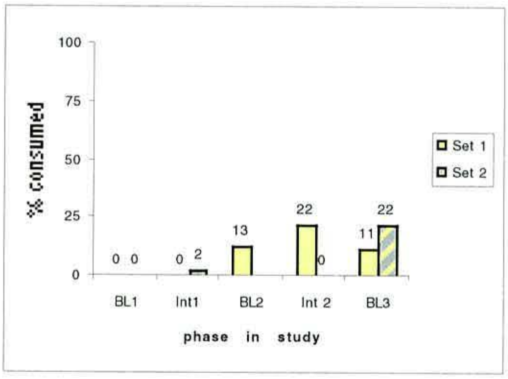


Figure 2.3.2. Changes in HI's consumption during the lunchtime session across all phases of the experiment, Baseline 1 (BL1), Intervention 1 (INT1), Baseline 2 (BL2), Intervention 2 (INT2), and Baseline 3 (BL3).

Figure 2.3.2 shows very little consumption of any foods at lunchtime.

Consumption of foods in Set 1 increased from zero to 22% when the intervention was applied to consumption at lunchtime and remained at 11% when th eintervention was withdrawn at Baseline 3. Foods in Set 2 remained largely uneaten in this context until Baseline 3.

Discussion

During Baseline 1, HI ate none of the experimental foods when they were presented in the morning experimental session. When Intervention 1 was applied to Set 1 foods, his consumption of those foods during the morning experimental session increased whilst consumption of Set 2 foods remained at baseline levels, indicating that the intervention was responsible for the changes in consumption. Further, consumption of foods in Set 2 rose when the intervention was applied directly to them, providing additional evidence for the influence of the intervention.

The data from Set 1 foods during Baseline 2 show that the gains in consumption made during Intervention 1 were not maintained when the intervention was removed. Data from Intervention 2 further highlight the lack of maintenance of behaviour change with both Set 1 and Set 2 foods.

There was little evidence of any generalisation of behaviour to the lunchtime setting during Intervention 1. HI ate small amounts of lychee at lunchtime during Intervention 1, stopped during Intervention 2 and resumed again during Baseline 3. His pattern of guava consumption is interesting. HI's guava consumption was the most stable of all the six foods when presented during Intervention 1. However, he continued to refuse it at lunchtime. When guava was presented in Baseline 2, HI rejected it during the morning experimental session, but began eating it at lunchtime.

The intervention that targetted lunchtime consumption had little effect on HI's consumption of any of the experimental foods at lunchtime. He refused all foods but guava, which he had begun to consume in the previous phase.

HI's consumption of the target foods during Intervention 1 was variable and less stable in comparison to that of RN or WD. He ate some foods (lettuce, mange-tout and lychee) immediately they were targetted, although only consumption of lychee was stable across the phase. All other foods (celery, spinach and guava) were all targetted on at least three occasions before they were consumed. Fruit was more consistently consumed across the phase than vegetables.

In summary, it can be said that there was change in HI's target food consumption during the morning experimental sessions in the Intervention phase. The changes were immediate for half the foods; others had to be presented on more than one occasion before they were eaten. The effect of the intervention appeared to be stronger for fruits than for vegetables. Fruits continued to be eaten into the latter stages of the study, but vegetables were consistently refused at this time.

Similar to both RN and WD, there was little evidence of generalisation of consumption to the lunchtime context during Intervention 1.

The data presented in Figure 2.3 do not show that progression to the end of the study (i.e. to obtain the treasure) took considerably longer for HI than for either RN or WD. Each food was targetted on at least five occasions and in the worst case (spinach) ten. Because of his slow progress (and in effect his reluctance to consume some foods) it was decided to attempt to 'get hold of' the behaviour by rewarding any instance of it. Thus, 'the Taste Buddies' presented HI with a plastic model dinosaur in return for his eating a relatively small portion (e.g. 25%) of target food. This did seem to have the desired effect (inducing consumption) but also had the effect of disrupting morning sessions and limiting time available to continue beyond one food each time.

Other factors in this study (absence, illness and holidays) increased the time span of the procedure, which took over five months to complete.

JR

Figure 2.4 (overleaf) shows JR's consumption of the six experimental foods, both in the morning experimental session and at lunchtime across all phases of the experiment.

Morning Experimental Session

Baseline 1

Of the foods in Set 1, both lettuce and celery were consistently refused. Guava was eaten once (at 100%) on the final presentation of the phase.

JR did not eat foods in Set 2 during Baseline 1, despite 15 presentations of each food.

Intervention 1

When consumption of foods in Set 1 was rewarded, consumption of all three increased. Consumption of individual foods across the phase was variable. Although lettuce and guava were eaten maximally (on days 1, 2 and 7 and days 1, 2, 3 and 6 respectively) consumption of those foods occurred on only half the occasions that they were presented. Guava was more reliably consumed than lettuce, and celery consumption increased but was unstable.

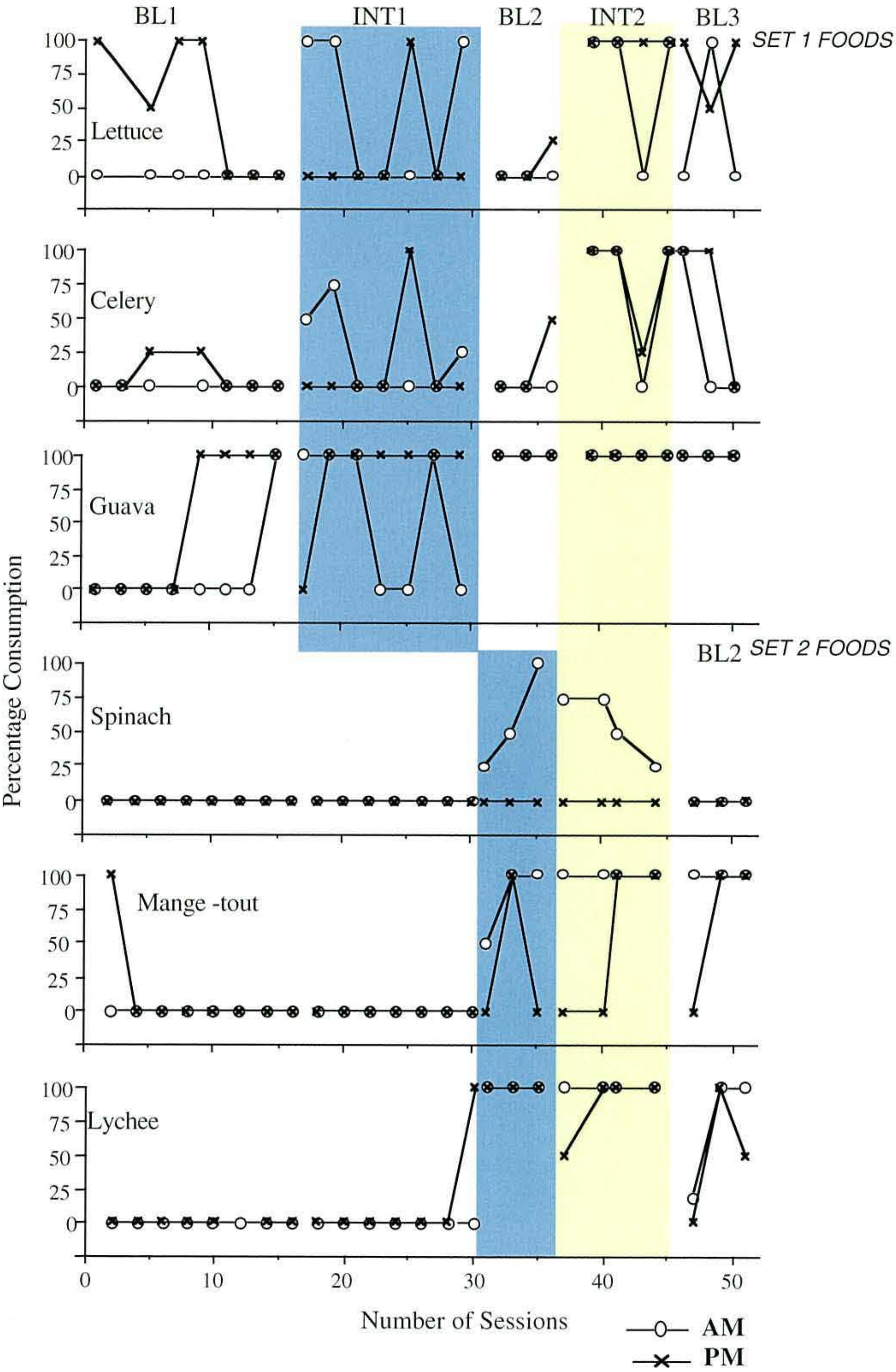


Figure 2.4. JR's consumption of each experimental food in the mid-morning experimental session (AM) and at lunchtime (PM) during Baseline 1 (BL1), Intervention 1 (INT1), Baseline 2 (BL2), Intervention 2 (INT2) and Baseline 3 (BL3) phases of Experiment 2.

Of the foods in Set 2, lychee was immediately consumed maximally when the intervention was applied and remained at that level for the duration of the phase. Mange-tout and spinach were also consumed as soon as the intervention was applied and the trend for these foods was upward. In contrast to what was observed with foods in Set 1, foods in Set 2 were eaten on every occasion they were presented.

Baseline 2

When Intervention 1 was removed from foods in Set 1, guava consumption remained stable at 100% for the duration of the phase. Consumption of vegetables reverted to zero.

Intervention 2

When foods in Set 1 were targetted at lunchtime, there was an immediate effect on all foods. Stable consumption of lettuce and celery was recorded (100% on three out of four presentations) and guava consumption continued at 100% across the phase.

Of foods in Set 2, the effect was also immediate with all foods. Lychee and mange-tout were eaten at 100% on every presentation. Spinach was also consumed on every presentation, but levels were variable, and downward, ranging from 75% at the start to 25% on the final presentation.

Baseline 3

Baseline 3 data show that when all interventions were withdrawn JR continued to reliably eat guava, mange-tout and lychee. Lettuce and celery were consumed sporadically (once out of three presentations) and she reverted to refusing to eat spinach.

Figure 2.4.1 below shows the average (mean) number of times JR consumed the target foods during the morning experimental session throughout each phase of Experiment 2.

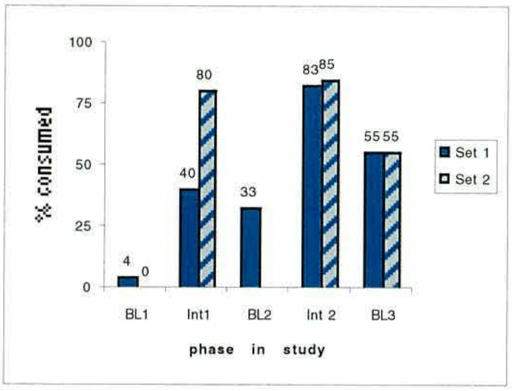


Figure 2.4.1. Changes in JR's consumption of foods during the morning experimental session across all phases of the experiment, Baseline 1 (BL1), Intervention 1 (INT1), Baseline 2 (BL2), Intervention 2 (INT2) and Baseline 3 (BL3).

Figure 2.4.1 shows that JR's consumption of foods in Set 1 rose from 4% in Baseline to 40% when Intervention 1 was introduced. She continued to eat 33% of Set 1 foods in Baseline 2. A substantial rise in consumption during Intervention 2 (up to 83%) was recorded. When all interventions were withdrawn, consumption remained at 55%, higher than that recorded during Baseline 1.

For foods in Set 2, consumption levels increased from 0% to 80% when Intervention 1 was applied. This continued during Intervention 2 during which time levels of 85% were recorded. At the end of the study, consumption was at 55%, greater by the same amount than in Baseline 1.

Lunchtime Context

Baseline 1

Variable consumption on all foods in Set 1 was recorded. JR's lettuce consumption was high on the first four presentations at between 50 and 100%, but decreased to nil on the final three presentations. She ate small amounts of celery (25%) on two presentations out of seven. Guava was also eaten at 100% on the fourth presentation and this remained the case for the duration of the phase.

Consumption of foods in Set 2 was less variable but low. Spinach was consistently refused, mange-tout was eaten once, (on the first presentation of fifteen) and lychee was consumed at 100% on its final (thirteenth) presentation.

Intervention 1

When Intervention 1 was introduced in the morning experimental session, there was little change in consumption of foods in Set 1 at lunchtime. Lettuce and celery were eaten at 100% on one out of seven presentations. Guava was initially refused, but consumption increased to 100% on the second presentation where it remained across the rest of the phase.

During Intervention 1, JR also began to eat foods in Set 2. Lychee was reliably eaten and mange-tout was consumed once (at 100%). Spinach was consistently refused.

Baseline 2

When Intervention 1 was removed, JR continued to eat guava reliably and consumed minimal quantities of vegetables. Celery and lettuce were eaten on one occasion, (the third and final presentation) at 25% and 50% respectively.

Intervention 2

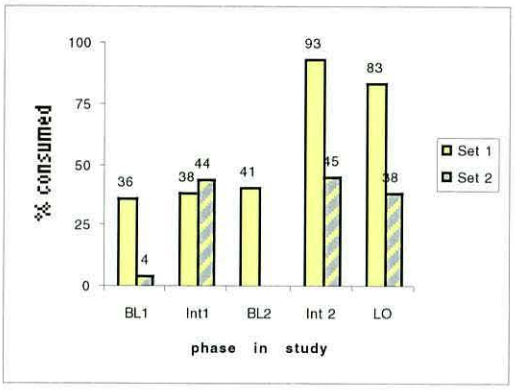
When lunchtime consumption was directly intervened upon, JR's consumption of all Set 1 foods increased. Only once (3rd presentation of celery) did she eat less than 100% of any food and none were refused.

There was a less immediate effect when the Intervention was applied to Set 2. Only lychee (at 50%) was eaten immediately with stable and reliable maximum levels of consumption recorded thereafter. Mange-tout was presented twice before it was eaten (at 100%) and spinach was refused for the duration of the phase.

Baseline 3

Post-intervention data show that JR continued to reliably consume lettuce, guava, and to some extent celery, mange-tout and lychee. Spinach was the only food that she did not eat at lunchtime during this final baseline.

Figure 2.4.2 below shows the average (mean) number of times RN consumed the target foods during the morning experimental session throughout each phase of Experiment 2.



1

Figure 2.4.2. Changes in JR's consumption at lunchtime across all phases of the experiment, Baseline 1 (BL1), Intervention 1 (INT1), Baseline 2 (BL2), Intervention 2 (INT2), and Baseline 3 (BL3).

Figure 2.4.2 shows that for foods in Set 1, consumption levels were relatively high during Baseline 1 at 36%. This remained almost unchanged during Intervention 1 and increased slightly in Baseline 2. There was a substantial increase in consumption to 93% when Intervention 2 was applied. This high level was maintained at 83% at the end of the final baseline phase.

Foods in Set 2 were consumed at 4% during Baseline 1 and this rose to 44% when Intervention 1 was applied. During Intervention 2 there was little change at 45% and JR's overall consumption was maintained at 38% in the final baseline phase.

Discussion

Baseline measures show that during the morning experimental sessions (with the exception of guava) JR consistently refused all foods in the morning experimental session. Immediately Intervention 1 was applied during the morning experimental session to foods in Set 1, consumption increased of those foods increased, thus providing evidence for the effect of the intervention. Likewise, consumption of Set 2 foods increased only when they were specifically targetted with the intervention, additional evidence that the intervention was the effective variable. It should be borne in mind however, that JR had consumed some of the experimental foods during Baseline 1 at lunchtime.

Data from Baseline 2 show that there was little maintenance of the effects of the intervention on Set 1 foods. Guava remained consistently eaten, but consumption of this fruit in baseline had been high. During Intervention 2 (targetting consumption at lunchtime) and Baseline 3, consumption of all foods returned to the high levels recorded during Intervention 1.

JR had, to varying degrees consumed the experimental foods at lunchtime (particularly those in Set 1) during Baseline 1. When Intervention 1 was introduced during the morning experimental session, there was little increase in her consumption of foods in Set 1 at lunchtime. Consumption of those foods was as unreliable as it had been during Baseline 1. There was a greater increase in consumption of foods in Set 2, although this was largely confined to lychee, one of the foods she had consumed at lunchtime during Baseline 1.

When Intervention 2 was introduced, JR's consumption of all foods (with the exception of spinach) at lunchtime increased; reliable patterns were recorded.

Baseline measures taken at Baseline 3 show some evidence of maintenance of consumption at lunchtime.

In summary, it can be said that Intervention 1 was effective in increasing consumption of previously refused foods during the morning experimental session. Given that consumption had begun in baseline, it is not possible to say whether fruit consumption was effected more quickly than that of vegetables, but certainly, fruit consumption was maintained to a greater extent. Intervention 2 was effective in bringing about increased consumption at lunchtime, whilst consumption in the morning experimental session also became more stable. Changes in consumption were maintained when the interventions were withdrawn.

JR's mother reported that JR often asked for guava at home, suggesting that consumption of guava had generalised to the home environment.

GENERAL DISCUSSION

Intervention 1 was effective (to varying degrees) with all participants in promoting consumption of previously refused fruits and vegetables during the morning experimental session. In Baseline 1 little consumption of any of the experimental foods was recorded. When Intervention 1 was introduced, all four participants consumed the experimental foods on at least three occasions. For RN, the increase in consumption was immediate, high and stable. With JR, the increase was immediate, variable and unstable. WD's increase in consumption was immediate and low, but with a stable upward trend. For HI, the effects took longer to emerge and consumption was low and very variable.

A fruit and vegetable dichotomy was noted: RN and WD increased consumption of vegetables more quickly than fruits, whilst the converse was true for JR and HI.

The effects of Intervention 1 were maintained into the subsequent baseline phase for two out of the four participants (RN and JR) with the one set of foods that was monitored in this phase.

Since little effect on consumption at lunchtime was recorded with any participant during the Intervention 1, Intervention 2 was introduced.

When Intervention 2 was applied, RN's vegetable consumption at lunchtime did increase although his consumption was variable in contrast to the stable patterns recorded during the morning experimental session. These changes were not maintained when the intervention was removed. RN's consumption of vegetables increased, but his fruit consumption was unaffected.

Changes in JR's consumption at lunchtime were more difficult to assess, since she had consumed some of the experimental foods (mostly at lunchtime) during Baseline 1. Her consumption of foods in Sets 1 and 2 increased during Intervention 2 and her consumption at lunchtime was more stable than during previous phases. She continued to eat some of the foods at lunchtime during Baseline 3.

HI's consumption of target foods at lunchtime was confined to guava and it cannot be directly attributed to Intervention 2 since HI began consuming guava (at lunchtime only) during Baseline 2.

In summary, the greatest effects on consumption of the experimental foods were observed in the morning experimental session. Some of the changes in consumption were maintained when Intervention 1 was withdrawn and there was little evidence of any generalisation of the effects of the intervention to the lunchtime meal context.

Given these findings, it is likely that increases in consumption recorded in the morning experimental session were the result of compliance and that some, or all of the variables in place during the experimental session 'forced' food consumption in that context. There were instructions (via the actors in the film) to consume food and if that behaviour was performed, it was immediately rewarded, both verbally (thanks from the actors) and tangibly, with stickers. If the behaviour was not performed, then there would be a period when the video was paused, waiting for the participant to consume, another cue for the target behaviour. In addition, the experimenter provided verbal encouragement and/or praise for food consumption.

Since participants in Experiment 2 were given only three rewarded taste opportunities before Intervention 1 was withdrawn, it is possible that these relatively few opportunities were insufficient to allow the natural consequences of ingestion to take over from the external rewards and thereby support maintenance (via tracking).

The present results can be compared to those obtained by Dowey (1996) with 5-7 year old children in a home setting. In those studies, consumption of fruit and vegetables was high and stable for the intervention period of three targettings but a general decline followed withdrawal of the intervention. A second intervention of a further seven targettings brought consumption of all participants near to maximum and a follow-up phase after two months showed consumption to be maintained at greater levels than during Baseline 1. In the present study, a second intervention, applied in the morning experimental session, giving further rewarded taste opportunities, may have had the effect of establishing food consumption and thereby increasing the maintenance (and perhaps even generalisation) of behaviour change.

Birch et al. (1987) have suggested that between 10 and 15 taste exposures are necessary to achieve changes in verbal liking. Changes in verbal liking however, may or may not be directly relevant to changes in consumption. It is also the case that the foods used in the present experiment were those that had been consistently rejected by each participant, rather than the 'novel' foods employed in the experiments reported by Birch et al.. It may be more difficult to promote consumption of foods with which a child has a history of rejection.

The small number (i.e. three) of rewarded taste exposures may well be the reason for the lack of generalisation to the lunchtime setting. These few exposures were sufficient to promote initial consumption in the experimental setting during the intervention, but were not sufficient to support maintenance of these changes in that setting once the intervention was removed. If consumption in the experimental setting was not firmly established then generalisation is unlikely; it may be useful to target consumption in the generalisation setting with a separate intervention.

During Intervention 2, contingencies were placed on consumption of the experimental foods at lunchtime. The characters in the film described these contingencies during the morning experimental session and the experimenter described them again prior to the presentation of the foods at lunchtime. The resulting changes in consumption at lunchtime were much weaker than those observed in the morning experimental session during Intervention 1. In addition, the participants rarely complied fully with experimental instruction (i.e. to eat all three foods), even RN who regularly consumed all three foods during the experimental sessions.

It may be that since the consequences of behaviour (watching the actors in the video lift the lid of the treasure box) were not delivered until the next morning experimental session, some twenty hours (or longer if there was a weekend in between) after the behaviour was performed/not performed, these were not powerful enough to engender the child's compliance.

It is also possible, that despite careful explanation of the contingency by the experimenter (the participant was asked to verbalise this at the end of each morning session and at the start of the mid-day meal) the participant did not understand the contingency or had forgotten it by the time the lunch was served.

With regard to promoting consumption at lunchtime, it might prove more effective to fully establish consumption in one context (i.e. the morning experimental session) through rewarded taste exposures (compliance) until the natural consequences of ingestion come to the fore and tracking is established. Once this is achieved, then generalisation of consumption to other contexts is more likely.

Pliance and tracking at lunchtime may have been enhanced by providing external cues for eating the experimental foods in that context; for example presenting foods on plates that featured Taste Buddies logos or rewarding the participant with Taste Buddies badges or stickers for eating foods in the experimental session that he or she continued to wear during the lunchtime meal.

Baseline 1 data from Experiment 2 show that sight exposure alone was not enough to ensure a food was consumed and that by themselves, experimenter's instructions did not secure consumption. This is contrary to the experiences of those experimenters cited in Chapter 2 (Birch, 1979; Birch & Marlin, 1982; Birch, McPhee, Shoba, Pirok & Steinberg, 1987) who report few difficulties in ensuring that their participants 'tasted' the food presented during experimental procedures. Again, however, it should be noted that the foods in Experiment 2 had a history of participant refusal, rather than being 'novel'.

The reward procedures implemented in Experiment 2 did not appear to have a detrimental effect on food consumption; consumption increased when rewards were offered and furthermore, in all cases, reward interventions were necessary to induce initial consumption.

Some improvements could be made to the design of this experiment, a major one being the inclusion of a second baseline on Set 2 foods immediately after the first Intervention phase. A second baseline was not included because the participant achieved his/her reward on the last day of targetting Set 2 foods. The rationale of then opening the treasure box was used in attempting to increase consumption of target foods at lunchtime. Having an entirely separate baseline phase for these foods would have lengthened the procedure by six sessions (cycling Set 2 with Set 1) and run the risk of the participants losing interest and or being confused as to why their treasure wasn't forthcoming. It was thought that Set 2 foods could be presented in Intervention 2 as baseline foods, but this may have become confusing to the participant, as it would have interfered with feedback on the previous day's lunchtime performance and also have lengthened the procedure. It is difficult to see how a second baseline could be achieved within this particular design. If a completely new intervention were designed to target lunchtime consumption, using the rationale of the first part, but an entirely separate reward, then a second baseline for Set 2 foods could be included at the end of the first part of the study. A new rationale could be that the Taste Buddies need help for some other purpose and another reward would be on offer for consuming foods at lunchtime. This would build on the credibility achieved from the first part of the study - the Buddies always do what they say they will do. Of course, it is always possible that the child will be satisfied with his/her treasure and would not be interested in obtaining further rewards.

The effects of Intervention 1 in future studies might be enhanced if less target foods were involved in any one session. Consumption of two foods (perhaps a fruit and a vegetable) may be easier to achieve than three, particularly in the lunchtime context. The procedure might also take less time.

On a related issue, it may be possible to speed up participant's progress and/or maintain interest by interspersing target foods with 'surprise' foods that are normally consumed. This may also enhance the Taste Buddies' credibility in that they would be seen to extol the virtues of other foods that the participant normally eats as well as those that he or she always rejects. Such a strategy was used to good effect in the introductory video used at the beginning of the study to shape participants behaviour. However, this may encourage a participant to wait for a more favoured food to be featured.

One difficulty encountered during the implementation of the first video intervention was its lack of flexibility. This was a particular problem when a target food was refused on more than one occasion (as happened with HI). The film would be halted and the participant could go no further on the journey to the treasure. In practice, this meant re-running the same footage in each successive session until that food had been consumed, perhaps adding to the participant's history of refusing that particular food.

In conclusion, this was a first attempt to modify food choice and consumption in young children. The foods employed were specific items that each participant had previously refused to eat on a number of occasions. Some of the foods were familiar, others more exotic. The original aims of the study were to change consumption patterns of those foods in two contexts, one immediate, and the other remote in both space and time. Whilst results showed that it was possible to effect change in one context, further modification of the intervention may yield improved effects on maintenance which may then impact on consumption in a second context.

CHAPTER 7

A CATEGORY-BASED VIDEO PEER-MODELLING INTERVENTION TO INCREASE CONSUMPTION OF FRUIT AND VEGETABLES IN A PRE-SCHOOL CLASSROOM

General Method for Experiments 3 and 4

INTRODUCTION

Experiment 1 showed that what children aged between two and five years choose to consume can be influenced by others, to some extent in a positive way and to a very great extent in a negative way. The experiment was limited in that it was designed to investigate only short term changes in the children's acceptance/rejection of particular foods; little could be concluded regarding the stability or maintenance of the consumption patterns observed during the study.

Experiment 2 showed that it is possible, using an interactive video plus rewards intervention, to increase young children's consumption of fruit and vegetables that they have previously refused. The intervention was effective in increasing fruit and vegetable consumption in the context of the mid-morning experimental setting, but there was little evidence of a corresponding change in consumption of those foods during the midday meal. Not enough data were available to assess any longer term changes in the target behaviour.

Both of the above experiments were carried out with individual children participating in a series of sessions and were (particularly Experiment 2) very labour-intensive, costly and inefficient.

The purpose of the two experiments to be reported in the following chapter was to examine the possibility of increasing consumption of fruit and vegetables in a whole class of pre-schoolers using a video and rewards intervention similar to that employed in Experiment 2 and to observe whether any increases in consumption would be maintained when the intervention was withdrawn.

A series of interventions designed to promote fruit and vegetable consumption in a pre-school nursery class was developed. The data reported in Experiment 3 show the results of an intervention that targetted only fruit consumption, whilst those for Experiment 4 show the results of an intervention that first targetted fruit and then vegetable consumption.

Both experiments were carried out at Tir Na n'Og nursery over the course of several months and the procedures were designed to fit in with the normal daily routine there and to be implemented as far as possible by the childcare staff. Target behaviour was measured in two settings, during the morning snack time (intervention based) and at the midday meal (as a generalisation measure). In addition, post-intervention questionnaire data regarding participants' eating behaviour at home were collected from parents (Experiment 4 only). Single case methodology was used to assess the effectiveness of each intervention.

GENERAL METHOD

Participants

The children who took part in the studies were those who attended morning sessions from 8 am to 1pm daily in the pre-school playroom at Tir Na n'Og. Their ages ranged from 23 months to 54 months and they were from a variety of cultural backgrounds, namely Welsh, English, Canadian, Afro-Caribbean, Northern European, South American and Hong Kong Chinese. Roughly half the attendees were male and half were female. The socio - economic status of parents varied from that of low income (e.g. university student) to affluent double incomes. Each child was assigned to one nursery nurse for the duration of his or her nursery attendance; in this respect, it could be said that participants were assigned to a particular social group during the experimental periods although not for experimental purposes.

Some children attended 5 daily sessions per week, some 4, others 3 or 2 or 1. Thus, there was a different mixture of children in the playroom each day. On any one day, there were likely to be up to 32 children in attendance.

Parental Consent

In Experiment 3 parents were notified that procedures designed to increase fruit and vegetable consumption were to be implemented in the pre-school playroom. Parents were invited to ask for and were provided with more information if they so wished and were free to request the non-participation of their child. All parents agreed to their child's participation in the study.

In Experiment 4, a letter was sent to each parent that explained the procedures involved together with a request for written consent for their child's participation. All parents agreed to their child's participation in the study.

Ethics

Ethical approval for the study was sought and obtained from The University of Wales Bangor Ethics Committee.

Staff

There were four full-time nursery nurses working in the playroom. Each one was responsible for the day-to-day care of twelve particular children, up to eight of who could be attending the playroom on any one day.

In addition to carrying out their normal child care duties, the nursery nurses were instrumental in training the children to discriminate between fruit and vegetables, explaining the experimental contingencies and delivering rewards. In the final stages of the research, each nursery nurse also recorded the food consumption of the children in her group. Verbal instructions and feedback were given to the staff throughout (see Procedure).

Setting and Foods

The target behaviour was recorded in two different contexts each day, firstly in the playroom during the morning snack period at 9.30 am and then again in the dining room during the lunchtime meal at 11.45 am. Figure 1 (see Experiment 1) shows the layout of the nursery.

Sixteen experimental foods, eight fruits and eight vegetables, were presented in each experiment; these were selected from a larger range presented during pre-baseline consumption test trials. Foods selected for use were those in each category (fruit or vegetables) that were consumed by the least number of children.

All foods (with the exception of dried prunes and the occasional use of tinned guava) were fresh. Each food was presented in a uniform size/shape to allow efficient food preparation and for consumption to be assessed reliably and simply. The approximate weights of each food portion are detailed in Table 3.1 below. Figure 3.1 overleaf shows how each food portion was presented.

Table 3.1 The weight of each food portion as presented during Experiments 3 and 4.

Fruit	**Portion Weight**	**Vegetable**	**Portion Weight**
Banana	21g	Baby Carrot*	14g
Dragon fruit	5g	Baby Sweetcorn	9g
Fig	23g	Broad Bean*	4g
Guava	6g	Celery	4g
Kiwi Fruit	11g	Courgette*	5g
Mango	10g	Cucumber	12g
Papaya	6g	Green Bean*	4g
Prune	8g	Mange Tout*	5g
Satsuma Orange	12g	Mushroom	5g
Sharon Fruit	7g	Parsnip*	6g
Star Fruit	25g	Red Cabbage	2g
Sweetie Grapefruit	25g	Swede*	5g
Water Melon	18g	Yam*	5g
		Yellow Pepper	3g

Foods marked with an asterisk were cooked in a microwave, until they were 'al dente'. All other foods were presented raw.

The foods were presented in 200mm x 80mm stainless steel, twin portion, oval serving dishes. Each dish was permanently labelled with the name of a participant, for easy identification of each individual's food consumption. Coloured stickers, denoting fruit (red) and vegetables (blue) were placed in each corresponding side of the dish to further aid the children's fruit/vegetable category discrimination.

Figure 3.1. The appearance of each food portion as they were presented in Experiments 3 and 4. The object in the top left and bottom right corners is a one pound coin measuring 2cm in diameter and is presented as a means of scaling the size of the food portions.


Asparagus
Baby Carrot
Baby Sweetcorn
Celery
Courgette
Cucumber
Green Beans
Mange-Tout
Mushroom
Parsnip
Red Cabbage
Swede
Yam
Dragon Fruit
Fig
Guava
Kiwi
Mango
Papaya
Prune
Sharon Fruit
Star-Fruit
Sweetie Grapefruit
Water-Melon

148a

Equipment

Recording equipment. The video recording facilities in place at the nursery (see Experiments 1 and 2, Procedure) were used to record the target behaviour of the children in both the snack time setting of the playroom and at the midday meal in the dining room.

There were two cameras in each room which could be operated remotely from a console room located behind the playroom. Figure 1 (see Experiment 1) shows the layout of the nursery and the locations of the cameras in each room. It was possible to record the behaviour of a group of children or to focus on particular individuals. The cameras in the playroom were Hitachi KP-C50, 240v ac PAL with 8-80 mm motorised zoom lens. Each was fixed to the wall at a height of 4.5 metres on Molnyx Pan and tilt heads and controlled using purpose-built pan and tilt controllers. Both were fitted with long range microphones. The two cameras installed in the dining room were Vista VZ8551A with 8.5 – 51 mm zoom lens and were fitted on Vicon pan and tilt heads at a height of 2.5 metres. Two Panasonic radio microphones (as in Experiment 2) were used in conjunction with the cameras to record sound. Video recordings were made on Panasonic AG 1050 video recorders sited in the central console room.

Films. The intervention videos were produced in-house, by PsyCam, the audio-visual unit of the School of Psychology at the University of Wales, Bangor. They featured two animated child characters, Jess and Jarvis and two target foods per film. The backdrop to all the video scenarios was the nursery. Jess and Jarvis were shown entering the front door of Tir Na n'Og and proceeding to the playroom. In each film, Jess and Jarvis named two of the target foods and also described them in terms of their generic or category label (i.e. fruit or vegetable). They enthusiastically modelled consumption of the target foods and described the reward contingencies that would apply for children who complied with the instruction to eat those foods (the children were urged to "eat fruit" or "eat vegetables" depending on the target food category featured in the video). Each fruit intervention video lasted approximately 4 minutes and each vegetable intervention video approximately 7 minutes. Extra footage, showing real children eating vegetables was incorporated into the vegetable intervention video. A pre-reward video, approximately 2 minutes long, showed Jess and Jarvis praising fruit eaters and reiterating their promise to deliver rewards to any child who ate the target foods. This video was used in Experiment 3 and during Intervention 1 in Experiment 4.

Presentation Media. The intervention films were shown via a Panasonic 27" television and video recorder. These were kept ready for use in the playroom.

Supporting letters. Supporting letters were produced to accompany the intervention films. These were read to the children by the nursery nurses prior to each intervention video presentation. In each day's letter 'from Jess and Jarvis', target behaviours were reiterated, feedback was given about the children's food consumption on the previous day and further rewards were promised for those who continued to follow the experimental instructions to "eat fruit" or "eat vegetables". The content of letters varied each day to reflect the children's performance of the previous day. For example, the letter might read 'yesterday, EVERYBODY ate fruit' or 'yesterday, lots of children ate fruit, but today we hope EVERYONE will try their fruit at snack time.'

A second letter was read each day during the intervention phase, just before the reward procedures were implemented. This served to signal the delivery of rewards and to reiterate the criteria for receiving a reward. Example of all letters are shown in Appendix 3.

Rewards

Three types of reward were available in each experiment. Jess and Jarvis 'Fruitdude' or 'VeggieTot' badges were given as individual rewards. The badges featured Jess and Jarvis and were adhesive so that they could be easily attached to clothing. Examples are shown in Figure 3.2 overleaf.

Secondly, there were stickers for use with a wall chart. These were rectangular and measured 2.5cm x 1.25cm. They depicted a brown treasure chest bearing a gold question mark (see Figure 3.3 overleaf.)

Figure 3.4 overleaf shows the wall chart which measured 1.2m x 1m and was displayed on one wall in the playroom. It depicted a series of four ladders, each of which could be filled with stickers. The background theme of the chart was either fruit or vegetables depending on the phase of the experiment. Throughout the intervention phase of each experiment, a large cardboard box, covered in red paper and decorated with pictures of Jess and Jarvis was fixed to the wall above the wall chart. When the stickers reached the top of the ladders on the wall chart, group prizes consisting of books, videos, cassettes, face cloths etc., were dispensed from the box.

Thirdly, small sets of Duplo, (such as those shown in Figure 3.5 overleaf) consisting of between 8 and 14 bricks were purchased and used as individual rewards, brick by brick. Each set cost less than £4. One set was obtained for each child in the playroom. Prior to it's presentation, each Duplo brick reward was wrapped in coloured paper (red during interventions on fruit and blue during interventions on vegetables) and clearly labelled with the name of the child who had earned it. The Duplo box, bearing an illustration of the toy that could be constructed from its contents, was supplied with the first brick so that the child could see which model he or she was attempting to complete. The box was labelled with name of the owner and kept on a shelf in the playroom that was given over for the purpose. When a child had collected all the bricks in one set, another (different) set was provided. The Duplo was taken home at the end of each intervention phase.

Rewards were prepared by the experimenter either in the dining room (Experiment 3) or in the observation room adjacent to the playroom (Experiment 4) immediately after snack consumption had been assessed. Except for the group prize,

Figure 3.2. Examples of Jarvis and Jess badges awarded for fruit and vegetable consumption in Experiments 3 and 4.

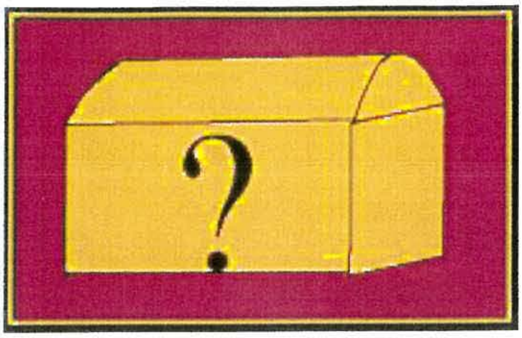


Figure 3.3. The wall sticker used in conjunction with the wall chart in Experiments 3 and 4.

Figure 3.4. The wall chart used in Experiments 3 and 4.

Figure 3.5. Examples of Duplo sets used as rewards in Experiments 3 and 4.

Figure 3.6. Treasure box used to deliver rewards in Experiments 3 and 4 .

which was hidden in the box on the wall until it was due for presentation, all rewards were delivered to the playroom in a plastic 'treasure chest' covered in brown paper and decorated with small stickers (see Figure 3.6 overleaf.)

Dependent Variables and Recording

Target behaviour

The dependent variable was the quantity consumed, by each child, of the particular experimental foods presented during the snack time and lunchtime meal sessions. Consumption was defined as food being taken into the mouth and ingested; food placed in the mouth and spat out did not qualify as consumption.

Data collection

The amount of each food consumed by each child was calculated by visual assessment of residual food, subtracting the latter from the quantity presented and using the following scale:

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

Foods were presented in a way that aided measurement. Figure 3.1 (see setting and foods) shows that at snack time most were presented as a serving consisting of four pieces of a standard size per food. If a child ate any or all of one piece, 25% consumption was recorded. If all of one piece and any or all of a second piece was consumed, 50% consumption of that food was recorded, and so on.

This method of measurement was more practical than weighing food before and after each presentation. Some foods used were very light (e.g. mange-tout) and would require a very sensitive weighing scale to determine how much had been eaten. Also, given that four foods were presented on one dish and the liquescent consistency of some of the fruits, scraping plate waste onto a measuring scale was not considered a reliable option.

At lunchtime, serving sizes were half those presented at snack time, usually two pieces of each food, and the percentage consumption measure adjusted accordingly.

As a means of ensuring reliability, consumption in baseline phases was assessed by both the experimenter and a research assistant. Assessments were carried out in the kitchen after snack and after lunch. In the intervention phases of Experiment 3, in order to speedily award prizes, the experimenter and assistant assessed each child's consumption immediately after all the children were finished eating; these assessments were re-checked by the experimenter and research assistant following the prize-giving. In Experiment 4, consumption at snack time was initially assessed in situ by psychology assistants (in Intervention 1) and by nursery staff (in Intervention 2). The experimenter and research assistant verified these assessments from plate waste at the end of the session. In all experimental phases, in both experiments, 100% agreement was achieved.

Floors were checked for experimental food at the end of each session in order to ensure that plate waste constituted a reliable basis for the measurement of the children's food consumption.

Experimental Design

A multiple baseline across food category design (see Figures 3.7 & 3.8) was used to evaluate the effectiveness of each intervention. Multiple baseline designs provide control for the influence of extraneous variables by applying an intervention to one particular behaviour while continuing to monitor other behaviours. If the frequency of a behaviour changes *only* when the intervention is applied to it, the possibility that such change is due to variables other than the intervention is unlikely (Barlow & Hersen, 1984; Kazdin, 1982).

FRUIT	BASELINE	FRUIT INTERVENTION	BASELINE	FOLLOW-UP
VEG	BASELINE	BASELINE	BASELINE	FOLLOW-UP

← TIME →

Figure 3.7. The phases of Experiment 3

FRUIT	BASELINE	INTERVENTION	BASELINE	BASELINE	FOLLOW-UP
VEG	BASELINE	BASELINE	INTERVENTION	BASELINE	FOLLOW-UP

← TIME →

Figure 3.8. The phases of Experiment 4

In the following two experiments, each intervention was designed to increase consumption of foods within a specific food category, either fruit or vegetables and the design of the experiment was such that whilst one category was being targetted, the other was presented under baseline conditions. The effect(s) of the intervention could then be assessed by comparing changes in consumption across food categories.

If there were no changes in the consumption of vegetables during an intervention on fruit, then it could be concluded that the intervention was responsible for the effect rather than some other variable (increasing exposure to the foods for example) that coincided with the intervention.

In both Experiments 3 and 4, half the foods within each category presented during Baseline phases were targetted with the intervention and half were not. Thus, in the baseline following the Intervention, it was possible to assess any short-term effects of the intervention that may generalise to non-targetted within-category exemplars. Long-term effects were assessed at Follow-ups.

The multiple baseline thus also allowed the effectiveness of the interventions within as well as across food categories to be assessed. For example, an intervention may be effective only with particular targetted exemplars within a food category, or the effect may generalise to others. There may also be more of an effect with one category of foods than another.

In Experiment 3, a single intervention phase was introduced after an initial baseline phase. Both fruit and vegetables were presented throughout, but the intervention focussed on fruit consumption and was followed by a second baseline phase and a follow-up phase six months later. Within Experiment 4, following the initial baseline, a number of interventions were introduced with baseline phases between. The first intervention targetted fruit consumption and the second vegetable consumption. All interventions centred on Jess and Jarvis modelling consumption of particular foods and all involved an imposed reward contingency placed on each child's consumption of those foods. Follow-up phases in which foods were presented in the absence of any intervention were carried out after three days and nine months.

A particular strength of these experiments is that they were designed to fit in with the normal daily activities of the nursery, thus providing a natural environment in which to apply the interventions and assess their effectiveness. The lunchtime meal context was used to provide an ecologically valid setting to examine generalisation of the effects of the intervention across time and settings. In addition, questionnaires were used in Experiment 4 to assess any generalisation of effects to the home setting.

The interventions were all implemented by the nursery nurses following instruction from the experimenter. The Jess and Jarvis theme was intended as a means of ensuring that the children perceived Jess and Jarvis (rather than the nursery staff or the experimenters) to be the contingency managers. Instructions to consume foods and contingencies in operation were all described in letters, allegedly from Jess and Jarvis and read out by the nursery nurses, or via the films.

Finally, these experiments were carried out over a period of several months. Thus, the measures taken show individual and group patterns of behaviour across a period of time when interventions were and were not in operation. Results demonstrate whether any changes in behaviour were transient or long lasting.

Procedure

During the course of the research, participants were never explicitly told that their meal time behaviour was being video-recorded, although most children may have been generally aware that sometimes they were 'on television'. All the nursery staff were aware of the video recordings.

The experimenter and a research assistant spent each morning at the nursery, preparing foods, providing experimental materials, monitoring procedures, assessing food consumption and preparing rewards. The nursery staff were instrumental in carrying out procedures, under instruction, during each phase of the experiment (see the relevant section of each experiment). The nursery nurses were given continual feedback regarding their performance.

Foods: In Experiments 3 and 4, four food sets, each comprised of two fruits paired with two vegetables, were employed. Each food set remained constant throughout the course of each experiment. Each day, one set was presented to each child as the daily morning snack along with a glass of milk. The same food set was presented as an addition to the lunchtime meal.

Four pieces of each food in the day's food set were served at snack time and two pieces of each of the latter foods at lunchtime. A different food set was targetted each day using a four-day rotational cycle of food set presentation.

Category Training: At the start of Baseline 1 and throughout each phase of each experiment, the children were given categorisation training designed to teach them to discriminate between the fruit and vegetables (and to name them appropriately as such) that were presented throughout the experiments. Since the interventions were designed to impact on the two categories of foods, it was important that participants were able to make the distinctions correctly and reliably. The training exercise was conducted by the senior nursery nurse and it became a feature of the daily early morning schedule at the nursery.

Each morning, at 9 am, the experimenter prepared a demonstration tray. The tray contained the set of foods to be presented that day, in the stainless steel dish as they would appear at snack time, along with whole, uncut examples of these same foods. The children sat in a circle on the floor of the playroom and watched as a member of staff named and categorised each food on the tray. Individual children were then chosen at random and asked to select food items named by the nursery nurse and show them to the group. The other children were required to call out the name of the food and then give its generic label. This exercise lasted between five and ten minutes and was conducted daily throughout all phases of the study.

Following the categorisation procedure, the other scheduled activities of the playroom continued until it was time for snack at approximately 9.30 am.

Snack Time

At snack time, the children were seated at tables in the playroom under the supervision of their designated nursery nurse. Nursery nurses filled the children's cups with milk which was normally available at this time. Throughout the study, unlimited servings of milk were available to each child.

Dishes containing snack foods were brought down from the kitchen by the experimenter and research assistant and given to the children simultaneously by the nursery staff. Each nursery nurse asked the children in her group to indicate which of the foods were fruits and which vegetables. The children were then allowed to consume (or otherwise) the snack foods. The general instruction was "you can start now."

Lunchtime

At lunchtime the children were seated at tables in the dining room. There was no particular order for seating. The dishes containing the experimental foods were presented between the main course and the dessert and were left for approximately five minutes before they were collected and taken to the kitchen for assessment. Consumption was neither encouraged nor discouraged.

The lunchtime presentations continued thus throughout the course of the study. Food consumption in this context was never subject to any intervention.

Prebaseline

A prebaseline phase was implemented prior to the first baseline phase of both experiments. This allowed for an habituation to the basic procedures for both staff and children.

During this period, participants were presented with a wide range of fruits and vegetables, both in the snack time context and at lunchtime. One vegetable and one fruit were presented at snack time and a different fruit and vegetable were presented at lunch time. Each food was presented twice during pre-baseline, once at snack time and once at lunchtime. Sixteen foods, eight fruits and eight vegetables that were consumed least from the range presented were selected as the experimental foods to be used in the main phases of the research.

Baseline phases

The baseline phase began when eight experimental foods from each category had been identified. The sixteen foods were randomly ordered into four sets, with the constraint that each set consisted of two fruits and two vegetables. These sets were held constant throughout the remainder of the experiments, a different set being presented each day so that each set was presented once every four day cycle. This continued until three (Experiment 3) or four (Experiment 4) cycles were completed.

At snack time, each child was presented with a set of four experimental foods in a stainless steel dish and the experimenter withdrew to an observation room just behind the playroom (see Figure 1, Experiment 1) where it was possible to observe what was happening in the playroom and also to be available to answer any questions the nursery staff might have regarding experimental procedures.

Nursery nurses were asked to respond in a neutral way to questions or comments that the children might have regarding the experimental foods. For example, a child may point to a food and say "I don't like that". In that circumstance, the nurse would say "OK" and make no further comment. If a child pushed the dish away the nursery nurse would ask that child if he or she had finished eating. When staff indicated that all the children had finished (between 10 minutes and half an hour) the dishes were removed and taken to the kitchen for consumption to be assessed.

Intervention phases

About 30 minutes after the categorisation procedure, just prior to snack time, the children were seated on the floor of the playroom around the television and video. On the first intervention day, a nursery nurse read out a letter from Jess and Jarvis that explained the experimental procedures. On subsequent days, the letter from Jess and Jarvis contained general feedback on the previous day's consumption, along with encouragement to continue eating fruit/vegetables.

The children then watched the intervention video. At the end of the film, they were instructed to sit at their group tables ready for their snack, which was presented in the same way as in Baseline 1.

At the end of snack time, the children were asked to sit on the playroom floor, where they watched the pre-reward video. At this time, the experimenter and research assistant prepared the rewards.

As soon as possible after the end of the pre-reward video, the treasure chest containing the badges, stickers and individual prizes, along with a list that specified the reward(s) earned by each child, was left outside the playroom. The experimenter signalled that the rewards were ready by knocking on the door, whereupon the senior nursery nurse instructed one of the children to open the door and bring in the treasure chest whilst the other children remained seated on the floor. The nursery nurse opened the lid of the treasure chest and picked out the list of children who had earned the rewards. Those children whose names appeared on the list were called individually to the front of the group, and, in view of all the other children, given the reward(s) appropriate to his/her level of fruit/vegetable consumption that day.

In all cases, the nursery nurse delivering the rewards re-stated the experimental contingencies and encouraged the rest of the group to applaud each recipient.

When all the rewards had been delivered, children who received Duplo bricks put them with any others they had already earned. Children with wall chart stickers lined up to stick them on the wall chart.

At the end of the Intervention period (Experiment 3) or whenever the stickers reached the top of the ladders (Experiment 4) a group prize was delivered from the box on the wall. A loud noise was made (banging on the door/cymbal/bells etc.) to engage the children's attention. A nursery nurse pointed to the chart and announced that the top of the ladders had been reached. She then opened the front of the red box (green during vegetable interventions) to reveal the prize(s) and a note from Jess and Jarvis that praised the children for their fruit/vegetable eating efforts. When the prizes were opened, the nursery nurse instructed the children to thank Jarvis and Jess by shouting "thank you" very loudly!

Follow-ups

In Experiment 3, one follow-up phase was carried out six months after Baseline 2. Procedures were exactly as described in Baseline 1.

In Experiment 4, there were three follow-up phases; the first was conducted two months after the fruit intervention phase and was carried out as described in Baseline 1. This follow-up also served as a baseline prior to the vegetable intervention.

A second, continuous follow-up was instigated three days after the end of Baseline 4 and continued for two months. A third follow-up began nine months after the end of Baseline 4 and continued for three months. Procedures for the second and third follow-ups are described in the Procedure section of Experiment 4.

CHAPTER 8

EXPERIMENT 3:

A CATEGORY-BASED VIDEO AND REWARD INTERVENTION TO INCREASE CONSUMPTION OF FRUIT IN A PRESCHOOL CLASSROOM.

INTRODUCTION

This experiment was designed to increase consumption of fruit amongst children in the pre-school playroom of Tir Na n'Og nursery. A prebaseline phase identified eight fruits and eight vegetables that on average, the children consumed at less than 50%. Following an initial baseline phase, during which consumption of those fruit and vegetables was recorded, the children were exposed to an intervention that targetted a sub-set of four of the fruits. The intervention included two Jess and Jarvis films, each focussing upon a different target fruit pair and an imposed reward contingency. In the intervention, children were exposed to video models that named specific fruits, modelled consumption of those fruits, instructed the viewer also to consume fruit and offered rewards for compliance with this instruction. Corresponding vegetable pairs were also presented daily in all experimental phases and served as control foods. Following the intervention phase, there was a second baseline phase in which all eight fruit and all eight vegetables were again presented. A follow-up phase was conducted under baseline conditions after six months.

METHOD

Participants

Thirty-seven children who were registered as attending the pre-school playroom for morning sessions participated in this experiment. There were 18 females and 19 males; their ages ranged from 22 to 48 months. Of the ten children who attended five days per week, two were first language Welsh speakers, one child had an Afro-Caribbean background, one was Hong Kong Chinese and the remainder were all from the local community. Six children attended four days per week. All were first language English speakers. Amongst this group was one twin pair (female) and a sibling pair (brother and sister). Of those children who attended three days per week, all were first language English speakers. Amongst those who attended less than three days per week, four were first language Welsh speakers and the remainder were first language English speakers.

Other subject details are presented in Table 3.2 below.

Table 3.2. For each of the five subgroups of nursery participants, the number of sessions attended per week, age range and mean age in months, and number of males and females.

Weekly attendance	Children Registered	Age Range (months)	Mean Age (months)	Male	Female
5	10	25 - 47	35	5	5
4	6	26 - 48	41	2	4
3	3	22 - 34	26	1	2
2	14	23 - 47	32	9	5
1	4	22 - 33	30	2	2
			Total	19	18

Foods

The foods selected for presentation in all experimental phases and the configurations of each food set are shown in Table 3.3 below.

Table 3.3. The fruit and vegetable constituents of each of the four experimental food sets. Target food combinations are shown in italics.

Set No.	Fruit Pair	Vegetable Pair
1	*Water Melon + Prune*	Swede + Mange-tout
2	Star Fruit + Papaya	Celery + Asparagus
3	*Sweetie Grapefruit + Fig*	Mushroom + Green Beans
4	Sharon Fruit + Guava	Red Cabbage + Parsnip

One 'set' consisting of bananas and oranges with yellow pepper and broad beans was presented once as a 'primer' to the intervention.

Equipment

A 'primer' video, two fruit intervention videos, one targetting Fruit Pair 1 and the other targetting Fruit Pair 3, and a pre-reward video were used during the intervention phase of the experiment. These videos had the general features described in the General Procedure.

The Primer Video. In the primer video, oranges and bananas were the featured fruit. These were chosen because they were the most highly consumed fruits in pre-baseline. The purpose was to enable as many children as possible to be rewarded for performing the target behaviour.

The Intervention Video. There were two Intervention videos, one featured Fruit Pair 1 (prunes and water melon) the other Fruit Pair 3 (fig and sweetie grapefruit).

Pre-Reward Video. This video was very short (lasting less than 2 minutes) and was shown after snack time and before the delivery of the rewards. Its purpose was to remind the children of the rewards on offer and the criteria for earning them. It also served as a time frame within which the experimenter could prepare the reward(s) appropriate to each child.

Experimental Design and Procedure

Each set of experimental foods, constituted on the basis of the children's fruit and vegetable consumption during the Pre-Baseline phase, was presented under baseline conditions for a total of six presentations, three during the snack time (experimental) setting and three during the lunchtime (generalisation) setting. Consumption of each food in all of the sets was assessed at the end of Baseline 1 to determine which fruits were to be subject to the intervention and which would serve as non-target fruits. It was critical that baseline consumption of target and non-target fruits was comparable in order that valid conclusions about the effectiveness of the intervention could be made.

During the following intervention phase only two of the four food sets were presented. The intervention was implemented at snack time and targetted the fruit portion of each of the two food sets. Each of the latter was presented on alternate days, and five times in total. All four food sets were then once again presented under baseline conditions. Using this design it was possible to examine: i) whether the intervention package was effective in increasing consumption of the target fruit in the snack time context; ii) whether any increases in consumption of target fruit would be evidenced in the generalisation setting of the midday meal; iii) whether increases in target fruit consumption would generalise to the other, non-targetted fruit exemplars in either the snack time or lunchtime setting, or both; iv) whether increases in fruit consumption would be accompanied by an increase in children's consumption of vegetables; and v) whether any changes in consumption would be maintained in the absence of rewards.

A follow-up phase was carried out under baseline conditions six months later to ascertain whether any changes in behaviour were maintained in the longer term and in the absence of any intervention.

The procedure employed was as described in the General Procedure; features specific to this experiment are noted below.

Intervention

On the first day of this phase, the primer video, featuring bananas and oranges was shown. On subsequent days, the videos featured either prunes and water melon or sweetie grapefruit and fig.

The intervention phase continued for 11 days. Following presentation of the primer foods on Day 1, Food Sets 1 and 3 were cycled every other day until each fruit pair had been presented 5 times.

Rewards System

Table 3.4 below shows the reward system in operation during the Intervention phase of Experiment 3.

Table 3.4. The relation between target fruit consumption and rewards.

Target Food Consumed	Reward
1 – 3 pieces	Wall sticker
4 – 7 pieces	Wall sticker + Jarvis & Jess badge
All 8 pieces	Wall sticker + Jarvis & Jess badge + Duplo

Baseline 2

Baseline 2 began immediately Intervention 1 was complete. As in Baseline 1, all 4 food sets were scheduled for presentation 3 times in a four day cycle. However, due to competition from Christmas activities and an increasing number of children beginning their Christmas holidays, Baseline 2 continued for only 6 days.

Follow -up

Six months after the end of the second baseline period and nine months after the start of Experiment 3, a follow-up phase was implemented. The procedure for the follow-up was identical to that of Baselines 1 and 2 with food presentations occurring at both snack and lunchtime. This phase continued for twelve days until each food set had been presented on three occasions to the children in the five sessions per week sub-group. Children attending the nursery less than five sessions per week received proportionally fewer presentations of the four food sets. In between Baseline 4 and Follow-Up phases, the normal nursery diet was resumed.

RESULTS AND DISCUSSION: Individual Data

Daily consumption of each food by each participant was calculated from plate waste and expressed as a percentage of the total amount presented. Foods were categorised for analysis as follows:

Target Fruit	Fruit in Food Sets 1 and 3 targetted with the video and reward intervention.
High Exposure Vegetables	Vegetables in Food Sets 1 and 3 presented with the target fruit, but not targetted with the video and reward intervention.
Low Exposure Fruit	Fruits in Food Sets 2 and 4 presented only in Baselines and Follow-up.
Low Exposure Vegetables	Vegetables in Food Sets 2 and 4 presented only in Baselines and Follow-up.

The results of selected individuals will be presented in this section, and group results will be presented in the next section.

When the individual consumption patterns were examined in this experiment, five different response types emerged:

Group I (Target Fruit Only). Six children showed an increase in consumption of all the target fruits at snack time when the intervention was introduced and there was no increase in consumption of foods in the other categories. Three of the five day attendees fell into this group, together with one four day attendee and one child who attended only once a week.

Group II (Partial Target Fruit Only). Five children showed an increase in consumption of some, but not all of the target fruits at snack time. This group consisted of two five day attendees, two four day attendees and one three day a week attendee.

Group III (High Exposure Vegetables Only). Two children showed no effect on fruit consumption at snack time, but high exposure vegetable consumption increased. One five day a week attendee and a once a week attendee fell into this category.

Group IV (Very Small Unstable Target Fruit). Five children showed small and unstable changes in target fruit consumption at snack time. This group was made up of one five day attendee, two four day attendees and two three day attendees.

Group V (No Effect). Seven of the children showed no effect of the intervention at snack time. Those in this category were three of the five day attendees, one four day attendee, a two day attendee and two children who attended once a week.

Group VI consisted of nine children for whom there were not enough data to make any statements about their responses to the intervention.

The data for individual children falling into Groups I, II and IV will be presented next. Target fruit consumption at snack time and lunchtime across the course of the study will be considered.

Group I (Target Fruit Only)

WLP (5 days)

Snack. Figure 3.9 shows that W's baseline consumption of all target fruits at snack time was low; the little consumption recorded was at 50% or less. As soon as the intervention was applied, consumption of two fruits (grapefruit and prune) increased to 100% and by the third intervention, all fruit but fig was eaten reliably at 100%. At follow-up, all four fruits were reliably consumed.

Lunch. Patterns of consumption at lunchtime show that W's Baseline 1 consumption of target fruits was similar to that in the experimental (snack) setting. Virtually none of the target fruits were eaten during Baseline 1. Generalisation of snack time intervention

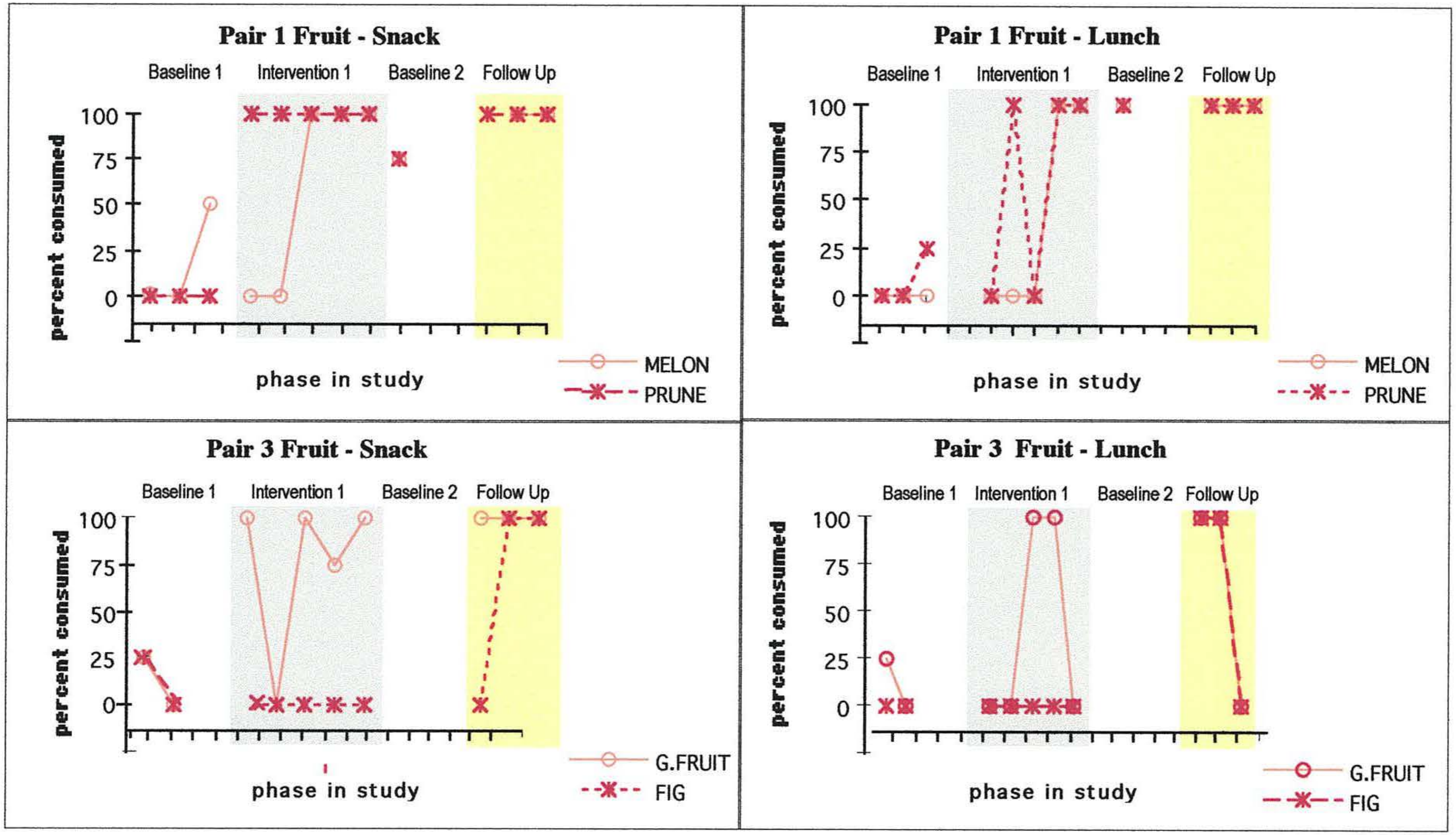


Figure 3.9. WLP's consumption of target fruit across all phases of the experiment, Baseline 1, Intervention, Baseline 2 and Follow-Up. Snack time consumption is illustrated on the left, lunchtime consumption on the right.

effects on consumption did not occur immediately. W ate Pair 1 fruits more reliably and at maximum than she had during Baseline 1. Of Pair 3 fruits, W increased her consumption of grapefruit, but did not maintain the increase across the phase. As at snack time, only fig was refused throughout.

TS (5 days)

Snack. Figure 3.10 shows that during Baseline 1, with the exception of prune, T ate very little of the target fruits (only 25% grapefruit on one occasion). When the intervention was applied, she immediately ate both fruits in Pair 1 at 75% and above. Of Pair 3, there was some increase in consumption, but it was less stable than consumption of fruits in Pair 1. There was evidence of maintenance with water melon and prune during Baseline 2. Interestingly, at follow-up, T reliably ate fig and prune, whilst water melon was on a downward trend and grapefruit refused.

Lunch. There is some difference in T's pattern of consumption at lunchtime. Generalisation of the effects of the intervention at snack time was less immediate and less powerful compared to the direct effects of the intervention. Some prune and some water melon were eaten during Baseline 1, although the trend was downward. When the intervention was applied at snack time, T began to eat prunes at lunchtime immediately and consistently for three presentations, but this performance began to degrade before the end of the phase. Some melon was consumed but on less than half the occasions on which it was presented. Pair 3 fruits were not eaten until the last presentation of the phase. T continued to eat prunes during Baseline 2 and both melon and prunes at Follow-up. Of the fruits in Pair 3, T began to consume at fig Follow-up but continued to refuse grapefruit

CJ (5 days)

Snack. Figure 3.11 shows that during Baseline 1, C regularly ate one fruit from each pair (prunes and fig) at maximum levels. Small, variable amounts of water melon and grapefruit were also consumed. When the intervention was applied, C began eating

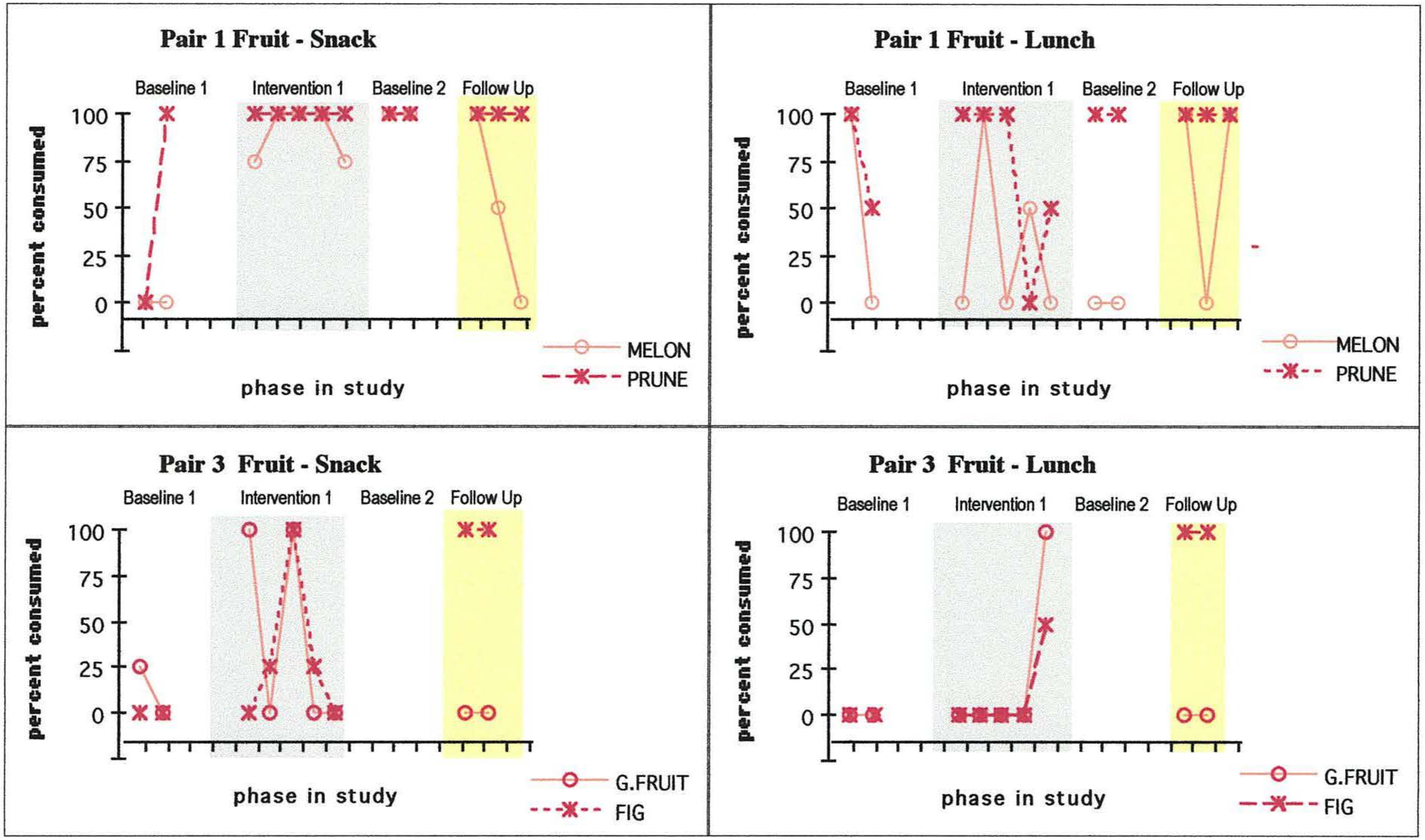


Figure 3.10. TS's consumption of target fruit across all phases of the experiment, Baseline 1, Intervention, Baseline 2 and Follow-Up. Snack time consumption is illustrated on the left, lunchtime consumption on the right.

176a

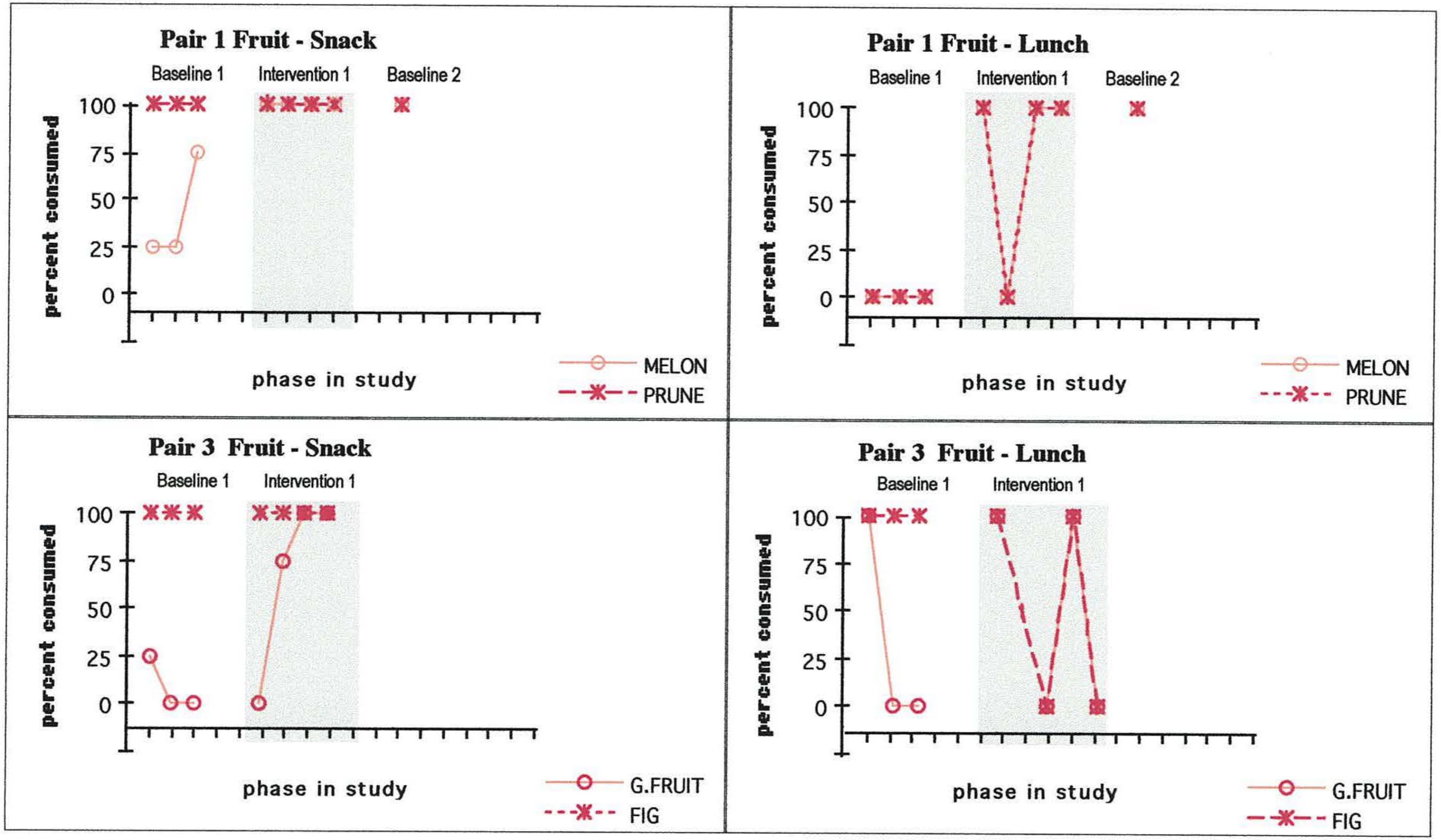


Figure 3.11. CJ's consumption of target fruit across all phases of the experiment, Baseline 1, Intervention, Baseline 2 and Follow-Up. Snack time consumption is illustrated on the left, lunchtime consumption on the right.

maximum amounts of water melon and by the third intervention on Pair 3 fruits C was eating all target fruit at 100%.

Lunch. C's lunchtime consumption differs from that at snack time. At lunchtime during Baseline 1, she ate only fig consistently. The snack time intervention had an immediate impact on all foods, with lunchtime consumption of Pair 1 relatively stable at 100%. Consumption of grapefruit from Pair 3 increased, but was not as stable as it had been in the snack context. C ate less fig, compared with Baseline 1. The data available show that when the intervention was removed C continued to eat Pair 1 fruit.

SL (4 days)

Snack. Figure 3.12 shows that during Baseline 1, S ate none of the target fruits. When the intervention was introduced, she immediately began to consume all target fruit at 100% and continued to do so for the duration of the phase. Baseline 2 and follow-up data suggest that at least for prune and water melon, this change in eating behaviour was maintained beyond the intervention.

Lunch. Patterns of consumption at lunchtime were somewhat different to those recorded in the experimental setting. Any effects of the snack time intervention took longer to appear in the lunch context, and when they did, were less powerful and were confined to two fruits, fig and water melon. Maintenance data were available for Pair 1 fruits only; these showed that S continued to eat water melon during Baseline 2 and during follow-up. Some prune consumption at follow-up was also noted.

GP (2 days)

Snack. G is a particularly interesting participant as he attended the nursery only twice per week. There are less data points than would be desirable, but in those that are available some changes in consumption can be observed. Figure 3.13 shows very little consumption during Baseline 1. The intervention had an immediate impact, G ate all fruits (with the exception of fig) on at least one occasion. Prune consumption was the

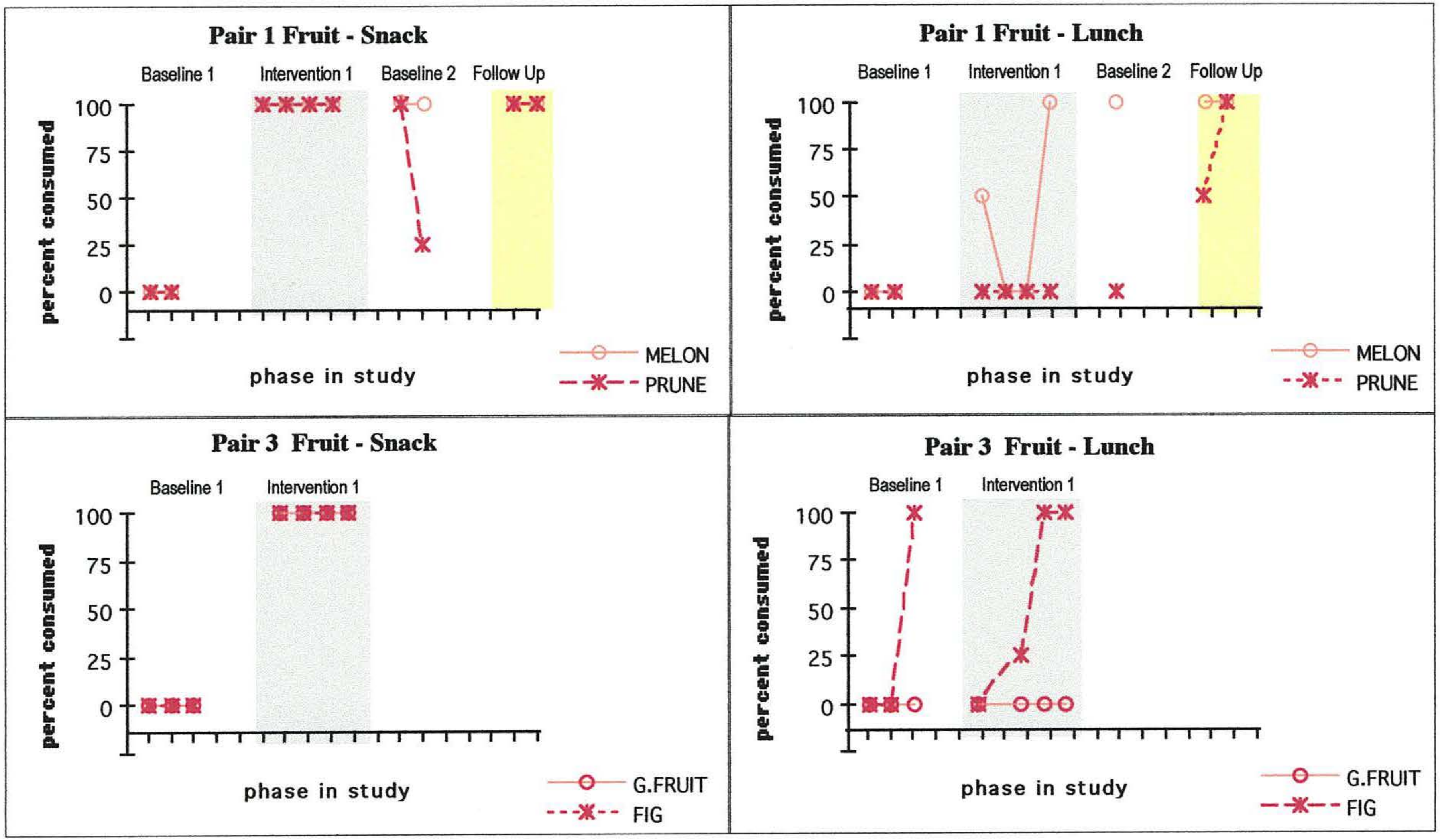


Figure 3.12. SL's consumption of target fruit across all phases of the experiment, Baseline 1, Intervention, Baseline 2 and Follow-Up. Snack time consumption is illustrated on the left, lunchtime consumption on the right.

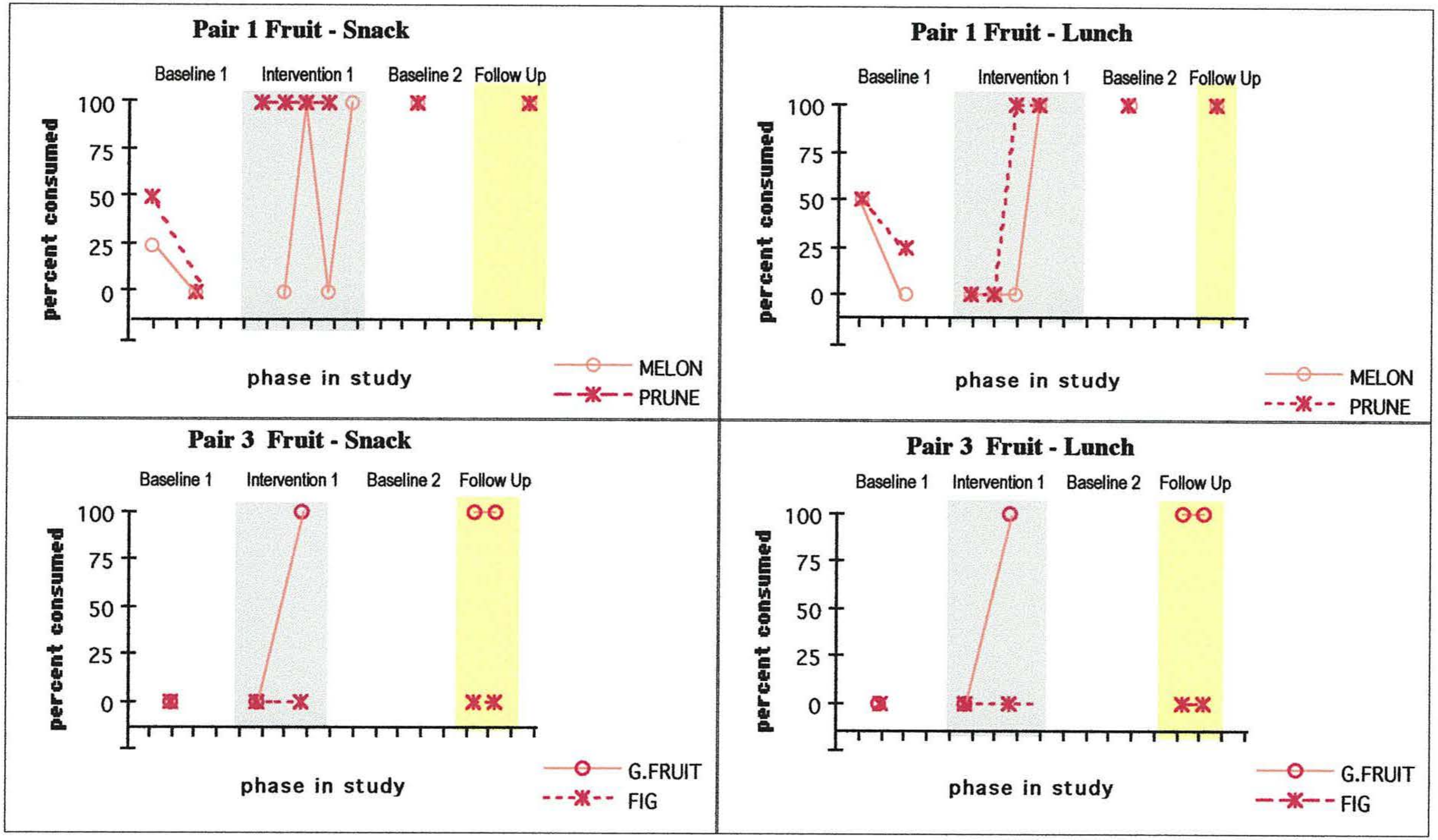


Figure 3.13. GP's consumption of target fruit across all phases of the experiment, Baseline 1, Intervention, Baseline 2 and Follow-Up. Snack time consumption is illustrated on the left, lunchtime consumption on the right.

most reliable at 100% across the phase. Baseline 2 and follow-up data show that the increases in consumption were maintained in the absence of the intervention and in the longer term.

Lunch. Data at lunchtime show that G ate very little fruit during Baseline 1. The effects of the snack time intervention were slower to impact on lunchtime consumption, however by the end of the phase, G had eaten three of the fruits. During Baseline 2, he continued this behaviour with Pair 1 and also into follow-up with maximum consumption of three out of four foods.

Type II Responses (Partial Target Fruit Only)

WH (5 days)

Snack. Figure 3.14 shows that during Baseline 1, W consistently ate one food (water melon) from Pair 1, but no others. When the intervention was introduced, he immediately began eating both fruits from Pair 1 at 100% and continued to do so across the course of the phase. This change was partially maintained in Baseline 2, but was not in evidence at the six month follow-up. Other target fruits were unaffected.

Lunch. It is interesting to note that in the lunchtime context, W ate none of the target fruits, even the one fruit that he consistently ate at snack time. When the snack time intervention was introduced, he immediately consumed in the lunchtime context, both Pair 1 fruits, eating both on four out of five presentations. He continued to eat water melon at maximum levels in Baseline 2 and at the six month follow-up. Prune consumption was more variable, there was a descending trend in both Baseline 2 and at follow-up. Pair 3 fruits were consistently refused across the study.

RA (5 days)

Snack. Figure 3.15 shows that during Baseline 1, R reliably ate Pair 1 fruits at 100% and consumed very little of the Pair 3 fruits. When the intervention was introduced, she continued to consume Pair 1 fruits and at the same time, immediately began to eat one

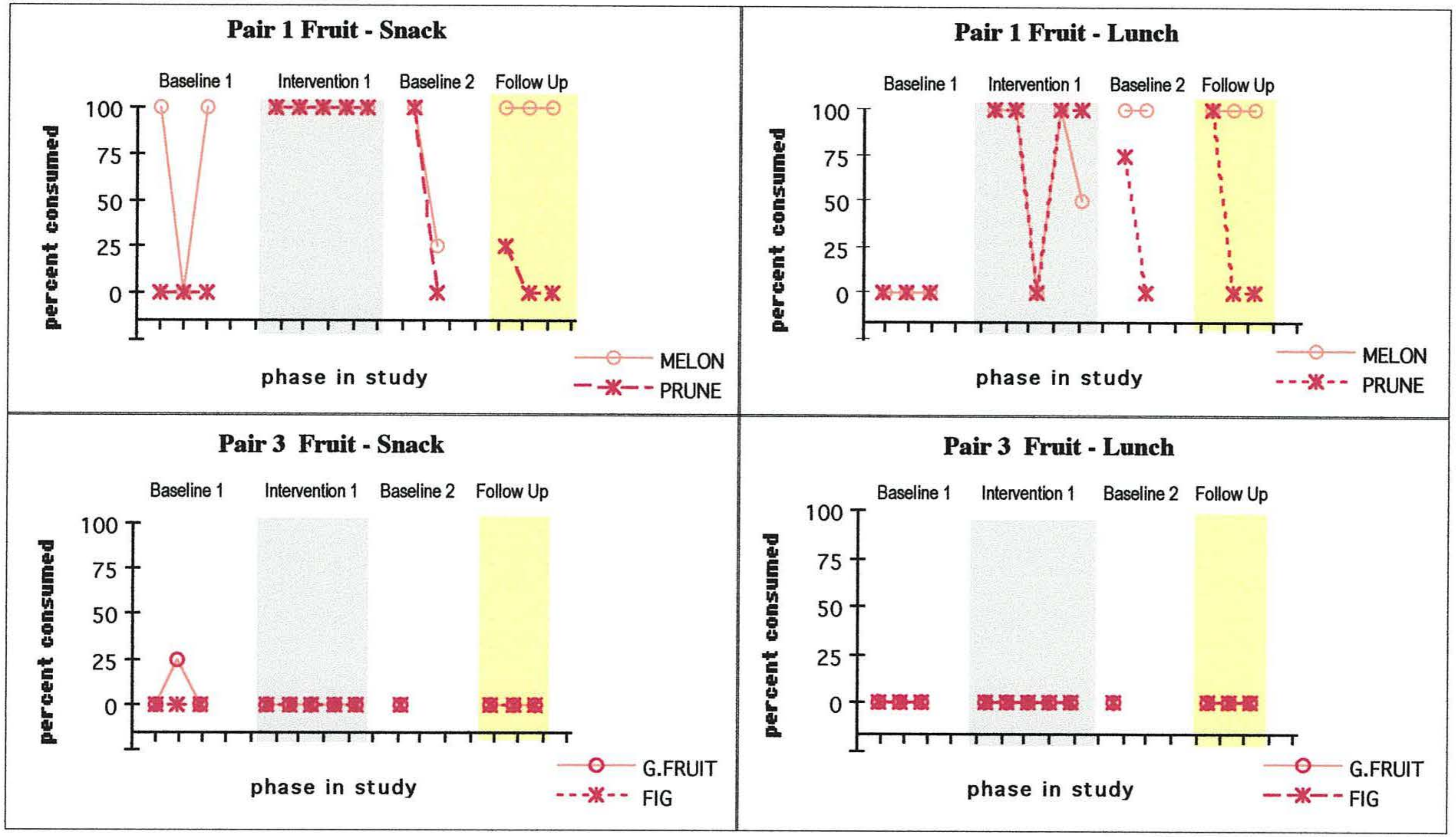


Figure 3.14. WH's consumption of target fruit across all phases of the experiment, Baseline 1, Intervention, Baseline 2 and Follow-Up. Snack time consumption is illustrated on the left, lunchtime consumption on the right.

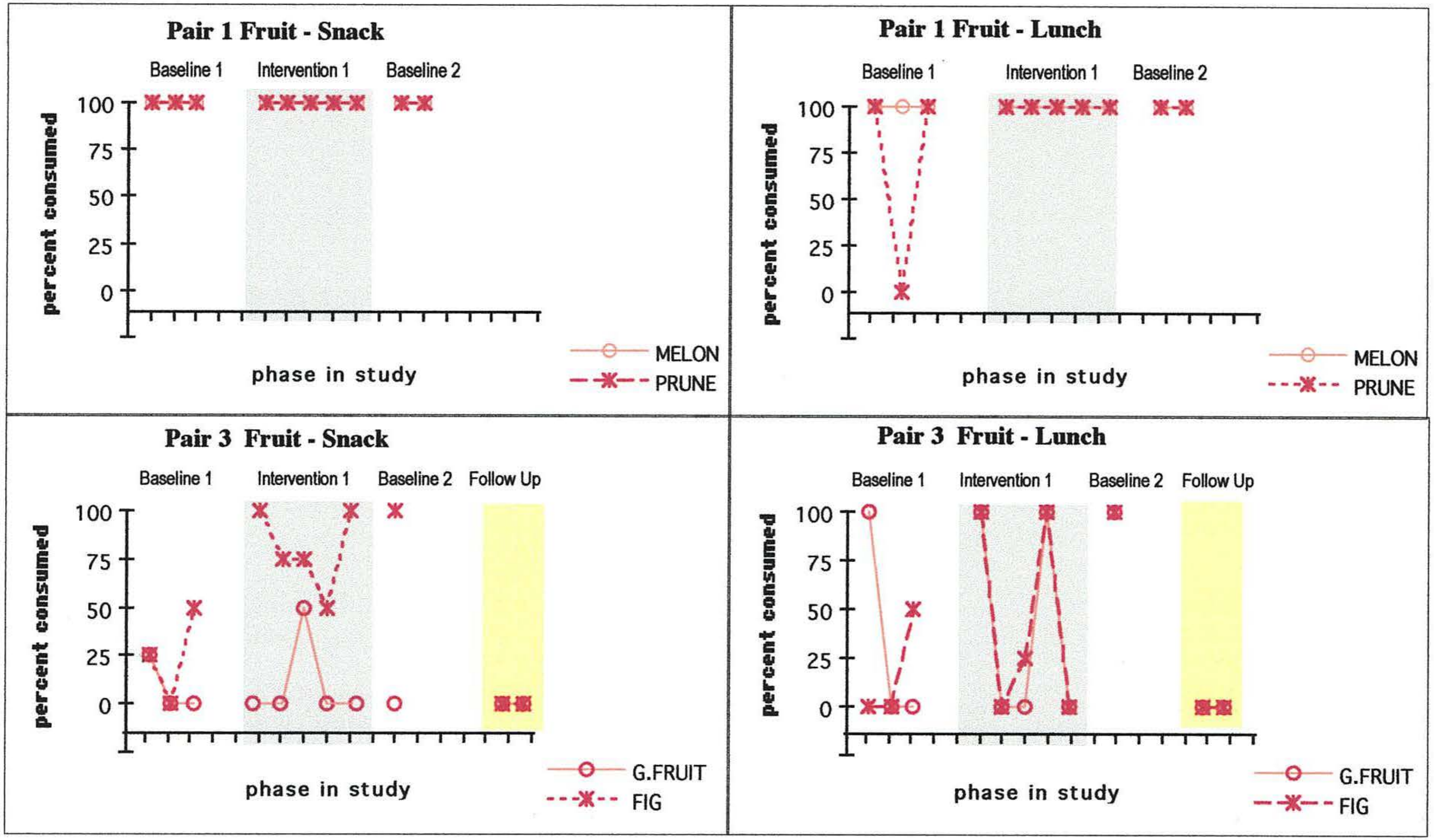


Figure 3.15. RA's consumption of target fruit across all phases of Experiment 3, Baseline 1, Intervention, Baseline 2 and Follow-Up. Snack time consumption is illustrated on the left, lunchtime consumption on the right.

fruit from Pair 3 (fig). A small amount of the other fruit in this pair (grapefruit) was eaten on one occasion. When the intervention was withdrawn at Baseline 2, R did eat fig on the one occasion it was presented and continued to consume both Pair 1 fruits. The data available at follow-up show that she was not eating either of the fruits in Pair 2.
Lunch. The lunchtime data show a different pattern of target fruit consumption. Both fruits in Pair 1 were reliably eaten across the course of the study. When the intervention was introduced at snack time, R immediately consumed *both* fruits in Pair 3 at lunchtime and continued to do so into Baseline 2. As was the case at snack time, follow-up data show that this change was not maintained six months later.

WM (4 days)

Snack. Figure 3.16 shows that prior to the intervention, W reliably ate only one target fruit, grapefruit from Pair 3 at 100%. The intervention was effective immediately on both Pair 1 fruits and W continued to eat the fruit from Pair 3 that she had eaten in Baseline 1. Data for prune and water melon during Baseline 2 show that consumption of these fruits was largely maintained when the intervention was withdrawn. At follow-up, W was still eating both Pair 1 fruits, but neither of the fruits in Pair 3, including the one fruit she had reliably consumed during Baseline 1.
Lunch. W's consumption of fruit at lunchtime was different to that observed in the snack setting. Consumption during Baseline 1 was largely similar in both contexts, but in contrast to the snack setting, there was little change in lunchtime consumption when the snack time intervention was applied, with only a small increase in consumption of prune from Pair 1 noted. As at snack time, W continued to eat the Pair 3 fruit that she reliably consumed during Baseline 1. However, during Baseline 2, consumption of prune from Pair 1 was in evidence. At follow-up, W was eating both Pair 1 fruits. As was the case in the snack setting, her consumption of grapefruit (which was initially high) was reduced to zero.

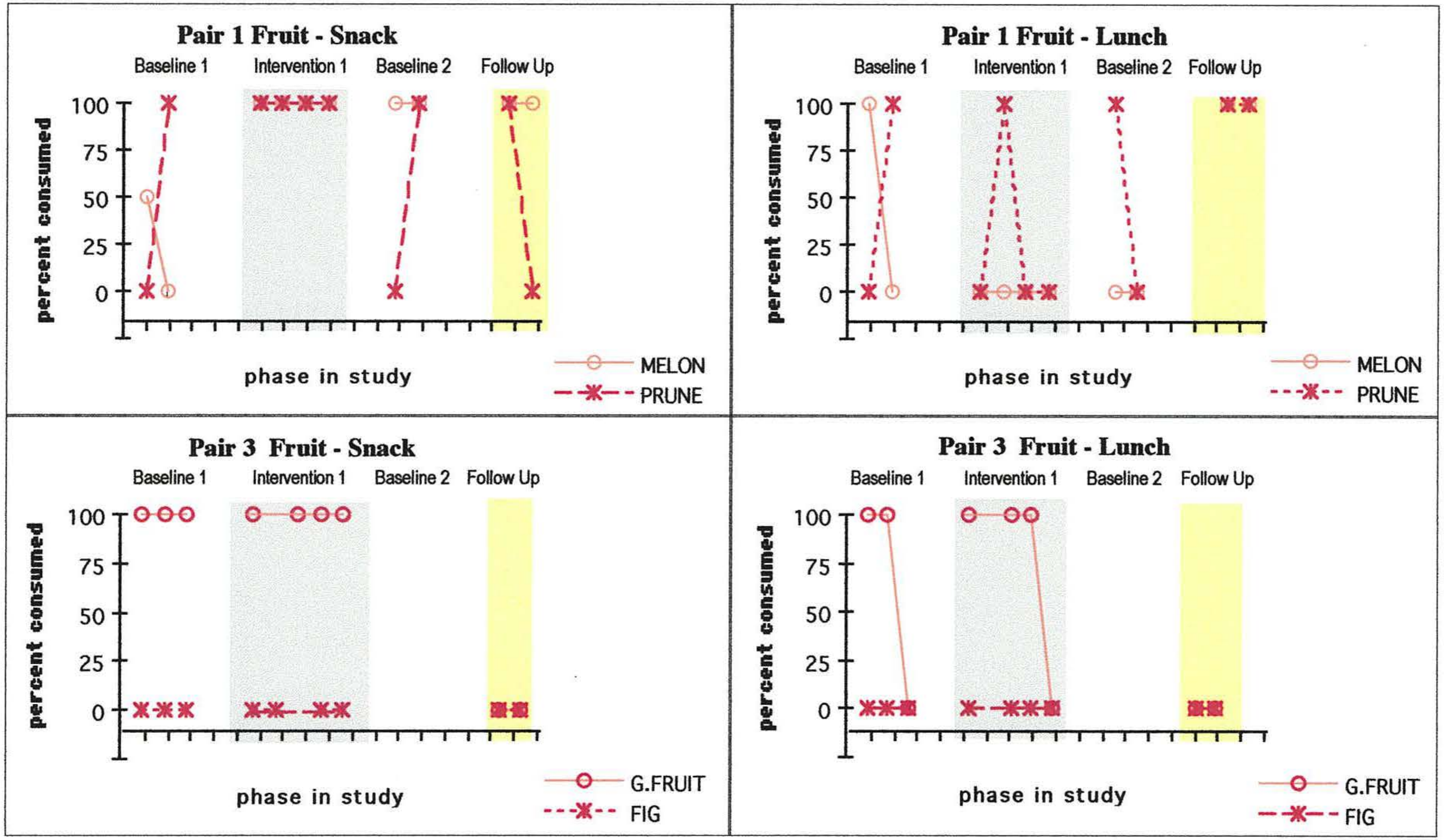


Figure 3.16. WM's consumption of target fruit across all phases of the experiment, Baseline 1, Intervention, Baseline 2 and Follow-Up. Snack time consumption is illustrated on the left, lunchtime consumption on the right.

DK (4 days)

Snack. Figure 3.17 shows that D ate little fruit during Baseline1. Following the introduction of the intervention, D's consumption of prune increased immediately to 100% and remained at that level for the duration of the phase. On one occasion she also ate both Pair 3 fruits at maximum levels. Prune consumption was maintained when the intervention was withdrawn.

Lunch. At lunchtime, D's consumption corresponded to that at snack time. When the intervention was introduced at snack time, there was an immediate effect on her consumption of prunes at lunchtime, which remained elevated across the phase and was maintained into Baseline 2.

Type IV Responses (Very Small Unstable Target Fruit)

BC (5 days)

Snack. Figure 3.18 shows that during Baseline 1, B reliably ate one fruit from Pair 1 (water melon) and occasionally a small amount of one fruit from Pair 3 (grapefruit). When the intervention was introduced, he continued to reliably consume water melon, but also increased consumption of prune and grapefruit which he ate in variable quantities across the phase. He also tried fig on one occasion. When the intervention was withdrawn in Baseline 2 consumption of all fruits was reduced to zero. At follow-up, of Pair 1, reliable 100% consumption was recorded with the water melon whilst there was no consumption of prunes. Of Pair 3, B ate fig maximally on two out of three presentations, more than during any previous phase. He ate grapefruit maximally on the last presentation, having previously refused it.

Lunch. At lunchtime, B ate water melon, but less regularly than he had in the snack context and he ate no other fruit. His consumption of target fruit in this context was largely unaffected by the snack time intervention, apart from an increase in water melon consumption (that he consistently ate at snack time). Interestingly, he continued to eat

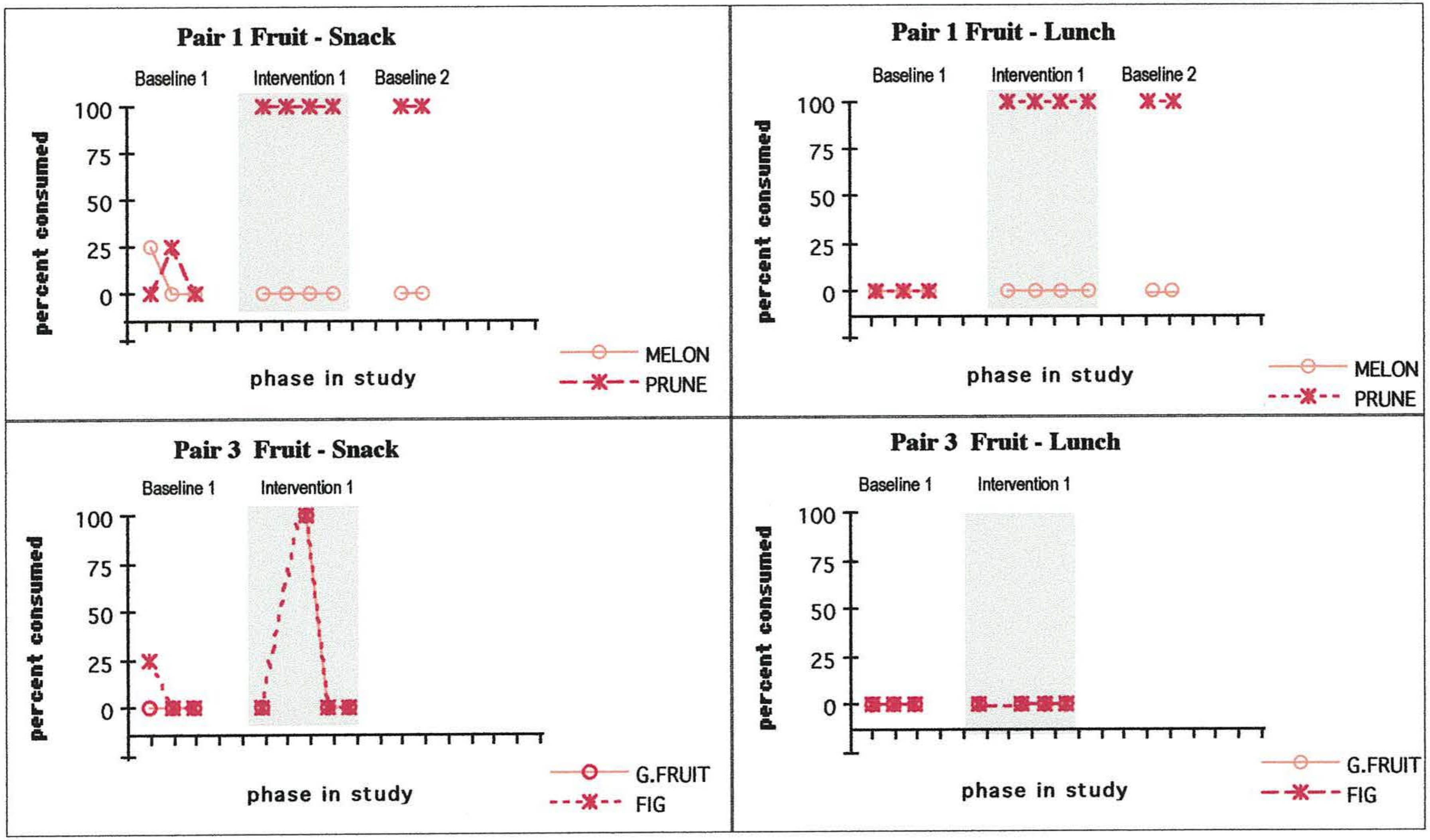


Figure 3.17. DK's consumption of target fruit across all phases of the experiment, Baseline 1, Intervention, Baseline 2 and Follow-Up. Snack time consumption is illustrated on the left, lunchtime consumption on the right.

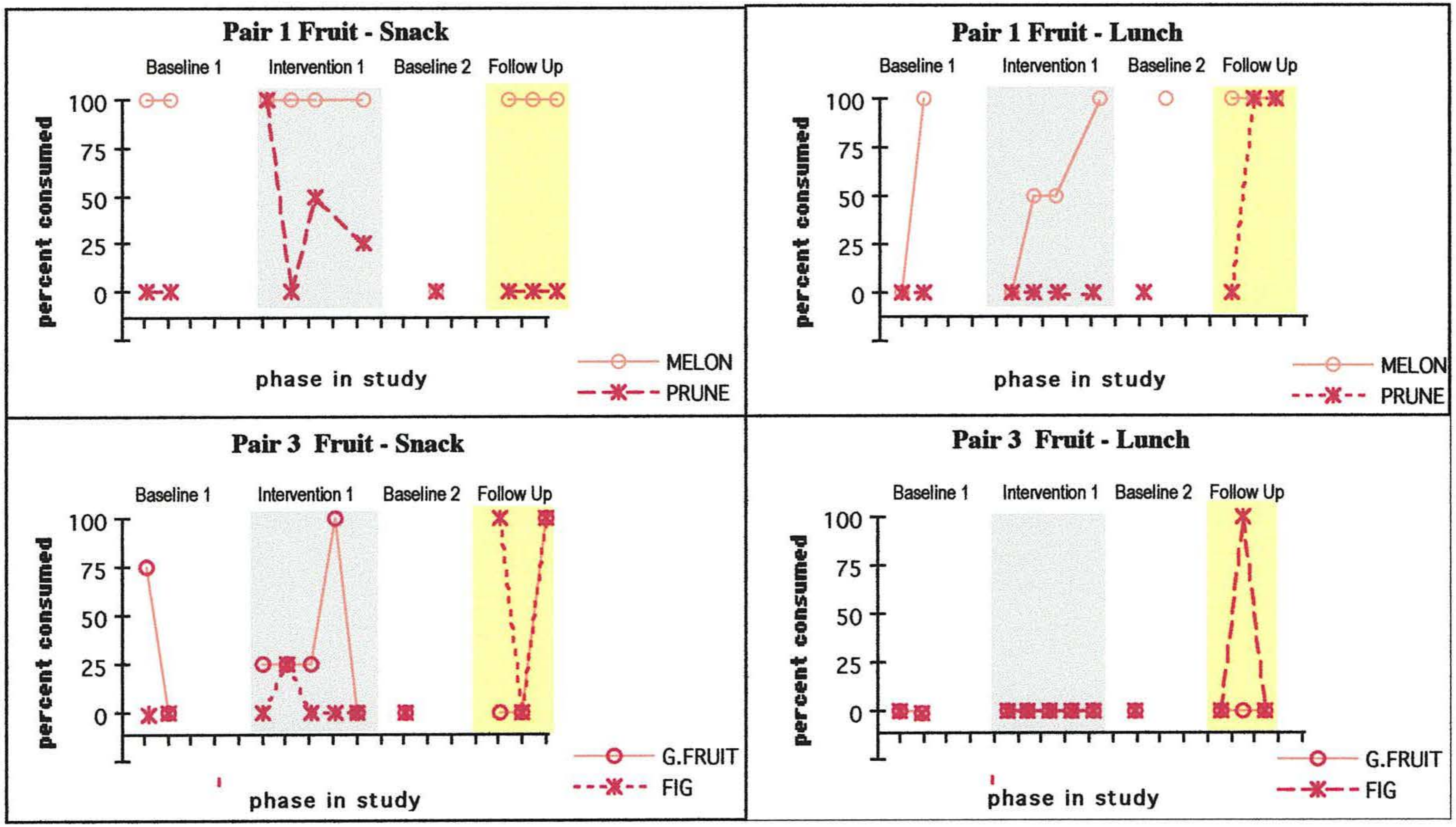


Figure 3.18. BC's consumption of target fruit across all phases of the experiment, Baseline 1, Intervention, Baseline 2 and Follow-Up. Snack time consumption is illustrated on the left, lunchtime consumption on the right.

water melon during Baseline 2 (the only fruit eaten at this time) even though he had refused it at snack time. At follow-up, there was continued reliable consumption of water melon, along with an increase in prune consumption and on one occasion consumption of fig was recorded.

HB (4 days)

Snack. Figure 3.19 shows that H's consumption during Baseline 1 in the snack context consisted of a small amount (25%) of fig from Pair 3 fruits on one occasion and 100% consumption of prune from Pair 1 fruit on one occasion. When the intervention was introduced, H continued to eat the Pair 1 fruit, although on two occasions only and with a downward trend. He also ate some fig, but again the trend was downward. During Baseline 2, minimal amounts (25%) of melon and prune only were consumed.
Lunch. None of these changes were apparent in the lunchtime setting. H refused all the target fruits (with the exception of 25% of a Pair 1 fruit on day 1 of Baseline 1) across the course of the study.

EC (3 days)

Snack. Figure 3.20 shows that at snack time, E ate none of the target fruits prior to the intervention. During the intervention, he tried two of the fruits, prune from Pair 1 and fig from Pair 3. When the snack time intervention was withdrawn during Baseline 2, he again ate prune at 100% along with 50% of the second fruit in Pair 1 (water melon). At follow-up he continued to consume both fruits in Pair 1 and maximum amounts of prune along with smaller amounts of water melon. With the exception of fig (one single occasion) Pair 3 fruits were refused throughout the study.
Lunch. At lunchtime, E consumed prune during Baseline 1 and continued to do so throughout the course of the study. It is interesting that he did not eat this same fruit in the snack setting until the third time that it was targetted. During the snack time

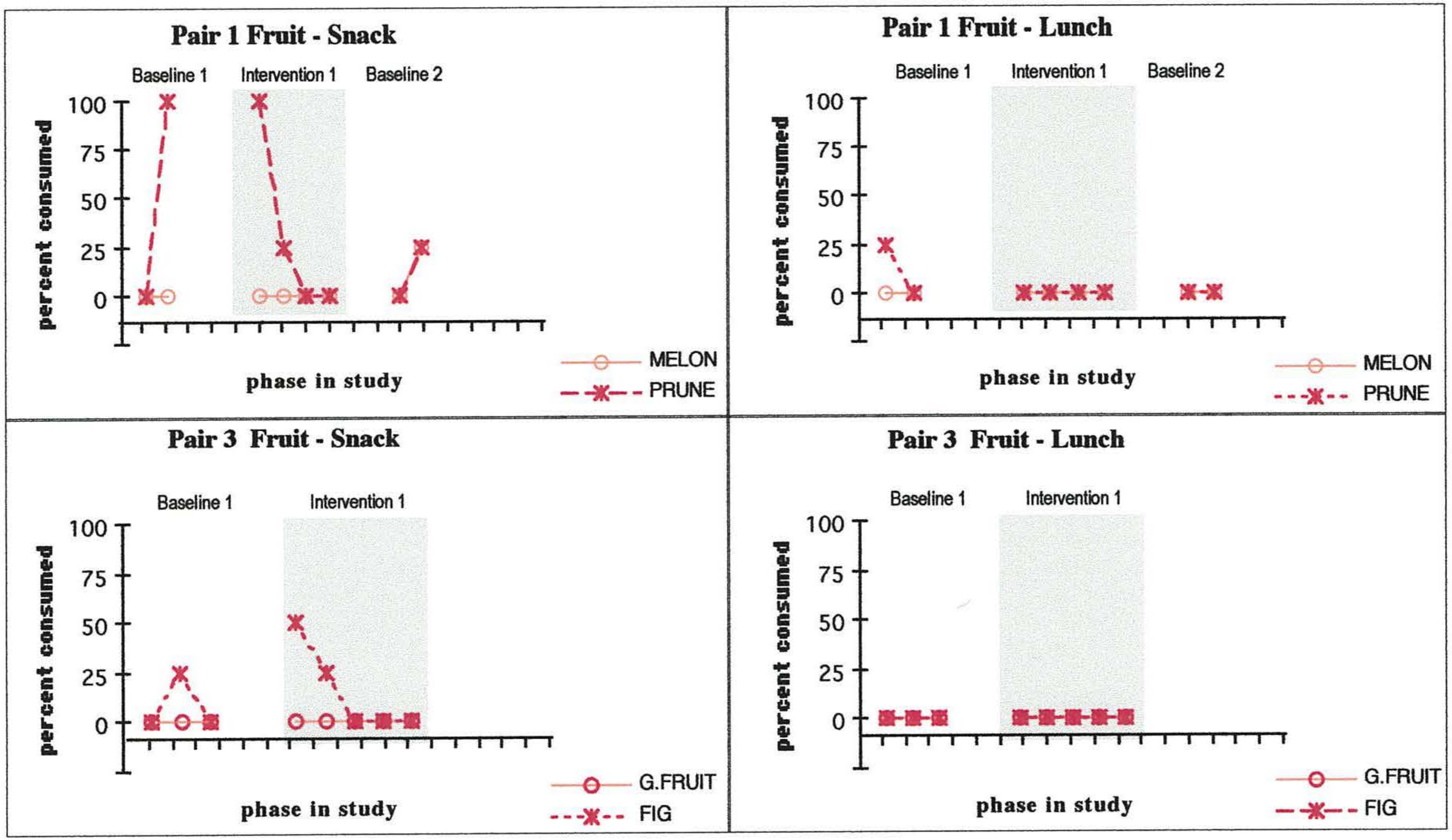


Figure 3.19. HB's consumption of target fruit across all phases of the experiment, Baseline 1, Intervention, Baseline 2 and Follow-Up. Snack time consumption is illustrated on the left, lunchtime consumption on the right.

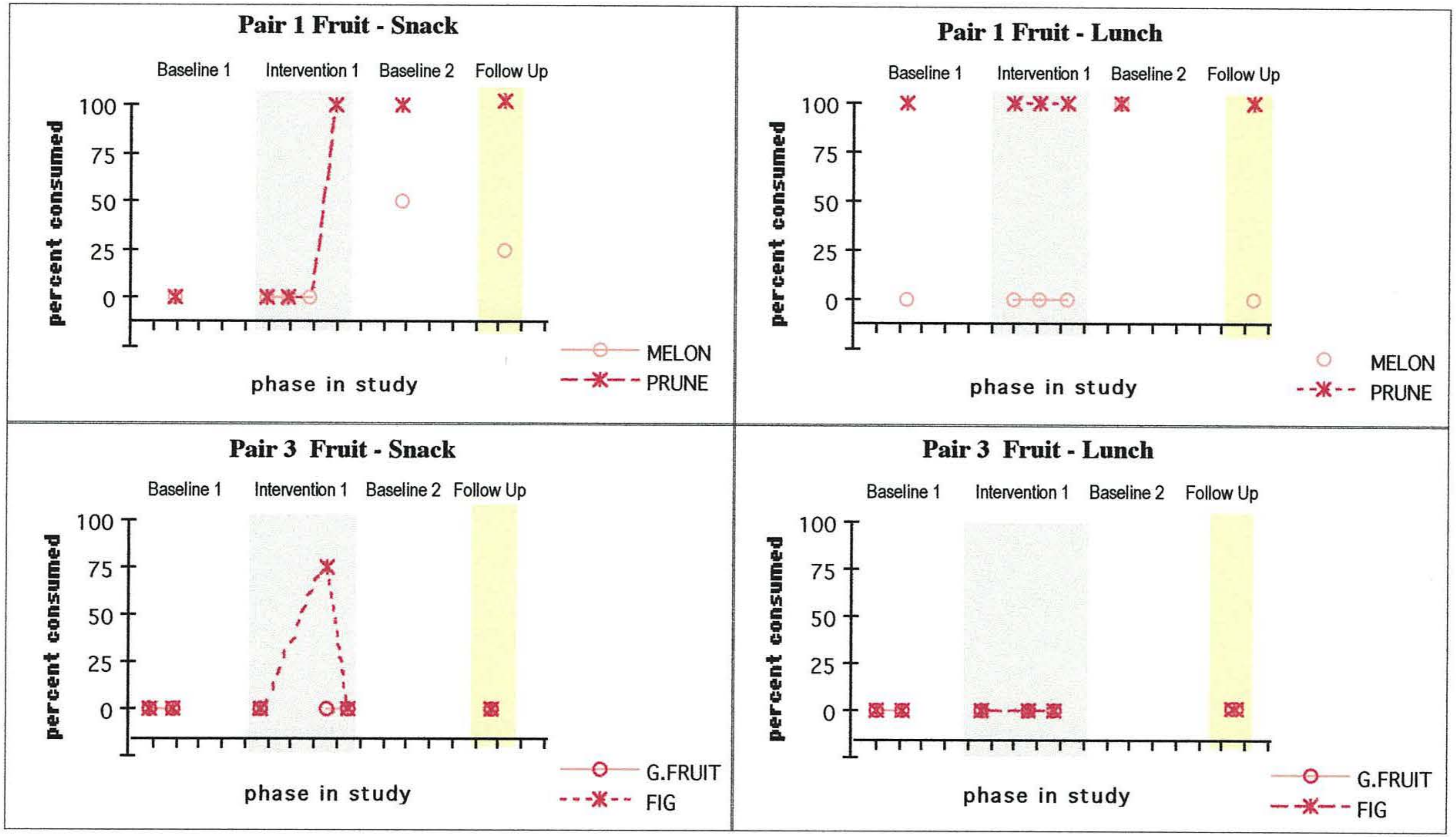


Figure 3.20. EC's consumption of target fruit across all phases of the experiment, Baseline 1, Intervention, Baseline 2 and Follow-Up. Snack time consumption is illustrated on the left, lunchtime consumption on the right.

intervention period, E ate only prunes at lunchtime. When the intervention was withdrawn in Baseline 2, he ate both fruits in Pair 1 at 100%. At the six-month follow-up, he had returned to eating only prunes.

Discussion: Individual Data

From the graphs presented, it can be seen that the effects of the intervention differed between participants. For some children, the impact was immediate and applied to all foods, while for other children the impact was immediate for some foods and less so with others. During the time that the intervention was in place, there were some children who began to eat all the target fruits. With other children the effects of the intervention were limited to one, two or three target fruits.

The individual graphs also show that in the lunchtime setting, in most cases, the generalisation effects of the snack time intervention took a little longer to appear than the direct effects of the intervention applied in the snack setting and again, in some cases, the effects on consumption were less powerful at lunchtime than they had been in the snack setting.

There were two examples included in the above graphs of children who attended less than four or five sessions per week. It was not possible to include other children whose attendance was less than four or five days because too few data points were collected for those children. Thus, it is not possible to say whether rate of attendance at the nursery (i.e. number of targettings) is an important factor in changing the children's eating patterns. It is interesting to note that at least one child who attended on only one or two occasions each week seemed to respond as well as some children who attended on a full time basis (see GP above). Similarly, EC, who only attended three days per week showed some response to the intervention. Conversely, it can be seen that not all of the full time attendees responded optimally to the intervention. Thus, it is possible that different children require a greater or fewer opportunities for rewarded taste experiences in order to respond optimally to the intervention. It is also likely that the number of rewarded taste experiences a child has will influence the likelihood of maintenance of behaviour. For example, a child who begins to change his or her eating behaviour on the first or second occasion that the intervention is implemented will have a further three or four opportunities to continue with that change. Another child who begins to change his or her eating behaviour on the fourth or fifth occasion on which the intervention is implemented will have only one or two further opportunities to continue with that change. A future study could address this issue by increasing the length of the intervention phases, so that there is more time for behaviour change to become established.

Nonetheless, there are indications that an intervention run along similar lines to that reported above could, with some alterations, be successful in encouraging children of this age to eat more of and a wider range of fruit and vegetables.

RESULTS: GROUP DATA

Participants' data were grouped according to daily attendance per week during the study (i.e. 5 day, 4 day, 3 day, 2 day and 1 day attendees). For the 5 and 4 day attendance groups, the mean consumption of each of the experimental foods, in each experimental phase is shown in Tables 3.5 and 3.6 respectively. Figures 3.21 and 3.22 show, for each of the latter attendance groups, the average consumption of pairs of target and non-target fruit, and all vegetable pairs, at snack time and lunchtime, in each experimental phase. Figures 3.21.1 and 3.22.1 show, for each of the latter attendance groups, the average consumption of pairs of target and non-target fruit, and all vegetable pairs, at snack time and lunchtime, in each experimental phase *relative to Baseline 1.* Figure 3.23 shows consumption across all phases of the experiment of the sub-group of 5 day attendees who were available to participate in Follow-Up 1. Only group data for the 5 day and 4 day attendees are presented since the data for children attending less than 4 days were sparse and unrepresentative of the scheduled food presentations. Some data from individual children who attended less then 4 days were presented previously in this section where individual performances were considered.

Results: 5 day attendees

Consumption at Snack Time: Target Foods

The upper left quadrant of Figure 3.21 shows consumption of target fruit and high exposure vegetables in the snack time context for the ten children who attended the playroom for five sessions per week. The broken lines within each column show consumption of each of the fruit or vegetable food pairs within Food Sets 1 and 3. Mean consumption of each experimental food in each setting and in each experimental phase is shown in Table 3.5.

The upper left quadrant of Figure 3.21.1 shows consumption of target fruit and high exposure vegetables in the snack time *context relative to Baseline 1* for the ten children who attended the playroom for five sessions per week.

Table 3.5 shows consumption of individual foods across all phases of the experiment at snack time and lunchtime.

Baseline 1

Food category consumption: More fruit was consumed (46%) than vegetables (26%).

Within-category consumption: There was a dichotomy in fruit consumption; relatively high levels of Pair 1 were eaten (60%) whilst Pair 3 was consumed at around half that level. Consumption of the vegetable pairs was more comparable; Pairs 1 and 3 were consumed at 23% and 30% respectively.

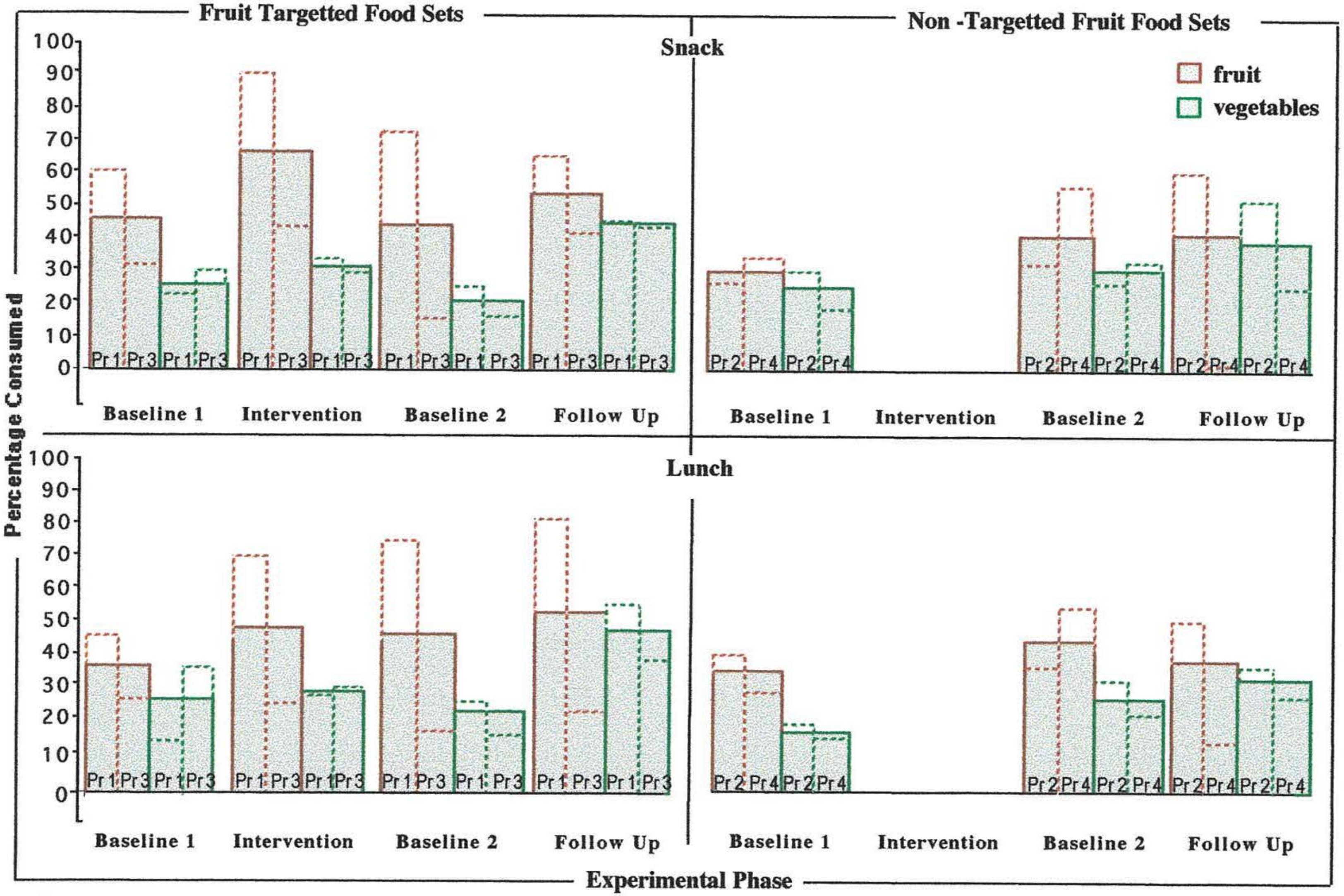


Figure 3.21. Mean consumption for 5 day attendees of target fruit, accompanying vegetables, and non-target fruit and vegetables in the experimental (snack) context and in the generalization (lunch) context across all phases of Experiment 3. Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit, and accompanying vegetables for Food Sets 1 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 2 and 4 (upper and lower right panels).

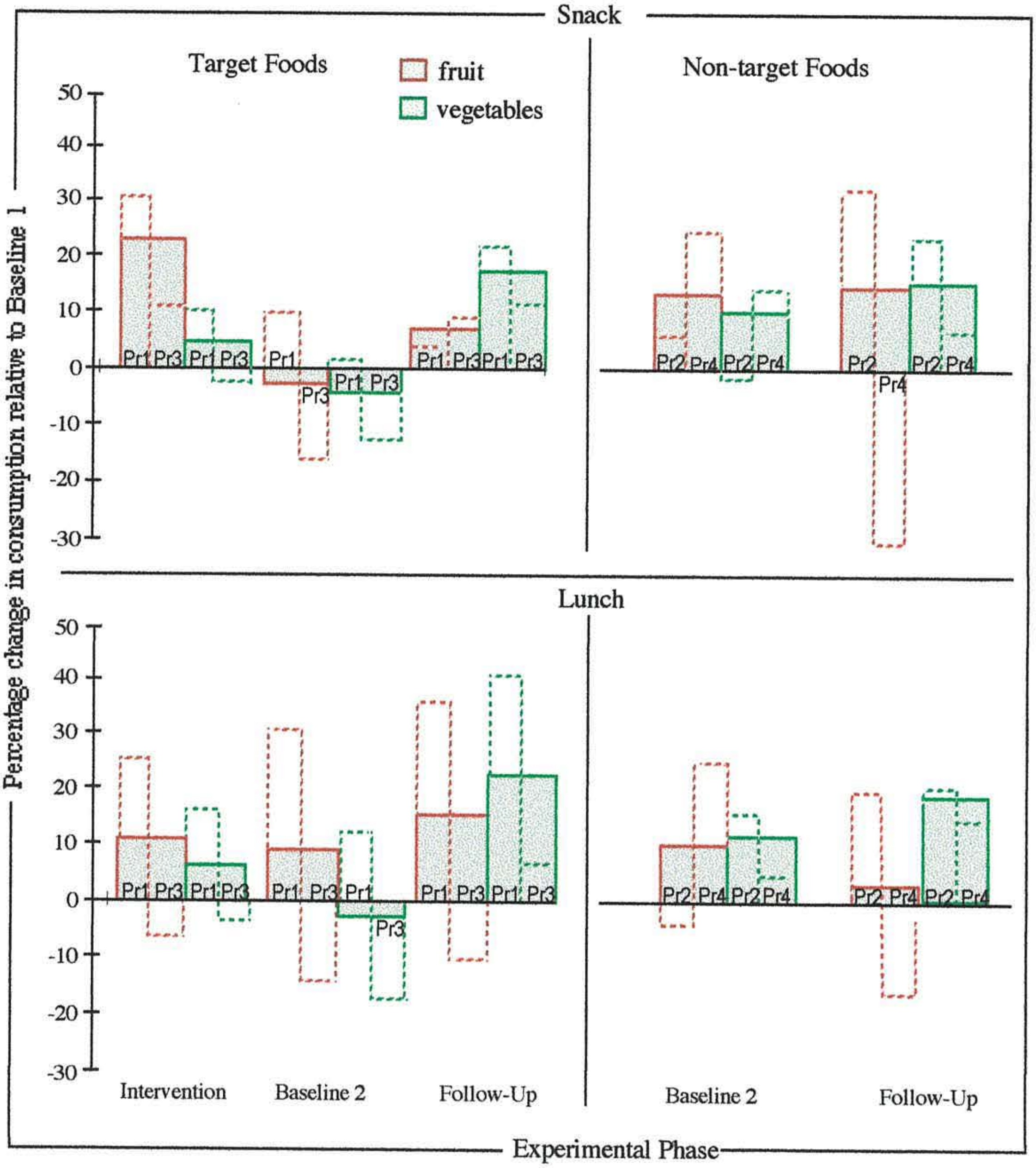


Figure 3.21.1. The percentage change in consumption of target fruit and accompanying non-target vegetables, and non-target fruit and non-target vegetables in the experimental (snack) context and generalisation (lunch) context *relative to Baseline 1* for the 5 day attendees . Dashed lines show the total mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit, and accompanying vegetables for Food Sets 1 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 2 and 4 (upper and lower right panels).

Table 3.5. 5 day attendees mean consumption of each food pair across the course of Experiment 3 showing target fruit (TF), high exposure vegetable (HV), low exposure fruit (LF) and low exposure vegetable (LV). The upper section shows snack time consumption and the lower section shows lunchtime consumption (blue type) during Baseline 1 (BL1), Intervention (INT), Baseline 2 (BL2), and Follow-up (FU). Mean total category consumption is shown in bold.

/ denotes some foods unavailable for presentation

Snack	**TF**	Pair 1	Pair 3	**HV**	Pair 1	Pair 3	**LF**	Pair 2	Pair 4	**LV**	Pair 2	Pair 4
BL1	**46**	60	32	**26**	22	30	**29**	26	33	**24**	30	18
INT	**67**	90	43	**31**	33	29						
BL2	**43**	72	15	**20**	24	16	**40**	31	57*	**30**	28	31
FU	**53**	64	41	**43**	44	41	**41**	60*	2	**39**	52	24
Lunch												
BL1	**37**	46	27	**25**	13	35	**35**	40	30	**16**	18	15
INT	**48**	70	24	**28**	27	30						
BL2	**46**	75	17	**21**	25	16	**43**	37	54*	**26**	31	21
FU	**52**	82	21	**47**	54	39	**38**	50*	13	**32**	37	27

Table 3.5a. 5 day attendees' mean percentage consumption of each experimental food at snack time and lunchtime across all phases of Experiment 3.
* & * indicate food not available for presentation.

		Experimental Phase							
		Baseline 1		Intervention		Baseline 2		Follow-Up	
Food Set	Food Pair	Snack	Lunch	Snack	Lunch	Snack	Lunch	Snack	Lunch
1	Water Melon	64	47	92	68	76	73	84	87
	Prune	56	45	88	73	68	78	44	77
	Swede	9	2.5	18	9.3	8	14	21	52
	Mange Tout	36	23.76	48	46	41	36.5	68	56.66
3	Sweetie Grapefruit	31	30	54	35	13	17	34.47	12.3
	Fig	34	24.66	32	14.57	17	17	46.6	31
	Mushroom	15	26	20	21.94	0	0	35	28.89
		45	44	39	37.6	33	33	47.6	50.33
2	Star Fruit	33	56			62	52	91.6	84
	Papaya	18.96	23.66			0	22	27.76	16.67
	Celery	38	24			34.5	31	55.56	63.89
	Asparagus	21.87	12			21.83	31	48.61	11
4	Sharon Fruit	42.55	35.8			56.94	53.57	*	*
	Guava	22.5	25			*	*	2.1	13
	Red Cabbage	25.76	17			42	37	34	41.66
	Parsnip	11	13			21	6	14.55	12.5

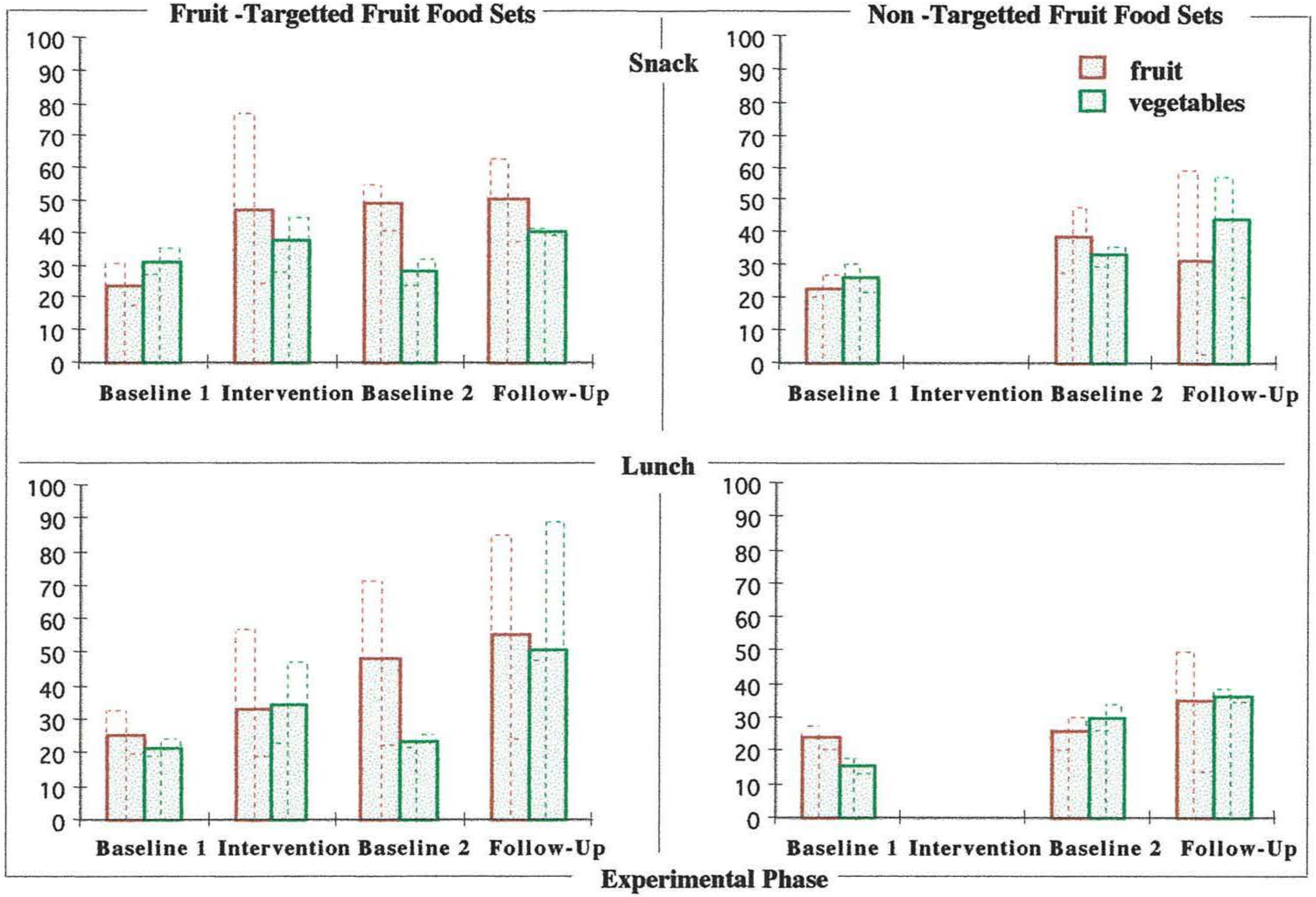


Figure 3.23. Mean consumption for the subgroup (n=6) of 5 day attendees *remaining at Follow-up* of target fruit, accompanying vegetables, and non-target fruit and vegetables in the experimental (snack) context and in the generalization (lunch) context cross all phases of Experiment 3. Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit, and accompanying vegetables for Food Sets 1 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 2 and 4 (upper and lower right panels).

Intervention

Food category consumption: When the Intervention was applied to fruit, consumption of target fruit increased to it's highest level of the study representing a rise of 21% from Baseline 1. Vegetable consumption remained at levels similar to Baseline 1, showing only a 5% increase.

Within-category consumption: Both Pair 1 and Pair 3 target fruit consumption increased; the initially more popular fruit (Pair 1) increased by 30% to almost maximum levels, whilst the less popular Pair 3 showed an increase of 11%. Of the high exposure vegetables there was a 10% increase in consumption of Pair 1; Pair 3 remained at around Baseline 1 levels.

Baseline 2

Food category consumption: With the removal of the Intervention, a decline in target fruit and high exposure vegetable consumption was recorded; both reverted to levels similar to, but less than those recorded in Baseline 1.

Within-category consumption: The decline in consumption of fruit was the result of a marked decrease in consumption of Pair 3 to half the level recorded in Baseline 1. Pair 1 fruit consumption remained elevated (by 10%) relative to Baseline 1. Of the high exposure vegetables, relative to Baseline 1 there was little change in consumption of Pair 1; however, there was a marked decline (13%) in consumption of Pair 3 to almost half that of Baseline 1.

For all of these foods, it was only possible to collect, at the most, two data points per child in Baseline 2. As data collection took place during the Christmas season, there were many disruptions and distractions, rehearsals for a concert, parties, etc. In addition, there were also many absences due to holidays. On some days only six of the ten full-time attendees were present.

Follow-up

Food category consumption: When the same foods were presented again, six months after Baseline 2 and nine months after Baseline 1, target fruit consumption was 7% higher than during Baseline 1. Vegetable consumption was also greater than during Baseline 1 (by 17%) and was recorded at its highest level of the study.

Within-category consumption: Of the target fruits, consumption of Pair 1 was slightly elevated (4%) relative to Baseline 1, whilst consumption of Pair 3 had recovered from its previous low point in Baseline 2 to 9% above that recorded during Baseline 1, almost equal to intervention levels. Consumption of Vegetable Pairs 1 and 3 was also increased, 11% and 12% greater respectively than during Baseline 1.

At the time that the follow-up phase was in operation, many of the original participants were either on holiday, or had left the nursery. For example, on the majority of the trials, there were only six of the original ten participants in attendance. Such small numbers can produce skewed data. These data can therefore not be considered to be representative of the entire group's performance had there been no attrition at Follow-up. Figure 3.23 shows the consumption patterns across all phases of the experiment for the six participants remaining at follow-up. This will allow the reader to assess how representative the data collected at follow-up might be.

Consumption at Snack Time: Non-Target Foods

The upper right quadrant of Figure 3.21 shows 5 day attendees' consumption of the non-targetted (and therefore low exposure) fruit and vegetables of Food Sets 2 and 4 during the snack time session. The broken lines within each column show consumption of each of the fruit or vegetable food pairs within Food Sets 2 and 4. Mean consumption of each experimental food in each setting and in each experimental phase is shown in Table 3.5.

The upper right quadrant of Figure 3.21.1 shows 5 day attendees' consumption of the non-targetted (and therefore low exposure) fruit and vegetables of Food Sets 2 and 4 during the snack time session *relative to Baseline 1.*

Baseline 1

Food category consumption: Both fruit and vegetables were poorly consumed, at 31% and 24%, respectively.

Within-category consumption: Of the fruit, Pair 4 was marginally more popular than Pair 2 (32% compared to 28% respectively). More Pair 2 vegetables were eaten than Pair 4 (31% compared to 18%, respectively).

Baseline 2

Food category consumption: Following the application and removal of the intervention on target fruit, an increase in consumption of low exposure fruit was recorded, with a rise of 13% to 44%. A smaller increase (6%) in low exposure vegetable consumption was also recorded. Since guava was not available for presentation during this phase, mean category consumption was calculated by dividing non-target fruit consumption by the number of fruits presented (i.e. 3).

Within-category consumption: Given that guava was unavailable during Baseline 2, the reader is referred to Table 3.5 which shows consumption patterns for individual foods. From Table 3.5, it can be seen that there was a substantial increase in consumption of star fruit (from Pair 2), but this is offset by a concurrent decrease in the paired fruit papaya. Table 3.5 also shows that there was an increase in consumption of sharon fruit (up by 14%). If guava had been presented and no change was recorded in consumption, or consumption had decreased (as it had at follow-up) then the average consumption of Pair 4 fruit would be much less than it appears in Figure 3.21.

Of the low exposure vegetables, a rise was recorded for Pair 4 only (12%); consumption of Pair 2 remained largely unchanged.

It is important to bear in mind that these data are for 6 of the 10 children in the original cohort. Figure 3.23 will assist the reader in deciding whether or not the data collected at follow-up can be considered to be a representation of the consumption patterns of the whole group.

Follow-up

Food category consumption: Fruit consumption was reduced to Baseline 1 levels whilst vegetables reached the highest recorded level of the study (39%). Sharon fruit was unavailable for presentation during this phase. Mean category data for non-target fruit was calculated as above, by dividing the quantity of fruit consumed by the number of fruits presented (i.e. 3).

Within-category consumption: Given the absence of sharon fruit during this phase, the reader is referred to Table 3.5 which shows consumption of individual foods. There was a substantial increase in consumption of Pair 2 fruit, reflecting a further increase in consumption of star fruit to almost maximum levels. A smaller (10%) increase was noted in papaya consumption. As only guava was available for presentation, the graph shows only consumption (which was less than during Baseline 1) of this fruit. Thus, there appears a substantial decrease in consumption of Pair 4 as illustrated on the graph. If sharon fruit were presented and it was consumed at Baseline 1 levels, then the apparent difference between Follow-up and Baseline 1 consumption of Pair 4 fruit would be greatly reduced.

Relative to Baseline 1, consumption of both pairs of low exposure vegetables increased. The rise was greater for Pair 2 (23%) than for Pair 4 (7%).

Consumption at Lunchtime: Target Foods

The lower left quadrant of Figure 3.21 shows 5 day attendees' consumption of target fruit and accompanying (therefore high exposure) vegetables in the lunchtime setting. The lower left quadrant of Figure 3.21.1 shows the 5 day attendees' consumption of those same foods at lunchtime relative to Baseline 1.

Baseline 1

Food category consumption: Baseline consumption was slightly less than, but otherwise similar to that recorded in the snack context, with more fruit consumed than vegetables.

Within-category consumption: The same dichotomy in the consumption of fruits was in evidence at lunchtime as in the snack setting; once again, Pair 1 was eaten to a greater degree than Pair 3 (46% compared to 26%, respectively). Of the high exposure vegetables, consumption on the average was comparable across lunch and snack contexts; though on the average, Pair 3 was consistently preferred over Pair 1. There was a greater difference in consumption between Pair 1 and Pair 3 at lunchtime (10%) than was noted at snack (25%).

Intervention

Food category consumption: When the Intervention was applied to target fruit at snack time, target fruit consumption at lunchtime increased to the highest level of the study at 48%, a rise of 11% compared to Baseline 1. Vegetable consumption was increased by 5%.

Within-category consumption: As was the case at snack time, a substantial increase in consumption of the initially popular Pair 1 fruit was recorded. At the same time, relative to Baseline 1, a small decline in consumption of Pair 3 (no change was noted in the snack context) was recorded. Of the high exposure vegetables, the static nature of the mean category consumption was the result of an increase of 10% in Pair 1 and a decrease of 13% for Pair 3 relative to Baseline 1.

Baseline 2

Food category consumption: Following the removal of the intervention at snack time, target fruit consumption remained similar to intervention levels, whilst high exposure vegetable consumption was reduced slightly relative to Baseline 1.

Within-category consumption: Consumption of Pair 1 fruits increased to levels above those recorded during the intervention and (as had occurred at snack time) a reduction in consumption of Pair 3 to less than Baseline 1 levels was recorded. Consumption of Pair 1 vegetables was increased, whilst consumption of Pair 3 was reduced, relative to Baseline 1. The effect was more exaggerated than that in the snack context.

Follow-up

Food category consumption: When the same foods were presented six months after Baseline 2 and nine months after Baseline 1, levels of consumption of both fruit and vegetables were the highest recorded during the study.

Within-category consumption: The elevated level of consumption in target fruit was the result of a further increase in consumption of Pair 1 which was eaten at 82%, 11% greater than during the intervention. Pair 3 fruit continued to be consumed at less than Baseline 1 levels. There was less correspondence in this phase between snack time and lunchtime consumption of target fruit. Consumption of Pair 1 at snack time was much less than at lunchtime and consumption of Pair 3 was greater at snack time than at lunch.

Both pairs of high exposure vegetables were eaten at twice the levels that they had been during Baseline 1 and relative to snack time, twice the amount of Pair 3 vegetables were consumed.

At the time that the follow-up phase was in operation, many of the original participants were either on holiday, or had left the nursery. For example, on the majority of the trials, there were six of the original ten participants in attendance. These data can therefore not be considered to be representative of the entire group's performance had there been no attrition at Follow-up. Figure 3.23 shows the patterns of consumption throughout all phases of the study for the six participants remaining during follow-up. From this, the reader can assess the representativeness or otherwise of the sub-group.

Consumption at Lunchtime: Non-Target Foods

The upper right quadrant of Figure 3.21 shows 5 day attendees' consumption of the non-targetted (and therefore low exposure) fruit and vegetables of Food Sets 2 and 4 during the snack time session. The broken lines within each column show consumption of each of the fruit or vegetable food pairs within Food Sets 2 and 4. Mean consumption of each experimental food in each setting and in each experimental phase is shown in Table 3.5.

The upper right quadrant of Figure 3.21.1 shows 5 day attendees' consumption of the non-targetted (and therefore low exposure) fruit and vegetables of Food Sets 2 and 4 during the snack time session *relative to Baseline 1.*

Baseline 1

Food category consumption: Both fruit and vegetable consumption was low and resembled levels recorded in the snack setting. Fruit consumption was twice that of vegetables.

Within-category consumption: There was very little difference between consumption of the two fruit pairs. Of the vegetable pairs, more of Pair 4 was consumed than Pair 2 (18% and 15% respectively).

Baseline 2

Food category consumption: When the Intervention had been applied to and then removed from target fruit in the snack setting, small increases in low exposure fruit (9%) and low exposure vegetable consumption (8%) were noted.

Within-category consumption: Given the absence of guava during this phase, the reader is referred to Table 3.5a, which gives consumption data for individual foods. There was a small decline in consumption of Pair 2 foods relative to Baseline 1 (about 3%). At the same time, consumption of sharon fruit, the only Pair 4 fruit presented, increased by 18%. Only data for sharon fruit are illustrated in Figure 3.21. If guava had been presented during this phase and, in addition had been eaten at Baseline 1 levels or less (as it was during follow-up), then consumption of "Pair 4" fruit would be less than appears in Figure .

An increase in Pair 2 vegetables of 20% was recorded (the result of an increase in asparagus consumption – see Table 3.5). Consumption of Pair 4 vegetables remained at Baseline 1 levels. Vegetable consumption at lunchtime was the reverse of that recorded in the snack context.

Follow-up

Food category consumption: Fruit consumption was similar to (3% less) levels recorded during Baseline 1, whilst vegetable consumption had doubled, so that 17% more vegetables were eaten than in Baseline 1.

Within-category consumption: Given the absence of sharon fruit during follow-up, the reader is referred to Table 3.5. Relative to Baseline 1, more Pair 2 fruit and less Pair 4 were eaten. This is similar to trends shown in the snack time context, although the effects were much larger in the former context. Table 3.5 shows that there was a large increase in consumption of star fruit, but a lack of increase in consumption of the paired fruit, papaya. In the snack context, an increase in papaya consumption was recorded.

Data illustrated in Figure 3.21 represents guava consumption only, which was 4% less than was recorded during Baseline 1. A rise in sharon fruit consumption would have lessened the decrease relative to Baseline 1.

Consumption of both pairs of vegetables was greater than at any other time in this context. This trend was similar to that recorded during the snack-time context.

At the time that the follow-up phase was in operation, many of the original participants were either on holiday, or had left the nursery. For example, on the majority of the trials, there were only six of the original ten participants in attendance. These data can therefore not be considered to be representative of the entire group's performance had there been no attrition at Follow-up. Figure 3.23 shows the pattern of consumption of this subgroup of six across all phases of the study and will enable the reader to assess the representativeness or otherwise of this small group.

Discussion: 5 day attendees

Figure 3.21 illustrates the percentage changes in consumption of fruit and vegetables relative to Baseline 1. It shows that in the snack setting when the intervention was applied to target fruit, consumption of those fruits increased. The increase (21%) was the largest single rise in consumption recorded across the course of the experiment. At the same time, there was little change in consumption of those vegetables that were presented with (and therefore equally frequently as) the target fruit. The marked increase in target fruit consumption together with the only very small change in consumption of the accompanying vegetables are indicative that the intervention was responsible for the observed changes in eating patterns.

When the intervention was removed, consumption of target fruit and the accompanying vegetables fell to slightly less than Baseline 1 levels, further indication that the intervention alone was the cause of the observed increases in consumption.

The intervention was effective with both food pairs, but more so with Pair 1 (prunes and water melon) than Pair 3 (sweetie grapefruit and fig) and the results of this differential effectiveness can be seen when one looks at Baseline 2 data for each fruit pair. These show that in the absence of the intervention, consumption of Pair 1 was maintained at above Baseline 1 levels, whereas consumption of Pair 3 was reduced relative to Baseline 1. Since the fruits in Pair 1 were the sweeter of the two pairs, this could be interpreted as preliminary evidence for the beginnings of transfer of control of consumption from the extrinsic scheduled rewards to the intrinsically reinforcing taste of the fruit.

Longer term effects of the intervention (illustrated in the Follow-up phase) show a small (7%) increase in fruit consumption relative to Baseline 1 involving both pairs of target fruits. The accompanying increase in high exposure vegetable consumption may be an effect of the passage of time. If so, it confirms the power of the intervention which, as a result of ten days intensive targetting, achieved a 21% increase in fruit consumption in comparison to several months of 'the passage of time' that resulted in a 17% increase in vegetable consumption. However, this interpretation must be viewed with caution because of the small sample of original participants that were available to take part in the follow-up.

Evidence that the effects of the intervention generalised to other, non-targetted fruits in the same setting can be seen in the upper right quadrant of Figure 3.21. This shows an overall enhancement in non-targetted fruit consumption of 13% during Baseline 2, suggestive of generalisation having occurred. Both pairs were affected, on the face of it, Pair 4 more than Pair 2. However, since only one of the two fruits from

Pair 4 was available to be presented during this phase, the data shown for Pair 4 represent consumption of one fruit only. This may or may not be a true representation of generalisation to non-target foods. If consumption of the non-presented food had decreased (as it did at Follow-up), or remained the same, then this would reduce the overall size of the effect as shown in Baseline 2. What can be said is that there were marked increases in consumption for one fruit from each fruit pair (31% and 14%). At follow-up, consumption of Pair 2 fruit was further enhanced.

During Baseline 2, consumption of low exposure vegetables also increased, but in smaller increments than for the concurrently presented fruits.

Overall trends at snack time were reflected in the lunchtime context. When the intervention was applied at snack time, target fruit consumption at lunchtime increased, whilst no change in high exposure vegetable consumption was recorded. The increase at lunchtime was smaller (11% compared with 21% at snack time) and reflected increases in consumption of Pair 1 foods only. These data indicate that the effects of the intervention did generalise to a second context, at least with one fruit pair, and, as suggested earlier, may be evidence that the *taste* of the foods was controlling the behaviour since no rewards were on offer for eating target foods at lunchtime.

Baseline 2 data for fruit also show that changes in consumption observed at lunchtime during the intervention phase were maintained when the intervention was removed. Baseline 2 consumption at lunchtime was greater than at snack-time, relative to Baseline 1. As was true of consumption at snack time, the effects of the intervention were maintained only with Pair 1 fruits; relative to Baseline 1 a reduction in the lunchtime consumption of Pair 3 fruits was recorded.

At Follow-up, it can be seen that there was a larger increase in consumption at lunchtime of target fruit relative to Baseline 1 than was observed at snack time; 15% compared with 7%. Post-intervention consumption during Baseline 2 and Follow-up began to match consumption at snack time.

Consumption of fruit not specifically targetted by the intervention are shown in the lower right quadrant of Figure. In Baseline 2, there was an increase in consumption of the non-targetted fruits, similar to that recorded for the same fruits at snack time. The data here suffer from the same limitations as outlined previously. What can be said is that there was a similar increase in consumption of the Pair 4 fruit (as at snack time) but not with the Pair 2 fruit. Any effects of the intervention to non-targetted fruits in the lunchtime setting would be the result of secondary generalisation and would thus be expected to be somewhat weaker (as it was) than those in the directly targetted snack session.

It is interesting to note that target and non-target vegetable consumption was greater than fruit consumption at Follow-up, but again, the reader is reminded of the very small numbers of participants involved (therefore a distorted sample) in this phase.

Results: 4 day attendees

Consumption at Snack time: Target Foods

The upper left quadrant of Figure 3.22 shows consumption of target fruit and high exposure vegetables in the snack time context for the six children who attended the playroom for four sessions per week. The broken lines within each column show consumption of each of the fruit or vegetable food pairs within Food Sets 1 and 3.

The upper left quadrant of Figure 3.22.1 shows consumption of target fruit and high exposure vegetables in the snack time context *relative to Baseline 1* for the six children who attended the playroom for four sessions per week. The broken lines within each column show consumption of each of the fruit or vegetable food pairs within Food Sets 1 and 3.

Mean consumption of each experimental food in each setting and in each experimental phase is shown in Table 3.6.

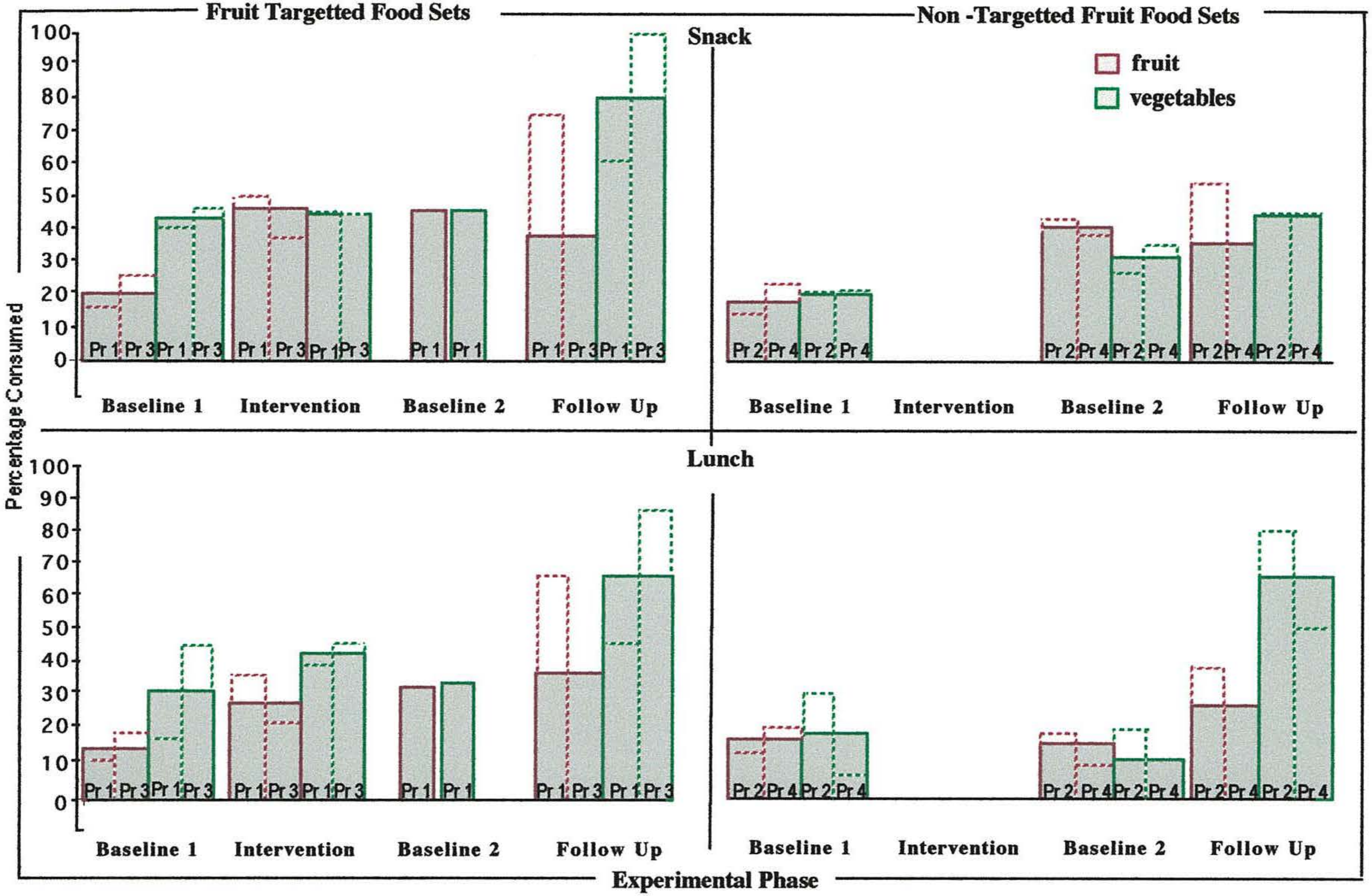


Figure 3.22. Mean consumption for 4 day attendees of target fruit, accompanying vegetables, and non-target fruit and vegetables in the experimental (snack) context and in the generalization (lunch) context across all phases of Experiment 3. Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit, and accompanying vegetables for Food Sets 1 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 2 and 4 (upper and lower right panels).

116

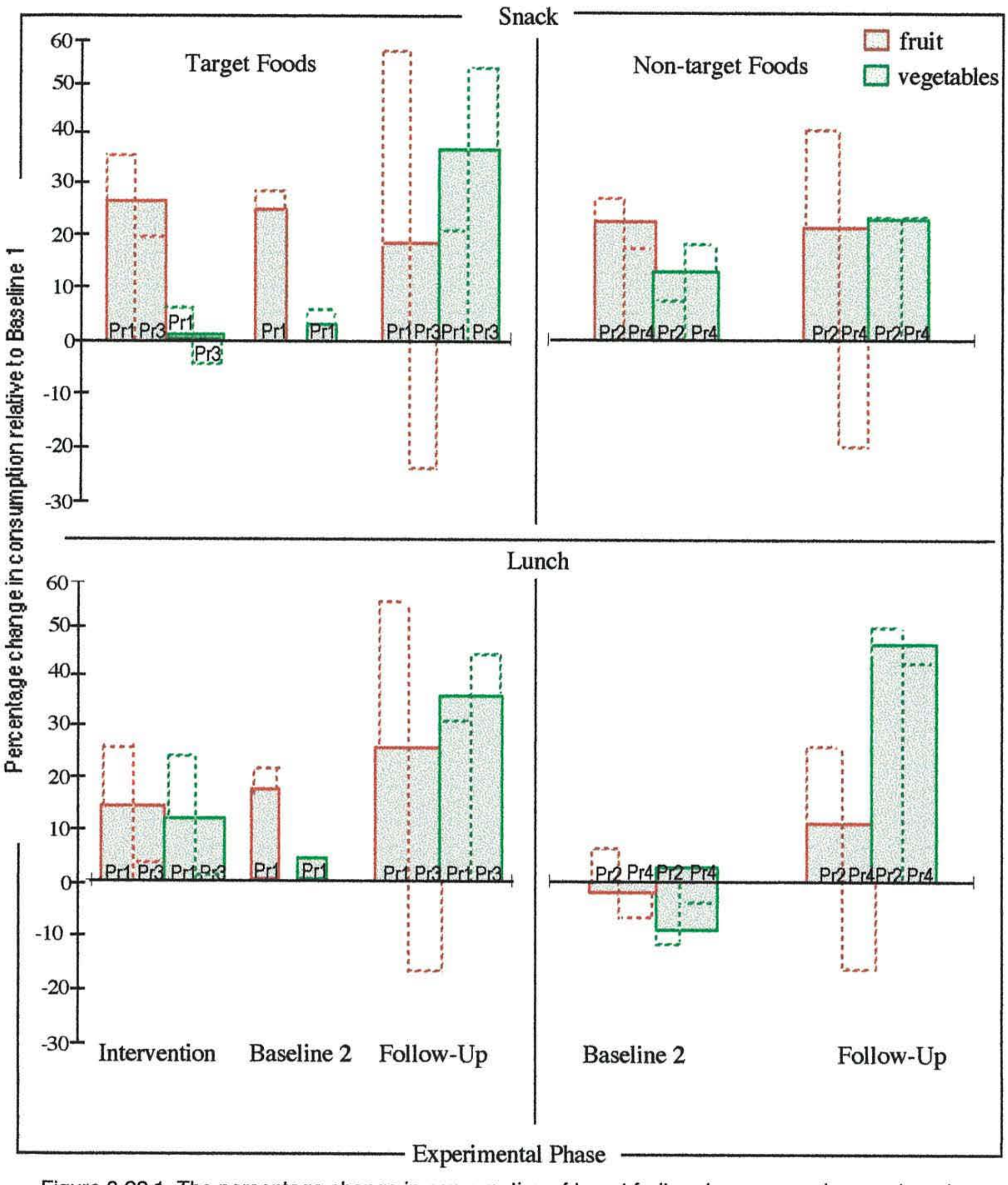


Figure 3.22.1 The percentage change in consumption of target fruit and accompanying non-target vegetables,and non-target fruit and non-target vegetables in the experimental (snack) context and generalisation (lunch) context *relative to Baseline 1* for the 4 day attendees . Dashed lines show the total mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit, and accompanying vegetables for Food Sets 1 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 2 and 4 (upper and lower right panels.

Table 3.6. 4 day attendees mean consumption of each food pair across the course of Experiment 3 showing target fruit (TF), high exposure vegetable (HV), low exposure fruit (LF) and low exposure vegetable (LV). The upper section shows snack time consumption and the lower section shows lunchtime consumption (blue type) during Baseline 1 (BL1), Intervention (INT), Baseline 2 (BL2), and Follow-up (FU). Mean total category consumption is shown in bold.

/ denotes participants absent for presentation

/ denotes some foods unavailable for presentation

Snack	**TF**	Pair 1	Pair 3	**HV**	Pair 1	Pair 3	**LF**	Pair 2	Pair 4	**LV**	Pair 2	Pair 4
BL1	**20**	17	24	**43**	40	46	**18**	14	22	**20**	20	20
INT	**47**	50	44	**45**	46	44						
BL2	**46**	46	**	**46**	45	**	**41**	42*	39	**31**	27	34
FU	**38**	75	0	**80**	61	100	**44**	54	0*	**44**	44	44
Lunch												
BL1	**13**	9	17	**30**	16	43	**16**	12	19	**18**	30	6
INT	**28**	35	20	**42**	39	45						
BL2	**31**	31	**	**32**	32	32	**15**	17*	9	**10**	19	0
FU	**38**	71	6	**66**	45	87	**26**	39	0*	**65**	80	49

Table 3.6a. 4 day attendees' mean percentage consumption, at snack time and lunch time, of each experimental food across all phases of Experiment 3.
/ * indicate food not available for presentation. **/ indicate participants absent**

		Experimental Phase							
		Baseline 1		Intervention		Baseline 2		Follow-up	
Food Set	Food	Snack	Lunch	Snack	Lunch	Snack	Lunch	Snack	Lunch
1	Water Melon	10	5.56	33	6.74	35.5	8.3	67	66.67
	Prune	23.6	21.67	68.3	62	56.5	53.35	83.5	76.67
	Swede	12.6	7.8	31.6	14	32	18.5	58.5	58.5
	Mange Tout	68.3	23.4	61	52.76	59	45.88	62.3	33.33
3	Sweetie Grapefruit	31	27.3	55.56	27.6	**	**	0	0
	Fig	16.7	7.06	32	12.73	**	**	0	0
	Mushroom	43	31.94	38.67	40	**	**	100	100
	Green Beans	49	55.33	50	50	**	**	100	75
2	Star Fruit	17.78	5.56			41.67	8.4	80.56	77.8
	Papaya	11	5.5			41.7	16.67	28	0
	Celery	28.9	17.19			33.35	37.5	50	83.33
	Asparagus	12	21.11			20.84	15.3	38.89	78
4	Sharon Fruit	35	31.3			38.67	8.83	*	*
	Guava	9	10.41			*	*	0	0
	Red Cabbage	19	5.66			48	0	13	22.33
	Parsnip	21	5.6			21	0	75	77.66

Baseline 1

Food category consumption: More of the vegetables (43%) destined for presentation in the intervention phase were consumed than target fruit (21%).

Within-category consumption: Pair 3 fruits were slightly more popular than Pair 1 (24% compared to 17%) and Pair 3 vegetables were eaten in slightly smaller quantities than Pair 1 (46% compared to 40%).

Intervention

Food category consumption: When the intervention was applied to fruit, consumption of target fruit rose to the highest level recorded during the study, increasing to 47%, 26% more than during Baseline 1. At the same time, vegetable consumption remained at around Baseline 1 levels.

Within-category consumption: There were increases in consumption of both fruit pairs, although the increase was greater for Pair 1 than Pair 3 (34% and 15% respectively). There was little change in consumption of either vegetable pair.

Baseline 2

Food category consumption: Data are available only for Pair 1 foods, but they show that with the removal of the intervention, fruit consumption was recorded at 46%, 25% higher than in Baseline 1 and only 1% less than during the intervention. Vegetable consumption was slightly reduced (by 4%) from Baseline 1 levels.

Within-category consumption: Pair 1 fruit consumption declined slightly relative to the intervention, but was still 30% greater than during Baseline 1. There was no change in consumption of Pair 1 vegetables which continued to be eaten at levels similar to those recorded in Baseline 1.

For all of these foods, it was only possible to collect, at the most, two data points per child in Baseline 2. As data collection took place during the Christmas season, there were many disruptions and distractions, rehearsals for the Christmas concert, parties, etc. In addition, there were also many absences due to the holidays.

Follow-up

Food category consumption: When the same foods were presented again, six months after Baseline 2 and nine months after Baseline 1, target fruit consumption was at 38%, 17% greater than during Baseline 1. High exposure vegetable consumption had reached its highest recorded level, at 80%, 38% greater than during Baseline 1.

Within-category consumption: Fruit consumption consisted of Pair 1 fruits only which were consumed at greater levels during Follow-up than during any other phase. Consumption of both high exposure vegetable pairs increased substantially, with Pair 3 being consumed at maximum levels.

The follow-up data described above must be viewed with caution. At the time that the follow-up phase was in operation, many of the original participants were either on holiday, or had left the nursery. For example, on the majority of food presentations, there were between 3 and 4 original participants in attendance. Such small numbers can produce skewed data and clearly cannot be taken as representative of the original sample.

The data for the follow-up phase suffer from the same limitations as those outlined with the 5 day attendees in that only a subgroup of the original participants were available to take part. The problem is further compounded by the attendance patterns of the 4 day attendees i.e. these participants did not attend the nursery for one food presentation each week. The outcome of this is that three of the participants were exposed to 3 presentations each of foods in Sets 1 and 4, whilst only one participant was exposed to any presentations of foods in Sets 2 and 3 during follow-up. Consequently, unlike the 5 day attendees, it not possible to graphically present the data from the sub-group of 4 day attendees across all phases of Experiment to compare with the consumption patterns of the group as a whole.

Consumption at Snack Time: Non-Target Foods

The upper right quadrant of Figure 3.22 shows the 4 day attendees' consumption of low exposure fruit and vegetables at snack time for the six children who attended the playroom for four sessions per week. The broken lines within each column show consumption of each of the fruit or vegetable food pairs within Food Sets 1 and 3.

The upper right quadrant of Figure 3.22.1 shows the 4 day attendees' consumption of low exposure fruit and vegetables at snack time relative to Baseline 1 for the six children who attended the playroom for four sessions per week. The broken lines within each column show consumption of each of the fruit or vegetable food pairs within Food Sets 1 and 3.

Mean consumption of each experimental food in each setting and in each experimental phase is shown in Table 3.6.

Baseline 1

Food category consumption: Both fruit and vegetables were poorly consumed at 18% and 21%, respectively.

Within-category consumption: Of the two fruit pairs, Pair 4 was slightly more popular than Pair 2 (22%, compared to 15%). Both pairs of vegetables were consumed in equal proportions, (21%, 20% respectively).

Baseline 2

Food category consumption: Following the application and removal of the intervention on target fruit, there was a marked increase in consumption of both low exposure fruit and low exposure vegetables (23% and 11% respectively). Since guava was not available for presentation, the mean consumption for non-target fruit was calculated by dividing fruit consumption scores by the number of fruits presented, i.e. 3.

Within-category consumption: Given that guava was not presented, the reader is referred to Table 3.6 which shows that consumption of both Pair 1 fruits had increased. Consumption of sharon fruit from Pair 4 had remained at Baseline 1 levels. Figure 3.22.1 shows consumption of Pair 4 fruit to be elevated relative to Baseline 1 because Baseline 1 consumption includes a very poor level of guava consumption.

Of the vegetables, Figure shows a small 2% increase relative to Baseline in consumption of Pair 2 and a much larger 30% increase in consumption of Pair 4.

Follow-up

Food category consumption: Fruit consumption remained elevated in comparison with Baseline 1 (26% compared with 17%). Sharon fruit was not available during this phase and so the mean score is based on consumption of three fruits rather than four. Vegetable consumption reached its highest level of the study at 42%, 21% more than during Baseline 1.

Within-category consumption: Given that guava was not presented during this phase, the reader is referred to Table 3.6 which shows consumption of each food throughout each phase of the study. Of the two fruit pairs, only Pair 2 was eaten and consumption of one fruit from the pair (star fruit) was substantially greater than had been the case throughout the study. In contrast, consumption of the other fruit in Pair 2 (papaya) was greatly reduced from the previous phase and was less than during Baseline 1. Guava, the only fruit presented from Pair 4 was refused.

Consumption of both vegetable pairs was recorded at twice the levels of Baseline 1.

The data for the follow-up phase suffer from the same limitations as those outlined with the 5 day attendees in that only a subgroup of the original participants were available to take part. The problem is further compounded by the attendance patterns of the 4 day attendees i.e. these participants did not attend the nursery for one food presentation each week. The outcome of this is that three of the participants were exposed to 3 presentations each of foods in Sets 1 and 4, whilst only one participant was exposed to any presentations of foods in Sets 2 and 3 during follow-up. Consequently, unlike the 5 day attendees, it not possible to graphically present the data from the sub-group of 4 day attendees across all phases of Experiment to compare with the consumption patterns of the group as a whole.

Consumption at Lunchtime: Target Foods

The lower left quadrant of Figure 3.22 shows the 4 day attendees' consumption of low exposure fruit and vegetables at lunchtime for the six children who attended the playroom for four sessions per week. The broken lines within each column show consumption of each of the fruit or vegetable food pairs within Food Sets 1 and 3.

The lower left quadrant of Figure 3.22 shows the 4 day attendees' consumption of low exposure fruit and vegetables at snack time relative to Baseline 1 for the six children who attended the playroom for four sessions per week. The broken lines within each column show consumption of each of the fruit or vegetable food pairs within Food Sets 1 and 3.

Mean consumption of each experimental food in each setting and in each experimental phase is shown in Table 3.6.

Baseline 1

Food category consumption: Baseline consumption was lower for both food categories than that recorded in the snack context with target fruit consumed at 14% and high exposure vegetables at 30%.

Within-category consumption: Trends in fruit consumption were similar to those observed at snack time, with slightly more Pair 3 consumed than Pair 1 (13% and 17% respectively). The difference between consumption of both vegetable pairs was greater than that observed at snack time, with consumption of Pair 1 at 15% and Pair 3 at 44%.

Intervention

Food category consumption: When the intervention was applied to target fruit at snack time, target fruit consumption at lunchtime doubled to 28% an increase of 14%. At the same time, a 9% increase in consumption of high exposure vegetables was recorded.

Within-category consumption: There were increases in consumption of both fruit pairs, but the increase was greater for Pair 1 (25%) than Pair 3 (5%). These trends mirrored those recorded at snack time. Changes in vegetable consumption were largely the result of a substantial rise (23%) in consumption of Pair 1; Pair 3 remained largely unchanged.

Baseline 2

Food category consumption: Data are only available for one food set, but these show that following the removal of the Intervention at snack time, target fruit consumption (Pair 1) remained elevated relative to Baseline 1.

The increase in vegetable consumption noted in the previous phase was maintained and was greater than Baseline 1 by 16%.

Within-category consumption: Consumption of Pair 1 fruits was less than during the intervention, but greater than during Baseline 1, as was consumption of Pair 1 vegetables.

Follow-up

Food category consumption: When the same foods were presented six months after Baseline 2 and nine months after Baseline 1, target fruit consumption was 36%, the highest recorded level in this context, 22% more than during Baseline 1. There was also a substantial increase in high exposure vegetable consumption, which was also at the highest level recorded at lunchtime, so that at 67% consumption was 37% greater than during Baseline 1. Consumption of both fruit and vegetables was double that recorded during Baseline 1.

Within-category consumption: Of the target fruits, Pair 1 consumption had increased notably, reaching 71%, seven times greater than was recorded during Baseline 1. This trend reflected that documented in the snack setting. At the same time, Pair 3 was reduced to its lowest point of the study, and at 6% was less than Baseline 1 levels.

Of the high exposure vegetables, both pairs were eaten at twice the levels of Baseline 1.

As noted previously, these data may not be a true representation of the group, because of small numbers of subjects. Pair 1 data may be more reliable than Pair 4.

The data for the follow-up phase suffer from the same limitations as those outlined with the 5 day attendees in that only a subgroup of the original participants were available to take part. The problem is further compounded by the attendance patterns of the 4 day attendees i.e. these participants did not attend the nursery for one food presentation each week. The outcome of this is that three of the participants were exposed to 3 presentations each of foods in Sets 1 and 4, whilst only one participant was exposed to any presentations of foods in Sets 2 and 3 during follow-up. Consequently, unlike the 5 day attendees, it not possible to graphically present the data from the sub-group of 4 day attendees across all phases of Experiment to compare with the consumption patterns of the group as a whole.

Consumption at Lunchtime: Non-Target Foods

The lower right quadrant of Figure 3.22 shows the 4 day attendees' consumption of low exposure fruit and vegetables at lunchtime for the six children who attended the playroom for four sessions per week. The broken lines within each column show consumption of each of the fruit or vegetable food pairs within Food Sets 1 and 3.

The lower right quadrant of Figure 3.22.1 shows the 4 day attendees' consumption of low exposure fruit and vegetables at lunchtime *relative to Baseline 1* for the six children who attended the playroom for four sessions per week. The broken lines within each column show consumption of each of the fruit or vegetable food pairs within Food Sets 1 and 3.

Mean consumption of each experimental food in each setting and in each experimental phase is shown in Table .3.6.

Baseline 1

Food category consumption: Consumption of both fruit and vegetables was low; levels resembled those in the snack setting. There was no difference between fruit and vegetables; both were consumed at 13%.

Within-category consumption: Of the fruits, Pair 4 was slightly more popular than Pair 2. Of the vegetables, Pair 2 was more popular than Pair 4.

Baseline 2

Food category consumption: When the Intervention had been applied to and then removed from target fruit in the snack setting, there was little change in low exposure vegetable consumption in the lunch context, whilst low exposure fruit consumption decreased slightly (3%). Guava was not available for presentation during this phase and so mean consumption for target fruit was calculated using consumption values summed and divided by the number of fruits presented, i.e. 3.

Within-category consumption: Given the unavailability of guava during this phase, the reader is referred to Table which shows consumption of individual foods throughout each phase of the experiment. Relative to Baseline 1, there was very little difference in consumption of Pair 2 fruit; a small increase relative to Baseline 1 was recorded. Of the one fruit presented from Pair 4 (sharon fruit) there was a reduction in the amount consumed, from 31% to just under 9%.

Of the vegetable pairs, a slight increase in consumption (7%) was recorded for Pair 2, whilst Pair 4 were not eaten at all, representing a reduction in consumption from Baseline 1 of 5%.

Follow-up

Food category consumption: Consumption of low exposure fruit remained at Baseline levels. Sharon fruit was not available during this phase and the average category consumption was calculated by dividing consumption scores by 3 rather than 4. A much larger rise (42%) in non-target vegetable consumption was recorded at the same time.

Within-category consumption: Given that sharon fruit was not available for presentation during this phase, the reader is referred to Table 3.6 which shows mean consumption of each food per phase. This shows that in the Follow-up phase, there was a marked increase in consumption of one fruit from Pair 2 (star fruit) together with a smaller, reduction in consumption of papaya from Pair 2. Again, this corresponds to the trend noted in the snack context. Of Pair 4 fruit, only guava was presented and it was not eaten. Thus there was an overall reduction of 20% in Pair 4 consumption.

The overall increase in non-target vegetable consumption was the result of a substantial increase across all vegetables and again, a similar (but greater) increase in consumption was noted at snack-time.

The reader should remain aware that these data may not be representative of the group. Pair 2 data may be more reliable then Pair 4.

The data for the follow-up phase suffer from the same limitations as those outlined with the 5 day attendees in that only a subgroup of the original participants were available to take part. The problem is further compounded by the attendance patterns of the 4 day attendees i.e. these participants did not attend the nursery for one food presentation each week. The outcome of this is that three of the participants were exposed to 3 presentations each of foods in Sets 1 and 4, whilst only one participant was exposed to any presentations of foods in Sets 2 and 3 during follow-up. Consequently, unlike the 5 day attendees, it not possible to graphically present the data from the sub-group of 4 day attendees across all phases of Experiment to compare with the consumption patterns of the group as a whole.

Discussion: 4 day attendees

Figure 3.22 illustrates the percentage changes in consumption of fruit and vegetables relative to Baseline 1 in respect of the 4 day attendees. The upper left quadrant shows that when the intervention was applied to target fruit at snack time, target fruit consumption increased by 26%, whilst little change in consumption of the accompanying (and therefore as frequently presented) vegetables was recorded. Both of these factors suggest that the intervention was responsible for the increase in fruit consumption.

The intervention was effective with both fruit pairs when it was in operation. When the intervention was removed (Baseline 2), fruit consumption continued at intervention levels (at least for one pair of foods), perhaps evidence that the intrinsic taste of the fruit had come to control consumption rather than the external intervention-based rewards. Consumption of the accompanying vegetables remained at Baseline 1 levels.

Longer term effects of the intervention can be seen in the follow-up phase, where consumption of target fruit remained elevated relative to Baseline 1 (See Figure 3.22.1). The concurrent substantial increase in consumption of high exposure vegetables is curious, but may be explained by the fact that these data are based on the performance of only one child.

The upper right quadrant of Figure 3.22 illustrates generalisation effects of the intervention to non-targetted fruits in the snack-time setting. After the intervention had been applied to target fruit at snack time, non-target fruit and vegetable consumption was elevated relative to Baseline 1. Although these data have the limitations discussed earlier in this section, (lack of availability of sharon fruit, small numbers of subjects) a substantial (27%) increase in consumption of Pair 2 fruits was observed – some evidence of within and across-category generalisation to foods that were not directly targetted. Pair 2 data at follow-up suggest that this change in consumption was both maintained and increased. If the data from Pair 4 fruits were ignored then the trend for non-target fruit across the study would be upwards, ending at 55% in the follow-up phase.

It is interesting to look at the data for non-target vegetables, consumption of which increased across the course of the study even though consumption of high exposure vegetables was largely unaffected until the follow-up phase. However there are only limited data available for consumption of high exposure vegetables and the data at follow-up is based on consumption of small numbers of participants.

Trends for target fruit consumption at lunchtime corresponded to those recorded at snack time. There was an increase (smaller than at snack time) in consumption at the time of the intervention which was maintained (and slightly increased) in Baseline 2. Category data for Baseline 2 are representative of Pair 1 fruits and vegetables only, as none of the children in this group were in attendance when Pair 3 were presented. Unlike the trend at snack time, consumption at follow-up showed a further increase relative to Baseline 1 and at this point was equal to that of the snack time context. The effects of the intervention were greater for Pair 1 fruit than they were for Pair 3.

At the same time as target fruit consumption increased, there was also a rise (of a similar magnitude) in consumption of the accompanying vegetables. This could be suggestive of some other variable at work here in addition to or rather than the intervention, although it is possible that baseline data for one of the vegetables was artificially low. As Table 3.6a shows, mange-tout was eaten in the snack context at 68% but only at 23% at lunchtime. When the data are examined further on a day to day basis, they show that on Day One of Baseline 1, this group ate 63% mange-tout at snack time, but ate none at lunch on the same day. On Days 2 and 3, consumption at lunchtime was greater and more comparable with snack-time data, at 42% and 38% respectively.

Evidence for the generalisation of effects of the intervention within the fruit category and across settings is illustrated in the bottom right hand quadrant of Figure 3.21. This shows that there was very little movement across the course of the study for foods in either the fruit or vegetable category. The substantial rise in non-target vegetable consumption at lunchtime in the follow-up phase, (as was noted in the snack context) was curious, but if one looks at individual pairs of foods, one can see that the movement is in the data for Pair 4, which actually represents the consumption of only one participant.

GENERAL DISCUSSION

Experiment 3 was designed principally to investigate the feasibility of using a video peer-modelling plus rewards intervention to increase consumption of fruit in a pre-school nursery group.

Results suggest that in this respect, the package was successful. When the intervention was applied in the snack time context, consumption of target fruit for both groups of attendees showed the largest single increase of the study; children consumed 21% (5 day attendees) and 26% (4 day attendees) more fruit than they had at the beginning of the study. The intervention was effective with three out of the four fruits presented and, during the intervention phase, there was little change in consumption of the vegetables that were presented alongside the target fruit.

A second aim of Experiment 3 was to look for long term changes in behaviour following withdrawal of the intervention package. Baseline 2 data (which were limited due to constraints beyond the experimenter's control) showed that target fruit consumption reverted to Baseline levels for the group of 5 day attendees. Unfortunately, for the 4 day attendees, there were insufficient data to draw firm conclusions. There was however evidence that increased consumption was maintained with one of the fruit pairs (prune and water melon) across both groups. This maintenance of behaviour was observed in both the snack time and lunchtime settings. In contrast, consumption of all vegetables that were presented with the target fruits did not differ greatly from Baseline 1 through all phases up to and including Baseline 2.

Six months after the end of Baseline 2, target fruit consumption in the follow-up phase for the 5 day attendance group was 7% greater than it had been during Baseline 1, and 14% less than during Intervention 1, whilst consumption of high exposure vegetables had reached its highest level of the study and was increased by 14% compared to Baseline 1. For the 4 day attendees, consumption of target fruit at follow-up was much closer to that during the intervention than it was to levels recorded during Baseline 1. High exposure vegetable consumption was almost double that recorded in

Baseline 1, though it should be borne in mind that consumption data for fruit and vegetable Pair 1 were based on the performance of only one child, so again there are insufficient data to draw firm conclusions regarding longer term consumption patterns for this group of children.

A third element of Experiment 3 was that of within-category generalisation and whether any effects of the Intervention on specifically targetted fruits would carry over to fruits that were presented only in baseline conditions.

In Baseline 2, at snack time, both groups of attendees showed some increases in consumption of low exposure fruit compared to Baseline 1. The increase in the 5 day group was small and confined to one fruit whereas in the 4 day group, the increase was much greater (equal to that shown during the intervention on target fruit) and involved both pairs of fruit.

A major design feature of Experiment 3 was the use of the lunchtime setting to provide a naturalistic context in which to assess the impact of the intervention package across time and to another context. Following the application of the intervention at snack time, lunchtime consumption of target fruit increased, for both groups of attendees. The increase was only slightly smaller than that recorded at snack time and was limited to one pair of fruits (same pair for each group), whereas at snack time both pairs had been affected. At the same time, consumption of the accompanying vegetables was largely unchanged. Changes noted in consumption at lunchtime mirrored those seen in the snack time context, with the exception of an increase in consumption of Pair 3 fruits during the intervention, thus providing evidence of generalisation effects from the experimental to the lunchtime setting.

The changes in target fruit consumption recorded in the lunchtime setting during the intervention phase were maintained in Baseline 2, even though there was no evidence of this in the snack setting. The reason for this lies in the fact that consumption of both fruits at snack had increased, whereas consumption of only one fruit pair was increased at lunchtime. Consumption of this one pair remained elevated in both settings when the intervention was removed, whereas consumption of the fruit pair that was increased only at snack was reduced. Thus, it could also be said that the effects shown at lunchtime might predict how well a behaviour would be maintained, i.e. if the effects of the intervention are not in evidence in the lunch context, then any consumption gains at snack time will not be maintained.

In the follow-up phase, the trend in target fruit at lunchtime consumption was upward and was greater than that shown in the snack setting. This was true of both groups, although these findings should be viewed with caution given the decreased numbers of subjects involved. There was limited evidence of within category generalisation, for the 5 day attendees only, in the lunch setting, although given the limitations of the data (unavailability of foods) firm conclusions regarding this issue cannot be drawn.

Overall, the results of Experiment 3 demonstrated that it is possible to increase young children's consumption of fruit using a video peer-modelling with rewards intervention the effects of which were observed not only in the experimental setting, but also in the lunchtime generalisation setting. The question of within-category generalisation could not be fully addressed.

Short and long term maintenance of the observed changes is difficult to assess given the limitations of the follow-up data, but there was evidence that changes in behaviour were maintained with half of the fruits (those that were the sweetest i.e. prunes and water melon) in the target fruit category. This was true in both the snack and lunchtime settings. It may be the case that different foods may need different amounts of taste exposure before the taste of the fruit itself takes the place of extrinsic rewards and controls consumption.

The intervention in Experiment 3 produced increases in the fruit eating behaviour of a group of pre-schoolers in a relatively (compared to Experiment 2) short time span of 2 weeks (5 targettings for each fruit pair for the 5 day attendees). Any comparable increases in consumption of vegetables were only recorded at follow-up - seven months after the intervention on fruits had been introduced.

As was indicated in the individual data, it may be that five opportunities for reinforced tastings are not enough to establish a new behaviour. Thus, in order to improve upon Experiment 3, the duration of the intervention phase should be increased to provide further opportunities for rewarded taste exposures. This may also enhance maintenance of behaviour change as well as increasing the likelihood that within-category generalisation would occur. Other advantages would be gained by increasing the length of the intervention period; the time frame within which to assess the performance of individual children would be greater, thus allowing for 'within-intervention' interventions that would meet the needs of individual children to be implemented. A longer intervention phase would also increase the number of data points collected for all children who attended the playroom and so the effectiveness of the intervention with a larger number of children could be properly assessed.

It might also be the case that the categorisation procedure needed longer to take effect – this could have been tested by asking individual children to categorise the experimental foods and to compare these performances with their performance during the intervention. Finally, if it is possible to increase consumption of fruit, then perhaps vegetable consumption can be similarly affected.

CHAPTER 9

EXPERIMENT 4:

A CATEGORY-BASED VIDEO PEER-MODELLING AND REWARD INTERVENTION TO INCREASE CONSUMPTION OF FRUIT AND VEGETABLES IN A PRE-SCHOOL CLASSROOM.

INTRODUCTION

Results of Experiment 3 indicated that it is possible to increase fruit consumption amongst pre-schoolers in a group setting using a video peer-modelling plus rewards intervention. There was evidence of increases in the snack time experimental setting that generalised to the lunchtime setting where consumption was not rewarded. When the intervention was removed the increases in consumption were maintained with some foods (the sweeter items) but not others. There was some limited, preliminary evidence of the increases in consumption generalising to other foods in the fruit category.

The present experiment was designed to build on the results of Experiment 3 by increasing the length of the intervention phases and including in the multiple baseline procedure an intervention that specifically targetted the category 'vegetables'.

Experiment 4 began nine months after the end of Baseline 2 of Experiment 3. In this experiment, children were exposed, in turn, to a series of interventions, similar to that employed in Experiment 3, all of which included video modelling, instructions and rewards. The category of fruit was targetted first, followed by vegetables. Eight fruit and eight vegetables that were poorly consumed by all the participants were identified in a pre-baseline phase. Following an initial baseline phase during which consumption of all foods was recorded, the first intervention targetted a subset of four of the fruits. Following two further baseline phases, the second intervention targetted a subset of four of the vegetables. A third intervention then targetted intermittently, those same vegetables. After a fourth baseline phase, a continuous follow-up procedure was implemented that lasted for three months. A final follow-up phase was conducted nine months after the end of Baseline 4.

METHOD

Participants

Thirty-six children who were registered as attending the playroom for morning sessions participated in this experiment. There were 19 females and 17 males; the children were aged between 21 and 47 months.

Thirteen children attended 5 days per week. Seven were female and six were male. Two were first language Welsh speakers, two were from Finland, one from Canada; the remainder were all local English speaking children. There were two sibling pairs in this group, two brothers and a brother and sister. Four of the children had participated in the previous experiment. One male left half way through the study.

Of the other children who attended less than 5 sessions per week, five were first language Welsh speakers, one was from South America and there was one sibling pair, a brother and sister. Six of this group had participated in the previous experiment.

Table 4.1 below shows the children's nursery attendance per week at the start of the study.

Table 4.1. For each of the subgroups of nursery participants, the number of sessions attended per week, age range and mean age in months, and number of males and females.

Sessions Per Week	Children Registered	Age Range (months)	Mean Age (months)	Males	Females
5	13	24 - 44	35	6	7
4	4	32 - 47	39	2	2
3	7	22 - 35	31	2	5
2	9	21 - 44	31	5	4
1	3	24 - 41	30	2	1
			Total	17	19

Written consent for each child to participate was obtained from the parents prior to the start of the study. Four parents requested and received further information before granting consent. No parent refused their child's participation.

Four children left the nursery at the end of Baseline 2 and nine new children started at the beginning of Baseline 3. One child from the 4 days per week attendees did not regularly attend the nursery beyond Baseline 1 due to illness. Parental consent for participation was obtained as and when new children arrived.

Foods

Table 4.2 below shows the foods used and the configuration of each food set.

Table 4.2. The experimental foods presented in Experiment 4 and the configuration of each food set. Target foods are indicated in italics.

Set Number	Fruit Pair	Vegetable Pair
1	Dragon Fruit + Mango	*Green Beans + Baby Sweetcorn*
2	*Kiwi Fruit + Papaya*	Baby Carrot + Courgette
3	*Star Fruit + Sharon Fruit*	Cucumber + Yam
4	Water Melon + Prune	*Swede + Mange-tout*

Target Behaviour and Measurement

In addition to the measures of consumption (which were as described in the General Method) taken in the experimental and generalisation settings at the nursery, a questionnaire (see Appendix 4) designed to measure any generalisation of the effects of the intervention(s) to the home environment, was sent to parents at the end of Intervention 2.

Equipment

Two types of intervention video were used along with the pre-reward video. The primer video used in Experiment 3 was not used in this experiment as it was not certain that there were any benefits in presenting foods that would not appear again.

Intervention Video. The general format of the Intervention film used to target fruit in Experiment 3 was employed in the present experiment. The target fruits (see

Table 4.2) featured were kiwi and papaya (Set 2), star fruit and sharon fruit (Set 3). The Intervention film used to target vegetables was modified from the fruit version. New scenes were incorporated to show real life children modelling consumption of the target foods and receiving rewards for doing so. The featured vegetable pairs were green beans and baby sweetcorn (Set 1) and swede and mange tout (Set 4).

Pre-Reward Video. The Pre-Reward video was used during Intervention 1 only. Procedural changes were made during Intervention 2 (see Procedure) that entailed the pre-reward video being replaced by a message from 'Jarvis and Jess'.

Rewards

The rewards system in the present experiment was modified from that of Experiment 3. The prize for eating up to 3 pieces of a food (i.e. 25% consumption or more) was changed to a Jarvis and Jess badge rather than a wall sticker. The badge conferred 'fruit or vegetable eater' status on to the recipient and, as it was worn on clothing might serve as a greater incentive than a wall chart sticker to try the target foods and an overt cue to continue eating the target foods into the generalisation context. The reward system for consumption of four or more pieces of food was as in Table 4.3 below.

Table 4.3. The relationship between food consumption and rewards.

Target Food Consumed	Reward
1 – 3 pieces	Jarvis & Jess badge
4 – 7 pieces	Jarvis & Jess badge + Wall sticker
All 8 pieces	Jarvis & Jess badge + Wall sticker + Duplo

In this experiment, a group prize was dispensed from the wall-mounted box whenever the stickers reached the top of the ladders on the wall chart, rather than just once at the end of the intervention period. At the end of Intervention 2, the group prize was a pair of female gerbils along with a gerbil cage, toys and food. The gerbils were kept in the playroom. In Intervention 2a, group prizes were gerbil accessories and gerbil food treats.

For Intervention 2, a doorbell was fitted inside the reward box on the wall and the button for operating it located behind the door of the playroom so that it could be operated remotely. During the interventions the bell was used draw the children's attention to the reward procedures. For example, the bell was rung just prior to the treasure box containing the prizes being delivered to the playroom and also when a group prize was available from the wall-mounted box. It served as a signal that an event (connected to rewards) was about to happen, saving the nursery staff from having to call for the attention of the children. Since it was operated remotely, the doorbell also gave added plausibility to the idea that Jarvis and Jess were the contingency managers rather than the nursery staff or the experimenter.

Small, round pre-printed stickers were given contingently at the table to encourage consumption of target foods during each intervention phase. These small stickers were used for shaping behaviour to help the children to contact the experimental contingencies. Figure 4.1 overleaf depicts the stickers used.

Other small rewards were also purchased for use during the Intervention 2. These were items of plastic jewellery, small dolls and play make-up kits that were used on an individual basis with two children who were slower to respond to the experimental contingencies.

The nursery staff were given small rewards during Intervention 2. These were inexpensive items, such as brooches, toiletries or flowers, all with a vegetable-related theme.

Figure 4.1. Examples of stickers used in Experiment 4 to encourage food consumption at group tables at snack time.

Experimental Design

The design of this experiment allowed for fruit and vegetables to be targetted in turn, so that the impact of the intervention on each food category could be assessed. As in Experiment 3, foods were continuously presented during each baseline and follow-up phase to provide a means of examining both immediate and longer term effects of the intervention. Also, as in Experiment 3, only half the foods in each category were subject to the intervention, with the remainder presented under baseline conditions, allowing for assessment of generalisation of the effects of the intervention on foods within the same category but not specifically targetted. Finally, as in Experiment 3, foods from the non-target category were presented alongside those in the target category (i.e. in accordance with the Food Sets designated in Table 4.2)

Procedure

Baseline 1

This phase proceeded as for Experiment 3, but continued for 16 days. Food sets were cycled over 4 days until each one had been presented four times.

Intervention 1 - Fruit

The intervention video featured either sharon fruit and star fruit or kiwi fruit and papaya.

Phase 1

This phase continued for 8 days. A psychology postgraduate student was assigned to each table to monitor consumption and administer the intervention procedures. The nursery staff observed these procedures.

Food Sets 2 and 3 were cycled every 2 days until each fruit pair had been targetted 4 times. The postgraduate students recorded food consumption of the children on their table and gave the details to the experimenter. Reward procedures as described in the General Method were then operated.

Phase 2

The duration of this phase was 4 days. Food Set 2 only was presented.

The postgraduate students sat at the tables with dishes containing the same foods as the children and sheets of small round stickers (two different designs, one for each fruit). They were instructed to model the target behaviour (i.e. eat fruit) and encourage the children to do likewise, by reminding them of the contingencies and awarding the motivational stickers. The postgraduate had knowledge of each individual's current levels of consumption of each food and used the stickers to increase, encourage, or reward total consumption of the target foods.

Reward procedures outlined above were operated throughout.

Phase 3

The duration of this phase was 10 days. As in Phase 1, Food Sets 2 and 3 were cycled until each had been targetted 5 times. Otherwise, the procedure for Phase 2 (above) was followed.

Baseline 2

Due to the Xmas festivities, the duration of this phase was 12 days. All four food sets were cycled until each had been presented three times.

Following discussions with the nursery staff regarding the progress of the study, changes were implemented to involve the nursery staff more closely in the experimental procedures and at the same time speed up the experimental procedures. These changes will be highlighted below where appropriate.

Baseline 3

Since 8 weeks had elapsed (Xmas holidays and problems with fruit supply) between Baseline 2 and the start of more food presentations, it was decided to take another baseline measure of food consumption before commencing Intervention 2.

Baseline 3 continued for 16 days. All four food sets were cycled until each one had been presented 4 times. Baseline 1 procedures were followed, except that this time, nursery nurses assessed and recorded, at snack time, each child's consumption of the experimental foods.

Intervention 2 - Vegetables

The duration of this phase was 30 days. Food Sets 1 and 4 were presented alternately 15 times each.

The experimental procedure was changed during this intervention so that instead of the postgraduate student, each nursery nurse sat with her group, modelled consumption of vegetables and awarded motivational stickers. The nursery nurse filled in the monitoring sheets detailing how much of each food each child in her group had consumed and handed them to the experimenter for rewards to be prepared. The children remained at their tables rather than moving to sit on the floor.

The doorbell was operated from behind one of the playroom doors and a "message from Jarvis and Jess" to the children in the playroom was 'delivered' and read out by a nursery nurse. The message (which was similar in content to the video that had been shown during the fruit intervention) replaced the second (pre-reward) video. This modification to the procedure meant that the children remained at their tables where they were presented with their rewards.

As soon as possible after the message was read, two treasure boxes containing badges, stickers and individual prizes, along with a list specifying which children had earned which prizes were brought into the room to the nursery staff. Rewards were presented to the children at the table by their nursery nurse who praised each recipient, reiterated the experimental contingencies and instructed the other members of the group to clap and cheer.

The rest of the procedure continued as for the fruit intervention, except that whenever the stickers on the wall poster reached the top of the ladders, along with a group prize for the children, there would also be a small gift for each nursery nurse in the box on the wall. A note always accompanied all prizes and gifts from Jarvis and Jess thanking and congratulating all the vegetable eaters.

Daily feedback detailing consumption of the experimental foods for each child in her group was given to each nursery nurse.

Procedures with Individuals

Two males from the group who attended five sessions per week were consuming only baby sweetcorn out of the four target vegetables. To encourage consumption of green beans (the paired vegetable) and thus enable them to earn the full reward, on Presentation 5 (for TJ) and Presentation 8 (for OT) each piece of green bean was cut to half the size of a usual portion. Thereafter, normal sized portions were presented. A similar procedure was implemented for one male in the four day attendees group.

Two females from the group who attended 5 sessions per week initially consumed no target vegetables during Intervention 2. On presentations 16 and 17 for (OS) and 15 and 16 for (JR), these children were taken individually to separate tables to sit with the experimenter or an assistant who modelled consumption of one of the target foods and offered the participant a choice of 'alternative' rewards from a box on the table for doing likewise. The small round stickers were also used to encourage tasting as was much verbal praise. Each child was encouraged to consume as much as possible of a target food before being able to "take the present home." The child and the experimenter took the individualised reward item and put it in the child's going home bag before the child returned to her group where she was included in the main reward system.

Intervention 2a

The duration of this phase was 16 days. All 4 food sets were presented for four cycles. Reinforcement opportunity for target food consumption was reduced by 50%, as at this time, the intervention was applied to vegetables in Sets 1 and 4 *every other time* that they were presented. There were two reasons for including a supplementary intervention phase: to gradually fade out the reward procedures rather than abruptly stopping them (to improve ecological validity) and to utilise intermittent reinforcement to increase the chances of changes in eating behaviour being maintained.

Thus, whenever Food Sets 2 and 3 were presented, baseline procedure was followed. In cycles 1 and 3, the Intervention was applied to the vegetables in Set 1, but not Set 4. In cycles 2 and 4, the Intervention was applied to vegetables in Set 4, but not in Set 1.

Baseline 4

All four Food Sets were cycled under baseline conditions (no rewards) until each one had been presented 4 times.

Follow-up 1

The collection of post-experimental data under baseline conditions began three days after the end of Baseline 4.

Snack

At this time, the nursery staff took responsibility for preparation, presentation and measurement of consumption of foods in the snack context. There was no prior categorisation exercise and the foods were presented on plates in general use at the nursery rather than the stainless steel dishes used during the experiment. In the snack context, *experimental fruits only* were presented.

Each morning, just prior to snack time, one nursery nurse prepared a quantity of a fruit pair. At snack time, the children were seated at tables in their usual groups. The nursery nurses gave out milk, helped each child to a portion of both fruits and then recorded how much of each fruit each child ate. More fruit was available on request. The daily consumption data were collected weekly by the experimenter.

A research assistant visited the nursery once a week (on a different day each week) as a support to the staff and to independently score the children's consumption on that day (and thereby assess the reliability of the nursery staffs' recordings).

Lunchtime

At lunchtime, the kitchen staff took responsibility for preparing and serving the experimental vegetables. Portions of these vegetables were placed on each child's plate along with the usual mid-day meal, instead of in between the main course and dessert in the stainless steel dishes as in the main study. Once a week, a research assistant went to the dining area and assessed each child's consumption of the experimental foods. Table 4.4 below shows the weekly food schedule.

Table 4.4. The weekly timetable for food presentations at snack time and lunchtime.

Day	**Snack**	**Lunch**
Monday	Prune + Water Melon	Yam + Cucumber
Tuesday	Mango + Dragon Fruit	Baby Sweetcorn +Green Beans
Wednesday	*Nursery choice of fruit*	*Nursery choice of vegetables*
Thursday	Sharon Fruit + Star Fruit	Carrots + Courgettes
Friday	Kiwi + Papaya	Mange Tout + Swede

It should be noted that although the fruit pairs and vegetable pairs remained the same, vegetable pairs presented at lunchtime were not necessarily those that had been previously paired with the fruits presented at snack time. Vegetable pairs were chosen at this point to 'go best' with whatever meals were served on that day.

The follow-up procedure was implemented to assess the longer term effects of the interventions on fruit and vegetable consumption but also, importantly, to build on the gains already made. Rather than end the study at Baseline 4, return to the nursery some weeks later and re-present the experimental foods in a Baseline 5, the protocol used here allowed for the children to continue to be exposed to the range of experimental foods within the normal course of the nursery day. In addition, once a week, 'new' fruits and vegetables were introduced into the repertoire. No rewards were given during this phase for consumption of any food.

Follow-up 2

Nine months after the completion of Baseline 4, a second Follow-up phase was introduced. The procedure followed was exactly the same as for all other previous baseline phases.

Follow-up 2 continued until all four food sets had been cycled eleven times each, enough presentations to collect at least three data points per child per food and was and then continued as Follow-up 2b wherein all four food sets were cycled four more times. During this time, the children were able to request *more* of any of the experimental foods. The option to request more was only available during snack time.

Summary of Procedure

Table 4.5 overleaf summarises the snack time and lunchtime procedures employed in Experiment 4.

Table 4.5. Summary and description of all the phases of Experiment 4.

Phase	Duration	Snack Presentations	Lunch Presentations
Baseline 1	16 days	Categorisation Training All 4 Food Sets	All 4 Food Sets
Intervention 1 Target Fruit	22 days	Categorisation Training Video + rewards Food Sets 2 & 3	Food Sets 2 & 3
Baseline 2	12 days	Categorisation Training All 4 Food Sets	All 4 Food Sets
Baseline 3	16 days	Categorisation Training All 4 Food Sets	All 4 Food Sets
Intervention 2 Target Vegetables	30 days	Categorisation Training Video + rewards Food Sets 1 & 4	Food Sets 1 & 4
Intervention 2a Target Vegetables	16 days	Categorisation Training Video + rewards applied to Food Sets 1 & 4 intermittently All 4 Food Sets	All 4 Food Sets
Baseline 4	16 days	All 4 Food Sets	All 4 Food Sets
Follow Up 1 (continuous)	60 days	All fruit + new examples	All vegetables + new examples
Follow Up 2(a)	44 days	Categorisation Training All 4 Food Sets	All 4 Food Sets
Follow Up 2(b) (continuation of 2a)	16 days	Categorisation Training All 4 Food Sets Request for more	All 4 Food Sets

RESULTS: GROUP DATA

As with Experiment 3, daily consumption of each food by each participant was calculated from plate waste and expressed as a percentage of the total amount presented.

Percentage consumption scores, based on the last three data points recorded for each food, were calculated for each phase of the experiment.

In Experiment 4, foods were categorised in the following way:

Target Fruit	Fruit in Food Sets 2 and 3 targetted with the intervention.
High Exposure (non-target) Fruit	Fruits in Food Sets 1 and 4 presented with the target vegetables; these were not subjected to the intervention
Target Vegetables	Vegetables in Food Sets 1 and 4 targetted with the intervention.
High Exposure (non-target) Vegetables	Vegetables in Food Sets 2 and 3 presented with the target fruit; these were not subject to any intervention.

Again, as with Experiment 3, participants' data were grouped according to daily attendance per week during the study and for each attendance group, the average consumption of target fruit and target vegetables and high exposure (non-target) fruit and high exposure (non-target) vegetables at snack and lunchtime are presented for each experimental phase. Also presented are the average consumption data for each pair of fruit and vegetables at snack and lunchtime for each experimental phase. Data from individual children are presented after the group data.

At the beginning of the results section for each attendance group, separate figures will be presented that show consumption of all food categories across the course of Experiment 4; consumption of all food categories across Experiment 4 relative to

Baseline 1 and, where necessary, consumption of sub-groups of participants (for comparison purposes) of all foods across the course of Experiment 4. Separate tables will show consumption data for all food pairs and individual foods across the course of Experiment 4.

For all attendance groups, snack time consumption of target fruit and high exposure (non-target) vegetables will be considered first, followed by consumption of target vegetables and high exposure (non-target) fruit. Consumption of all these food categories in the lunchtime (generalisation) setting will then be considered.

Results: 5 day attendees

Figure 4.2 shows consumption of fruit and vegetables across the course of the study for the 12 children who attended the playroom five days per week. The upper left quadrant shows consumption of target fruit and accompanying non-target vegetables at snack time and the lower left quadrant shows consumption of those same foods at lunchtime. The upper right quadrant shows consumption of the target vegetables and accompanying non-target fruit at snack time and the lower right quadrant shows consumption of those same foods at lunchtime. The broken lines within each column show consumption of each of the food pairs within the category.

Figure 4.2.1 shows consumption of fruit and vegetables across the course of the study *relative to Baseline 1* for the 12 children who attended the playroom five days per week. The upper left quadrant shows consumption of target fruit and accompanying non-target vegetables at snack time and the lower left quadrant shows consumption of those same foods at lunchtime. The upper right quadrant shows consumption of the target vegetables and accompanying non-target fruit at snack time and the lower right quadrant shows consumption of those same foods at lunchtime. The broken lines within each column show consumption of each of the food pairs within the category.

Figure 4.2.2 shows consumption of the subgroup of four attendees who remained for Follow-Up 2.

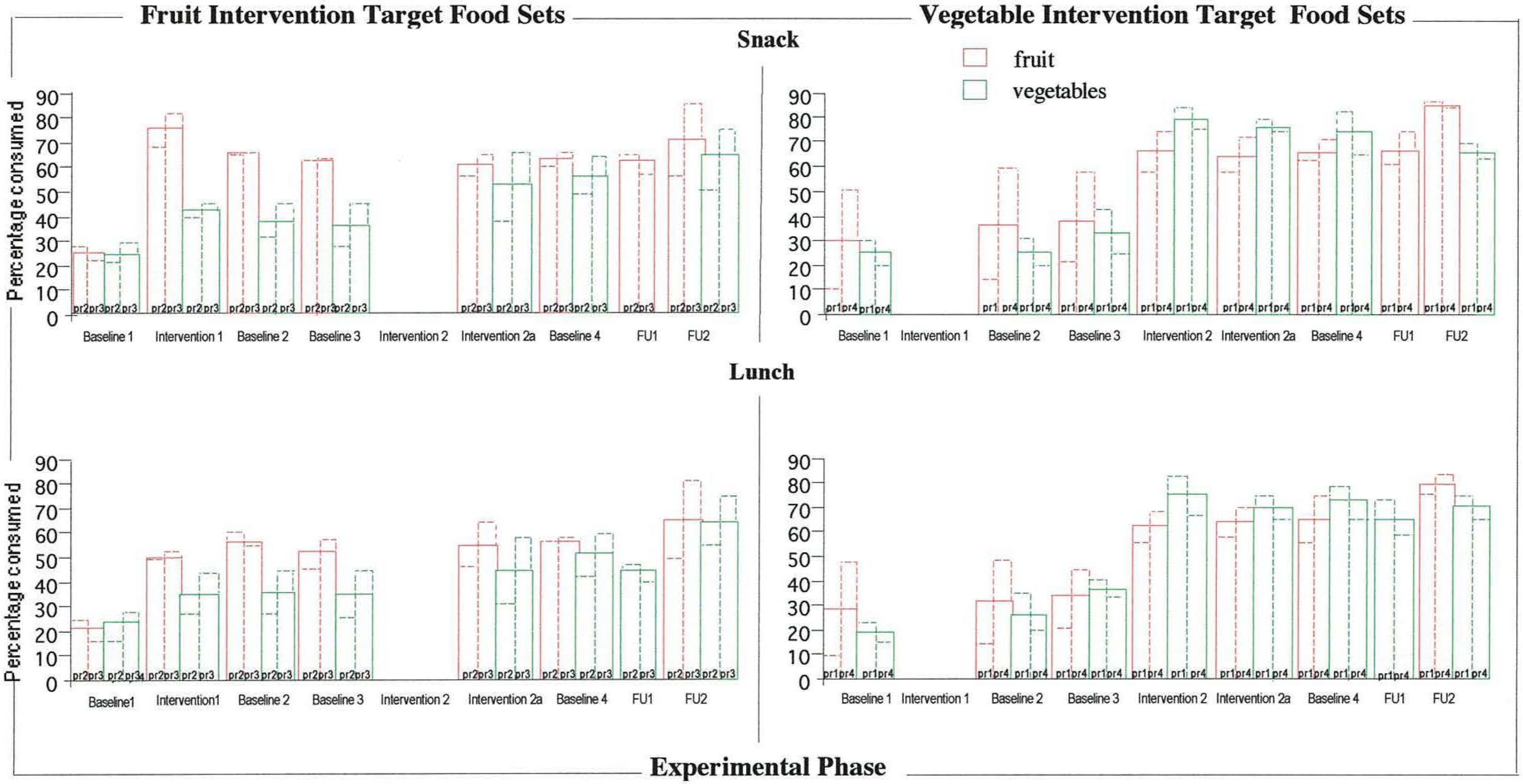


Figure 4.2. Mean consumption for 5 day attendees of target fruit, target vegetables, non-target fruit and non-target vegetables in the experimental (snack) context) and in the generalization (lunch) context across all phases of Experiment 4 including Follow-Up 1 (FU1) and Follow-Up 2 (FU2). Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit and vegetables for Food Sets 2 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 1 and 4 (upper and lower right panels).

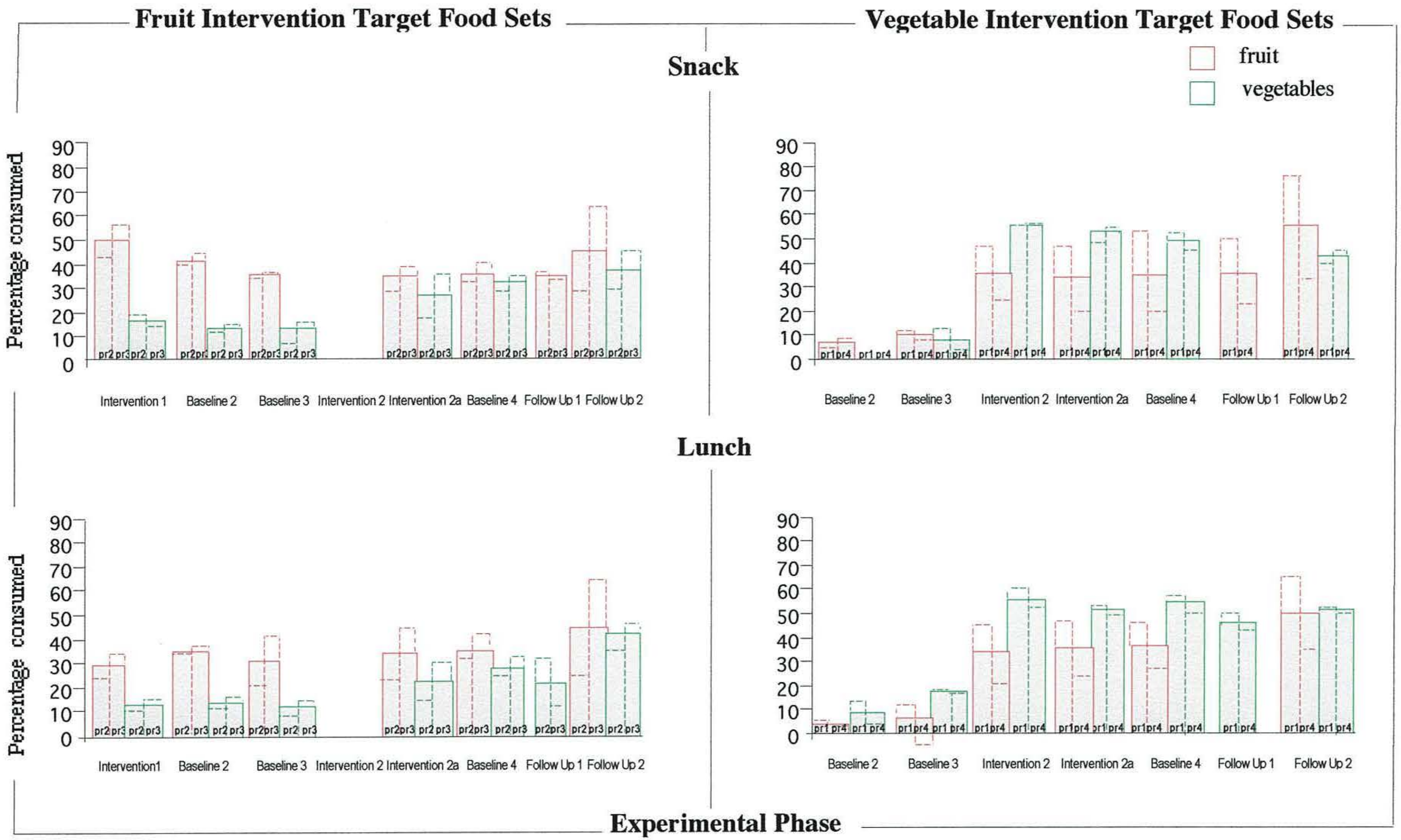


Figure 4.2.1. Mean consumption for 5 day attendees of target fruit, target vegetables, non-target fruit and non-target vegetables in the experimental (snack) context) and in the generalization (lunch) context across all phases of Experiment 4 *relative to Baseline 1*. Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit and vegetables for Food Sets 2 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 2 and 4 (upper and lower right panels).

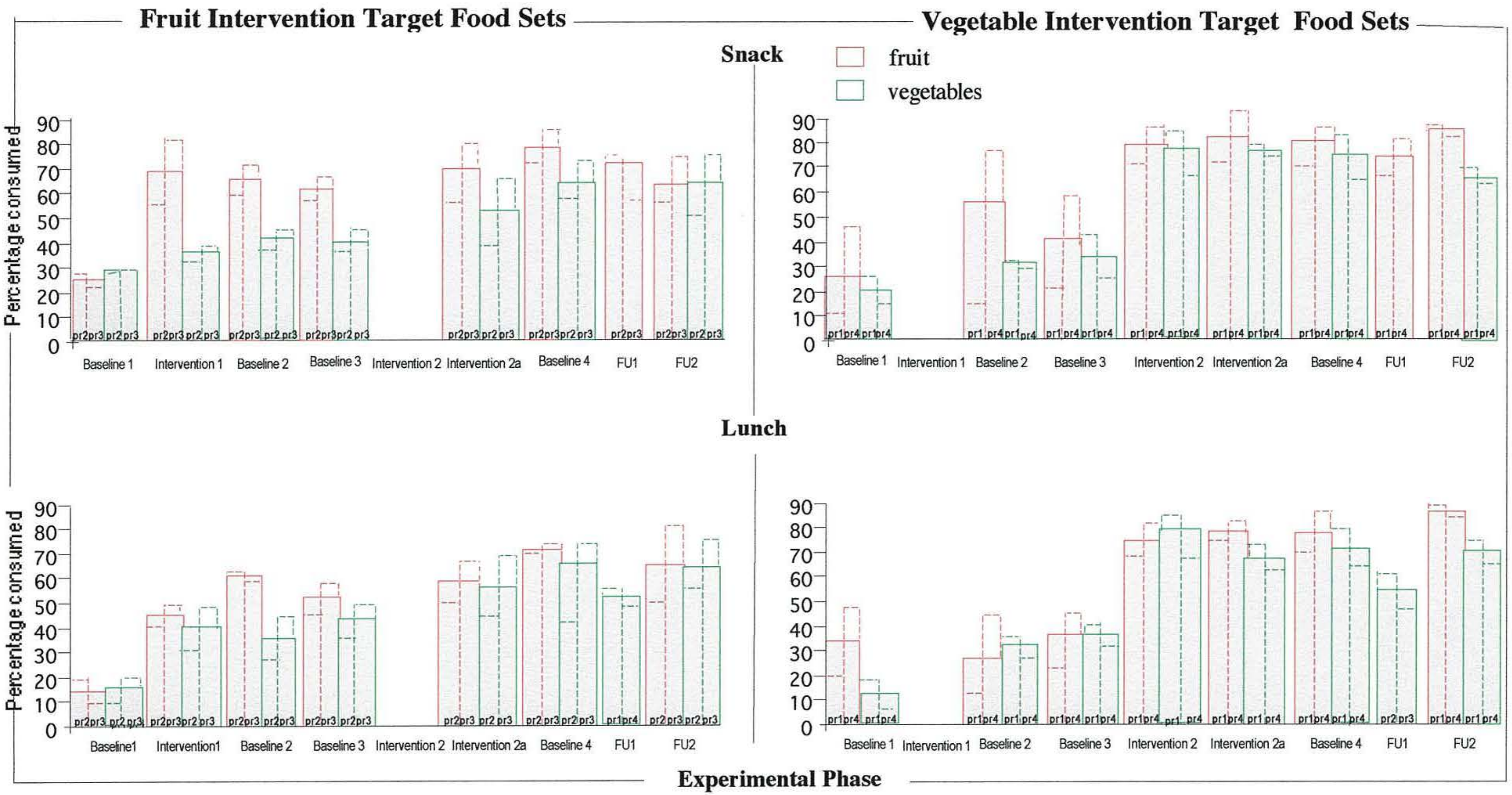


Figure 4.2.2. Mean consumption for the *subgroup of 5 day attendees who remained to participate in Follow-Up 2* of target fruit, target vegetables, non-target fruit and non-target vegetables in the experimental (snack) context) and in the generalization (lunch) context across all phases of Experiment 4 including Follow-up 1 (FU1) and Follow-up 2 (FU2). Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit and vegetables for Food Sets 2 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 1 and 4 (upper and lower right panels).

Table 4.6. 5 day attendees mean consumption of each food across the course of Experiment 4, Baseline 1 (BL1), Intervention 1 (I1), Baseline 2 (BL2), Baseline 3 (BL3), Intervention 2 (I2), Intervention 2a (I2a), Baseline 4 (BL4), Follow-up 1 (FU1) and Follow-up 2 (FU2). Snack time data (S) are shown in black type, lunchtime data (L) in blue type.

Food Set	Food Pair	S BL1	L	S I 1	L	S BL2	L	S BL3	L	S I 2	L	S I 2a	L	S BL4	L	S FU1	L	S FU2	L
1	Dragon Fruit	3	1.5			10	9	20	20	66	63	59	59	58	58	65		75	75
	Mango	17	17			18	18	22	22	50	50	58	58	67	54	55		100	75
	Green Beans	31	24			26	33	40	34	84	77	75	68	81	76		63	50	58
	Baby Corn	30	19			34	38	45	48	84	87	83	81	83	83.8		81	91	91
2	Kiwi	44	40	85	70	87	61	82	69			72	69	74	69	75	50	58	50
	Papaya	11	9	54	28	48	36	41	23			40	26	47	45	54		54	50
	Carrot	36	28	65	41	44	44	49	42			62	48	73	62		66	75	75
	Courgette	6	7	16	14	20	13	8	10.2			17	15	26	23		31	25	33
3	Star Fruit	42	30	90	57	71	64	72	65			76	76	77	64	42		98	87.5
	Sharon Fruit	6	4	72	46	58	39	53	52			50	50	54	54	73		75	75
	Cucumber	55	57	73	73	83	82	81	78			91	89	84	84.6		80	75	75
	Yam	4	0	16	14	5	6	11	8			41	27	43	35		0	74	75
4	Water Melon	45	51			55	46	57	44	74	73	74	75	71	71	69		91	92
	Prune	58	44			64	53	60	45	78	63	69	66	72	79	78		75	75
	Swede	21	15			17	15	19	39	80	62	76	61	60	60		63	70	75
	Mange- Tout	20	17			24	24	30	28	71	75	72	72	72	72		55	58	58

Table 4.6a. 5 day attendees mean consumption of each food pair across the course of Experiment 4 showing target fruit (TF), high exposure vegetable (HV), target vegetable (TV) and high exposure fruit (HF). The upper section shows snack time consumption and the lower section shows lunchtime consumption (blue type) during Baseline 1 (BL1), Intervention 1 (I1), Baseline 2 (BL2), Baseline 3 (BL3), Intervention 2 (I2), Intervention 2a (I2a), Baseline 4 (BL4), Follow-up 1 (FU1) and Follow-up 2 (FU2). Mean total category consumption is shown in bold.

Snack	**TF**	Pair 2	Pair 3	**HV**	Pair 2	Pair 3	**TV**	Pair 1	Pair 4	**HF**	Pair 1	Pair 4
BL1	**25**	27	24	**25**	21	30	**25**	30	20	**30**	10	51
I1	**75**	69	81	**42**	40	44						
BL2	**67**	67	68	**38**	32	44	**25**	30	20	**36**	14	59
BL3	**62**	61	62	**37**	28	46	**33**	42	24	**39**	21	58
I2							**79**	84	75	**67**	58	74
I2a	**60**	56	63	**52**	39	66	**76**	79	74	**64**	58	71
BL4	**62**	60	65	**56**	49	64	**74**	82	66	**66**	62	71
FU1	**61**	64	57							**66**	60	73
FU2	**71**	56	86	**63**	50	75	**67**	70	64	**85**	87	83
Lunch												
BL1	**21**	25	17	**23**	17	28	**19**	22	16	**29**	9	47
I1	**50**	49	52	**35**	27	43						
BL2	**57**	60	55	**36**	28	44	**28**	36	20	**31**	13	49
BL3	**52**	46	58	**34**	26	43	**37**	41	33	**33**	21	44
I2							**75**	82	68	**62**	56	68
I2a	**55**	47	63	**44**	31	58	**70**	74	66	**64**	58	70
BL4	**58**	57	59	**51**	42	60	**72**	79	66	**65**	56	75
FU1				**44**	48	40	**65**	72	59			
FU2	**65**	50	81	**64**	54	75	**70**	74	66	**79**	75	83

Table 4.6 shows the average consumption per phase of each food across the course of Experiment 4 at snack time and lunchtime.

Table 4.6a shows the average consumption per phase of each food pair across the course of Experiment 4 at snack time and lunchtime.

Consumption at Snack Time: Target Fruit and Non-Target Vegetables

Baseline 1

Food category consumption: Target fruit and non-target vegetable consumption was similar; both were approximately 25%.

Within-category consumption: Consumption of both pairs of fruits was similar and low (Pair 2 at 27% and Pair 3 at 24%). Consumption of the two vegetable pairs was also similar and low (Pair 2 at 21% and Pair 3 at 30%).

Intervention 1 – target fruit

Food category consumption: When the intervention was applied to target fruit, consumption of those foods rose substantially to 75%, an increase of 50% compared to Baseline 1. A smaller increase in the accompanying non-target vegetables was recorded, with consumption at 42%, 17% greater than during Baseline 1.

Within-category consumption: Consumption of both pairs of fruits increased substantially; Pair 2 by 42%, and Pair 3 by 57%. Consumption of both non-target vegetables increased, but the increase was smaller; Pair 2 vegetables by 19% and Pair 3 by 15%.

Baseline 2

Food category consumption: Target fruit consumption remained elevated at 67%, higher by 42% compared to Baseline 1, and only slightly reduced (by 8%) relative to Intervention 1. The increase in non-target vegetable consumption was largely maintained at 13% greater than Baseline 1.

Within-category consumption: Consumption of both fruit pairs remained elevated relative to Baseline 1, although Pair 2 fruits continued to be eaten at a similar level to that recorded during Intervention 1 whilst there was a reduction of 13% in the amount of Pair 3 consumed. Pair 3 vegetables continued to be eaten at Intervention 1 levels, whilst there was a drop of 8% in consumption of Pair 2.

Baseline 3

Food category consumption: Prior to the application of the intervention to target vegetables, target fruit consumption, at 62%, was 36% greater than during Baseline 1, although consumption was reduced in comparison to Intervention 1 by 13%. Non-target vegetable consumption remained low at 37%, 12% greater than during Baseline 1.

Within-category consumption: Both pairs of target fruit were eaten at more than double the levels recorded during Baseline 1. Consumption of both was similar with Pair 2 at 61% and Pair 3 at 62%. Whilst category consumption of non-target vegetables remained unchanged, a preference for Pair 3 vegetables over Pair 2 was in evidence (46% compared to 28%, respectively)

Intervention 2 – target vegetables

During this phase, only target vegetables and non-target fruits (Food Sets 1 and 4) were presented.

Intervention 2a – target vegetables intermittently

Food category consumption: Whilst the intervention was applied to *target vegetables* every other time they were presented, all other foods were presented under baseline conditions. During this phase, consumption of target fruit was, at 60%, 35% greater than during Baseline 1 and less than during Intervention 1 by 15%. Consumption of non-target vegetables was the highest of the study so far, having increased by 15% compared to Baseline 3 and, at 52%, was 27% greater than during Baseline 1.

Within-category consumption: Consumption of both fruit pairs remained elevated relative to Baseline 1, Pair 2 at 56%, by 29% and Pair 3 at 63%, by 39%. Of the vegetable pairs, consumption of Pair 3 was greater by 20% than during Baseline 3 and at 66% was at the highest recorded level so far. Consumption of Pair 2 vegetables, at 39% was 10% greater than during Baseline 3 and 18% greater than during Baseline 1.

Baseline 4

Food category consumption: In the absence of any intervention, target fruit consumption was, at 62%, 37% greater than during Baseline 1 and 13% less than during Intervention 1. Non-target vegetable consumption was maintained at 56%, 4% more than during Intervention 2a and 19% greater than during Baseline 3.

Within-category consumption: Of the target fruit, both pairs were eaten in substantially greater quantities than during Baseline 1, Pair 2 at 60%, by 33% and Pair 3 at 65%, by 41%. Of the non-target vegetables, 28% more Pair 2 and 34% more Pair 3 were eaten than during Baseline 1.

Follow-up 1

Food category consumption: When fruit was presented at snack time, in the absence of rewards, target fruit consumption was recorded at 61%, 36% greater than during Baseline 1 and 14% less than during Intervention 1. Vegetables were presented at lunchtime only during this phase.

Within-category consumption: Consumption of both fruit pairs was increased relative to Baseline 1; Pair 2, at 64% was increased by 37% and Pair 3 at 57% was greater by 33%.

Follow-up 2

Food category consumption: When all food sets were presented under baseline conditions nine months after the end of Baseline 4, target fruit consumption, at 71% was close to the 75% recorded during Intervention 1. Non-target vegetable consumption, at 63% was the highest recorded during the study.

Within-category consumption: A difference in consumption between the two fruit pairs emerged during this phase. Pair 2 fruit, at 56% was 29% greater than during Baseline 1, whilst consumption of Pair 3 was at its highest recorded level of 86%, 62% greater than during Baseline 1. Of the vegetables, consumption of both pairs was the highest recorded, but Pair 3 consumption was greater at 75%, 45% more than during Baseline 1. Consumption of Pair 2 at 50% was 29% greater than during Baseline 1.

It should be borne in mind that during Follow-up 2 only 4 of the original 12 participants were attending the nursery. Thus, the data may not be representative of the group as a whole.

Consumption at Snack time: Target vegetables and non-target fruit

Baseline 1

Food category consumption: There was little difference between consumption of target vegetables and non-target fruit, both were low at 25% and 30% respectively.

Within-category consumption: Of the target vegetable pairs, Pair 4 was less popular than Pair 1, consumed at 20% and 30% respectively. There was a greater difference in the relative consumption of the fruit pairs, with Pair 1 at 10% and Pair 4 at 51%.

Intervention 1 – target fruit

Target fruit and non-target vegetables only were presented during this phase.

Baseline 2

Food category consumption: When the intervention was removed from target fruit, non-target fruit consumption increased by 6% to 36%. Target vegetables remained at Baseline 1 levels.

Within-category consumption: Small increases in consumption of both fruit pairs were noted, 4% for Pair 1 and 8% for Pair 4. Consumption of both vegetable pairs remained unchanged.

Baseline 3

Food category consumption: Prior to the application of the intervention to target vegetables, consumption of those foods remained low at 33%, only 8% greater than during Baseline 1. Consumption of non-target fruit at 39% was 9% greater than during Baseline 1.

Within-category consumption: There was some difference from Baseline 1 in consumption of both vegetable pairs, Pair 1 at 42% was increased by 12% relative to Baseline 1 and Pair 4 at 24% was increased by 4%. Of the non-target fruits, consumption of Pair 1 was 11% greater than during Baseline 1 and Pair 4 was 8% greater.

Intervention 2 – target vegetables

Food category consumption: When the intervention was applied to target vegetables, consumption of those foods increased to 79%, the highest level recorded during the study and a 46% increase relative to Baseline 3. Non-target fruit consumption also increased substantially to 67%, 37% greater than levels recorded in Baseline 1 and 30% greater than post-fruit intervention levels at Baseline 2.

Within-category consumption: The increase in category consumption was the result of an increase in consumption of both pairs of vegetables so that Pair 1 was eaten at 84% and Pair 4 at 75% compared to 42% and 24% respectively, during Baseline 3. Consumption of both vegetable pairs was the highest recorded. Of the fruit pairs, relative to Baseline 3, Pair 1, at 58% had increased by 37% and Pair 4 at 74% had increased by 15%.

Intervention 2a – target vegetables intermittently

Food category consumption: Whilst the intervention was applied to target vegetables every other time they were presented, consumption of those foods at snack time remained at levels similar to Intervention 2, at 76%, 43% greater than during Baseline 3. Consumption of the accompanying non-target fruit also remained elevated at 64%, only 3% less than during Intervention 2.

Within-category consumption: Both vegetable pairs were eaten in similar quantities as during the Intervention phase, with Pair 1 at 79%, 5% less than during Intervention 2 and 37% greater than during Baseline 3. Pair 4 at 74%, was 1% less than during Intervention 1 and 50% greater than during Baseline 3. Similarly, consumption of both fruit pairs remained largely unchanged from Intervention 2.

Baseline 4

Food category consumption: In the absence of any intervention, target vegetable consumption remained elevated at 74%, only 6% less than during Intervention 2 and 41% greater than during Baseline 3. Non-target fruit also remained elevated, at 66%, 36% greater than during Baseline1 and 27% more than during Baseline 3.

Within-category consumption: Consumption of Pair 1 vegetables remained at Intervention 2 levels at 82%, 40% more than during Baseline 3, whilst consumption of Pair 4 vegetables was reduced by 10% relative to Intervention 2, but 41% greater than during Baseline 3. Consumption of both fruit pairs remained at levels similar to Intervention 2.

Follow-up 1

Food category consumption: When fruits were presented at snack time in the absence of rewards, non-target fruits were consumed at 66%, similar to levels recorded from Intervention 2 onwards and 36% greater than during Baseline 1.

Within-category consumption: Consumption of both fruits continued at intervention levels, Pair 1 at 60%, 39% greater than Baseline 3 and Pair 4 at 73%, 14% greater than during Baseline 3.

Follow-up 2

Food category consumption: When all foods were presented under baseline conditions, nine months after the end of Baseline 4, target vegetables were consumed at 67%, 42% more than during Baseline 1. Non-target fruit, at 85%, was at the highest level of consumption recorded for any food category during the study and was 55% higher than during Baseline 1.

Within-category consumption: Consumption of both vegetable pairs remained elevated; both were consumed in greater quantities than they had been during Intervention 2, Pair 1 at 70% and Pair 4 at 64%, (28% and 40% respectively more than during Baseline 3). Of the non-target fruit, consumption of both pairs was recorded at the highest level of the study, Pair 4 at 83% and Pair 1 at 87%. Relative to Baseline 1, 77% more Pair 1 fruit was eaten along with 32% more Pair 4.

The reader should remain aware that only 4 of the original group of 12 children participated in Follow-up 2.

Consumption at Lunchtime: Target Fruit and Non-Target Vegetables

The lower left quadrant of Figure 4.2 shows consumption of target fruit and accompanying non-target vegetables at lunchtime and the lower left quadrant of Figure 4.2.1 shows consumption of those foods at lunchtime *relative to Baseline 1.*

Baseline 1

Food category consumption: As was the case at snack time, consumption of target fruit and non-target vegetables was similar and low at 21% and 23% respectively.

Within-category consumption: Consumption of both fruit pairs was low with Pair 2 at 25% and Pair 3 at 17%. As at snack time, consumption of both vegetable pairs was more diverse, with Pair 2 at 17% and Pair 3 at 28%.

Intervention 1 – target fruit

Food category consumption: When the intervention was applied at snack time to target fruit, consumption of those foods at lunchtime increased by 29%, the largest single rise in target fruit recorded at lunchtime across the course of the study. At the same time, a smaller (12%) rise in non-target vegetable consumption was observed.

Within-category consumption: Consumption of both fruit pairs increased so that at 49%, Pair 2 consumption was 24% greater than during Baseline 1 and Pair 3 consumption at 52% was 35% greater than during Baseline 1. Consumption of Pair 2 and Pair 3 vegetables increased by 10% and 15% respectively. Similar trends were noted at snack time.

Baseline 2

Food category consumption: When the intervention at snack time was removed, target fruit consumption at lunchtime was greater than during Intervention 1, so that at 57%, consumption was 36% above that of Baseline 1. There was little change in consumption of non-target vegetables, which remained stable at 36%, 13% greater than during Baseline 1.

Within-category consumption: Consumption of both pairs of fruit remained elevated relative to Baseline 1. Pair 2 fruit was recorded at 60%, the highest in this context. Both pairs of non-target vegetables remained unchanged from Intervention 1.

Baseline 3

Food category consumption: Prior to the intervention being applied at snack time to target vegetables, consumption of target fruit was at 52%, 31% greater than during Baseline1 and 2% greater than during Intervention 1. Non-target vegetables were largely unchanged from Intervention 1 at 34%, 11% greater than during Baseline 1.

Within-category consumption: At 46%, Pair 2 fruit consumption was only 3% less than during Intervention 1 and 21% greater than during Baseline 1. Pair 3 fruit, at 58% was 7% greater than during Intervention 1 and 41% greater than during Baseline 1. Consumption of both vegetable pairs remained similar to the previous baseline phases.

Intervention 2 – target vegetables

Target vegetables and non-target fruit only were presented during this phase.

Intervention 2a – target vegetables intermittently

Food category consumption: When the intervention was applied at snack time, to target vegetables *every other time they were presented*, target fruit and non-target vegetables were presented under baseline conditions. During this phase, target fruit consumption was recorded at 55%, 5% greater than during Intervention 1 and 34% more than during Baseline 1. Non-target vegetable consumption had increased so that at 44%, it was 11% greater relative to Baseline 3.

Within-category consumption: Consumption of Pair 3 fruit was greater by 12% than during Intervention 1 and 46% more than during Baseline 1. Pair 2 consumption was similar to that recorded during Intervention 1 at 47% and was 22% greater than during Baseline 1. Of the vegetable pairs, a small (5%) increase in consumption of Pair 2 was noted so that at 31%, it was 14% greater than during Baseline 1. A larger increase of 15% was noted in consumption of Pair 3 so that at 58%, consumption was 30% greater than during Baseline 1.

Baseline 4

Food category consumption: In the absence of any intervention, target fruit consumption showed a further increase so that it was recorded at 58%, the highest in this context so far; consumption was 18% greater than during Intervention 1 and 37% more than during Baseline 1. An increase in non-target vegetable consumption, to 51% was also observed, representing a rise above Baseline 1 of 28%.

Within-category consumption: Consumption of Pair 2 fruit remained high at 57%, 32% more than during Baseline 1 and 8% greater than during Intervention 1. Pair 3, at 59% was 7% greater than during Intervention 1 and 40% greater than during Baseline 1. Consumption of Pair 3 vegetables was the highest recorded in this context so far at 60%, 32% greater than during Baseline 1, whilst consumption of Pair 2 vegetables at 42% was 25% greater than during Baseline 1.

Follow-up 1

Food category consumption: During this phase only vegetables were presented at lunchtime and consumption of non-target vegetables was recorded at 44%, 21% greater than during Baseline 1.

Within-category consumption: Consumption of Pair 2 vegetables at 48% was the highest recorded in this context so far, and 31% greater than during Baseline 1. Consumption of Pair 3 vegetables was, with the exception of Baseline 1 at the lowest recorded level in this context at 40%.

The reader should be aware that during Follow-up 1, measures of vegetable consumption at lunchtime were taken only once per week. Thus, only one data point per vegetable was collected.

Follow-up 2

Food category consumption: When the foods were presented under baseline conditions nine months after the end of Baseline 4, target fruit consumption at lunchtime was recorded at the highest level in this context, at 65%, 34% greater than during Baseline 1. Similarly, non-target vegetable consumption was also at the highest level, at 64%, 41% greater than during Baseline 1.

Within-category consumption: At 81%, consumption of Pair 3 fruit was at the highest recorded level in this context, 64% greater than during Baseline 1. Pair 2 fruit, at 50% was similar to levels recorded during Intervention 1 and 25% greater than during Baseline 1. Of the vegetables, consumption of Pair 3 had increased substantially to the highest level recorded in this context of 75% (the result of a 75% increase in yam consumption – a similar increase was observed at snack time), 47% more than during Baseline 1. The increase in Pair 2 consumption was more modest, so that at 54% (the highest recorded in this context) consumption was 37% greater than during Baseline 1.

Again, the reader should be aware that only 4 of the original sample of 12 children were present during Follow-up 2.

Consumption at Lunchtime: Target vegetables and non-target fruit

The lower right quadrants of Figures 4.2 and 4.2.1 show consumption of target vegetables and non-target fruit at lunchtime.

Baseline 1

Food category consumption: As was the case at snack time, consumption of target vegetables and non-target fruit was low at 19% and 29% respectively.

Within-category consumption: Similar to snack time, consumption of Pair 4 fruit was substantially greater than consumption of Pair 1 (47% compared to 9%). Consumption of both vegetable pairs also resembled that at snack time with Pair 1 slightly more popular than Pair 4 (22% and 16% respectively).

Intervention 1 – target fruit

Target fruit and non-target vegetables only were presented during this phase.

Baseline 2

Food category consumption: When the intervention was removed from target fruit at snack time, a slight increase (2%) in non-target fruit consumption at lunchtime was noted, an increase of 6% was recorded at snack time. Target vegetable consumption had increased to 28%, 9% greater than it had been during Baseline 1.

Within-category consumption: Pair 1 fruit consumption increased marginally, by 4%, while consumption of Pair 4 remained largely unchanged, increasing by 2%. Most of the increase in target vegetable consumption was recorded for Pair 1, at 14%. Consumption of Pair 4 increased by 4%.

Baseline 3

Food category consumption: Prior to the introduction of the intervention at snack time to target vegetables, target vegetable consumption at lunchtime was low at 37% and similar to that recorded at snack time. Non-target fruit consumption was also low, at 33%.

Within-category consumption: More Pair 1 vegetables were consumed than Pair 4, 41% and 33% respectively. More Pair 4 than Pair 1 fruit was eaten at 44% and 21% respectively.

Intervention 2 – target vegetables

Food category consumption: When the intervention was applied to target vegetables at snack time, consumption at lunchtime of those foods increased to 75%, a 38% increase from Baseline 3 and the largest single rise in category consumption in this context. Non-target fruits presented alongside the target vegetables also increased substantially to 62%, 29% above that recorded during Baseline 3. These same trends had also been noted at snack time.

Within-category consumption: Consumption of both pairs of vegetables increased substantially, so that at 82% consumption of Pair 1 was 41% greater than during Baseline 3 and consumption of Pair 4, at 68%, was 35% greater than during Baseline 3. Increases in consumption of both pairs of fruit were recorded, for Pair 1 at 56%, a rise of 35% relative to Baseline 3, and Pair 4 at 68%, showed a rise of 24% relative to Baseline 3.

Intervention 2a – target vegetables intermittently

Food category consumption: Whilst the intervention was applied to target vegetables at snack time on every other presentation, consumption at lunchtime of those foods continued at the elevated levels recorded during Intervention 2 at 70%, 33% more than during Baseline 3. Consumption of the non-target fruits increased by a further 2% compared to the previous intervention phase so that at 64%, consumption was 31% greater than during Baseline 3.

Within-category consumption: Very small changes in target vegetable consumption were recorded relative to Intervention 2; consumption of Pair 1 vegetables was reduced by 8% and consumption of Pair 4 by 2%, so that at 74% and 66%, consumption was greater than Baseline 3 by 33% for both pairs. Both pairs of fruit were consumed at the highest levels recorded in this context, so that at 58%, Pair 1 was increased by 37% relative to Baseline 3, and Pair 4, at 70% was 25% greater than during Baseline 3.

Baseline 4

Food category consumption: When all interventions were removed, target vegetable consumption remained, at 72%, largely unchanged from the previous two intervention phases and greater than Baseline 3 by 35%. Non-target fruit consumption was also similar to the previous two phases, so that consumption at 65% was 31% greater than during Baseline 3.

Within-category consumption: There was little change in consumption of either vegetable pair from the previous phase. Likewise, non-target fruit consumption remained similar to the previous phase, so that Pair 1 was 35% and Pair 4 was 31% greater than during Baseline 3.

Follow-up 1

Vegetables only were presented at lunchtime during Follow-up 1.

Food category consumption: When target vegetables were presented at lunchtime, consumption of those foods, at 65% remained elevated relative to Baseline 3 by 28%, only 9% less than during Intervention 2.

Within-category consumption: Compared to Baseline 3, 31% more Pair 1 vegetables and 26% more Pair 4 vegetables were eaten during this phase; only 8% and 9% respectively less than were eaten during Intervention 2.

Follow-up 2

Food category consumption: When all the foods were presented under baseline conditions nine months after the end of Baseline 4, consumption of target vegetables at lunchtime was high, at 70%, 33% greater than was recorded during Baseline 3 and only 4% less than during Intervention 2. Non-target fruit consumption was at the highest level recorded in the lunchtime context, at 79% and was greater, by 46% relative to Baseline 3.

Within-category consumption: Both vegetable pairs were eaten in greater quantities than during Baseline 3 (33% more). Similarly, both non-target fruit pairs were eaten in greater quantities than during Baseline 3, Pair 1 by 54% and Pair 4 by 38%.

Discussion: 5 day attendees

Snack time: Figure 4.2 shows that in Baseline 1, snack time consumption in all food categories was no more than 30%. When the intervention was applied to target fruit, there was an immediate increase in consumption of those foods. The increase, at 50%, was greater than the 17% (see Figure 4.2.1) rise in consumption of those vegetables that were presented with the target fruit. The comparative size of the increase in fruit consumption is indicative that the intervention was responsible for the observed changes in eating patterns.

When the intervention targetting fruit was removed, consumption of those foods continued to be at least 35% above Baseline 1 levels throughout the remainder of the study. Consumption of target fruit in Baseline 4 was 37% greater than had been recorded during Baseline 1 and was only 13% less than during Intervention 1.

Seven months after the end of the fruit intervention at Follow-up 1, consumption of target fruit was greater than Baseline 1 by 36% and nine months after the end of Baseline 4 was 46% greater than during Baseline 1. Consumption at Follow-up 2 was only 4% less than during Intervention 1, although the reader should be aware that all 12 children were present during Follow-up 1, whereas only 4 of these 12 were present during Follow-up 2.

Figure 4.1 shows trends in vegetable consumption at snack time that were similar to those recorded with target fruit consumption. At Baseline 3, target vegetable consumption was low at 33%. When the intervention was applied there was an increase in consumption of those foods of 46%. This was the largest single increase in target vegetable consumption across all phases of the study; indicative that the intervention was responsible for these observed changes in eating behaviour.

When the intervention was partially removed at Intervention 2a, target vegetables continued to be consumed at levels similar to those recorded during Intervention 2. At Baseline 4, when the intervention was completely removed, consumption of target vegetables was just 5% short of that recorded during Intervention 2.

At Follow-up 2 (carried out nine months after the end of Intervention 2) consumption of target vegetables was recorded at 67%, greater by 34% than that observed during Baseline 3, although the reader should bear in mind the reduced number of participants involved in Follow-up 2, only 4 of the original 12 children.

Overall, the evidence suggests that the intervention was successful in increasing consumption of both fruit and vegetables at snack time. Once consumption was increased, those changes were maintained even when the intervention was removed. Target vegetable consumption remained elevated 9 months after the end of the intervention targetting those foods, whilst target fruit consumption was elevated 15 months after those foods had been subjected to the intervention.

Lunchtime: The changes in consumption observed at snack time were also observed in the lunchtime generalisation setting. During Baseline 1, consumption was recorded at less than 30% in all categories. When the intervention was applied to target fruit, at snack time, consumption of those foods at lunchtime increased by 31%. At the same time, consumption of the non-target vegetables that were presented alongside the target fruit increased by only 13%. Thus, the effects of the snack time intervention on fruit were carried over into a second context, i.e. lunchtime. Consumption of target fruit at lunchtime remained at, or above levels recorded during the intervention, with an upward trend even when the intervention targetting fruit at snack time was removed. At Baseline 4, consumption of target fruit at lunchtime was 37% greater than it had been during Baseline 1 and at Follow-up 2, consumption was 44% greater than during Baseline 1 (although note the small numbers of participants involved in Follow-up 2).

When the intervention was applied at snack time to target vegetables, consumption of target vegetables at lunchtime increased to 37% above that recorded during Baseline 3, a very similar increase to that noted in the snack time experimental setting. Consumption of target vegetables at lunchtime continued at the elevated levels during Intervention 2a. At Baseline 4, in the absence of any reward, consumption was only 2% less than was recorded during Intervention 1 and was 35% greater than during Baseline 3.

At Follow-up 1, target vegetable consumption continued elevated at 65%, 28% greater than during Baseline 3 and at Follow-up 2, consumption was, at 70% only 4% less than during Intervention and 33% greater than Baseline 3. Again, the reader should note the lack of data points per food at Follow-up 1 and the reduced numbers (only four) of participants at Follow-up 2.

The effects of the intervention were almost as great in the generalisation context as they had been in the experimental setting. The changes in fruit and vegetable consumption following each intervention were maintained in the absence of any reward procedures increases in consumption of target fruit were in evidence 15 months after the intervention had targetted those foods and increased consumption of target vegetables was in evidence 9 months after the intervention was applied to those foods.

General issues: The interventions were equally effective with all target food pairs, so that during each intervention, both pairs of target foods were eaten in the same quantity, regardless of how much of each pair had been consumed during baseline phases. This was true of both target fruit and target vegetables in the snack and lunchtime settings.

It remains to consider the evidence for within-category generalisation. Taking the case of fruit first, during Intervention 1 (target fruit) consumption of target fruit at snack time increased by 47% and remained at least 34% greater than during Baseline 1 for the remainder of the study. At Baseline 2, however, there was only a small, 13% increase in consumption of non-target fruit that was maintained into Baseline 3. In the case of vegetables, when Intervention 2 was applied to target vegetables at snack time, consumption of those foods increased by 48%, but at Intervention 2a and at Baseline 4, consumption of non-target vegetables had increased by 15% and 19% respectively. These data do not enable any firm conclusions to be drawn about the issue of generalisation of consumption to non-targetted exemplars within each category.

An interesting feature of these results can be seen when one looks at non-target fruit consumption. At both snack and lunchtime, consumption of non-target fruit increased markedly when Intervention 2 was applied. One explanation for this increase is a lack of discrimination on the children's part between fruit and vegetables, although the lack of increase in consumption of non-target vegetables during Intervention 1 suggests that the children did discriminate in their food choices. An alternative explanation for the concurrent increase in non-target fruit is that the children thought they would be given rewards for eating fruit as well as vegetables, since the previous intervention had involved rewards for fruit consumption. Such a strategy could be viewed as a verbal over-generalisation effect. It is also possible that the children had developed a category of 'Jarvis and Jess' foods and as such any foods that appeared in the presentation dishes would have been consumed. The simplest means by which to determine which explanation was correct would be to ask the children themselves why they ate the fruit when rewards were available only for vegetable consumption.

Finally, what is clear from these data is that manipulating consumption in one context had implications for consumption in the second context and this was true for both target and non-target foods; trends in consumption at snack time were reflected in changes in consumption at lunchtime.

Results: 4 days per week attendees

Figure 4.3 illustrates consumption of fruit and vegetables across the course of the study for the 3 children who attended the playroom four days per week and completed the experimental procedures. The upper left quadrant shows consumption of target fruit and accompanying non-target vegetables at snack time and the lower left quadrant shows consumption of those same foods at lunchtime. The upper right quadrant shows consumption of the target vegetables and accompanying non-target fruit at snack time and the lower right quadrant shows consumption of those same foods at lunchtime. The broken lines within each column show consumption of each of the food pairs within the category.

Figure 4.3.1 illustrates consumption of fruit and vegetables across the course of the study *relative to Baseline 1* for the 3 children who attended the playroom 4 days per week. The upper left quadrant shows consumption of target fruit and accompanying non-target vegetables at snack time and the lower left quadrant shows consumption of those same foods at lunchtime. The upper right quadrant shows consumption of the target vegetables and accompanying non-target fruit at snack time and the lower right quadrant shows consumption of those same foods at lunchtime. The broken lines within each column show consumption of each of the food pairs within the category.

Table 4.7 shows the average consumption per phase of each experimental food at snack time and lunchtime.

Table 4.7a shows the average consumption per phase of each food pair at snack time and lunchtime

Consumption at Snack time: Target Fruit and non-target vegetables

Baseline 1

During Baseline 1, consumption of food in both categories was similar, target fruit was eaten at 33% and non-target vegetables were eaten at 32%.

Intervention 1

When the intervention was applied to target fruit, consumption of both fruit and vegetables increased, target fruit by 27% to 60% and vegetables increased by 20% to 52%

Baseline 2

Baseline 2 data show that when the intervention was removed, consumption of target fruit remained elevated, 17% greater than during Baseline 1, whilst consumption of the accompanying non-target vegetables reverted to levels recorded during Baseline 1.

Baseline 3

Prior to the introduction of Intervention 2 (target vegetables) Baseline 3 consumption of both target fruit and the accompanying non-target vegetables was at 52%, representing an increase of 19% and 20% respectively relative to levels recorded during Baseline 1.

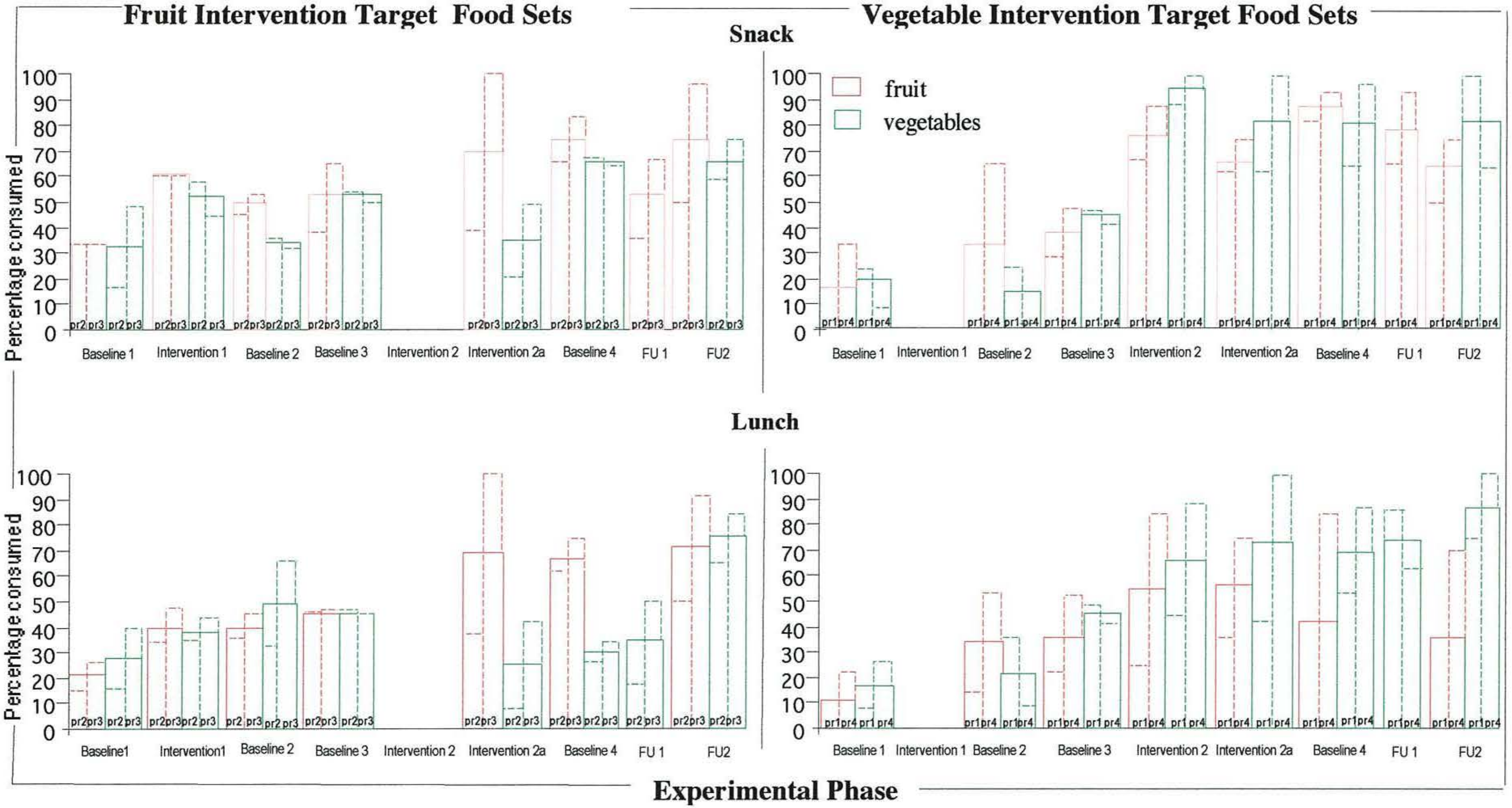


Figure 4.3. Mean consumption for 4 day attendees of target fruit, target vegetables, non-target fruit and non-target vegetables in the experimental (snack) context) and in the generalization (lunch) context across all phases of Experiment 4 including Follow-Up 1 (FU1) and Follow-Up 2 (FU2). Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit and vegetables for Food Sets 2 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 1 and 4 (upper and lower right panels).

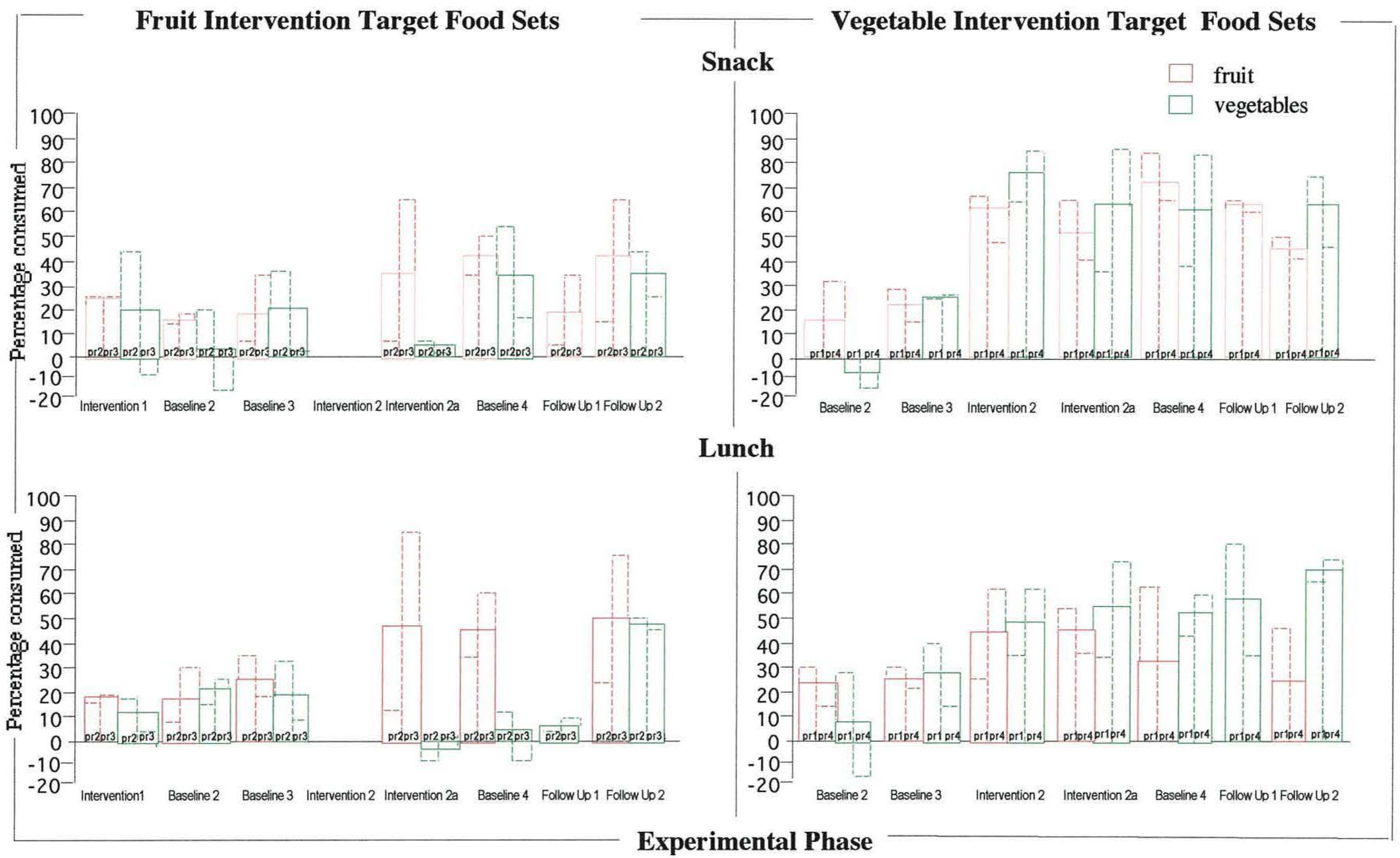


Figure 4.3.1. Mean consumption for 4 day attendees of target fruit, target vegetables, non-target fruit and non-target vegetables in the experimental (snack) context) and in the generalization (lunch) context across all phases of Experiment 4 *relative to Baseline 1*. Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit and vegetables for Food Sets 2 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 1 and 4 (upper and lower right panels).

Table 4.7. 4 day attendees mean consumption of each food across the course of Experiment 4, Baseline 1 (BL1), Intervention 1 (I1), Baseline 2 (BL2), Baseline 3 (BL3), Intervention 2 (I2), Intervention 2a (I2a), Baseline 4 (BL4), Follow-up 1 (FU1) and Follow-up 2 (FU2). Snack time data (S) are shown in black type, lunchtime data (L) in blue type.

Food Set	Food Pair	S BL1	L	S I 1	L	S BL2	L	S BL3	L	S I 2	L	S I 2a	L	S BL4	L	S FU1	L	S FU2	L
1	Dragon Fruit	0	0			0	0	0	0	33	16	25	0	67	0	33		0	0
	Mango	0	0			0	27	58	42	100	33	100	75	100	0	100		100	0
	Green Beans	0	0			6	25	64	64	100	44	66	50	93	36		100	100	100
	Baby Corn	50	16			44	50	33	33	78	44	58	33	33	67		75	25	50
2	Kiwi	33	33	67	55	67	67	67	75			50	50	67	67	75		50	50
	Papaya	33	0	53	11	25	5	12	18			30	27	67	55	0		50	50
	Carrot	33	22	89	38	58	52	75	61			42	16	91	55		37	100	100
	Courgette	0	8	30	30	14	11	33	33			0	0	44	0		0	16	33
3	Star Ft	58	44	90	86	71	75	64	36			100	100	67	100	71		100	83
	Sharon Ft	7	11	29	10	33	16.6	67	61			100	100	100	50	63		96	100
	Cucumber	77	77	77	55	41	67	67	67			50	50	67	67		100	100	100
	Yam	21	4	14	32	25	67	33	25			50	33	67	0		0	50	66
4	Water Melon	33	0			58	67	55	67	100	100	100	100	97	100	87		100	91
	Prune	36	44			72	38	41	38	67	67	50	50	100	67	100		50	50
	Swede	0	16			2	0	22	22	100	77	100	100	97	91		50	100	100
	Mange- Tout	33	38			0	16	64	61	100	100	100	100	100	83		75	100	100

Table 4.7a. 4 day attendees mean consumption of each food pair across the course of Experiment 4 showing target fruit (TF), high exposure vegetable (HV), target vegetable (TV) and high exposure fruit (HF) consumption. The upper section of Table 4.7a shows snack time consumption and the lower section shows lunchtime consumption (blue type) across all phases of the experiment, Baseline 1 (BL1), Intervention 1 (I1), Baseline 2 (BL2), Baseline 3 (BL3), Intervention 2 (I2), Intervention 2a (I2a), Baseline 4 (BL4), Follow-up 1 (FU1) and Follow-up 2 (FU2). Mean total category consumption is shown in bold.

Snack	**TF**	Pair 2	Pair 3	**HV**	Pair 2	Pair 3	**TV**	Pair 1	Pair 4	**HF**	Pair 1	Pair 4
BL1	**33**	33	33	**32**	16	49	**20**	25	8	**17**	0	34
I1	**60**	60	60	**52**	59	45						
BL2	**50**	46	52	**34**	36	33	**15**	25	1	**32**	0	65
BL3	**52**	39	66	**52**	54	50	**45**	48	43	**38**	29	48
I2							**94**	89	100	**77**	67	88
I2a	**70**	40	100	**35**	21	50	**81**	62	100	**67**	62	75
BL4	**75**	67	83	**67**	68	67	**80**	63	98	**88**	83	98
FU1	**52**	37	67							**79**	66	93
FU2	**74**	50	98	**66**	58	75	**81**	100	62	**62**	50	75
Lunch												
BL1	**21**	15	27	**27**	15	40	**17**	8	27	**11**	0	22
I1	**40**	33	48	**38**	34	43						
BL2	**40**	36	45	**49**	31	67	**21**	37	8	**33**	14	52
BL3	**47**	46	48	**46**	47	46	**45**	48	41	**36**	21	52
I2							**66**	44	88	**54**	25	83
I2a	**69**	38	100	**25**	8	41	**72**	41	100	**56**	37	75
BL4	**68**	61	75	**30**	27	33	**69**	51	87	**42**	0	84
FU1				**34**	18	50	**74**	87	62			
FU2	**71**	50	91	**75**	66	83	**87**	75	100	**35**	0	70

Intervention 2a

Whilst the intervention was applied to target vegetables *every other time* they were presented, target fruit consumption was increased relative to Intervention 1 and, at 70% consumption was 37% greater than during Baseline 1. At the same time, consumption of the accompanying non-target vegetables was reduced to levels similar to those recorded during Baseline 1.

Baseline 4

When all interventions were removed, consumption of target fruit remained elevated at 75%. At the same time, a substantial increase in the accompanying non-target vegetables was observed and consumption of these foods was the highest recorded, at 67%. Relative to Baseline 1, 42% more fruit was consumed and 35% more vegetables.

Follow-up 1

During Follow-up 1, target fruit consumption remained elevated at 52%, 19% greater than during Baseline 1.

Follow-up 2

Nine months after the end of Baseline 4, at Follow-up 2, both target fruit and the accompanying non-target vegetables were eaten at elevated levels of 74% and 66.5% respectively; consumption of fruit was 41% greater than during Baseline 1 and consumption of vegetables 34% higher.

The reader should note however that during Follow-up 2, only 2 of the original 3 participants were present.

Within-category consumption

The children ate both fruit pairs in equal quantities at the start of the study and consumption of both pairs was affected equally when Intervention 1 was applied. After Intervention 1, both pairs of fruit were eaten at levels greater than during Baseline 1, although at Baseline 2 and beyond, consumption of both fruit pairs differed and more Pair 3 fruit was eaten than Pair 2.

Of the vegetable pairs, more Pair 3 was consumed than Pair 2 during Baseline 1. Across the course of the study, increases in consumption of Pair 2 were observed, whereas consumption of Pair 3 was relatively stable, remaining at around Baseline 1 levels (with the exception of Baseline 3 during which a reduction was recorded). More substantial increases in consumption of Pair 3 were noted during Baseline 4 and Follow-up 2.

Consumption at Snack time: Target Vegetable and Non-Target Fruit

Baseline 1

During Baseline 1, the children's consumption of foods in both categories was low, non-target fruit eaten at 17% and target vegetables eaten at 20%.

Baseline 2

Following the application of Intervention 1 to target fruit, consumption of non-target fruit increased by 15% from Baseline1, whilst target vegetable consumption decreased by 5% to 15%.

Baseline 3

Prior to the introduction of intervention to target vegetables, consumption of those foods had increased to 45%, 25% greater than during Baseline 1. Non-target fruits continued to be consumed at 38%, similar to Baseline 2.

Intervention 2

During Intervention 2, consumption of target vegetables increased substantially to 94%, the highest recorded during the study and a rise of 45% relative to Baseline 3. At the same time, consumption of the accompanying non-target fruit also increased substantially, so that at 77%, consumption was 39% greater than during Baseline 3.

Intervention 2a

Whilst the intervention was applied to target vegetables every other time they were presented, consumption of both fruit and vegetables remained elevated. Although consumption of both food categories was lower than was noted during Intervention 2, at 81% and 67% respectively, 36% more vegetables and 29% more fruit were consumed relative to Baseline 3.

Baseline 4

When all interventions were removed at Baseline 4, target vegetable consumption continued at 80% and non-target fruit consumption increased to the highest level of the study at 88%. 40% more target vegetables and 50% more non-target fruit was consumed than during Baseline 3.

Follow-up 1

Target fruit consumption remained high at 79%, 31% more than was consumed during Baseline 3.

Follow-up 2

At Follow-up 2, (nine months after the end of Baseline 4), the children were eating 50% more target vegetables (81%) than they had during Baseline 3 and 24% more non-target fruit (62%).

The reader should note however that only 2 of the original 3 participants were present during Follow-up 2.

Within-category consumption

Table 4.7 shows phase by phase consumption of each food pair at snack time and lunchtime across the course of the study.

During Baselines 1 and 2, the children ate only small quantities of the target vegetable pairs. At Baseline 3, an increase in consumption of both pairs was observed, so that consumption of both was similar. Consumption increased further during Intervention 2, when Pair 1 was eaten at maximum levels and continued thus for the duration of the study. Consumption of Pair 4 vegetables likewise increased at Intervention 2, but decreased thereafter, and was recorded at 60% or more during the remainder of the study.

Of the fruit pairs, a difference in relative consumption was recorded at the beginning of the study; Pair 1 was not consumed at all whilst Pair 2 was consumed at 34%. Pair 4 fruit consumption increased after the intervention was applied to target fruit, whilst consumption of Pair 1 remained at zero until Baseline 3. During Intervention 2, consumption of both pairs increased substantially relative to Baseline 3 and these increases were maintained in the absence of any intervention during Baseline 4 and Follow-ups 1 and 2.

Consumption at Lunchtime: Target Fruit and Non-Target Vegetables

Baseline 1

Baseline consumption of target fruit and accompanying non-target vegetables was similar to that noted at snack time at 21% and 27% respectively.

Intervention 1

When the intervention was applied to target fruit at snack-time, consumption of target fruit at lunchtime increased to 40%, a rise of 19%, smaller than that noted in the earlier context. At the same time, an increase of 11% was recorded for non-target vegetable consumption.

Baseline 2

Following the removal of the intervention at snack time, lunchtime target fruit consumption at Baseline 2 remained at intervention levels of 40%, 19% above that recorded at Baseline 1. Non-target vegetable consumption increased to 49%, a rise of 22% above Baseline 1 levels.

Baseline 3

Prior to the application of the intervention at snack time to target vegetables, consumption of target fruit at Baseline 3 was increased to 47%, 7% more than during Intervention 1, and 26% greater than during Baseline 1. Non-target vegetable consumption was recorded at 46%, 19% more than during Baseline 1.

Intervention 2a

When the intervention at snack time was applied to target vegetables every other time they were presented, non-target vegetable consumption at lunchtime dropped to 25%, 2% below Baseline 1 levels. At the same time, an increase in target fruit consumption to 69% was recorded (48% more than during Baseline 1).

Baseline 4

In the absence of any intervention, target fruit consumption remained at the elevated levels observed in the previous phase, 47% greater than during Baseline 1. At the same time, consumption of non-target vegetables was 3% greater than during Baseline 1.

Follow-up 1

At Follow-up 1, 7% more non-target vegetables were eaten than during Baseline 1 (39%).

Follow-up 2

At Follow-up 2, (nine months after the end of Baseline 4) consumption of both fruit and vegetables was the highest recorded in this context, 71% and 75% respectively so that 50% more target fruit was eaten than during Baseline 1, along with 48% more vegetables.

Again, the reader should be reminded that only 2 of the original 3 participants were present during Baseline 3.

Within-category consumption

Table 4.7 shows phase by phase consumption of each food pair at snack time and lunchtime across the course of the study

The children's consumption of both target fruit pairs at lunchtime was similar to those observed at snack time with consumption of both pairs similar to Baseline 3. As was noted at snack time, During Intervention 2a, Pair 3 became more popular than Pair 2 and this trend continued throughout the remainder of the study.

Patterns of consumption of non-target vegetables were also similar to those observed at snack time. There were few notable changes in consumption of either pair, and those that were observed were unstable. At Baseline 4 there was little difference in consumption of eater pair relative to Baseline 1. A major increase was noted at Follow-up 2, with 51% more Pair 2 and 43% more Pair 3 vegetables eaten than was the case during Baseline 1.

Consumption at Lunchtime: Target Vegetable and Non-Target Fruit

Baseline 1

Trends in target vegetable and non-target fruit consumption mirrored those observed at snack time, at 11% and 17% respectively.

Baseline 2

After the intervention was applied at snack time to target fruit, non-target fruit consumption at lunchtime increased by 22% to 33%. Target vegetable consumption remained at Baseline 1 levels, increasing by 4%.

Baseline 3

Prior to the application of the intervention at snack time to target vegetables, consumption of those foods at lunchtime was increased relative to Baselines 1 and 2, and, at 45% was 28% greater than during Baseline 1. Non-target fruit consumption remained at the increased levels recorded at Baseline 2, at 25%.

Intervention 2

When the intervention was applied to target vegetables, a substantial increase in consumption of both food categories was recorded, target vegetables to 66%, an increase of 21% and non-target fruit to 54%, also an increase of 21% from Baseline 3. Similar trends were observed at snack time.

Intervention 2a

Vegetable consumption at lunchtime increased further to 72% when the intervention was applied intermittently to target vegetables at snack time so that it was 27% greater than during Baseline 3. Non-target fruit consumption was further increased to 56%, 23% above levels recorded at Baseline 3.

Baseline 4

The children were eating 69% target vegetables, 24% more than during Baseline 3 and 42% non-target fruit, 6% more than during Baseline 3.

Follow-up 1

Target vegetables were consumed at 74%, the highest level recorded up to this phase and 29% more than during Baseline 3.

Follow-up 2

Nine months after the end of Baseline 4, target vegetable consumption was the highest recorded in this context at 87%, 42% more than during Baseline 3. Unlike trends observed at snack time, non-target fruit consumption at lunchtime had declined so that consumption was similar to that during Baseline 3.

The reader should remain aware that only 2 of the original 3 participants were present during Follow-up 2.

Within-category consumption

Table 4.7 shows phase by phase consumption of each food pair at snack time and lunchtime across the course of the study

Of the vegetables, the pattern of consumption of both pairs matched that observed in the snack context, with consumption becoming equal at Baseline 3. Unlike trends observed at snack time, when Intervention 2 was applied, only consumption of Pair 4 increased.

Similarly, consumption of both non-target fruit pairs at snack time was similar to that observed at lunchtime up until Baseline 3. From Intervention 2 onwards, however, increases were recorded in consumption of Pair 4 only (both pairs were affected in the snack context). At the end of the study, consumption of Pair 1 fruit had reverted to

Baseline 1 levels of zero, whilst consumption of Pair 4 was 48% greater than during Baseline 1.

Discussion: 4 day attendees

Snack time: Figure 4.3 shows that at the start of the study, consumption in all food categories was less than 33%. When the intervention was applied to target fruit, consumption of those foods immediately increased. The increase, of 27% (see Figure 4.3.1) was the largest single increase in consumption of target fruit in this context, an indication that the intervention was the cause of the observed change. At the same time, a concurrent increase of 20% in non-target vegetable consumption was recorded.

When the intervention was removed from target fruit, consumption of those foods at Baselines 2 and 3 remained elevated relative to Baseline 1 and there was a further increase in target fruit consumption during Intervention 2a when rewards were only available intermittently for target vegetable consumption. Baseline 4 consumption of target fruit was recorded at 42% more than during Baseline 1 and at Follow-up 2 was recorded at 42% more than during Baseline 1. (See Figure 4.3.1).

In comparison to consumption patterns observed with target fruit, consumption of the accompanying non-target vegetables was unstable across the phases.

With regard to target vegetable consumption, the greatest increase was recorded during Intervention 2 when 50% more vegetables were consumed than during Baseline 3. This was the largest single increase in target vegetable consumption in this context and indicates that the intervention was responsible for the observed change.

Consumption of target vegetables remained elevated for the duration of the study so that Baseline 3 levels were consistently exceeded by at least 36%.

Thus, changes in consumption of both target vegetables and target fruit recorded when the intervention was introduced were maintained in the absence of the intervention at subsequent baseline phases and after periods of several months during Follow-up phases (9 months after the intervention on target vegetables and 15 months after the intervention was applied to target fruit). Both Interventions 1 and 2 were equally effective with the food pairs within each target category so that consumption of each pair was similar during the interventions regardless of any differences in consumption during Baseline phases.

Lunchtime: Trends observed in the lunchtime setting with respect to target foods corresponded to those in the snack setting. When the intervention was applied to target fruit in the snack setting, consumption of target fruit at lunchtime also increased. The increase was somewhat smaller than that recorded in the earlier setting, 19% compared with 27% recorded at snack time, and consumption of Pair 2 was less affected (6%) than was consumption of Pair 3 (23%).

As had been recorded at snack time, a second increase in target fruit consumption at lunchtime was observed during Intervention 2a, when target vegetable consumption was rewarded on an intermittent basis.

Consumption of target vegetables at lunchtime increased when the intervention was applied to those foods at snack time. The effects on lunchtime consumption of target vegetables were also not as great as those observed at snack time, but 21% (compared to 50% at snack time) was the largest single increase in target vegetable consumption recorded in this context. The smaller increase was due to an increase only in Pair 1 vegetables, rather than Pair 1 and Pair 4 at snack time. There was a further increase in consumption of target vegetables 2a when the intervention was applied to target vegetable at snack time intermittently.

Increases in consumption at lunchtime were also maintained in the absence of any intervention. Target fruit consumption at Baseline 4 was 47% greater than during Baseline 1 and target vegetable consumption was 24% greater at Baseline 4 than during Baseline 3. Longer-term changes in consumption were in evidence at lunchtime; 9 months after the end of the intervention on target vegetables, consumption of those foods was at the highest recorded in this context, as was consumption of target fruit recorded at 65% 15 months after the intervention on those foods.

General issues: As to the question of within-category generalisation with fruit, target fruit consumption at snack time increased by 27% when the intervention was applied to those foods. At Baseline 2, consumption of non-target foods increased by 15%, somewhere between the size of the increase in target fruit consumption at snack time and target fruit consumption at lunchtime during Intervention 1. As was the case with the 5 day attendees, these data do not settle the issue of within-category generalisation with fruit.

Following the intervention on target vegetables during which consumption of those foods increased by 50%, there was no subsequent increase in non-target vegetable consumption, rather, a decrease was observed at Intervention 2a. A similar trend was recorded in the lunchtime context. Thus, there was no evidence of generalisation to non-targetted items in the vegetable category. Data from Intervention 1 might also suggest a lack of discrimination between fruit and vegetables, given the concurrent increase in non-target vegetable consumption at snack time along with no increase noted at lunchtime.

With regard to non-target fruit consumption, at both snack and lunchtimes a marked increase in consumption was noted at Intervention 2a, matching the pattern observed in the data of the 5 day attendees, further evidence perhaps of a verbal over-generalisation effect with the 4 day attendees or the formation of a category of 'Jarvis and Jess' foods.

A further point of interest in the data of the 4 day attendees is the additional increase in consumption of target fruit at Intervention 2a in both the snack and lunchtime contexts along with a reduction in consumption of non-target vegetables. Moreover, at Baseline 4 in the snack context, a marked increase in consumption of non-target vegetables was noted; an increase that was not apparent at lunchtime.

As with consumption patterns of the 5 day attendees, in general, changes at snack time translated into changes at lunchtime with the exception of non-target fruit consumption at Baseline 4 and Follow-up 2 and non-target vegetables at Baseline 4.

Results: 3 Day Attendees

Figure 4.4 illustrates consumption of fruit and vegetables across the course of the study for the three children who attended the playroom three days per week and who attended through all phases of the experiment. The upper left quadrant shows consumption of target fruit and accompanying non-target vegetables at snack time and the lower left quadrant shows consumption of those same foods at lunchtime. The upper right quadrant shows consumption of the target vegetables and accompanying non-target fruit at snack time and the lower right quadrant shows consumption of those same foods at lunchtime. The broken lines within each column show consumption of each of the food pairs within the category.

Figure 4.4.1 illustrates consumption of fruit and vegetables across the course of the study *relative to Baseline 1*. The upper left quadrant shows consumption of target fruit and accompanying non-target vegetables at snack time and the lower left quadrant shows consumption of those same foods at lunchtime. The upper right quadrant shows consumption of the target vegetables and accompanying non-target fruit at snack time and the lower right quadrant shows consumption of those same foods at lunchtime. The broken lines within each column show consumption of each of the food pairs within the category. Figure 4.4.2 shows consumption of the one attendee who remained for Follow-Up 2.

Table 4.8 shows the average consumption of each food during each phase at snack time and lunchtime.

Table 4.8a shows the average consumption of each food pair during each phase at snack time and lunchtime.

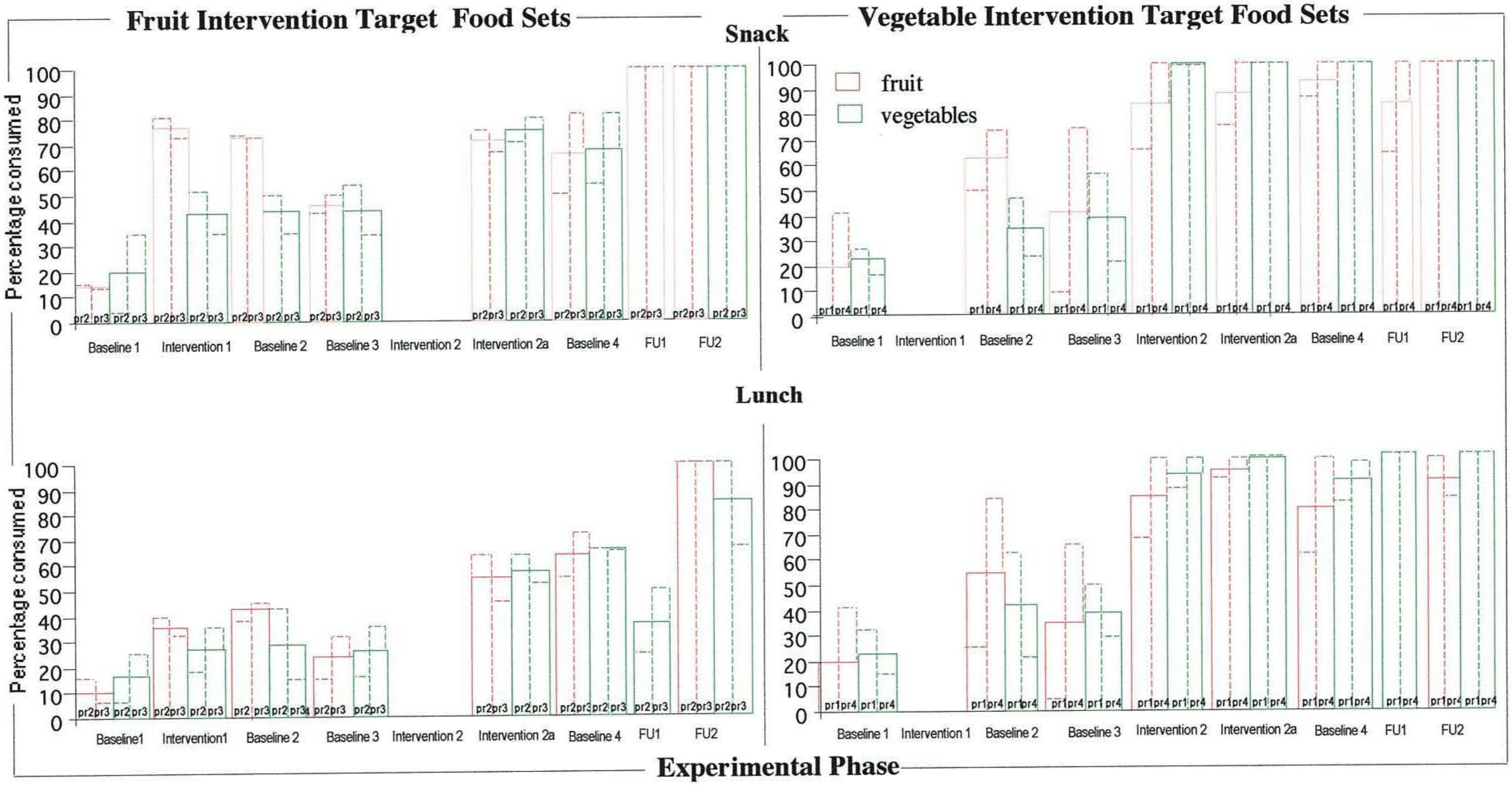


Figure 4.4. Mean consumption for 3 day attendees of target fruit, target vegetables, non-target fruit and non-target vegetables in the experimental (snack) context) and in the generalization (lunch) context across all phases of Experiment 4 including Follow-Up 1 (FU1) and Follow-Up 2 (FU2). Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit and vegetables for Food Sets 2 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 1 and 4 (upper and lower right panels).

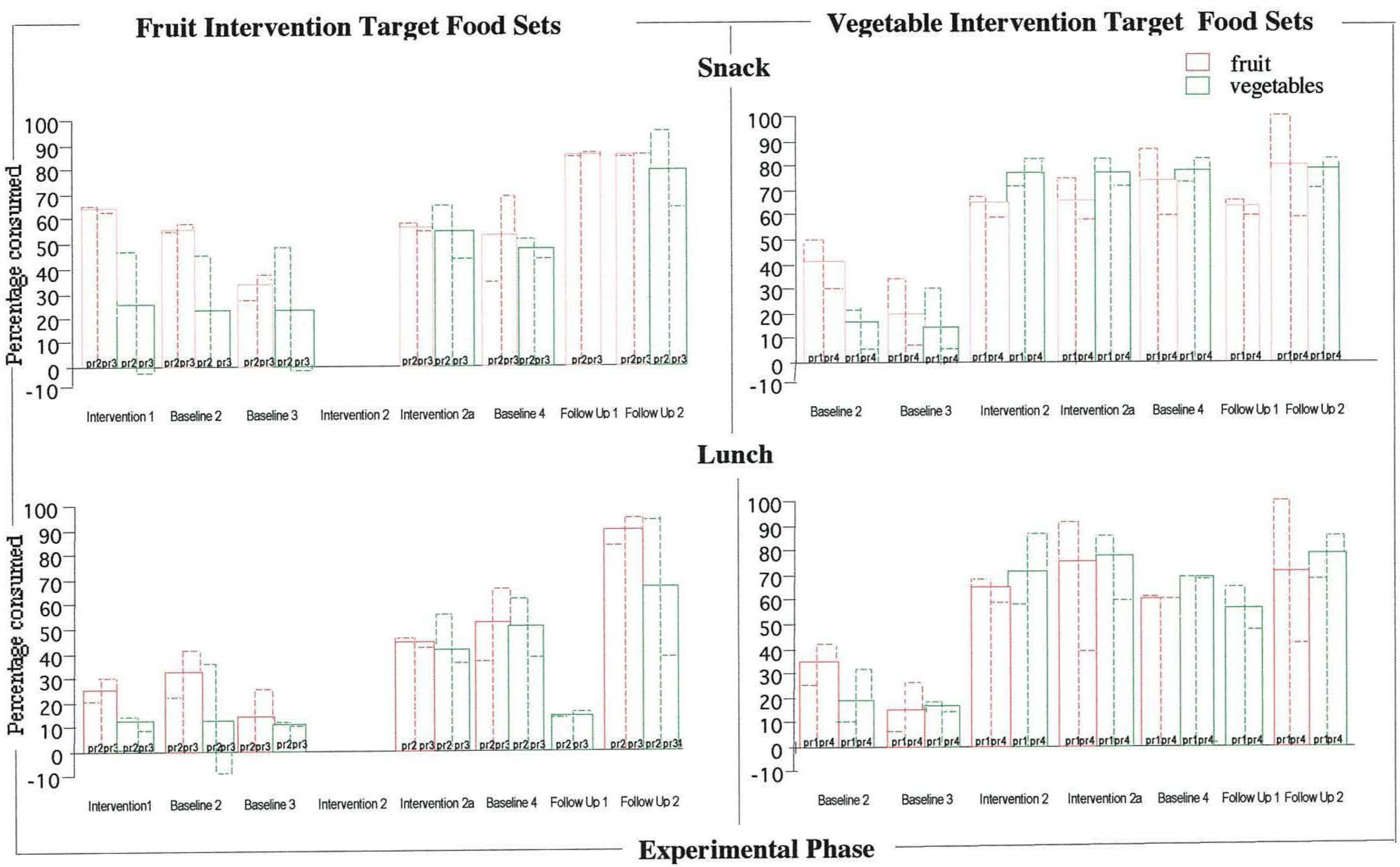


Figure 4.4.1. Mean consumption for 3 day attendees of target fruit, target vegetables, non-target fruit and non-target vegetables in the experimental (snack) context) and in the generalization (lunch) context across all phases of Experiment 4 *relative to Baseline 1.* Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit and vegetables for Food Sets 2 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 1 and 4 (upper and lower right panels).

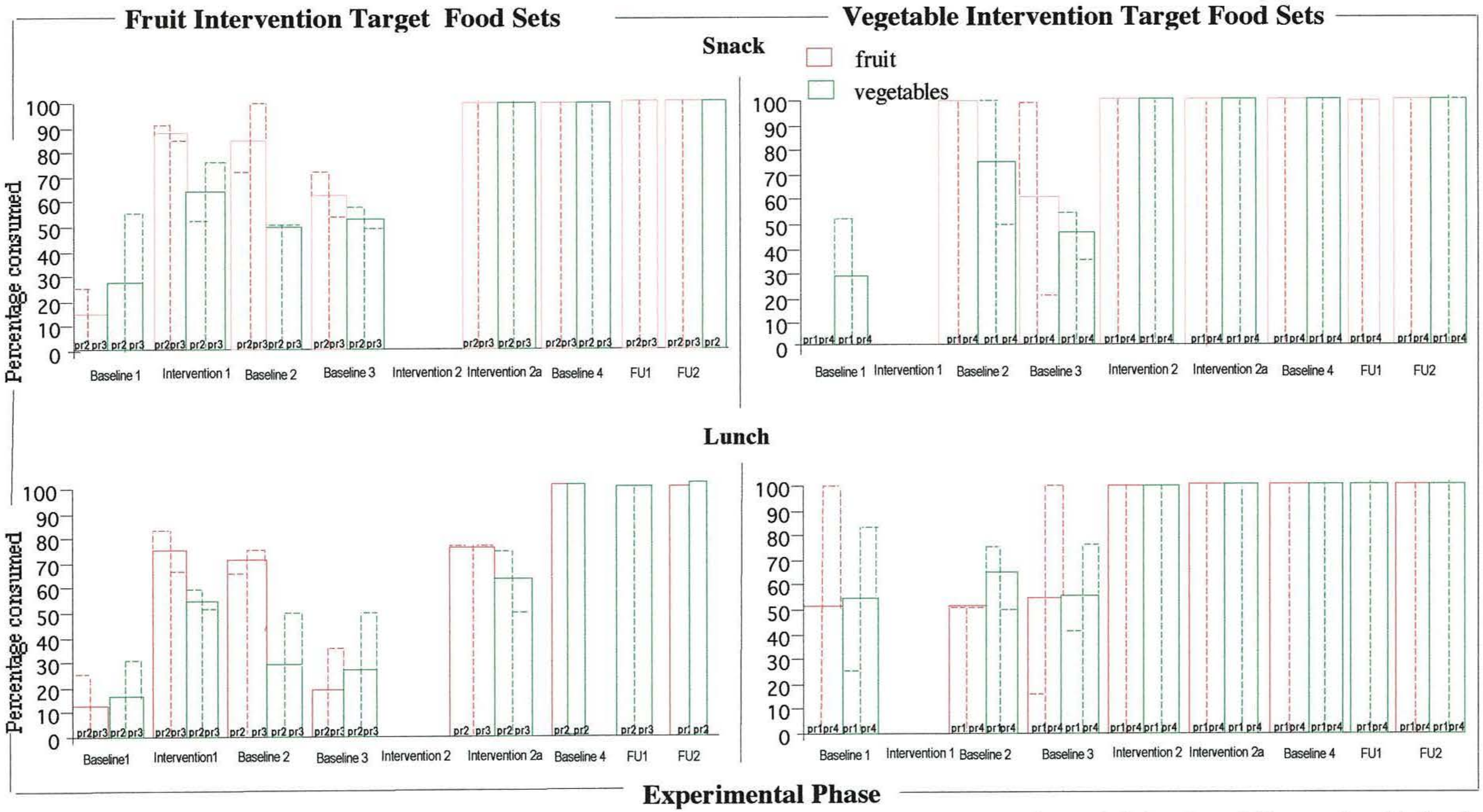


Figure 4.4.2. Mean consumption for the subgroup of 3 day attendees *who remained to participate in Follow-Up 2* of target fruit, target vegetables, non-target fruit and non-target vegetables in the experimental (snack) context) and in the generalization (lunch) context across all phases of Experiment 4 including Follow-Up 1 (FU1) and Follow-Up 2 (FU2). Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit and vegetables for Food Sets 2 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 1 and 4 (upper and lower right panels).

Table 4.8. 3 day attendees mean consumption of each food across the course of Experiment 4, Baseline 1 (BL1), Intervention 1 (I1), Baseline 2 (BL2), Baseline 3 (BL3), Intervention 2 (I2), Intervention 2a (I2a), Baseline 4 (BL4), Follow-up 1 (FU1) and Follow-up 2 (FU2). Snack time data (S) are shown in black type, lunchtime data (L) in blue type.
* indicates participants were not in attendance when food was presented.

Food Set	Food Pair	S BL1	L	S I 1	L	S BL2	L	S BL3	L	S I 2	L	S I 2a	L	S BL4	L	S FU1	L	S FU2	L
1	Dragon Fruit	0	0			50	50	2	0	69	83	91	100	77	55	100		100	100
	Mango	0	0			50	0	13	8	67	54	67	83	100	67	33		100	100
	Green Beans	22	27			41	50	52	33	100	89	100	100	100	100		100	100	100
	Baby Corn	33	36			55	75	61	67	100	89	100	100	100	100		100	100	100
2	Kiwi	16	16	100	55	100	67	54	33			83	83	67	75	100		100	100
	Papaya	16	16	63	25	47	10	33	0			67	41	33	33	100		100	100
	Carrot	2	10	52	10	41	22	41	0			67	67	75	67		50	100	100
	Courgette	5	0	52	27	58	63	64	0			75	58	33	67		0	100	100
3	Star Fruit	22	10	89	61	100	77	72	41			87	67	97	71	100		100	100
	Sharon Fruit	2	0	58	10	44	16	27	22			50	27	67	71	100		100	100
	Cucumber	67	50	67	67	75	30	67	67			97	94	100	100		100	100	100
	Yam	8	4	16	5	0	0	2	5			64	10	67	33		0	100	33
4	Water Melon	33	55			67	67	67	67	100	100	100	100	100	100	100		100	100
	Prune	50	67			80	100	83	67	100	100	100	100	100	100	100		100	67
	Swede	2	16			0	10	16	0	100	77	100	100	100	67		*	100	100
	Mange- Tout	33	10			47	33	27	58	100	89	100	100	100	100		*	100	100

Table 4.8a. 3 day attendees mean consumption of each food pair across the course of Experiment 4 showing target fruit (TF), high exposure vegetable (HV), target vegetable (TV) and high exposure fruit (HF) consumption. The upper section of Table 4.8a shows snack time consumption and the lower (blue type) section shows lunchtime consumption across all phases of the experiment, Baseline 1 (BL1), Intervention 1 (I1), Baseline 2 (BL2), Baseline 3 (BL3), Intervention 2 (I2), Intervention 2a (I2a), Baseline 4 (BL4), Follow-up 1 (FU1) and Follow-up 2 (FU2). Mean total category consumption is shown in bold.

Snack	**TF**	Pair 2	Pair 3	**HV**	Pair 2	Pair 3	**TV**	Pair 1	Pair 4	**HF**	Pair 1	Pair 4
BL1	**14**	16	12	**20**	3	37	**22**	27	17	**20**	0	41
I1	**77**	81	73	**43**	52	35						
BL2	**72**	73	72	**43**	50	37	**36**	48	24	**61**	50	73
BL3	**47**	44	50	**43**	52	35	**39**	57	21	**41**	7	75
I2							**100**	100	100	**84**	68	100
I2a	**71**	75	68	**75**	71	80	**100**	100	100	**88**	77	100
BL4	**66**	50	82	**68**	54	82	**100**	100	100	**94**	88	100
FU1	**100**	100	100							**83**	66	100
FU2	**100**	100	100	**100**	100	100	**100**	100	100	**100**	100	100
Lunch												
BL1	**10**	16	5	**16**	5	27	**22**	31	13	**20**	0	41
I1	**37**	40	35	**27**	18	36						
BL2	**42**	38	46	**28**	42	15	**41**	62	21	**54**	25	83
BL3	**23**	16	31	**26**	16	36	**39**	50	29	**35**	4	67
I2							**94**	89	100	**84**	68	100
I2a	**54**	62	47	**57**	62	52	**100**	100	100	**95**	91	100
BL4	**62**	54	71	**66**	67	66	**91**	100	83	**80**	61	100
FU1				**37**	25	50	**100**	100				
FU2	**100**	100	100	**83**	100	66	**100**	100	100	**91**	100	83

Consumption at Snack time: Target Fruit and Non-Target Vegetables

Baseline 1

The children's consumption of target fruit and accompanying non-target vegetables was poor with neither above 20%.

Intervention 1

When the intervention was applied to target fruit, there was a substantial increase in consumption of those foods, to 77%, a rise of 63%. At the same time, consumption of the accompanying non-target vegetables also increased, rising by 23% to 43%.

Baseline 2

At Baseline 2, consumption of both fruit and vegetables remained largely unchanged from Intervention1 at 72% and 43% respectively.

Baseline 3

Prior to the application of the intervention to target vegetables, target fruit consumption was reduced relative to the previous two phases, but at 47% remained greater than Baseline 1 by 33%. Non-target vegetables remained stable at 43%, 23% greater than during Baseline 1.

Intervention 2a

When the intervention was applied intermittently to target vegetables, target fruit consumption increased again to 71%, a similar level to that recorded during Intervention 1, and 57% greater than during Baseline 1. At the same time, non-target vegetable consumption had increased substantially to reach 75%, 55% more than during Baseline 1.

Baseline 4

The increases in fruit and vegetable consumption were largely maintained in the absence of any intervention so that the children were eating 52% more fruit (66%) than they had during Baseline 1 and 48% more vegetables (68%) than during Baseline 1.

Follow-ups 1 and 2

During both Follow-up phases, one immediately following Baseline 4, the other nine months after Baseline 4, consumption of fruit and vegetables had increased to maximum levels so that the children were eating 86% more fruit than they had during Baseline 1 and 80% more vegetables than they had during Baseline 1.

It should be noted that at Follow-up 2, only one participant from this group was available to take part. See Figure 4.4.2.

Within-category consumption

Table 4.8 illustrates the average consumption of individual foods across the course of the study.

Of the target fruit pairs, the children ate very little of either Pair 2 or Pair 3 at the start of the study. When the intervention was applied to target fruit, consumption of both increased substantially and the increase was maintained into Baseline 2. A reduction in consumption relative to the previous two phases was recorded during Baseline 3, but consumption of both pairs remained above Baseline 1 levels. Consumption of Pair 3 increased throughout the remainder of the study, and was recorded at maximum during both Follow-up phases. Consumption of Pair 2 also increased across the course of the study, but reduced consumption was recorded during Baseline 4. Throughout both Follow-up phases, maximum consumption of both fruit pairs was recorded.

Of the accompanying non-target vegetable pairs, the children showed a preference for Pair 3 over Pair 2 at Baseline 1. When Intervention 1 was applied to target fruit, only consumption of Pair 2 vegetables increased and the increase was maintained across the subsequent baseline phases. Consumption of both pairs increased at Intervention 2a, although the increase was greater for Pair 3 than for Pair 2 and, in the absence of any intervention at Baseline 4, only the increase in consumption of Pair 3 vegetables was maintained. At Follow-up 2, both vegetable pairs were consumed at maximum levels.

Consumption at Snack time: Target Vegetables and Non-Target Fruit

Baseline 1

The children's consumption of target vegetables and non-target fruit was low at the start of the study at 22% and 20% respectively.

Baseline 2

Following the application of the intervention to target fruit, non-target fruit consumption rose to 61%, 41% greater than during Baseline 1. At the same time, target vegetable consumption increased to 36%, 14% greater than during Baseline 1.

Baseline 3

Prior to the application of the intervention to target vegetables, levels of vegetable consumption were similar to those recorded during Baseline 2, whilst consumption of non-target fruit was reduced to 41%, 20% less than during the previous phase, but 21% more than during Baseline 1.

Intervention 2

When the intervention was applied to target vegetables, the children ate maximum quantities of those foods, 61% more than they had during Baseline 3. At the same time, consumption of non-target fruit increased further to 84%, 43% more than during Baseline 3.

Baseline 4

High levels of fruit and vegetable consumption were maintained in the absence of any intervention, vegetables were eaten at maximum levels, and fruit consumption was recorded at 94%. At Baseline 4, the children were eating 61% more vegetables than during Baseline 3, and 74% more fruit than during Baseline 1.

Follow-up 1

Non-target fruit continued to be consumed at elevated levels of 83%, 42% more than during Baseline 3.

Follow-up 2

At Follow-up 2, foods in both categories were eaten maximally, so that consumption of target vegetables remained 61% greater than during Baseline 3 and consumption of non-target fruit was 59% greater than during Baseline 3.

The reader should bear in mind that only one of the original 3 participants was present for Follow-up 2; see Figure 4.4.2.

Within-category consumption

Table 4.8 illustrates average consumption of each food pair across the course of the study.

Of the target vegetables, the children showed a preference for Pair 2 over Pair 3 during Baselines 1, 2 and 3, with consumption of Pair 2 increasing across those phases and consumption of Pair 3 remaining largely unchanged. When the intervention was applied to target vegetables, consumption of both increased to maximum levels and remained there for the duration of the study.

Of the accompanying non-target fruit, at the beginning of the study, the children ate only Pair 4 fruit. Following the introduction of the intervention to target fruit, they began to consume Pair 1 fruit and, at the same time, increased consumption of Pair 4. At Intervention 2, consumption of both pairs was further increased, with Pair 1 at 68% and Pair 4 consumed at maximum levels. These elevated levels were maintained for the duration of the study and, at Follow-up 2, both pairs were consumed maximally.

Consumption at Lunchtime: Target Fruit and Non-Target vegetables

Trends in target fruit and accompanying non-target vegetable consumption were similar to those observed in the snack time context, but the degree of change was less pronounced until Baseline 4.

Baseline 1

At the start of the study, the children's consumption of both fruit and vegetables was low at less than 20%

Intervention 1

When the intervention was applied to target fruit at snack time, consumption of target fruit at lunchtime increased by 27% to 37%. At the same time, non-target vegetable consumption increased by 11% to 27%.

Baseline 2

With the removal of the intervention at snack time, target fruit consumption at lunchtime was increased relative to Intervention1 and was 32% above that recorded during Baseline 1. Non-target vegetable consumption remained at Intervention 1 levels of 28%.

Baseline 3

During Baseline 3 (as had been observed in the snack context), a reduction in target fruit consumption at lunchtime was recorded. At 23%, consumption was 12%

greater than during Baseline 1. At the same time, non-target vegetable consumption remained stable at 26%.

Intervention 2a

As was the case at snack time, when the intervention was applied intermittently to target vegetables at snack time, consumption of target fruit increased by 44% to reach 54%. This increase was greater than that recorded during Interventon1. At the same time, consumption of non-target vegetables rose by 41% to 57%.

Baseline 4

In the absence of any intervention, further increases in both fruit and vegetable consumption was recorded so that 52% more fruit and 50% more vegetables were consumed than during Baseline 1.

Follow-up 1

Consumption of non-target vegetables was reduced to 37%, less that during Baseline 4, but remained greater than Baseline 1 by 21%.

Follow-up 2

As was the case at snack time, target fruit consumption was recorded at maximum levels so that it was 42% greater than during Baseline 1. Also as was true at snack time, non-target vegetable consumption was the highest recorded in this context at 83%, 73% greater than during Baseline 1.

Again, it should be remembered that only one of the original three participants was present for Follow-up 2; see Figure 4.4.2.

Within-category consumption

Table 4.8 illustrates average consumption of each food pair across the course of the study.

Consumption patterns of target fruit pairs at lunchtime was similar to those observed at snack time, although increases at Intervention 1 were somewhat smaller at lunchtime than at snack. During Intervention 2a, consumption at lunchtime of both pairs increased markedly and levels of consumption were more comparable with those recorded at snack time. Consumption n both contexts was recorded at maximum during Follow-up 2.

Similar to the fruit pairs, changes in consumption of individual vegetable pairs were not consonant with those recorded at snack time until Intervention 2a was applied. Prior to Intervention 2a, consumption of non-target vegetables at lunchtime was unstable, with preference switching between Pair 2 and Pair 3 throughout the baseline phases, whereas, at snack time, changes in consumption had been confined to Pair 2 only.

Consumption at Lunchtime: Target Vegetables and Non-Target Fruit

Trends at lunchtime closely matched those observed in the snack context.

Baseline 1

At the start of the study, the children's consumption of fruit and vegetables was low at 20% and 22% respectively.

Baseline 2

Following the application of the intervention to target fruit at snack time, consumption of non-target fruit increased by 34% to 54%. At the same time, target vegetable consumption increased by 19% to 41%.

Baseline 3

Prior to the intervention being applied to target vegetables at snack time, consumption of target vegetables was stable at 39%. Non-target fruit consumption was reduced by 19% relative to Intervention 1; a similar trend was observed in the snack setting.

Intervention 2

When Intervention 2 was applied to target vegetables at snack time, consumption of those foods at lunchtime increased to 94% and remained at that level for the duration of the study. At the same time, non-target fruit consumption increased to 84%, 30% more than following Intervention 1 and 64% more than during Baseline 1.

Intervention 2a

The elevated levels of consumption of vegetables and fruit continued into Intervention 2a when consumption of target vegetables at snack time was rewarded on an intermittent basis. Fruit consumption was recorded at 95% and vegetable consumption at 100%.

Baseline 4

In the absence of any intervention, the children consumed 94% of target vegetables, 53% more than during Baseline 3, and 80% non-target fruit, 60% more than during Baseline 1.

Follow-up 1

Only Pair 1 vegetables were presented during this phase, due to differential attendance of the participants. This pair was eaten at maximum.

Follow-up 2

Maximum vegetable consumption was recorded, 61% more than during Baseline 3. Consumption of fruit was recorded at 91%, 56% more than during Baseline 3.

The reader should remain aware that only one of the original 3 participants was present for Follow-up 2.

Within-category consumption

Table 4.8 illustrates average consumption of each food pair across the course of the study.

The children's eating patterns at lunchtime with regard to individual vegetable pairs was very similar to that recorded in the snack context. Up to Baseline 3, increases in consumption were largely confined to Pair 2 vegetables. Following the introduction of the intervention at snack time both pairs were eaten maximally (with the exception of Baseline 4) and this continued throughout the remainder of the study.

Snack and lunchtime consumption of non-target fruit was also similar. At the start of the study, only Pair 4 fruit was eaten. There was an increase in consumption of both fruit pairs following the intervention on target fruit at snack time but, unlike at snack time, the increase in consumption was only maintained into Baseline 3 for Pair 4. Following Intervention 2 targetting vegetables at snack time, consumption of both fruit pairs was further increased and at Intervention 2a, Pair 4 was consumed maximally and Pair 1 at close to maximum. At Follow-up 2, consumption of Pair 4 fruit remained at maximum, whilst a reduction in Pair 1 was recorded.

Discussion: 3 day Attendees

Snack time: Figure 4.4 illustrates that Baseline 1 consumption of target fruit for the 3 day attendees was low, at 14%. When the intervention was applied to target fruit, consumption of those foods increased to 77%. The increase of 63% was the largest single rise in consumption of target fruit, indicating that the intervention was responsible for the observed change. At the same time, consumption of the accompanying non-target vegetables increased by 23%.

Consumption of target fruit remained elevated when the intervention was withdrawn at Baseline 2, but declined at Baseline 3. Even so, consumption of target fruit remained at above Baseline 1 levels. Increased levels of target fruit consumption were recorded when Intervention 2a was in operation and maximum consumption was recorded at both Follow-up 1 and Follow-up 2.

Target vegetable consumption at Baseline 3 was recorded at 39% and this increased to 100% when the intervention was applied to those foods. The 61% increase indicates that the intervention was responsible for the change in consumption.

Consumption of target vegetables remained at maximum throughout the course of the study and into Follow-ups 1 and 2.

The effects of the interventions were equal between food pairs in each of the targetted categories.

Lunchtime: Similar patterns of consumption were noted at lunchtime. When the intervention was applied at snack time to target fruit, an increase in consumption of those foods at lunchtime was recorded. The increase of 27% was smaller than that at snack time and continued into Baseline 2 when the intervention at snack time was withdrawn. As was the case in the snack context, Baseline 3 consumption of target foods was reduced, but remained greater than during Baseline 1. Consumption of target fruit increased across the remainder of the study, and at Follow-up 2 was recorded at maximum levels.

When the intervention was applied to target vegetables, consumption of those foods rose to 94% from 39%. This 55% increase was the largest single increase in consumption of food recorded in this context. Following Intervention 2, target vegetable consumption increased to maximum levels and remained there throughout each phase.

At lunchtime, the effects of the Intervention were similar across food pairs within each category, but the magnitude of the effect on fruit pairs was not as great as that recorded in the snack context.

As with the other groups of attendees, data for the 3 day attendees show that the intervention was effective at the time that it was in operation, when it was withdrawn during Baseline phases and at Follow-ups carried out 9 months after the intervention targetting fruit and 15 months after the intervention targetting vegetables. This was the case both at snack time and lunchtime.

General issues: To address the issue of within-category generalisation, it is clear that there was a large effect on target fruit during Intervention 1. At Baseline 2, a marked increase in consumption of non-target fruit was recorded, 41% more than during Baseline 1. Approximately half of this increase was maintained into Baseline 3. Similarly, the data at Intervention 2 show a marked increase in target vegetable consumption which was followed at Intervention 2a by a 32% increase in non-target vegetable consumption, much of which was maintained into Baseline 4. These effects were also observed at lunchtime. Were the 3 day attendees the only attendance group to demonstrate generalisation of consumption to non-targetted food items within the same category? Should the concomitant rise in non-target vegetable consumption be explained in terms of over-generalisation, within-category generalisation or in terms of a category of 'Jarvis and Jess' foods?

It is also clear from these data, that like the consumption patterns of other groups of attendees, changes in consumption at snack time had implications for consumption at lunchtime.

2 Day Attendees

Figure 4.5 illustrates consumption of fruit and vegetables across the course of the study for the 6 children who attended the playroom two days per week and participated in all phases of the experiment. The upper left quadrant shows consumption of target fruit and accompanying non-target vegetables at snack time and the lower left quadrant shows consumption of those same foods at lunchtime. The upper right quadrant shows consumption of the target vegetables and accompanying non-target fruit at snack time and the lower right quadrant shows consumption of those same foods at lunchtime. The broken lines within each column show consumption of each of the food pairs within the category.

Figure 4.5.1 illustrates consumption of fruit and vegetables across the course of the study *relative to Baseline 1* for the same 6 children who attended the playroom 2 days per week. The upper left quadrant shows consumption of target fruit and accompanying non-target vegetables at snack time and the lower left quadrant shows consumption of those same foods at lunchtime. The upper right quadrant shows consumption of the target vegetables and accompanying non-target fruit at snack time and the lower right quadrant shows consumption of those same foods at lunchtime. The broken lines within each column show consumption of each of the food pairs within the category.

Table 4.9 shows the average consumption of each food in each phase at snack time and lunchtime.

Table 4.9a shows the average consumption of each food pair in each phase at snack time and lunchtime.

Consumption at Snack Time: Target Fruit and Non-Target Vegetables

Baseline 1

The children's consumption of fruit and vegetables at the start of the study was low at 31% and 25% respectively.

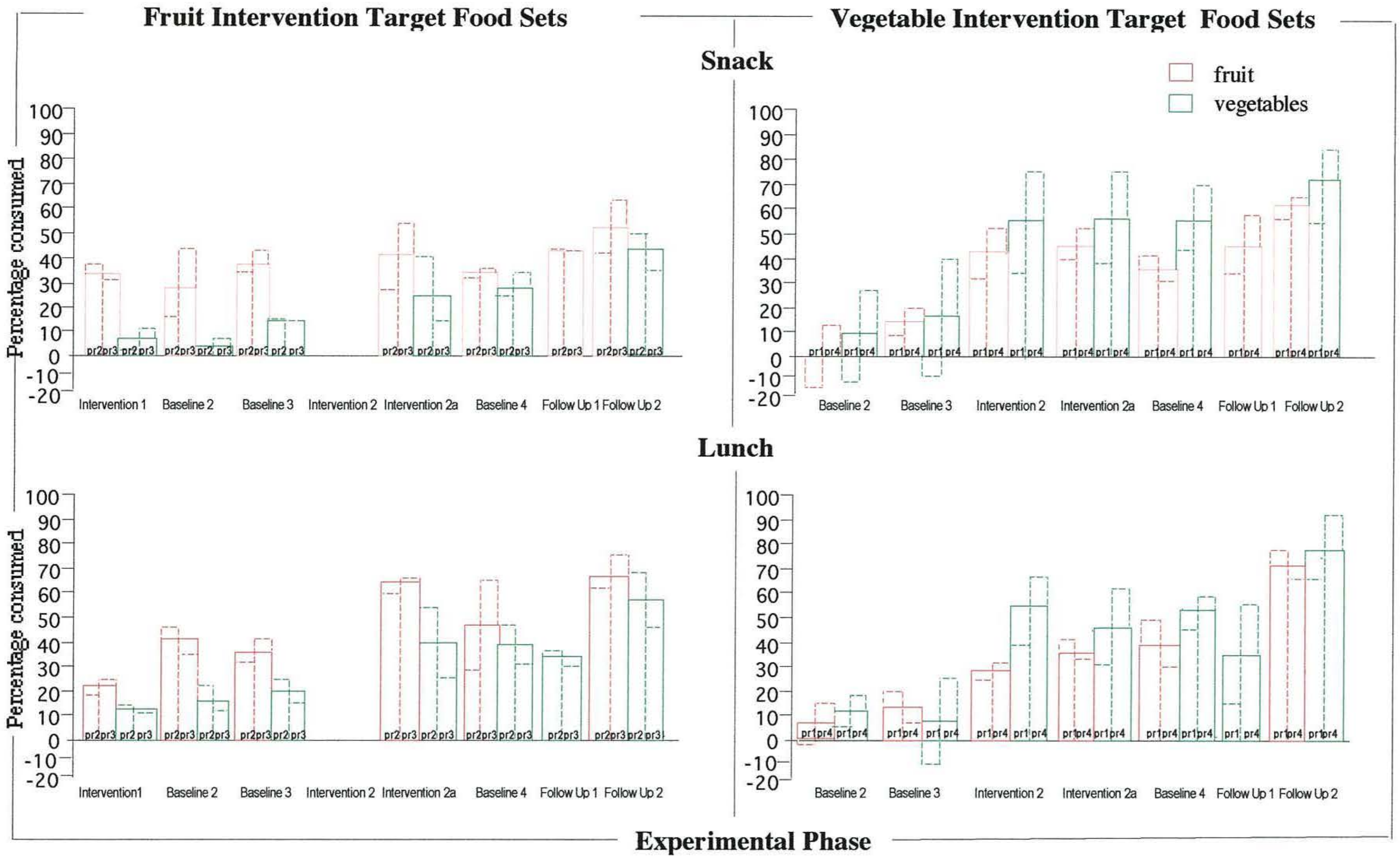


Figure 4.5.1. Mean consumption for 2 day attendees of target fruit, target vegetables, non-target fruit and non-target vegetables in the experimental (snack) context) and in the generalization (lunch) context across all phases of Experiment 4 *relative to Baseline 1*. Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit and vegetables for Food Sets 2 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 1 and 4 (upper and lower right panels).

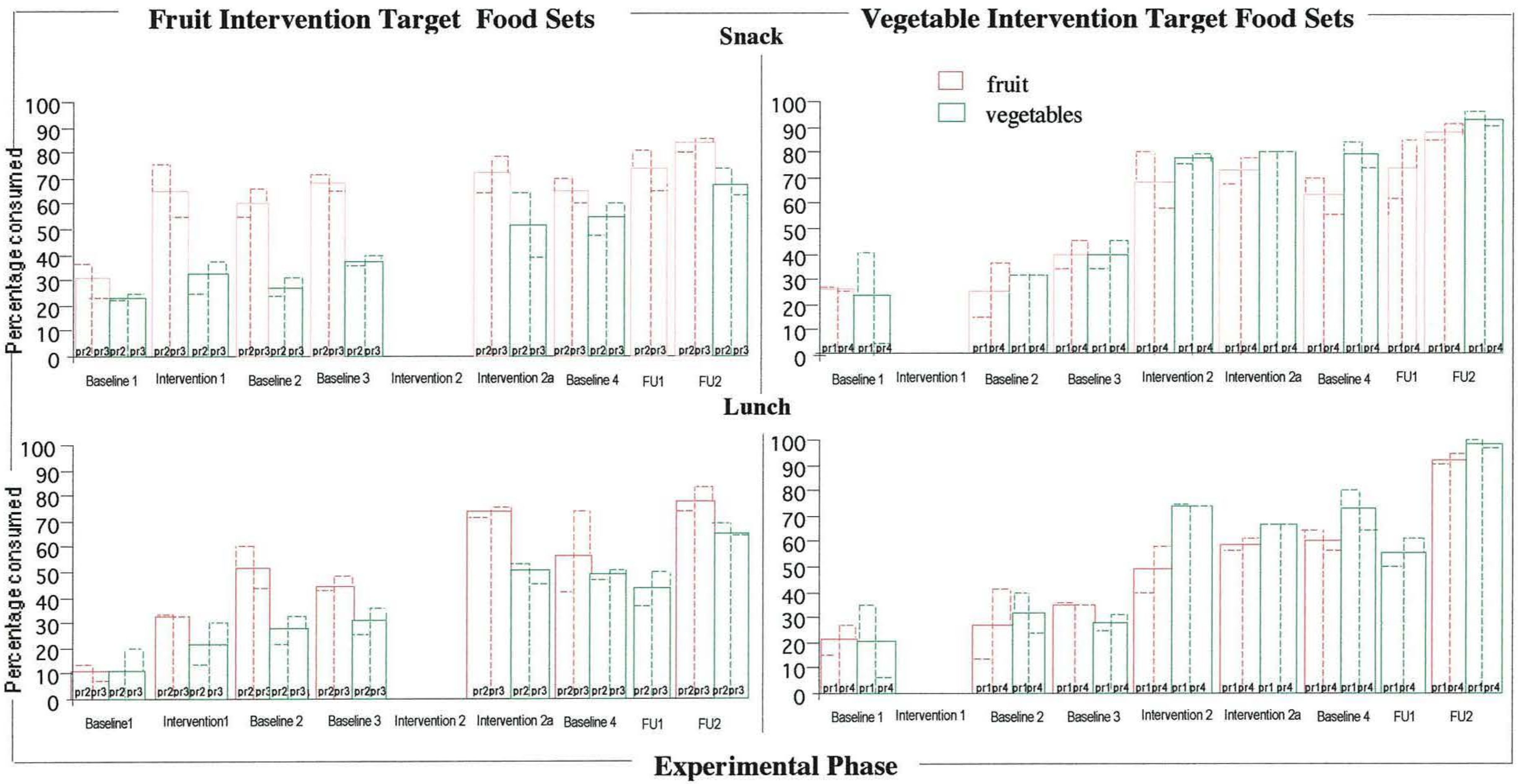


Figure 4.5. Mean consumption for 2 day attendees of target fruit, target vegetables, non-target fruit and non-target vegetables in the experimental (snack) context) and in the generalization (lunch) context across all phases of Experiment 4 including Follow-Up 1 (FU1) and Follow-Up 2 (FU2). Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit and vegetables for Food Sets 2 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 1 and 4 (upper and lower right panels).

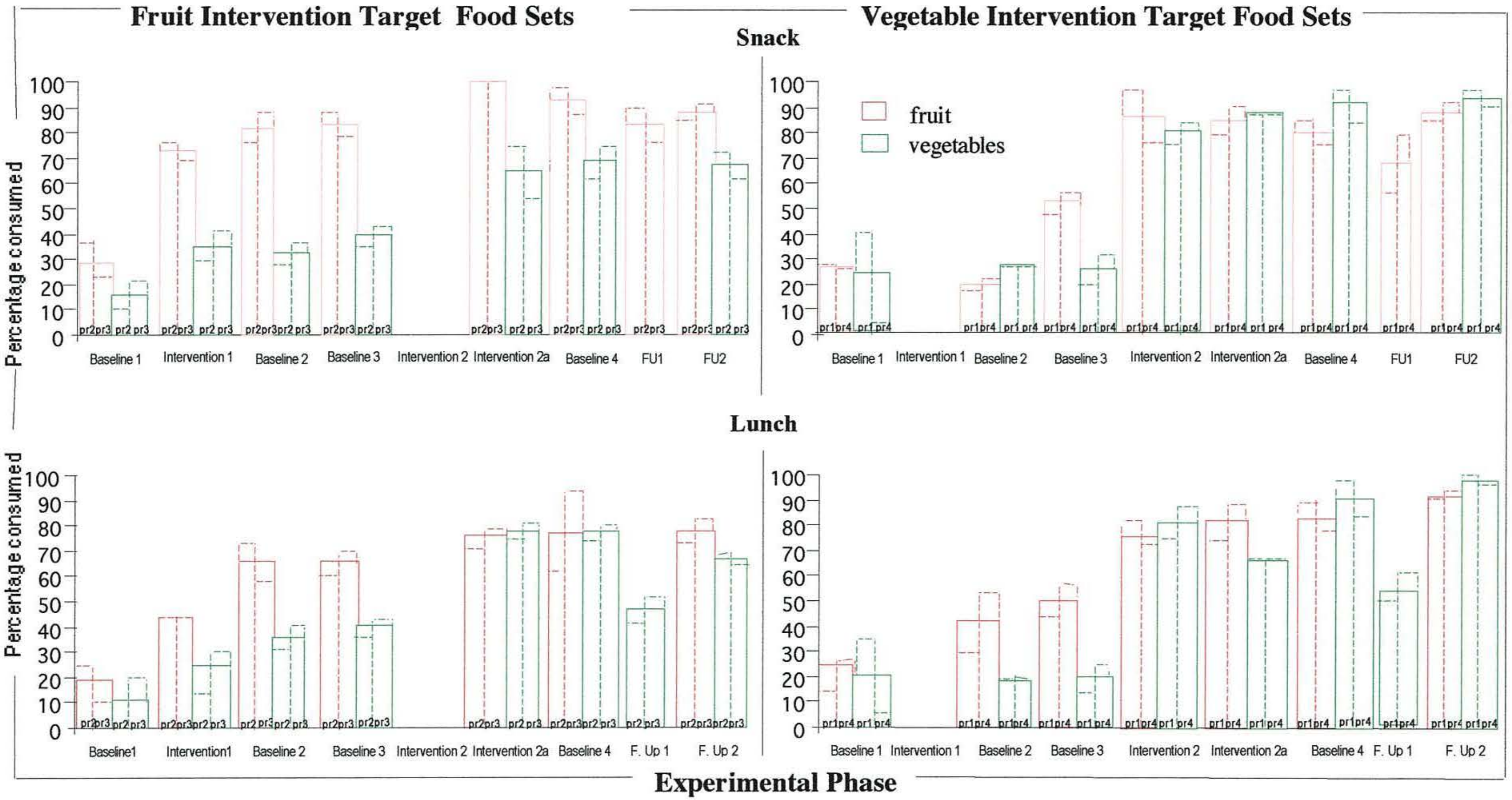


Figure 4.5.2. Mean consumption of the sub-group of 2 day attendees who remained at Follow-up 2. Shows consumption of target fruit, target vegetables, non-target fruit and non-target vegetables in the experimental (snack) context) and in the generalization (lunch) context across all phases of Experiment 4 including Follow-up 1 (FU1) and Follow-up 2 (FU2). Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit and vegetables for Food Sets 2 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 1 and 4 (upper and lower right panels).

Table 4.9. 2 day attendees mean consumption of each food across the course of Experiment 4, Baseline 1 (BL1), Intervention 1 (I1), Baseline 2 (BL2), Baseline 3 (BL3), Intervention 2 (I2), Intervention 2a (I2a), Baseline 4 (BL4), Follow-up 1 (FU1) and Follow-up 2 (FU2). Snack time data (S) are shown in black type, lunchtime data (L) in blue type.

Food Set	Food Pair	S BL1	L	S I 1	L	S BL2	L	S BL3	L	S I 2	L	S I 2a	L	S BL4	L	S FU1	L	S FU2	L
1	Dragon Fruit	31	0			0	0	28	27	76	38	62	62	66	52	58		81	91
	Mango	25	30			31	25	41	44	83	42	75	50	76	61	68		89	91
	Green Beans	46	20			40	40	61	27	74	66	80	66	80	75		25	95	100
	Baby Corn	37.5	50			25	40	28	22	77	77	80	66	88	86		75	100	100
2	Kiwi	57	5	83	43	64	83	87	57			58	81	78	38	93		97	89
	Papaya	19	20	70	21	44	27	57	31			75	61	61	48	70		64	60
	Carrot	37	0	37	18	33	28	25	31			64	55	62	57		45	87	79
	Courgette	9	0	12	9	13	14	40	20			64	50	34	40		29	60	60
3	Star Fruit	34	12	57	45	79	60	85	63			84	88	77	79	82		98	91
	Sharon Fruit	15	4	53	17	55	25	50	35			72	61	53	67	50		75	75
	Cucumber	50	41	64	55	56	65	65	60			63	62	70	66		75	79	79
	Yam	5	0	14	6	15	0	14	100			26	31	49	33		25	48	54
4	Water Melon	40	30			42	33	53	33	60	66	81	70	55	59	89		87	91
	Prune	12	25			34	50	40	33	56	51	75	50	60	55	91		96	98
	Swede	6.5	5			24	0	34	16	79	70	81	71	77	64		42	85	95
	Mange- Tout	25	5			30	46	38	45	81	74	78	62	71	64		80	95	100

Table 4.9a. 2 day attendees mean consumption of each food pair across the course of Experiment 4 showing target fruit (TF), high exposure vegetable (HV), target vegetable (TV) and high exposure fruit (HF) consumption. The upper section of Table 4.9a shows snack time consumption and the lower section shows lunchtime consumption (blue type) across all phases of the experiment, Baseline 1 (BL1), Intervention 1 (I1), Baseline 2 (BL2), Baseline 3 (BL3), Intervention 2 (I2), Intervention 2a (I2a), Baseline 4 (BL4), Follow-up 1 (FU1) and Follow-up 2 (FU2). Mean total category consumption is shown in bold.

Snack	**TF**	Pair 2	Pair 3	**HV**	Pair 2	Pair 3	**TV**	Pair 1	Pair 4	**HF**	Pair 1	Pair 4
BL1	**31**	38	24	**25**	23	27	**23**	41	4	**27**	28	26
I1	**65**	76	55	**32**	25	39						
BL2	**60**	54	67	**27**	23	32	**32**	32	32	**26**	16	38
BL3	**69**	72	67	**38**	37	40	**40**	35	46	**40**	35	46
I2							**78**	76	80	**69**	80	58
I2a	**72**	66	78	**52**	64	40	**80**	80	80	**73**	68	78
BL4	**65**	70	60	**54**	48	60	**79**	84	74	**63**	70	57
FU1	**73**	81	66							**73**	61	85
FU2	**83**	80	86	**68**	73	63	**94**	97	91	**88**	85	91
Lunch												
BL1	**10**	13	8	**10**	0	20	**20**	35	5	**21**	15	27
I1	**32**	32	31	**21**	13	30						
BL2	**51**	60	43	**27**	21	32	**31**	40	23	**27**	13	41
BL3	**46**	44	49	**30**	25	35	**27**	25	30	**34**	35	33
I2							**73**	74	72	**49**	40	58
I2a	**73**	71	75	**50**	53	46	**66**	66	66	**58**	56	60
BL4	**57**	42	73	**49**	48	50	**72**	80	64	**60**	64	57
FU1				**43**	37	50	**55**	50	61			
FU2	**78**	74	83	**67**	69	66	**98**	100	97	**92**	91	94

Intervention 1

When the intervention was applied to target fruit, consumption of target fruit increased by 34% to 65%. At the same time, consumption of the accompanying non-target vegetables increased by 7%.

Baseline 2

In the absence of the intervention at Baseline 2, target fruit consumption remained elevated at 60%, only 5% less than recorded in the intervention phase. Non-target vegetable consumption was stable at 27%.

Baseline 3

Prior to the introduction of the intervention to target vegetables, target fruit consumption had increased further to 69%, 38% more than during Baseline 1. At the same time, non-target vegetables were consumed at 38%, 13% more than during Baseline 1.

When the intervention was applied to target vegetables intermittently, consumption of target fruit increased further to 72%, 41% more than during Baseline1. At the same time, consumption of non-target vegetables increased relative to Baseline 3, by 14% to 52%.

Baseline 4

Consumption of both fruit and vegetables remained elevated when the interventions were withdrawn, so that the children were eating 34% more target fruit than during Baseline 1 and 22% more non-target vegetables than during Baseline 3.

Follow-up 1

Consumption of fruit continued to be high at 73%.

Follow-up 2

When Baseline conditions were re-established, the children were eating more target fruit and non-target vegetables than during any other phase of the study at 83% and 68% respectively.

Within-category consumption

Of the target fruit pairs, both were poorly consumed at the start of the study and both were equally affected by the introduction of the intervention targetting fruit. The increased consumption was maintained for the duration of the study.

Of the non-target vegetable pairs, both were poorly consumed at the start of the study and consumption was relatively unaffected until Intervention 2a when target vegetables were targetted by the intervention. Consumption of Pair 2 was more affected than consumption of Pair 3, although this was reversed in the subsequent baseline phase. At Follow-up, consumption of both pairs was greater than during Baseline 3.

Consumption at Snack time: Target Vegetables and Non-Target Fruit

Baseline 1

At the start of the study, consumption of both target vegetables and accompanying non-target fruit was less than 30%.

Baseline 2

Following the application of the intervention to target fruit, non-target fruit consumption decreased by 1% and target vegetable consumption showed an increase of 9%.

Baseline 3

Prior to the introduction of the intervention targetting target vegetables, non-target fruit and vegetables were consumed in equal quantities, 40% each, 17% and 13% more respectively than during Baseline 1.

Intervention 2

When the intervention was applied to target vegetables, consumption of those foods rose to 78%, 38% more than during Baseline 3. At the same time, non-target fruit was consumed at 69%, a 42% increase relative to Baseline 1.

Intervention 2a

Fruit and vegetable consumption was maintained when the intervention was applied intermittently to target vegetables so that vegetables were eaten at 80% and fruit at 73%.

Baseline 4

When the interventions were withdrawn, vegetable and fruit consumption remained elevated, vegetable consumption was recorded at 79% and fruit at 63%, 39% and 23% more respectively than during Baseline 3.

Follow-up 1

During Follow-up 1, non-target fruit was consumed at levels similar to those at Intervention 2a of 73%.

Follow-up 2

Consumption of both target vegetables and non-target fruit was the highest recorded at 94% and 88% respectively; 54% more vegetables and 48% more fruit was eaten than during Baseline 3.

Within-category consumption

Table 4.9 shows the average consumption of each food pair across the course of the study.

At the beginning of the study, the children were eating more Pair 1 vegetables than Pair 4, but consumption became more even during the two subsequent baseline phases. Consumption of both pairs increased markedly when the intervention was applied to target vegetables and the increase was maintained in the absence of any intervention at Baseline 4 and enhanced at Follow-up 2.

Of the non-target fruit pairs, consumption increased across the course of the study, but relative consumption was unstable throughout. Both were eaten in similar quantities at Baseline 1, but following the application of the intervention to target fruit, a switch in preference between the two fruit pairs was recorded. When the intervention was applied to target vegetables, Pair 1 was more affected than Pair 2, but note that during the intermittent target vegetable phase, this trend was reversed and but then reinstated at Baseline 4. At Follow-up 2, both pairs were eaten in similar and high quantities.

Consumption at Lunchtime: Target Fruit and Non-Target Vegetables

Trends in consumption of target fruit and non-target vegetables at lunchtime were similar to those recorded in the snack context.

Baseline 1

At the beginning of the study, the children ate small quantities of both target fruit and accompanying non-target vegetables, 10% of each, less than was recorded at snack time.

Intervention 1

When the intervention was applied, at snack time to target fruit, consumption of those foods at lunchtime increased by 22% to 32%. The increase in target fruit consumption was smaller than that recorded in the snack context. At the same time, the increase of 11% recorded for non-target vegetable consumption was similar to that observed at snack time.

Baseline 2

In the absence of the intervention, consumption of target fruit at lunchtime increased further to 51%, a rise of 41% above Baseline 1 levels and more like that recorded in the snack context. Non-target vegetable consumption increased by 6% to 27%, levels comparable to snack time.

Baseline 3

Prior to the application of the intervention at snack time to target vegetables, consumption of target fruit was at 46%, 36% greater than during Baseline 1. Non-target vegetable consumption was recorded at 30%.

Intervention 2a

Both target fruit and non-target vegetable consumption at lunchtime was similar to that recorded in the snack context following the implementation of Intervention 2a. Compared to Baseline 3, there was a 20% increase in non-target vegetable consumption along with a rise of 27% in target fruit consumption.

Baseline 4

In the absence of any intervention, the elevated levels of non-target vegetable consumption were maintained so that at 49%, consumption was 19% greater than during

Baseline 3. Target fruit consumption was reduced relative to Intervention 2a (a similar trend was recorded at snack time) but was greater by 47% than during Baseline 1.

Follow-up 1

Non-target vegetable consumption was less than was recorded during Intervention 2a, but at 43% was 13% higher than during Baseline 3.

Follow-up 2

Similar to snack time, the highest levels of consumption for both fruit and vegetables were recorded at Follow-up 2. At 78%, target fruit consumption was greater than during Baseline 1 by 68% and at 68%, non-target vegetable consumption, recorded at 67%, was 38% greater than during Baseline 3.

Within-category consumption

Table 4.9 shows the average consumption of each food pair across the course of the study.

Consumption of both target fruit pairs at lunchtime was less than that recorded in the snack context. When the intervention targetting fruit consumption at snack time was applied, the increase in target fruit consumption at lunch was not as great as that recorded in the earlier context. Increases in consumption of Pair 2 fruit were less stable at lunchtime than they had been noted in the snack context. Following Intervention 2a, levels of consumption of both fruit pairs were comparable with that recorded in the snack context.

Of the accompanying non-target vegetable pairs, the children's consumption was less than was recorded at snack time, but across the course of the baseline phases, increased to comparable levels. A further increase was noted at Intervention 2a. At Follow-up 2 consumption of both pairs was similar and the highest recorded of the study - as had been recorded at snack time.

Consumption at Lunchtime: Target Vegetable and Non-Target Fruit

Baseline 1

The children's consumption of foods in both categories was low at the start of the study, as it had been at snack time, vegetables at 20% and fruit at 21%.

Baselines 2 and 3

As was the case in the snack context, following the application of the intervention to target fruit, consumption of foods in both categories was little changed and remained so into Baseline 3.

Intervention 2

When the intervention was introduced at snack time to target vegetables, consumption of those foods at lunchtime increased markedly by 46% to 73%, a similar increase to that noted at snack time. A smaller increase of 15% in non-target fruit consumption was noted, less than was recorded at snack time.

Intervention 2a

Vegetable consumption remained elevated at 66% when the intervention was intermittently applied at snack time to target vegetables and consumption of non-target fruit was further increased to 58%.

Baseline 4

When all interventions were removed, consumption of fruit and vegetables remained high, vegetables at 72%, 45% greater than during Baseline 3 and fruit at 60%, 26% more than during Baseline 3.

Follow-up 1

Vegetable consumption was reduced relative to Intervention 2, but remained at 55%, 28% greater than during Baseline 3.

Follow-up 2

As noted in the snack context, consumption of food in both categories was the highest recorded, at near maximum levels. Vegetables were consumed at 98%, 71% more than during Baseline 3 and fruit was consumed at 92%, 58% more than during Baseline 3.

Within-category consumption

Table 4.9 shows the average consumption of each food pair across the course of the study.

The children's consumption of target vegetables at lunchtime at the start of the study resembled that observed in the snack context, with more Pair 1 consumed than Pair 4. As had also been observed at snack time, this difference decreased across the course of the baseline phases. At Intervention 2 (target vegetables) consumption of both vegetable pairs was equally affected, again, as had been the case at snack time and the observed increases were largely maintained across the course of the study.

The children's pattern of consumption of non-target fruit at lunchtime was similar to that recorded in the snack context, although the changes at lunchtime differed by degree. At the end of the study, consumption of both pairs in both contexts was similar.

Discussion: 2 day Attendees:

Snack time: Figure 4.5 shows target fruit consumption at snack time to be 31%. When the intervention was applied to target fruit, consumption rose to 65%. The increase of 34% (see Figure 4.5.1) was the largest single rise in target fruit consumption recorded in this context, indicating that the intervention was responsible for the changes. At the same time, consumption of non-target vegetables was largely unaffected. The increases in target fruit consumption recorded during Intervention 1 were maintained across the course of the study, when the intervention was withdrawn and into both Follow-up phases.

Likewise, consumption of target vegetables increased to 78% when the intervention was applied to those foods. This increase of 38% was the largest single rise in consumption of target vegetables recorded in this context, further evidence for the efficacy of the intervention package. The elevated consumption continued when the interventions were withdrawn and into Follow-up phases.

Lunchtime: Figure 4.5 shows that the increase in consumption of target fruit at lunchtime was not as great as that recorded at snack time. The increase at lunchtime recorded during Intervention 1 was 22%, less than at snack time, although a further increase in target fruit consumption was subsequently recorded at Baseline 2. Target vegetable consumption at lunchtime (as at snack time) increased when Intervention 2 was applied and the increase was similar to that recorded at snack time. The changes were maintained throughout the study (with a dip at Follow-up 1) and at Follow-up 2, consumption was recorded at close to maximum levels.

Thus the interventions had substantial effects on consumption at snack time; changes were maintained when the interventions were withdrawn and were in evidence at Follow-up's 1 and 2. The changes at snack time also impacted on consumption at lunchtime. In the case of target fruit consumption, the increases at lunchtime were less marked, but were enhanced during the subsequent Baseline phase – perhaps due to the irregularity of attendance of these two days per week children. Consumption at lunchtime of target vegetables in comparison to fruit was more marked.

As with all other attendance groups, the impact of the intervention(s) was equal with regard to the pairs of foods within each category.

There would seem to be little evidence of within-category generalisation for this group of attendees, following Intervention 1 (target fruit) a 1% decrease in non-target fruit consumption was recorded. Following Intervention 2 (target vegetables), a 14% increase in non-target vegetable consumption was observed, a similar increase was also recorded in the lunchtime context.

Patterns of consumption matching those of the other attendance groups were noted for non-target fruit during and following Intervention 2, when a substantial increase in consumption of those foods was recorded, again a matter of debate as to whether this was due to verbal over-generalisation or the emergence of a category of 'Jarvis and Jess' foods.

Results: Data from the 'More' Phase

At the end of Follow-up 2, the children were able to request more portions of any food presented at snack time. Table 4.10 shows the percentage of extra portions of each category that were requested and eaten by the children. The table is divided into attendance groups and shows the number of children remaining from each group during Follow-up 2 and the percentage of extra portions of experimental foods that were requested by each group during the 'more' phase.

Table 4.10 The percentage of extra portions per attendance group eaten during the 'more' phase of Follow-up 2.

Food Category	5 days (n=4)	4 days (n=2)	3 days (n=1)	2 days (n=4)	Total (n=11)
Target Fruit	10	11	16	11	12
Target Vegetables	23	20	50	27	30
Non-Target Fruit	24	5	37	30	24
Non-Target Vegetables	10	18	8	7	11

Table 4.10 shows that the children did ask for more helpings of foods in all categories. With the exception of the 3 day attendee group (which was represented by only one child) the number of extra portions across the groups was similar. The most requests were made for target vegetables and non-target fruit. Requests for extra portions of target fruit and non-target vegetables were similar.

Results: Children who participated from Baseline 3 onwards

Figure 4.6 shows consumption of a group seven children who joined the study just prior to the implementation of Intervention 2 (target vegetables). Table 4.11 shows their mean consumption of each food pair from Baseline 3 to Follow-up 2. Three of the children attended five days per week, one attended four days per week and three children attended two days per week. These data are of interest because they show the impact of the vegetable intervention on a group of children who had never been exposed to any intervention designed to increase eating.

Consumption of target vegetables and non-target fruit.

Snack time: Initially at Baseline 3, consumption of target vegetables and non-target fruit was similar to the Baseline 1 levels of those children who had participated during Intervention 1, with vegetable consumption recorded at 19% and fruit consumption at 26%.

When Intervention 2, targetting vegetables was implemented, consumption of those foods increased to 62%, so that it was 43% greater than during Baseline 3. At the same time a similar increase in non-target fruit consumption was recorded of 45%.

The increases in consumption of both fruit and vegetables were maintained into Intervention 2a, when the intervention was withdrawn at Baseline 4 and throughout both Follow-up phases.

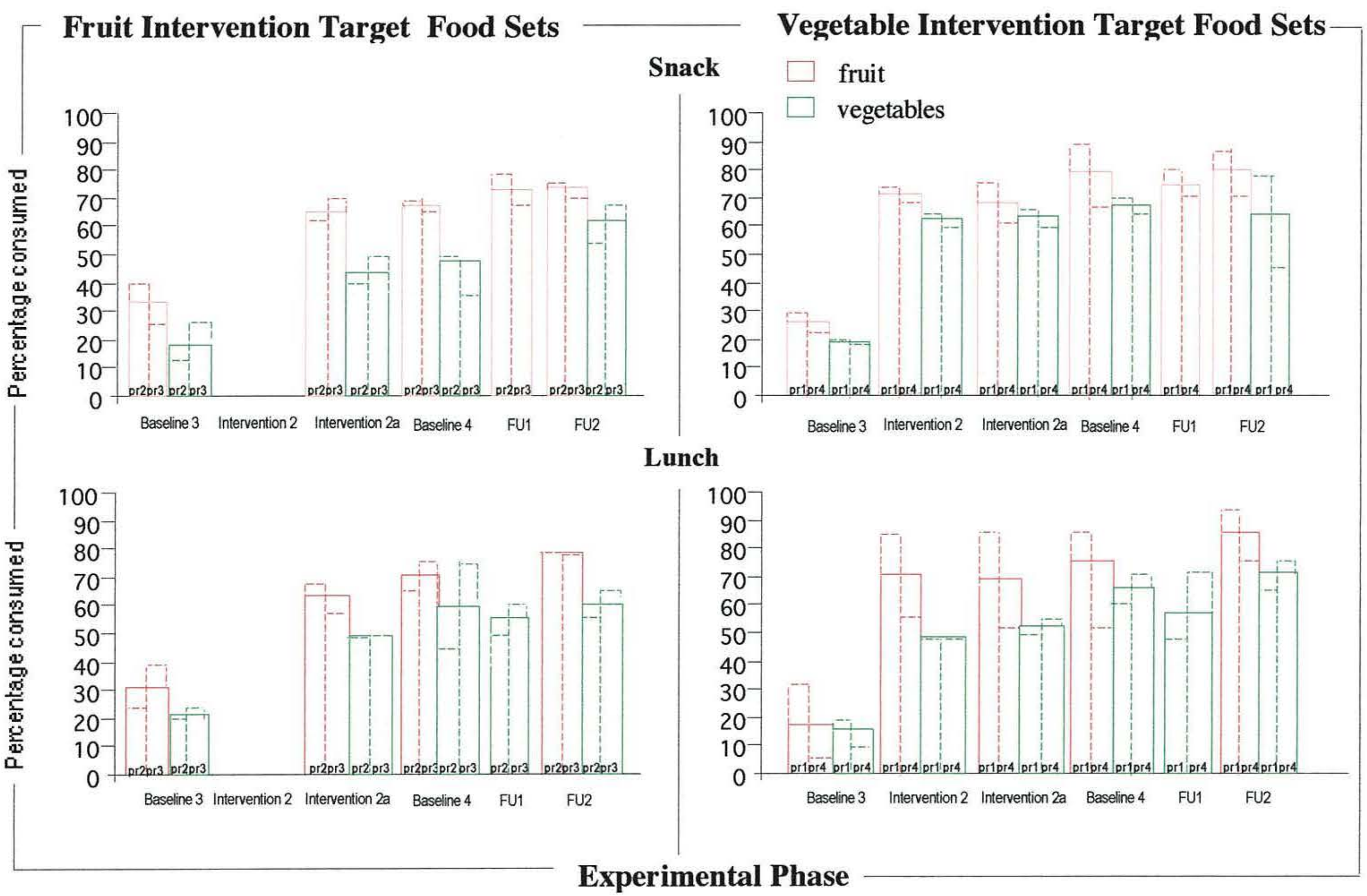


Figure 4.6. Mean consumption of target fruit, target vegetables, non-target fruit and non-target vegetables in the experimental (snack) context) and in the generalization (lunch) context across all phases of Experiment 4 for children who joined the study at Baseline 3. Dashed lines show mean consumption of each food pair; solid lines show the total mean consumption of targetted fruit and vegetables for Food Sets 2 and 3 (upper and lower left panels) and of the non-targetted food pairs of Food Sets 1 and 4 (upper and lower right panels).

Table 4.11. Attendees who joined at Baseline 3; mean consumption of each food across the course of Experiment 4, Baseline 3 (BL3), Intervention 2 (I2), Intervention 2a (I2a), Baseline 4 (BL4), Follow-up 1 (FU1) and Follow-up 2 (FU2). Snack time data (S) are shown in black type, lunchtime data (L) in blue type.

Food Set	Food Pair	S BL3	L	S I 2	L	S I 2a	L	S BL4	L	S FU1	L	S FU2	L
	Dragon Fruit	26	9	69	47	58	47	72	57	68		58	77
	Mango	20	0	70	66	66	57	65	64	62		84	77
	Green Beans	14	15	65	52	68	50	66	54		73	75	72
	Baby Corn	28	22	65	47	66	51	76	61		70	83	83
2	Kiwi	39	28			75	89	79	81	94		86	94
	Papaya	41	20			48	50	60	50	76		66	63
	Carrot	10	27			66	57	58	38		57	52	52
	Courgette	11	13			14	41	60	52		41	55	61
3	Star Fruit	35	51			83	68	71	80	59		89	100
	Sharon Fruit	14	28			58	49	59	70	51		51	55
	Cucumber	48	37			54	71	33	86		80	83	75
	Yam	3	11			45	29	41	66		60	54	55
4	Water Melon	38	45	93	97	88	94	92	90	90		90	94
	Prune	22	19	55	71	66	78	89	85	88		88	94
	Swede	26	2	63	54	60	66	73	81		41	44	78
	Mange- Tout	9	13	58	46	60	47	57	61			50	55

Table 4.11a. Attendees joining at Baseline 3 mean consumption of each food pair across the course of Experiment 4 showing target fruit (TF), high exposure vegetable (HV), target vegetable (TV) and high exposure fruit (HF) consumption. The upper section of Table 4.6a shows snack time consumption and the lower section shows lunchtime consumption (blue type) across all phases of the experiment, Baseline 1 (BL1), Intervention 1 (I1), Baseline 2 (BL2), Baseline 3 (BL3), Intervention 2 (I2), Intervention 2a (I2a), Baseline 4 (BL4), Follow-up 1 (FU1) and Follow-up 2 (FU2). Mean total category consumption is shown in bold.

Snack	**TF**	Pair 2	Pair 3	**HV**	Pair 2	Pair 3	**TV**	Pair 1	Pair 4	**HF**	Pair 1	Pair 4
BL3	**32**	40	24	**18**	10	25	**19**	21	17	**26**	23	30
I2							**62**	65	60	**71**	69	74
I2a	**66**	61	70	**44**	39	50	**63**	67	60	**69**	62	77
BL4	**67**	70	65	**48**	59	37	**68**	70	65	**79**	68	90
FU1	**72**	80	65							**76**	65	89
FU2	**73**	76	70	**61**	53	68	**63**	79	47	**80**	71	89
Lunch												
BL3	**31**	24	40	**22**	20	24	**13**	18	7	**18**	4	32
I2							**49**	49	50	**70**	56	84
I2a	**64**	69	58	**49**	49	50	**53**	50	56	**69**	52	86
BL4	**70**	65	75	**60**	45	76	**64**	57	71	**73**	60	87
FU1				**59**	49	70	**58**	71	46			
FU2	**78**	78	77	**60**	56	65	**72**	77	66	**85**	77	94

Lunchtime: Consumption at lunchtime shows a similar pattern to that observed at snack time. At Baseline 3, consumption of vegetables and fruit matched that at snack time, 13% and 18% respectively. When the intervention was applied to target vegetables at snack time, an increase in target vegetable consumption at lunchtime was noted. The increase of 36% was only slightly less than the 43% observed at lunchtime and was the largest single rise in target vegetable consumption in this context. At the same time, non-target fruit consumption rose by 52%, again, the largest single rise in non-target fruit consumption in this context.

These increases were maintained during Intervention 2a and when the intervention was withdrawn at Baseline 4. Consumption of both fruit and vegetables continued to be elevated at Follow-up 2.

Consumption of target fruit and non-target vegetables

Snack time: Baseline 3 consumption of fruit was 32% and consumption of vegetables was low at 18%. When the intervention was applied to target vegetables intermittently, target fruit and non-target vegetables were presented under baseline conditions. Target fruit consumption increased markedly by 34% to 66% and an increase of 28% in non-target vegetable consumption was recorded, so that 44% non-target vegetables were eaten.

These increases were maintained when the intervention was completely withdrawn at Baseline 4 and during Follow-up phases.

Lunchtime: Consumption at lunchtime shows similar trends to those at snack time, with similar increases in target fruit and non-target vegetables during Intervention 2a . The increase in vegetable consumption at Baseline 4 was somewhat larger than that recorded in the snack context. As was the case at snack time, all increases were maintained in the absence of any intervention and during Follow-up phases.

The data from those children who joined the study at Baseline 3 show that when Intervention 2 was applied, consumption of both target vegetables and non-target fruit was increased at both snack time and lunchtime.

At Intervention 2a, consumption of target fruit and target vegetables increased at both snack and lunchtimes.

Thus, Intervention 2 may have been responsible for increasing consumption of all foods in both contexts. It is likely that these children, rather than basing their consumption on particular food categories, based their consumption on 'Jarvis and Jess foods'. Whatever the basis for their consumption the children continued to consume those foods when no rewards were available for doing so.

Results: New attendees

In addition to children who joined the study at Baseline 3, there were other children who started attending the nursery at the time of Follow-up 2. These children took part in the Follow-up procedure, although they were never exposed to any of the interventions. Figure 4.7 below compares data collected from the 'new' children and data collected at Baseline 1 from the children who were exposed to the interventions.

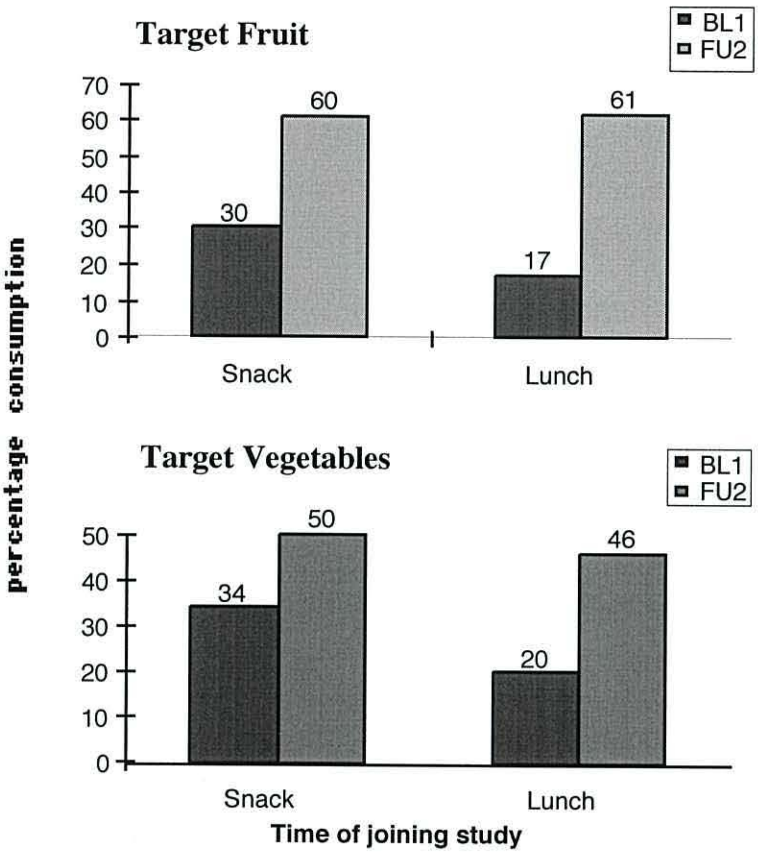


Figure 4.7. Target fruit and target vegetable consumption at snack and lunchtime of the children entering the study at Baseline 1 and those entering at Baseline 3.

The data at Baseline 1 represents the Baseline consumption of the original cohort. Target fruit consumption at snack time was 30%. This can be compared with 60% for those children who arrived at the nursery during Follow-up 2. Baseline 1 vegetable consumption at snack time was recorded at 34% whilst the new attendees were eating 50%. There was a similar picture in the lunchtime context where the new attendees were eating three times as much fruit as the children starting at Baseline 1 and twice as many vegetables.

It is of interest to note the greater disparity between snack and lunchtime consumption of the original cohort and the snack and lunchtime consumption of the 'new' attendees.

Individual Responses and the Relationship between Consumption at Snack Time and Consumption at Lunchtime

Although the group data presented previously indicated that changes in consumption at snack time also occurred at lunchtime, those data did not show whether the changes occurred at the same time, or whether lunchtime consumption followed snack consumption or vice versa. They also do not show how rapidly each child responded to the interventions. Table 4.12 (overleaf) shows, for each 5 day attendee, the point during each intervention at which each food was consumed at snack time and at lunchtime.

Thus, the 5 day attendees individual responses to each intervention can be observed as can any relationship between food consumption in the snack context and that in the lunch context.

In general, consumption at lunchtime tended to lag behind that observed in the snack context. For example, Participant 3 ate kiwi at snack time on the 5th occasion that it was targetted with the intervention, but did not consume kiwi at lunchtime until Day 12 of the intervention phase. Likewise, Participant 8 consumed papaya at snack time on the 8th day that it was targetted by the intervention, but did not consume papaya at lunchtime until Day 17 of that phase.

Some participants began to consume foods at lunchtime on the same day that they consumed them in the snack context, for example, Participant 4 with baby sweetcorn, green beans, and mange-tout.

Not all children did generalise consumption to the lunchtime setting, for example Participants 4, 6 and 8 with sharon fruit or Participant 1 with swede.

Occasionally, consumption occurred at lunchtime prior to snack time, this was true for Participant 1 with kiwi fruit and Participant 5 with sharon fruit. Participant 8 reliably ate green beans at lunchtime before eating them in the snack context.

The table also serves to illustrate that all children differed in their acceptance of each food.

Tables 4.13, 4.14 and 4.15 (overleaf) show similar trends for the 4 day, 3 day and 2 days per week attendees respectively.

Table 4.12. Point during intervention phase at which each participant in the 5- day subgroup consumed each food at snack time (black type) and lunchtime (blue italics).

	Participant Number											
Food	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Kiwi	2	A	5	A	A	A	0	4	6	0	3	1
	1	*A*	*12*	*A*	*A*	*A*	*0*	*10*	*10*	*0*	*9*	*A*
Papaya	0	4	6	5	2	3	0	7	8	0	0	A
	0	*11*	*0*	*0*	*2u*	*0*	*0*	*11u*	*17*	*0*	*0*	*A*
Sharon	0	4	5	5	1	4	0	5	4	5	0	A
	0	*4*	*9*	*0*	*2*	*0*	*0*	*0*	*5*	*5*	*0*	*A*
Star	A	A	u	5	A	A	0	4	5	4	A	A
	A	*A*	*0*	*0*	*A*	*0*	*0*	*6*	*7*	*0*	*4*	*5*
Baby Sweetcorn	1	A	1	3	A	4	0	1	3	A	0	A
	2	*A*	*1*	*3*	*A*	*10*	*0*	*A*	*3*	*A*	*0*	*A*
Green Beans	9	A	A	5	A	2	0	3	A	A	0	3
	10	*A*	*A*	*5*	*A*	*3*	*0*	*A*	*3*	*A*	*0*	*9*
Swede	9	A	A	5	A	2	0	A	3	A	0	3
	0	*A*	*9*	*5*	*1*	*2*	*0*	*2*	*4*	*4*	*0*	*A*
Mange-Tout	0	A	A	3	A	3	0	2	2	1	0	3
	0	*A*	*A*	*5*	*A*	*3*	*0*	*5*	*5*	*3*	*0*	*9*
Carrot	1	A	1	1	A	0	0	A	A	1	0	A
	0	*0*	*5*	*A*	*A*	*0*	*0*	*A*	*A*	*0*	*0*	*A*
Courgette	0	0	0	0	A	0	0	0	11	0	0	0
	0	*0*	*0*	*0*	*A*	*0*	*0*	*0*	*15*	*0*	*0*	*0*
Cucumber	A	A	A	A	A	A	0	A	7	A	A	3
	A	*A*	*A*	*A*	*A*	*A*	*0*	*A*	*0*	*A*	*14*	*0*
Yam	0	0	0	0	0	0	0	0	9	0	0	5
	0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Dragon Fruit	0	2	1	7	1	A	0	1	3	0	10	A
	0	*3*	*11u*	*6*	*0*	*A*	*0*	*1*	*3*	*0*	*9*	*A*
Mango	0	1	A	A	A	A	0	A	A	A	3	A
	0	*0*	*0*	*A*	*A*	*A*	*0*	*1*	*2*	*0*	*9*	*A*
Prune	0	A	A	A	A	A	0	A	A	3	A	A
	0	1	0	A	A	A	0	A	A	A	0	A
Water Melon	1	A	A	A	A	A	0	2	A	0	A	A
	1	A	0	A	A	A	0	6	A	0	A	A

Key: A/*A* = participant ate item prior to intervention
0/*0* = participant did not consume item
u/*u* = participant's consumption across the phase was unstable

Table 4.13. Point during intervention phase at which each participant in the 4- day subgroup consumed each food at snack time (black type) and lunchtime (blue italics).

	Participant Number		
Food	**1**	**2**	**3**
Kiwi	1	A	0
	6	*A*	*0*
Papaya	1	0	A
	0	*0*	*3u*
Sharon	0	6	0
	0	*0*	*0*
Star	A	A	0
	A	*A*	*1*
Baby Sweetcorn	A	4	5
	A	*0*	*U*
Green Beans	A	2	A
	A	*5u*	*A*
Swede	1	3	A
	6	*3u*	*A*
Mange-Tout	A	4	A
	A	*8*	*A*
Carrot	1	1	A
	0	*0*	*A*
Courgette	1	0	0
	2	*0*	*3u*
Cucumber	A	A	A
	A	*A*	*A*
Yam	0	0	A
	0	*0*	*0*
Dragon Fruit	1	0	5
	2u	*0*	*6u*
Mango	1	A	A
	0	*A*	*A*
Prune	A	1	A
	A	*0*	*5*
Water Melon	1	A	A
	2	*A*	*A*

Key:
A/*A* = participant ate item prior to intervention
0/*0* = participant did not consume item
u/*u* = participant's consumption across the phase was unstable

Table 4.14. Point during intervention phase at which each participant in the 3- day subgroup consumed each food at snack time (black type) and lunchtime (blue italics).

	Participant Number		
Food	**1**	**2**	**3**
Kiwi	A	4	1
	A	*0*	*3u*
Papaya	1	4	0
	5	*0*	*0*
Sharon	3	4	0
	5	*0*	*0*
Star	1	2	4
	2	*1*	*0*
Baby Sweetcorn	A	1	A
	A	*2*	*A*
Green Beans	1	A	5
	A	*3*	*3*
Swede	1	A	5
	3	*A*	*3*
Mange-Tout	A	A	3
	A	*A*	*4*
Carrot	5	4	0
	1u	*0*	*0*
Courgette	3	2	0
	1u	*2u*	*0*
Cucumber	A	A	0
	A	*A*	*0*
Yam	4	0	0
	0	*0*	*0*
Dragon Fruit	1	1	7
	2	*3*	*0*
Mango	A	1	4
	1u	*4*	*4*
Prune	A	A	2
	A	*A*	*2*
Water Melon	A	A	2
	A	*A*	*2*

Key:

A/A = participant ate item prior to intervention
0/0 = participant did not consume item
u/u = participant's consumption across the phase was unstable

Table 4.15. Point during intervention phase at which each participant in the 2-day subgroup consumed each food at snack time (black type) and lunchtime (blue italics).

	Participant Number					
Food	**1**	**2**	**3**	**4**	**5**	**6**
Kiwi	A	1	3	A	0	A
	1	*5*	*2*	*A*	*0*	*A*
Papaya	A	1	3	A	0	A
	3u	*5*	*0*	*0*	*0*	*A*
Sharon	1	1	0	A	0	A
	0	*3*	*0*	*0*	*0*	*0*
Star	2	2	0	A	0	1
	0	*3*	*3*	*A*	*0*	*0*
Baby Sweetcorn	2	2	A	A	0	2
	2	*4*	*6*	*A*	*0*	*1*
Green Beans	1	2	A	A	0	2
	1	*4*	*A*	*A*	*0*	*0*
Swede	A	1	1	A	0	3
	A	*4*	*3*	*1*	*0*	*3*
Mange-Tout	1	1	1	1	0	0
	1	*4*	*3*	*A*	*0*	*0*
Carrot	0	0	A	A	0	4
	0	*0*	*1u*	*A*	*0*	*0*
Courgette	0	0	0	A	0	0
	0	*0*	*0*	*A*	*0*	*0*
Cucumber	0	4	A	A	0	1
	0	*3u*	*1*	*A*	*0*	*A*
Yam	0	0	0	A	0	0
	0	*0*	*0*	*0*	*0*	*0*
Dragon Fruit	1	1	4	A	0	A
	1	*1*	*0*	*0*	*0*	*0*
Mango	A	A	1	A	0	A
	A	*A*	*1*	*3u*	*0*	*A*
Prune	A	A	A	0	0	A
	A	*A*	*A*	Au	0	Au
Water Melon	A	1	0	0	0	*A*
	A	*3*	*8*	0	0	3

Key: A/*A* = participant ate item prior to intervention
0/*0* = participant did not consume item
u/*u* = participant's consumption across the phase was unstable

Parental Feedback

A questionnaire designed to find out if any of the changes in eating behaviour in the nursery had generalised to the home environment, was distributed to the parents of all the children who took part in the study. Of the thirty-six questionnaires that were distributed, 25 were returned.

Table 4.16 below summarises how the 25 parents responded to the items on the questionnaire.

Table 4.16. Summary of parental responses to food questionnaire.

Number of parents reporting changes in child's eating at home	10
Number of parents reporting child asking for foods not normally bought	15
Number of parents reporting child eating more fruit	18
Number of parents reporting child eating more vegetables	20
Number of parents reporting child more willing to try new foods	16

Parents were also asked to give general comments (positive or negative) about the study. Three respondents said that they would have appreciated more parental involvement, perhaps co-ordinating foods used in the study at home etc.

One parent reported that her child 'very proudly showed his stickers at home.'

One parent said that when she served some of the foods at home that were used in the study, her child had commented that they didn't taste like those in the nursery. Other parents commented directly on the changes they had observed in their child's eating:

'increased the variety eaten'
'certainly eats more vegetables now'
'continually attacks the fruit bowl and often opts for fruit as a pudding'
'eats many different foods (extra to previously) and many /much more regular fruit and veg'

Some parents shared observations regarding their child's increased awareness of fruit and vegetables:
'has taught me a thing or two'
'now enjoys spending a lot of time in the fruit and veg section (of supermarket) telling me which one's he's tried and naming them'
'surprised me in (supermarket) by naming star fruit'
'I'd never heard of dragon fruit until she asked for it....'

One parent reported that her child had asked for dragon fruit and kiwi fruit but hadn't eaten them when purchased.

GENERAL DISCUSSION

In Experiment 4, the effects of the video peer-modelling with rewards intervention on children's consumption of fruit and vegetables were examined. The data were considered in terms of the weekly attendance of each participant; there were four groups of children, those who attended five days each week, those who attended four days, three days and two days.

The direct impact of the intervention on consumption of target fruit and target vegetables was the same across all attendance groups. When the intervention was applied to each food category in turn, consumption of targetted foods within that category increased substantially. The observed increases were maintained in subsequent baseline phases and also during the continuous three month follow-up phase, as well as the final follow-up carried out nine months after Baseline 4. In addition, during the final follow-up phase, when the children were able to request extra portions of fruit and vegetables at snack time, the children were observed to be asking for and eating more of many foods that they had refused at the start of the study.

The effects of the intervention were not limited to the context in which they were implemented, but were observed in a second setting in which no rewards were given for consuming any food. This was particularly true for the category of target vegetables; consumption in the lunchtime context generally matched that recorded at snack time. The observed increases in consumption of both fruit and vegetables at lunchtime continued to be recorded when the intervention at snack time was withdrawn and in Follow-up phases.

In addition to the effects of the interventions generalising to the lunchtime setting at the nursery, parental reports (see Table 4.16) indicated that eating behaviours at home had been affected. The children were reported to be asking for fruit and vegetables not normally on the parent's shopping list, eating more fruit and vegetables at home and were also more willing to try new foods.

Thus, the impact of the interventions was observed at the time they were introduced (snack time) and, without further application, were also observed in two other settings that were remote in place and time (lunchtime and at home).

Experiment 4 was designed so that any impact of the interventions on consumption of foods that were not directly targetted (within-category generalisation) could be examined. The strongest evidence for category-based consumption of fruit was observed with the 3 day attendees. Following the intervention targetting fruit, consumption of non-target fruit increased by 6% for the 5 day attendees, by 15% for the 4 day attendees, and decreased by 1% for the 2 day attendees. The 3 day attendees increased their consumption of non-target fruit by 41%. Following Intervention 2 (target vegetables) non-target vegetable consumption increased by 15% in the 5 day group, group and by 14% in the 2 day group. Consumption of non-target vegetables in the 4 day group was reduced. In the 3 day attendance group, consumption increased by 32%, so again, the strongest evidence for within-category generalisation was recorded for the 3 day attendance group.

One unexpected feature of the data from all attendance groups was that during the intervention targetting vegetables, a substantial increase in consumption of the accompanying non-target fruits was observed. No such increase occurred with non-target vegetables during the intervention targetting fruit. It may be that since the children had previously been rewarded for eating the foods in the fruit portion of their bowls during Intervention 1, they continued to do so (i.e. verbal over-generalisation) or perhaps a category of 'Jarvis and Jess foods' had emerged and the children were prepared to eat any food that was presented in conjunction with Jarvis and Jess.

A simple way to test these assumptions would have been to ask the children why they were eating foods for which they were given no rewards, or to test their skills in categorising foods. Unfortunately, neither of these strategies was applied in Experiment 4 and so it is only possible to speculate about possibilities.

Other important findings emerged during the course of Experiment 4. Firstly, the children who were exposed to the second half of the study only (i.e. vegetable intervention only) responded as well to that one intervention as the children exposed to both. Their consumption of fruit and vegetables during Baseline 3 was poor, and comparable to Baseline 1 levels. During Intervention 2, their consumption of vegetables increased substantially and was maintained in the absence of rewards. The children joining at Baseline 3 also tended to eat the non-target fruits presented during Intervention 2, which again may be due to non-discrimination between the food categories or consumption based on 'Jarvis and Jess' foods.

The importance of the social context is also highlighted in this study. Figure 4.7 compares 'baseline' data for the children who joined the nursery at Follow-up 2 (i.e. were never exposed to any of the interventions) with baseline data of the children who were exposed to both interventions. The new attendees were immediately eating, without any intervention, twice as much target fruit and one third more target vegetables at snack time and at lunchtime, three times more target fruit and twice the amount of target vegetables. It would seem that if children are exposed to an environment in which eating fruit and vegetables is the 'norm' then they will adapt their behaviour accordingly.

Finally, in Experiment 4, foods in the category of fruit were targetted prior to the category of vegetables. It is interesting to note that although fruit consumption increased substantially when the intervention was applied, the response to the vegetable intervention was even greater. Moreover, consumption of vegetables at lunchtime was more affected during Intervention 2 than was fruit consumption at lunchtime during Intervention 1. It may be that the effects of these interventions were cumulative. It is interesting to speculate as to whether the response to an initial vegetable intervention would be as great as or less than responses to a subsequent fruit intervention.

The individual data showed that the increase in food consumption at lunchtime often lagged behind the increase observed at snack time, but generally followed consumption at snack time. This suggests that repeated taste opportunities are crucial if changes in eating behaviour are to occur in more than one context. The individual data also showed that individual children responded differently with different foods within each intervention and highlights the need to constantly monitor individual performances during any intervention that is designed to be applied to a group.

CHAPTER 10

GENERAL DISCUSSION

GENERAL DISCUSSION

It was reported in Chapter 1 that there are many health benefits to be gained from consuming a diet that is rich in fruit and vegetables but that in the UK, consumption of these foods amongst children and adults is generally poor. Since food habits learned in childhood may persist into adulthood and diets in childhood may affect health in adulthood, understanding the psychological factors that influence young children's consumption of foods is a pertinent area of study.

Various methods of investigating food behaviours were outlined in Chapter 2: there were measures of verbal liking, verbally choosing between two foods, and measures of consumption. It was argued that a person cannot change their risk of, for example hypertension, by simply *saying* that they will change their diet, or by *saying* that they prefer one food over another; thus food *consumption* is the most appropriate measure for monitoring dietary change; what is actually ingested is the crucial issue. (See Dowey, 1996 for other problems with using measures of preference).

The present experiments were systematic investigations of methods of enabling children aged between 2 and 5 years to increase their consumption of target foods. The measure of behaviour change in each experiment was consumption.

In Experiment 1, the target foods were novel and 'manufactured', whilst the target foods in Experiments 2, 3 and 4 were fruit and vegetables that were refused or were poorly consumed by the participants. An in vivo peer-modelling intervention was utilized in Experiment 1, whilst in Experiments 2, 3 and 4, video peer-modelling with rewards interventions were utilized. Experiments 2, 3 and 4 were specifically designed for use in a pre-school nursery environment.

Summary of findings

Experiment 1 demonstrated that peer-modelling without contrived rewards can affect whether or not a novel food is, at least initially, consumed. In the presence of confederates, children tended to reject or accept a novel food in accordance with the behaviour of those confederates. These trends were observed when the novel food was next presented in the absence of the confederates and generalised to a second novel food that was similar in appearance to the target food. When the children who were initially exposed to positive peer interventions (i.e. other children who ate the target food whilst making positive comments about it) were exposed to a second positive intervention, their consumption of the target food increased further, whilst those children initially exposed to negative peer interventions (i.e. other children who refused to eat the target food and made negative statements about it) continued to refuse the target food even after subsequent exposure to a positive peer intervention. The design of Experiment 1 precluded any firm conclusions regarding any effects of the interventions beyond the short-term experimental context, but when compared with a similar study carried out with older children, results were suggestive of interesting possible developmental differences in reversing negative reactions to food via social pressure.

Experiment 2 employed single-case methodology to assess the effectiveness of a video peer-modelling with rewards intervention in promoting consumption of specific fruit and vegetables that the four participants had previously refused. The intervention targetted food consumption in a mid-morning experimental session, and the nursery's scheduled lunchtime meal provided a setting in which to assess any generalisation effects of the intervention.

Each child's consumption of the fruit and vegetables presented during the experimental sessions increased when the intervention was in place. The rate of response (both in terms of responding to experimental contingencies and increase in amounts consumed) differed between individual children. Some maintenance effects of the intervention were observed in subsequent baseline phases for two of the four participants; consumption of those same foods at lunchtime remained largely unaffected, despite the introduction of a second intervention specifically designed to target lunch time consumption. Since no follow-up measures were taken, it is not known how long the (limited) effects of the intervention lasted.

Although labour intensive and inefficient, Experiment 2 showed that consumption of previously refused fruit and vegetables could be promoted by the use of a combination of video peer-modelling and rewards. If the social (group) conformity effects observed in Experiment 1 were added together with the video peer-modelling and rewards effects observed in Experiment 2, an economic and powerful intervention to promote consumption of fruit and vegetables in an entire class of children might be produced.

Experiment 3 employed a video peer-modelling with rewards intervention which was designed to increase consumption of fruit (whilst continually monitoring vegetable consumption) in a class of pre-school nursery children. Two fruits were targetted during each intervention session and the design allowed for an examination of within-category generalisation of fruit consumption. Each intervention took place within a daily scheduled morning snack period, and the daily lunchtime meal context again provided a setting within which generalisation of the effects of the intervention could be examined. Results of this experiment were encouraging, consumption of fruit increased during the intervention phase and there was evidence of this increase generalising to the lunch time context. The effects of the intervention were differential across the participants, and seemed to be unrelated to the number of sessions the child attended the nursery each week. The effects were also differential across foods, with consumption of the sweeter fruits increasing to a greater extent than the less sweet ones. The increased consumption of the sweeter fruits was better maintained (lasted beyond the intervention) than the increases in the non-sweet fruits.

With regard to consumption of fruits presented but not directly targetted by the Intervention, the results of Experiment 3 were weakened by a lack of availability of two of the generalisation fruits, one during Baseline 2 and the other during the Follow-up.

Longer-term effects of the intervention were assessed at a second baseline phase and a Follow-up phase, but during these times it was only possible to collect consumption data from a sub-group of all the participants which may or may not be representative of the group as a whole. Overall however, the results of Experiment 3 indicated that a similar intervention, with some modifications could prove successful in increasing and maintaining children's consumption of fruit and even vegetables.

Experiment 4 was designed to build on the findings of Experiment 3 and, as well as including longer intervention phases an intervention to target consumption of vegetables was added. Consumption of all targetted fruit and vegetables increased in both the experimental and generalisation settings and remained elevated when interventions were removed. During a three-month continuous follow-up phase and a final follow-up phase carried out nine months after the end of the last baseline phase, the children were observed eating fruit and vegetables in quantities similar to those recorded during intervention phases. In a final phase, children were requesting and eating extra portions of those very foods that they had consumed very poorly, or refused when they were presented in initial baseline phases. The changes in fruit and vegetable consumption were seen with children from across the different attendance groups, regardless of whether they attended two days or five days a week.

Applicability of findings

The results of Experiment 1 showed that exposing a child to other (slightly older) children, who express opinions about a food and whose behaviour is consonant with those expressions, might be one means of ensuring, at least in the short-term, that a target child consumes a novel food. However, it was observed that children in Experiment 1 were more sensitive to negative than positive information about foods, and the aversions once created were not easily reversed. This is in contrast to the findings of Dowey (1996) wherein participants subsequently exposed to positive peers consumed the target food. The differences in outcome using the same procedure suggests that there may be age-related differences in the learning and unlearning of aversions to foods with older children more able to 'unlearn' than the younger ones. Thus, with this group of 3 – 5 year old children, first impressions of the food counted, particularly if those impressions were negative. There were no data in Experiment 1 to evaluate any effects of the intervention(s) beyond the study. Moreover, it is not certain how successful peer-modelling by itself might be in promoting consumption of foods that are already familiar but refused, or do not have an initially appealing taste, as might be the case with foods such as fruit and vegetables. Further, on an applied level, it may not be practical to invite several children for tea every time one wished to introduce a child to a new food; although this practice may in part be invoked by a parent at meal time. "I bet Superman/Bob the Builder/Postman Pat eats peas" etc.

Experiment 2 indicated that a video-modelling and rewards intervention could be used to promote consumption of specific foods that individual children had previously refused; however, the intervention might be more powerful and efficient if used in combination with the elements of social pressure observed in Experiment 1.

The procedures employed in Experiments 3 and 4 were the most cost-efficient and reliable methods of increasing fruit and vegetable consumption in young children and were simply incorporated into the daily routine of the nursery. The evidence from Experiment 4 showed that many advantages were conferred by utilizing the procedures: there were marked increases in consumption of both fruit and vegetables across a large number of children when each intervention was applied; increases were maintained when the intervention(s) were withdrawn; and the new level of fruit and vegetable consumption was sustained into the follow-up phases carried out several months after the final baseline phase. In addition, the effects of each intervention generalised to the lunch time context and these were also maintained in the absence of any intervention. Consumption of all food pairs targetted within each category were equally affected by the intervention and changes in consumption were observed with children from all attendance groups. In the final follow-up phase conducted nine months after the end of the experiment, many children were requesting extra portions of many of the fruits and vegetables that they had refused to eat at the beginning of Experiment 4. Parent's responses to a questionnaire indicated that the behaviour change observed in the nursery setting had to some degree also been observed at home. Secondary effects of the intervention were observed with a new group of children who entered the nursery during the final follow-up phase; these 'new' children consumed substantially greater quantities of fruit and vegetables than had been recorded, pre-intervention, for the existing nursery attendees, evidence perhaps of the power of an established fruit and vegetable-eating culture amongst these pre-school children.

It remains to consider the relationship between the present Experiments and those from the mainstream food literature reviewed in Chapter 2 and the behaviour-analytic perspective outlined in Chapter 3.

Exposure

In Chapter 2, it was reported that in order to enhance verbal liking of novel foods, taste (as opposed to sight only) exposure was necessary, and that 10 or 15 taste exposures might be the optimum number to "significantly enhance liking" (Birch et al., 1987, p.177). The low and stable baseline data in Experiments 2, 3 and 4 however, show that without specific procedures to promote *tasting*, enhanced liking of fruit and vegetables is unlikely to occur, even with fruit and vegetables that the children had never seen before.

In the baseline phases of Experiment 2, the experimenter offered the experimental foods to each child a minimum of three times; on each occasion the food was named (either by the experimenter or by the child) and the participating child was then asked if he or she would like to try them. This procedure did not succeed in establishing tasting, even though it seems little different from the procedures used by Birch and colleagues in preference tests and experimental procedures. Moreover, in the early stages of the intervention phase of Experiment 2, it was sometimes difficult to persuade the child to comply with the instruction to eat issued by the characters in the film, despite the availability of rewards for consumption.

In Experiments 3 and 4, there was a level of exposure to peers who ate the experimental foods during baseline phases (no one food was rejected by all the children) but this was not enough to promote more general tasting amongst the group.

Whilst it may be the case that 10 or 15 taste exposures do enhance liking for a particular food, the above examples serve to illustrate the difficulties that can be involved in ensuring initial tasting of a food. The examples may also highlight the difference between applied and experimental research. In the exposure literature, children were given differential taste exposures to foods that they neither liked nor disliked. In real life, one might want to ensure consumption of foods that a child has previously refused.

The notion of the importance of the social context in which foods are presented rather than 'exposure' per se is highlighted by the data from Experiment 4. The children who entered the nursery after the experimental procedures had been withdrawn (i.e. had not been exposed to interventions to promote fruit and vegetable consumption), were eating three times as much fruit and twice the quantity of vegetables that the participating children had eaten during Baseline 1. The new children had continuous exposure to fruit and vegetables, but the exposure took place in a social environment that supported (and enjoyed doing so) consumption of those foods.

Peer-modelling

Peer-modelling was a feature of all the present experiments, but only in Experiment 1 were these procedures utilized without rewards. The results of Experiment 1 suggest that while peer-modelling of 'liking' produced some increase in the consumption of a novel food, the modelling of distaste or rejection of that food produced a disproportionately greater opposing effect. These behaviour changes were observed subsequent to the modelling episode when no peers were present. A second novel food (not subject to the modelling intervention) that was presented in the 'test' phase along with the target food was consumed or rejected in accordance with whether or not the target novel food had been eaten. The results of Experiment 1 extend the findings of many of the experiments reported in the mainstream food literature by showing that in addition to affecting measures on a verbal liking scale (see Birch 1980; Duncker 1938; Marinho 1942), food consumption can be altered by peer-influence.

The findings of Experiment 1 also extend those of Dowey (1996) in which consumption was used as the outcome measure and the effects of negative peer modelling were examined. In that study, children aged between five and seven years either ate or refused to eat a novel target food in accordance with the behaviour of peers. The behaviour in the presence of the peers was observed when peers were absent and generalised to a second novel food that was not the subject of the modelling procedures. Children who refused the novel food following 'negative' peer modelling ate that food when subsequently exposed to 'positive' peers. In Experiment 1 of the present thesis the children continued to refuse the target food even after a positive intervention. It may be the case that younger children (than five years) are less responsive to positive modelling and more responsive to negative modelling.

The findings of Experiment 1 also concur with those reported by Greer et al (1991) who used peer-modelling procedures to induce eating in a 29 month old child, although a decrease in consumption was observed when the peer-modelling procedures were removed. In Experiment 1, consumption of the positive influence group remained higher than that of the control group when the peer-modelling was withdrawn. However, in Experiment 1, the target foods were novel, whereas Greer et al employed more common foods.

In Experiments 2, 3 and 4, video peer-modelling was utilized in combination with rewards. The research cited in Chapter 2 that examined the effects of televised peer modelling relied on that medium alone as a tool for behaviour change. In addition, the majority of those studies measured either verbal liking as the dependent variable, or choice and assumed this to be indicative of consumption. The one study that looked at consumption in addition to verbal liking showed changes in the latter but not in the former following the experimental manipulations (Peterson et al 1984).

Experiments 2, 3 and 4 can be compared with the Horne et al (1998) studies reviewed in Chapter 3 wherein rewards were combined with video-modelling to increase children's consumption of fruit and vegetables in a home context and in a school environment. In all those studies, the interventions were successful in promoting consumption of a wide range of fruit and vegetables that were either previously refused or poorly consumed by the participants. Those experiments were conducted with the 5-7 year old age group; the present experiments have extended the findings to show that similar increases in consumption of fruit and vegetables can be obtained in the 2-5 year old age group. Large increases in consumption of foods in both categories were noted following the application of each intervention and these increases were not confined to one context but were observed to generalise to the home (in the case of the school studies) and the lunchtime meal (in the case of the nursery children). All the children involved showed changes in eating behaviour that lasted beyond the intervention and were observed in subsequent baseline phases; they continued to be in evidence during follow-up phases carried out several months after the end of the studies. In addition, parents of children of all ages reported changes in their children's eating habits and food requests.

Categorisation

In Chapter 3, the behaviour of categorising and its origins was discussed in terms of the Horne and Lowe (1996) account of naming. It was argued that verbal classifying of foods might determine whether or not a particular food is consumed. It was further argued that adding other verbal descriptions to those classifications might also affect the likelihood that foods within a whole category will be eaten. The interventions employed in Experiments 3 and 4 were specifically designed to impact on the food categories of fruit and vegetables. The characters in each film classified the target foods as either fruit or vegetables and gave verbal descriptions as to their taste and their energy-giving properties. The badges given as rewards for food consumption referred to the recipient as a 'fruit eater' or 'vegetable eater' and participants were awarded these badges for consuming fruit or vegetables.

Included in the procedures of Experiments 3 and 4 was the daily verbal categorisation exercise, the purpose of which was to teach the children to discriminate between the two food categories of fruit and vegetables. In addition, each half of the bowl in which the experimental foods were presented was also labelled with the appropriate category name and a colour (blue for vegetables, red for fruit) to further aid each child to correctly distinguish the two. There were two messages within each intervention film: "eat fruit/vegetables" and "these are today's fruits/vegetables."

A distinctive feature of the design of Experiments 3 and 4 was that only half the fruit and half the vegetables presented in each baseline phase were targetted with the intervention. This particular design was chosen so that any changes in consumption of the non-targetted exemplars within each food category following each intervention could be observed.

In Experiment 3, circumstances beyond the control of the experimenter (unavailability of some foods and subject attrition) precluded any firm conclusions on the matter of within-category fruit generalisation.

In Experiment 4, following the intervention targetting fruit, there was very little change in consumption of non-target fruit for any of the children in the five, four or two day attendance groups. Following the intervention targetting vegetables, some changes were noted in consumption of non-target vegetables. The five day group increased their consumption by 15%, the four day group decreased their consumption by 17% and in the two day group consumption increased by 14%. The most substantial changes in consumption of non-target foods were recorded for those children who attended three days each week. Following the intervention targetting fruit, consumption of non-target fruit at Baseline 2 was three times greater than during Baseline 1 and was close to the target fruit consumption recorded during Intervention 1. Following the intervention targetting vegetables, consumption of non-target vegetables had almost doubled. Whilst the data from the three day attendance group might suggest consumption based on categorisation, data from all other attendance groups are equivocal.

An unexpected and interesting pattern of consumption was observed in all attendance groups. When the intervention was applied to target vegetables, there was a concurrent increase in consumption of the accompanying non-target fruit, although when the intervention was applied to target fruit, no such increase in the accompanying non-target vegetables was observed. This effect may be due to verbal over-generalisation on the part of the children who may have been eating fruit because they had previously been rewarded for doing so rather than on the basis of the category of fruit per se. Similarly, all foods were 'Jarvis and Jess' foods in addition to being fruit or vegetables. Following extensive reinforcement for eating fruit and then for eating vegetables, it may be that the children perceived that they were rewarded for eating 'Jarvis and Jess' foods or even that they had developed a liking for 'Jarvis and Jess' foods. If this was the case, then a new 'category' of foods had been formed.

Foods such as baked beans or spaghetti in tomato sauce are often marketed in connection with popular children's characters, for example there are a range of such products associated with 'Barbie' or 'Postman Pat'. This suggests interesting possibilities for promoting fruit and vegetables. If the children in Experiment 4 based their eating on a category of 'Jarvis and Jess' foods, then it might be that fruit and vegetables could be as successfully promoted by "Barbie' etc. as baked beans and pasta shapes already are.

The issue of how the children in Experiment 4 came to eat foods for which there were no rewards is an important one and the answer may have wide-reaching consequences in terms of health promotion. Gillman (1996) advises that individual fruit and vegetables contain differing amounts of vitamins etc. and to maximise intake of these nutrients, it is most beneficial to consume a wide range of items from each category. Thus, healthy eating messages based on 'eat fruit' or 'eat vegetables' rather than on the basis of the nutrient content (i.e. eat more Vitamin C) of each individual food item, would be most useful. If children learn to categorise foods from an early age and carry out behaviour based on those categories in the way that Horne and Lowe (1996) suggest, then it may be possible for even very young children to be empowered to eat their way to health.

Rule-governed behaviour

In Experiment 1, there may be three different, but overlapping descriptions as to how the peer behaviours might have affected each participants' consumption (or otherwise) of the novel target food. Firstly, the peer descriptions of the food ("it tastes horrible" or "it tastes great") may have acted as a pointer to the natural consequences of ingesting the food. Secondly, in the presence of the novel target food, the participating child heard the confederates describe properties of that food (in many different ways – "this tastes horrible" , "there's no way I'm eating this" or I've had this before, it tastes great" etc) and the participating child responded to those descriptions with appropriate listener behaviours (i.e. consumed or rejected it). The children may also have generated their own descriptions of the confederates' behaviour (both verbal and non-verbal) and then performed similar listener behaviour (i.e. consumed or rejected) with regard to the novel target food. Whatever the mechanism(s) at work were in Experiment 1 the negative descriptions were much more powerful than the positive descriptions.

Some anecdotal evidence from Experiment 2 would support the notion of verbal descriptions of foods being used as a basis for consumption. Following the actors in the film describing lettuce as nice, RN asked the experimenter to confirm that this was so and promptly consumed lettuce for the first time. HI used the actors descriptions of foods and refuted them, often saying "I don't believe it!"

In the intervention phases of Experiments 2, 3 and 4, children were rewarded for compliance with the instruction to "eat fruit" or "eat vegetables". During experimental sessions, there was little delay between compliance with consumption of the appropriate foods and at least one level of reward, either stickers at the table, praise from staff or encouragement from other members of the group. These consequences were quickly followed by the delivery of the programmed rewards. It is likely that consumption at this stage was controlled by those rewards and the behaviour could be described as a compliance with the experimental instructions. The notion that eating functioned as a ply for many of the participants in Experiment 4 is evidenced by their verbal behaviour. On some occasions during the intervention phases, group members were heard shouting encouragement, urging slower eaters to eat up and get a prize, thus verbalising the experimental contingencies; the encouragement was based on the reward rather than the taste properties of the foods. The children themselves may have been effective as reminders to each other of the contingencies involved in their snack consumption.

Since no rewards were available for consuming any experimental food at lunch time, consumption in that context might be considered to be *tracking* with consumption driven by a rule in the form of "I always eat these foods" and consumption being reinforced by the natural consequences of ingesting the foods. The conception of tracking guiding consumption at lunchtime seems plausible in the light of the finding that consumption of foods at lunchtime generally lagged behind that at snack time. In those (few) cases where consumption at lunch time preceded that at snack time, the same rule-based account could be invoked, i.e. a rule similar to "I must like these foods since I ate them at lunchtime yesterday" may be being followed when foods were subsequently presented at snack time.

Similarly, maintenance of consumption in the absence of external rewards may have been supported by a rule such as "I always eat these foods", or "this food tastes good".

Given the maintenance and generalisation data, at some point during the intervention phases, food consumption at snack time for most children must have changed from being based on compliance to being governed by tracking. The point at which this transition occurred varied across individual children and foods and might be pinpointed to when consumption at lunchtime occurred.

In this account, consumption in Experiment 2 was for the most part a ply since consumption of experimental foods was not in evidence at lunchtime. However, tracking could be inferred in cases were consumption at snack time was maintained.

In Experiment 3, both groups of attendees (5 day and 4 day) increased their consumption of fruit at lunchtime during the intervention phase. The increase was largely confined to one fruit pair, the sweeter of the two, whereas increased consumption at snack time involved both pairs of fruit. When the intervention was withdrawn, increased consumption of only one pair was maintained – the sweeter pair. It is possible that consumption at snack time of the less sweet fruit pair was based on pliance and never shifted to tracking, whereas consumption of the sweeter fruit pair began as a ply and then shifted to a track based on the taste properties of those foods. Individual data from Experiments 3 and 4 show that when the children began to consume target fruits at lunchtime it was after they had begun to eat them at snack time.

In Experiment 4, the evidence is that when consumption of one food category increased at snack time, consumption at lunchtime was similarly affected, but in comparison to Experiment 3, greater maintenance of these changes was observed, perhaps because the children had many more taste opportunities than was the case in Experiment 3. Individual data show that in the main, children tended to regularly consume foods at lunchtime after they had begun to do so at snack time. For some children the transition from snack to lunchtime consumption was immediate, for other children, the transition took longer. There were also individual responses to different foods. Thus, it would seem that consumption based on 'liking' developed at different rates with different children and with different foods.

As with the categorisation issue, it is important to ascertain why the children ate the food items when no reward was available (i.e. at lunchtime and during baseline phases) and one way to find out would be to ask them. The answer to the question would determine whether the rule for consumption was based on something like, "I always eat these foods", "these are Jarvis and Jess foods", or "I always eat fruit/vegetables" – a crucial difference in terms of wider generalisation. If systematic monitoring of verbal behaviour were included in future studies, pre- and post- intervention comments about the experimental foods could be compared and may shed light on the changes in eating behaviour. It may also be enlightening to directly ask the children why they ate the experimental foods.

The Jarvis and Jess badges may have functioned in more than one way. As well as being rewards for consumption of foods at snack time, they also engendered verbal praise from other members of the nursery staff and possibly parents at home time. In addition, they may also functioned beyond the snack context as reminders to the children themselves (at lunchtime and at home) that they were 'official' fruit eaters or vegetable eaters and as such always ate those foods. If similar badges for consumption during Experiment 2 had been awarded to the children, they may have performed a similar function and greater generalisation of behaviour to the lunchtime setting might then have been observed.

Rewards

In Chapter 2, it was reported that within the mainstream food psychology literature, there is a widely held view that rewarding food consumption can lead to a decrease in a child's reported verbal liking of that food. The evidence from Experiments 2, 3 and 4, along with those cited in Chapter 3 (Horne, Lowe, Bowdery & Egerton, 1998) is that when consumption of fruit and vegetables was the subject of reward procedures, consumption of those foods increased and the increases were maintained when the intervention was withdrawn and during follow-up phases carried out many months later. Furthermore, the increases in consumption were *achieved* by initially using rewards to induce tasting. During Experiments 2, 3 and 4, no cases were noted in which food consumption was reduced relative to initial baseline measures following reward procedures.

Applied Issues

In practical terms, when applying an intervention in a group setting, it may be necessary to devise a few 'sub-interventions' for use with children who are slower to respond to the experimental contingencies. Some of these were used during Experiment 4. One successful strategy was to reduce the portion size of a food. In the case of two boys who had previously refused to eat green beans on five consecutive occasions, their portion size of green beans was halved. Consequently, both children ate the entire reduced portion and went on to eat the normal quantity of green beans on the next presentation and for the duration of the study. At the same time, both boys consumed green beans when they were presented at lunchtime.

Two girls who had not responded during the intervention targetting vegetables were seen individually by the experimenter, and, in addition to receiving a reduced portion size of vegetables were offered individualized rewards for consuming them. Some effect was recorded with one child but not with the second. Since these sub-interventions were implemented during the last days of the Intervention 2, there was little opportunity to further refine them. It is possible that any strategy of this kind needs to be introduced much earlier (perhaps after two or three refusals) in order to maximise the chances of success and to allow time for other procedures to be explored.

There was one child with whom no intervention was successful. Some extra encouragement at the table was tried with this little boy as well as the smaller portion sizes, but with little effect. He was too shy to sit on his own with the experimenter and so further procedures were not tried.

An obvious addition to the design of Experiment 4 would be to incorporate the home context into the procedures. In the post-experimental questionnaires filled out by parents at the end of the study, many parents indicated that they had observed changes in their child's food behaviours at home (and when shopping) following procedures at the nursery. If the experimental foods were presented in the home context, generalisation to this context could be more rigorously examined and if necessary, separate interventions employed to target consumption there. Results of studies carried out in schools (Horne, Lowe, Bowdery & Egerton 1998) with five to seven year old children showed that consumption of experimental fruit and vegetables presented in the home environment increased once their consumption had been targetted at school and the responses of parents to the questionnaire from Experiment 4, give no reason to doubt that the younger children would be any different.

Greater parental involvement should be carefully planned. It was speculated in Chapter 2 that whether or not a food is consumed may be to some extent context dependent and that one possible context in which children may be less likely to eat food is in the home environment. This context-dependency may be related to the role and status of the parent, which may be somewhat different to that of a nursery-nurse or peer-models in a film or in real life. Some anecdotal evidence from Experiment 4 may support the view that parental involvement is not always helpful. The parent of one of the children who arrived at the nursery at the start of Baseline 3 was very keen that the child be involved, and reported having difficulty in getting the child to eat any vegetable other than baked beans. During the course of the study, the experimenter often had occasion to talk to this parent and the child's progress in the study was generally discussed, as was the timetable for interventions and baselines. The child made progress during Intervention 2, gradually building a small repertoire of experimental foods that she was prepared to eat and had earned badges and Duplo bricks. Some change in eating behaviour was noted in the home context – she chose to eat cucumber and also made requests for green beans. According to the parent, Jarvis and Jess badges adorned the walls of the child's bedroom.

Unfortunately, a decline in the child's consumption was noted at around the same time that the parent reported that she had informed the child that Jarvis and Jess would be leaving the nursery within a few days. It is possible that the child began to perceive the parent as having some part in the intervention and responded to the intervention as she might do to parental instructions. This is not to say that parents should not be involved at all, rather that the involvement should be carefully monitored and parents given appropriate instructions.

The method of measurement employed in this series of experiments warrants further discussion. All food consumption was assessed using a visual rating scale based on consumption of either 0%, up to 25%, up to 50%, up to 75% and up to 100% and at least two different people verified ratings during the course of each experiment. Whilst this method of measurement enabled the swift execution of rewards, it is acknowledged that the scale may have allowed for over-estimates of consumption in some cases. For example, a child who had nibbled at one piece of food from the four presented in Experiment 3 or 4 would be recorded as having eaten 25% of that particular food. Likewise, a child who had consumed three of the pieces of one food and then nibbled at the fourth would be recorded as having eaten 100% of that food portion. Whilst the first example was a frequent occurrence, children would often try a very small bite of a food, the second example was actually quite rare. In practice, the children tended to either eat very little of (i.e. a nibble at the corner of a piece of food) or all of a particular food, with very few in-between measures recorded. Thus, over-estimates of consumption were likely to be recorded at the low end of the consumption scale and would be systematic across the baseline, intervention and follow-up phases of the studies. Further consideration must also be given to the five point measuring scale employed throughout the present experiments. Such a scale may be somewhat insensitive to behaviour change given that each point on the scale represented an increase or decrease of 25%. Thus, any increases or decreases in consumption would need to be relatively large for changes in behaviour to become apparent. The limited number of available data points (i.e. five) also limits the scope for measuring behaviour change using statistical analysis. Future studies might investigate the practicability of other means of assessing food consumption. In Experiments 1 and 2, weighing food portions before and after presentation may have been a viable option, but the method of food presentation in Experiments 3 and 4 (four foods in one bowl) and the liquid consistency of some of those foods, made weighing an unreliable option. Nonetheless, the measure of consumption used in the present studies at the very least shows strong evidence for relative changes and in an applied setting, a measure of consumption must be more relevant than any other measurement (verbal liking, or choice for example). The fact that the children ate more portions of fruit and vegetables when given the opportunity attests to the reliability of the method of measured used in the present experiments.

For the Future

Although the procedures in Experiment 4 were most successful in increasing fruit and vegetable consumption in a large group of children, the relative contributions or effectiveness of each component of the intervention is unknown. In addition to the explicit rewards programmed into the intervention, other forms of rewards may have been in operation. During the intervention phases, 'staff' in charge of each particular table ate the experimental foods and in Intervention 1, 'staff' were psychology assistants who were previously unknown to the participants. In Intervention 2, 'staff' were the nursery nurses, who the children were very familiar with and who may themselves have been role models for the children. This factor may in part account for the relatively more powerful effects of the intervention on vegetables compared to fruit. The potential influence of the nursery nurses on fruit and vegetable consumption within the nursery environment warrants further investigation.

During each intervention phase, the number of positive role models in each peer-group increased. The power of these peer-models, once behaviour is established is evidenced in the consumption data of those children who entered the nursery at the start of the final follow-up phase. Compared to baseline data of those children who took part in the interventions, the new attendees consumption of fruit and vegetables was greater both at snack (60% compared with 30% for fruit and 50% compared with 34% vegetables) and lunchtimes (61% compared to 17% fruit, 46% compared to 20% vegetables). Thus, once a number of children reliably consume fruit and vegetables in a social environment, that environment becomes one in which consumption of fruit and vegetables is the norm and therefore new members are more likely to follow suit. In this way, a culture of fruit and vegetable eaters has arisen and the practices of that culture are passed on to new members. Occasional interventions may be necessary to boost general consumption, or to promote consumption of individuals, but these will not need to be as intense as those procedures documented within Experiment 4. This deserves further investigation.

A component analysis of the intervention might tease out which variables are the most effective. The component analysis carried out by Dowey (1996) with the home based experiments might suggest that the power of the intervention is in its whole form (i.e. video peer-modelling with rewards) rather than individual components, however, the variables in Experiment 4 were somewhat different from those in the home-based studies; the role of the nursery staff and the effects of the peer-group were additional variables in Experiments 3 and 4.

The children who participated in Experiments 3 and 4 were from a wide variety of backgrounds, which suggests that the procedures would be as successful in other pre-school nursery environments, although this assumption awaits further testing.

Conclusions

The results of the present series of studies and particularly those of Experiment 4 suggest that it is possible to alter children's eating behaviours. In Experiment 4, modelling and rewards techniques were manipulated to ensure repeated tasting of initially poorly consumed fruit and vegetables. Great increases in consumption of those fruit and vegetables were brought about with a group of 26 pre-school children. During the interventions, the children's consumption of fruit and vegetables was twice and three times greater than during previous baseline phases. These changes were sustained when the interventions were subsequently withdrawn and at a nine-month follow-up, at least 46% more fruit was being consumed than was recorded during Baseline 1 and consumption of vegetables was at least 42% greater than during Baseline 1. The children came to eat wide variety of fruit (from dragon fruit to water-melon) and vegetables (from carrots to yam) during the course of the study and in the final phase were requesting more of those foods.

The interventions yielded effects that reached beyond the initial experimental setting. With no further intervention, similar changes in consumption of fruit and vegetables were observed in a second (lunchtime) setting, and these changes were maintained as well as those recorded in the experimental setting. Parental reports indicated that changes in eating behaviour were in evidence at home also. Further, children entering the nursery when the interventions had been withdrawn were eating twice more fruit and vegetables than the participating children had at the start of the study indicating that a 'culture' of fruit and vegetable eaters had arisen.

In Experiment 4, the eating and enjoyment of the fruit and vegetables presented became the norm for those children who were exposed to the manipulations and also became the norm for a second group of children entering this new 'culture'. These effects were not achieved by 'merely exposing' children to fruits and vegetables, but by systematically programming external contingencies to ensure their consumption. The inflated consumption levels of the 'new' children were also not achieved by 'merely exposing' those children to the fruits and vegetables, but by exposing them to a 'culture' of fruit and vegetable eaters who had learned to enjoy eating them. This concept of changing cultural habits that are then passed on to new members of the culture has important implications for the changing the eating habits of other groups within the general population, the elderly and teenagers, for example. Leslie and O'Reilly have pointed to the importance of changing behaviour at a community level as well as at an individual level:

> Applied behavior analysts have, of course, developed powerful technologies to change the behavior of individuals and rigorous empirical methodologies to demonstrate the effectiveness of these intervention technologies. However, hard-won changes at the individual level may not be maintained over time if that person returns to a community which differentially reinforces the original problem behavior. (Leslie & O'Reilly, 1999, p. 312).

It has been demonstrated (see Horne, Lowe, Bowdery & Egerton, 1998) that it is possible for individual children to learn to enjoy eating fruit and vegetables. However, how many of these gains are lost when those individual children enter into an environment (school, for example) that does not support the consumption of those foods? It would be much more effective to change to change the culture of the school so that eating fruit and vegetables becomes part of that culture.

The comments from parents regarding the children's behaviour at home following the procedures in Experiment 4, indicate that the children were requesting more fruit and vegetables at home and when out shopping. This is the kind of 'pester-power' that should be actively fostered and encouraged; it may well signal the end of the mealtime 'battleground', and in the process, may also teach parents 'a thing or two'. How many of these parents modified their diets in response to their children's pester power?

The procedures that facilitated these remarkable changes were easily incorporated into the pre-school nursery daily routine and, with some simple training, were implemented by the staff at the nursery. The result was that a large group of children were able to enjoy eating foods that could lay the foundations for their future health and may influence their diets in adulthood. These children then passed on the eating patterns they had learned to children who joined their 'culture'.

On a final note, whilst this thesis was being written, fruit and vegetables have continued to be served to children attending Tir Na n'Og nursery, under the management of the staff there. Figure 10.1 below represents fruit and vegetable consumption in the pre-school playroom for the month of May 2000. It shows that fruit and vegetable consumption has remained high.

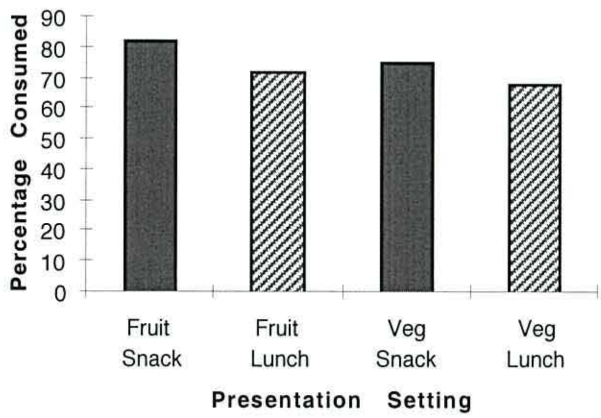


Figure 10.1 Current fruit and vegetables consumption at snack and lunchtime of the 38 children attending the playroom at Tir N'a n'Og nursery

Consider again the quotation from Chapter 1 taken from an HM Government report:

Nutritional deficiencies no longer present a major public health problem in England, and an improved diet has contributed to a longer lifespan. Nevertheless, many people still eat and drink in ways which, over time, can contribute to the risk of developing serious ill-health and of premature death. (The Health of The Nation p.68)

Compare this with a quotation from Skinner's Contingencies of Reinforcement:

In an environment in which only simple foods have been available a man eats sensibly - not because he must, but because no other behavior has ever been strengthened. The normal environment is of a very different sort. In an affluent society most people are prodigiously reinforced with food. Susceptibility to reinforcement leads men to specialise in raising particularly delicious foods and to process and cook them in ways which make them as reinforcing as possible. Overanxious parents offer especially delicious food to encourage children to eat. Powerful reinforcers (called 'candy') are used to obtain certain favours, to allay emotional disturbances, and to strengthen personal relations. It is as if the environment had been designed to build the very behaviors which later prove troublesome. (Skinner p.54)

and then consider the following from Meazzini and Ricci (1986):

Often behaviour analysts have been characterised as having an obsession with the practical implications of their research. Indeed, because of their practical concerns, it has been suggested that the field 'risks' becoming nothing more than a technology. But a more attractive view is that behaviour analysts, as scientists, are concerned about the world in which they live. (Meazzini and Ricci 1986, p.26)

REFERENCES

Baer, R., Blount, R., Detrich, R., & Stokes, T. (1987). Using intermittent reinforcement to program maintenance of verbal/nonverbal correspondence. *Journal of Applied Behavior Analysis, 20,* 179-184.

Baer, R.A., Detrich, R., Weninger, J.M. (1988). On the functional role of the verbalization in correspondence training procedures. *Journal of Applied Behavior Analysis, 20,* 391-400.

Baer, D. M., & Deguchi, H. (1985). Generalized imitation from a radical-behavioral viewpoint. In S. Reiss, & R. R. Bootzin (Eds.), *Theoretical Issues in Behavior Therapy,* (pp. 179-217). Orlando: Academic Press.

Baer, D.M., Peterson, R.F., & Sherman, J.A. (1967). The development of imitation by reinforcing behavioral similarity to a model. *Journal of Applied Behavior Analysis, 10,* 405-416.

Barlow, D. H., & Hersen, M. (1973). Single case experimental designs: Uses in applied clinical research. *Archives of General Psychiatry, 29,* 319-325.

Baum, W. M. (1994). *Understanding Behaviorism: Science, Behavior, and Culture.* New York: Harper Collins College Publishers.

Baum, W. M. (1995). Rules, culture, and fitness. *The Behavior Analyst, 18,* 1-23.

Beauchamp, G.K., Cowart, B.J., & Moran, M. (1986). Developmental changes in salt acceptability in human infants. *Developmental Psychobiology, 19,* 17-25.

Bentall, R. P., Lowe, C. F., & Beasty, A. (1985). The role of verbal behavior in human learning II developmental differences. *Journal of the Experimental Analysis of Behavior, 43*, 165-181.

Bentall, R. P., & Lowe, C. F. (1987). The role of verbal behavior in human learning III developmental differences. *Journal of the Experimental Analysis of Behavior, 47*, 177-190.

Bernal, M. E. (1972). Behavioral treatment of a child's eating problem. *Journal of Behavior Therapy and Experimental Psychology, 3,* 43-50.

Birch, L. L. (1979a). Preschool children's food preferences and consumption patterns. *Journal of Nutrition Education, 11,* 189-192.

Birch, L. L. (1979b). Dimensions of preschool children's food preferences. *Journal of Nutrition Education, 11,* 77-80.

Birch, L. L. (1980a). Effects of peer models' food choices and eating behaviors on preschoolers' food preference. *Child Development, 51,* 489-496.

Birch, L. L. (1980b). Experiential determinants of children's food preferences. In L. G. Katz (Ed.), *Current Topics in Early Childhood Education Vol. III* (pp. 29-46). Norwood, New Jersey: Ablex Publishing. Co.

Birch, L. L. (1981). Generalization of a modified food preference. *Child Development, 52,* 755-758.

Birch, L. L. (1987a). Children's food preferences: developmental patterns and environmental influences. In R. Vasta (Ed.), *Annals of Child Development Vol. 4* (pp. 171-208). Greenwich, CT: JAI Press Inc.

Birch, L.L. (1987b). The acquisition of food acceptance patterns in children. In R. A. Boakes, D. A., Popplewell, & M. J. Burton (Eds.) *Eating Habits* (pp. 107-130). Chichester: John Wiley & Sons Ltd.

Birch, L. L. (1990). Development of food acceptance patterns. *Developmental Psychology, 26* , 515-519.

Birch, L.L., Billman, J., & Richards, S. (1984). Time of day influences food acceptability. *Appetite, 5,* 109-112.

Birch, L. L., Birch, D., Marlin, D., & Kramer, L. (1982). Effects of instrumental consumption on children's food preference. *Appetite*, *3*, 125-134.

Birch, L. L., & Marlin, D. W. (1982). 'I don't like it, I never tried it': effects of exposure on two-year old children's food preferences. *Appetite, 3,* 353-360.

Birch, L. L., Marlin, D. W., & Rotter, J. (1984). Eating as the 'means' activity in a contingency: effects on young children's food preference. *Child Development, 55,* 431-439.

Birch, L. L., McPhee, L., Shoba, B. C., & Steinberg, L. (1987). What kind of exposure reduces children's food neophobia? Looking vs tasting. *Appetite, 9,* 171-178.

Birch, L. L., Zimmerman, S. I., & Hind, H. (1980). The influence of social-affective context on the formation of children's food preferences. *Child Development, 51,* 856-861.

British Medical Association (1999). Growing up in Britain: Ensuring a healthy future for our children. A study of 0-5 year olds. London: BMJ Books.

Brody, G. B., & Stoneman, Z. (1981). Selective imitation of same-age, older, and younger peer models. *Child Development, 52,* 717-720.

Cameron, J., & Pierce, D.W. (1994). Reinforcement, reward, and intrinsic motivation: A meta-analysis. *Review of Educational Research, 64*, 363-423.

Catania, A.C., Shimoff, E., Matthews, B.A. (1989). An experimental analysis of rule-governed behavior. In S. C. Hayes (Ed.), *Rule-Governed Behavior: Cognition, Contingencies, and Instructional Control* (pp. 119-150). New York: Plenum Press

Catania, A. C., Matthews, B. A., & Shimoff, E. (1990). Properties of rule-governed behavior and their implications. In D. E. Blackman & H. Lejeune (Eds.), *Behaviour Analysis in Theory and Practice: Contributions and Controversies* (pp. 215-230). Brighton: Lawrence Erlbaum.

Cooper, L.J., Wacker, D.P., Brown, K., McComas, J.J., Peck, S.M., Drew, J., Asmus, J., & Kayser, K. (1999). Use of concurrent operants paradigm to evaluate positive reinforcers during treatment of food refusal. *Behavior Modification, 23*, 3-40.

Crook, C.K. (1978). Taste perception in the newborn infant. *Infant Behavior and Development, 1,* 52-69.

Darch, C., Carnine, D., & Gersten, R. (1984). Explicit instruction in mathematics problem solving. *Journal of Educational Research, 77*, 351-359.

Deacon, J. R., & Konarski, E. A. J. (1987). Correspondence training: an example of rule-governed behavior? *Journal of Applied Behavior Analysis, 20,* 391-400.

Deguchi, H. (1984). Observational learning from a radical-behavioristic viewpoint. *The Behavior Analyst, 7,* 83-95.

Department of Health (1991, June). *The Health of the Nation.* London: HMSO.

Department of Health (1998). *Our Healthier Nation-A Contract for Health.* Command Paper CM 3852. London: The Stationery Office.

Dibb, S. & Castell, A. (1995). Easy to swallow, hard to stomach. The results of a survey of food advertising on television. London: National Food Alliance.

Duncker, K. (1938). Experimental modification of children's food preferences through social suggestion. *Journal of Abnormal and Social Psychology, 33,* 489-507.

Dowey, A.J. (1996). Psychological determinants of children's food preferences. *Unpublished PhD thesis.* University of Wales.

Fantz, R. (1961). The origin of form perception. *Scientific American, 204*, 66-72.

Galst, J. P., & White, M. A. (1976). The unhealthy persuader: the reinforcing value of television and children's purchase-influencing attempts at the supermarket. *Child Development, 47,* 1089-1096.

Garcia, J., Hankins, W., Coil, J. (1977). Koalas, men and other conditioned gastronomes, In Milgram, NW. (Ed.), *Food Aversion Learning*. New York: Plenum Press.

Gewirtz, J. L., & Stingle, K. G. (1968). Learning of generalized imitation as the basis for identification. *Psychological Review, 75,* 374-397.

Gillman, M.W. (1996). Enjoy your fruits and vegetables. *British Medical Journal, 313*, 765-766

Goldberg, M. E., Gorn G.J., & Gibson W. (1978). TV messages for snack and breakfast foods: do they influence children's preferences? *Journal of Consumer Research, 5,* 73-81.

Gorn, G. J., & Goldberg, M. E. (1982). Behavioural evidence of the effects of televised food messages on children. *Journal of Consumer Research, 9,* 200-205.

Grant, L., & Evans, A. (1994). *Principles of Behavior Analysis,* New York: Harper Collins College Publishers.

Greer, R. D., Dorow, L., Williams, G., McCorkle, N., & Asnes, R. (1991). Peer-mediated procedures to induce swallowing and food acceptance in young children. *Journal of Applied Behavior Analysis, 24,* 783-790.

Handen, B. L., Mandell, F, & Russo, D. C. (1986). Feeding induction in children who refuse to eat. *American Journal of Diseases of Children, 140,* 52-54.

Harper, L., & Sanders, K. (1975). The effect of adults' eating on young children's acceptance of unfamiliar foods. *Journal of Experimental Child Psychology, 20,* 200-214.

Hatcher, R. P. (1979). Treatment of food refusal in a two-year old child. *Journal of Behavior Therapy and Experimental Psychology, 10,* 363-367.

Hayes, S. C., & Hayes, L. J. (1989). The verbal action of the listener as a basis for rule-governance. In S. C. Hayes (Ed.), *Rule-Governed Behavior: Cognition, Contingencies, and Instructional Control* (pp. 153-190). New York: Plenum Press.

Hayes, S. C., Zettle, R. D., & Rosenfarb, I. (1989). Rule-Following. In S. C. Hayes (Ed.), *Rule-Governed Behavior: Cognition, Contingencies, and Instructional Control.* New York: Plenum Press.

Horne, P. J., & Lowe, C. F. (1993). Determinants of human performance on concurrent schedules. *Journal of Experimental Analysis of Behavior, 59,* 29-60.

Horne, P. J., & Lowe, C. F. (1996). On the origins of naming and other symbolic behavior. *Journal of the Experimental Analysis of Behavior, 65,* 185-241.

Horne, P.J., & Lowe, C.F. (in press). Putting the naming account to the test: preview of an experimental program. In J. C. Leslie & D.Blackman (Eds.), *Issues in experimental and applied analysis of human behaviour*. Reno, Nevada: Context Press.

Horne, P.J., Lowe, C.F., Bowdery, M.A., Egerton, C. (1998). The way to healthy eating for children. *British Food Journal, 100,* 133-140

Israel, A.C. (1978). Some thoughts on correspondence between saying and doing. *Journal of Applied Behavior Analysis, 11*, 276-276.

Kazdin, A. E. (1973). The effect of vicarious reinforcement on attentive behavior in the classroom. *Journal of Applied Behavior Analysis, 6,* 71-78.

Leslie, J.C., & O'Reilly, M.F.(1999). *Behavior Analysis: Foundations and applications to psychology*. Amsterdam: Harwood Academic Publishers.

Leung, A. K. C., Fagan, J. E., Cho, H., Lim, S. H. N., & Robson, W. L. M. (1994). Children and television. *American Family Physician, 50,* 909-915.

Lowe, C. F. (1979). Determinants of human operant behaviour. In M. D. Zeiler, & P. Harzem (Eds.), *Advances in Analysis of Behaviour Vol. 1* (pp. 159-192). Chichester, England: Wiley.

Lowe, C.F. (1983). Radical Behaviorism and human psychology. In G.C.L. Davey (Ed.) *Animal models of human behavior* (pp. 71-93). Chichester, England: Wiley.

Lowe, C. F., Beasty, A., & Bentall, R. P. (1983). The role of verbal behavior in human learning: infant performance on fixed-interval schedules. *Journal of the Experimental Analysis of Behavior, 39,* 157-164.

Luria, A. (1961*). The role of speech in the regulation of normal and abnormal behavior.* New York*:* Liveright.

Malott, R. W. (1989). The achievement of evasive goals: control by rules describing contingencies that are not direct acting. In S. C. Hayes (Ed.), *Rule-Governed Behavior: Cognition, Contingencies, and Instructional Control* (pp. 269-322). New York: Plenum Press.

Mansdorf, I.J. (1977). Rapid token training of an institution ward using modeling. *Mental Retardation, 15*, 37-39.

Marinho, H. (1942). Social influence in the formation of enduring preferences. *Journal of Abnormal and Social Psychology, 37,* 448-468.

Meazzini, P. & Ricci, C. (1986). Molar vs molecular units of behavior. In T. Thompson & M.D. Zeiler (Eds.), *Analysis and integration of behavioral units* (pp. 19-43). Hillsdale, NJ: Lawrence Erlbaum Associates.

Mikula, G. (1989). Influencing food preferences of children by 'if-then' type instructions. *European Journal of Social Psychology, 19,* 225-241.

National Diet and Nutrition Survey: children aged 1 1/2 to 4 1/2 years. *A survey carried out in Great Britain on behalf of the Ministry of Agriculture, Fisheries and Food and the Departments of Health by the Social Survey Division of the Office of*

Population Censuses and Surveys and the Medical Research Council Dunn Nutrition Unit. Volume 1*: Report of the diet and nutrition survey*. London: HMSO.

National Food Alliance Advertising Project. (1995). Easy to swallow, hard to stomach. The results of a survey of food advertising on television. London: A *National Food Alliance Publication.*

Newman, J., & Taylor, A. (1992). Effect of a means-end contingency on young children's food preferences. *Journal of Experimental Child Psychology, 64*, 200-216.

Nowlis, G.H. (1973). Taste elicited tongue movements in human newborn infants: An approach to palatability. In J.F. Bosma (Ed.), *Fourth symposium on oral sensation and perception: Development of the fetus and infant* (DHEW Publication No. NIH 73-546) Washington, DC: U.S. Government Printing Office.

Ollendick, T. H., Daily, D., & Shapiro, E. S. (1983). Vicarious reinforcement: expected and unexpected effects. *Journal of Applied Behavior Analysis, 16,* 485-491.

Ollendick, T. H., Shapiro, E. S., & Barrett, R. P. (1982). Effects of vicarious reinforcement in normal and severely disturbed children. *Journal of Consulting and Clinical Psychology, 50,* 63-70.

Pelchat, M. L., & Pliner, P. (1995). 'Try it. You'll like it.' Effects of information on willingness to try novel foods. *Appetite, 24*, 153-166.

Peterson, P. E., Jeffrey, D. B., Bridgwater, C. A., & Dawson, B. (1984). How pronutrition television programming affects children's dietary habits. *Developmental Psychology, 20,* 55-63.

Pliner, P. (1982). The effects of mere exposure on liking for edible substances. *Appetite, 3,* 283-290.

Poulson, C. L., Kymissis, E., Reeve, K.F., Andreatos, M., & Reeve, L. (1991). Generalized vocal imitation in infants. *Journal of Experimental Child Psychology, 51*, 267-279

Riordan, M. M., Iwata, B. A., Finney, J. W., Wohl, M. K., & Stanley, A. E. (1984). Behavioral assessment of and treatment of chronic food refusal in handicapped children. *Journal of Applied Behavior Analysis, 17*, 327-341.

Risley, T. R., & Hart, B. (1968). Developing correspondence between the non-verbal and verbal behavior of preschool children. *Journal of Applied Behavior Analysis, 1*, 267-281.

Rozin, P. (1981). Study of human food selection and problems of a Stage 1 Science. In S. A. Miller (Ed.), *Nutrition and Behavior* (pp. 9-18). Franklin Inst. Press.

Rozin, P. (1982). Human food selection: the interaction of biology, culture and individual experience. In L. M. Barker (Ed.), *The Psychobiology of Human Food Selection* (pp. 225-253). Chichester: Wiley.

Russell, B. (1961). Knowledge by acquaintance and knowledge by description. In R.E. Egner & L.E. Dennon (Eds.), *The basic writings of Bertrand Russell: 1903-1959* (pp.217-224). New York: Simon and Schuster. Original work published 1912.

Ryle, G. (1949). The concept of mind. New York: Barnes and Noble Books.

Scottish Office (1998). Working Together for a Healthier Scotland: A Consultation Document. Command Paper CM 3854. The Stationery Office.

Siegal, L. J. (1972). Classical and operant procedures in the treatment of a case of food aversion in a young child. *Journal of Clinical Child Psychology, 11*, 167-172.

Skinner, B. F. (1953). *Science and Human Behavior.* New York: The Free Press.

Skinner, B. F. (1969). *Contingencies of Reinforcement.* Englewood Cliffs, NJ: Prentice-Hall, Inc.

Skinner, B. F. (1971). *Beyond Freedom and Dignity.* New York: Knopf.

Skinner, B. F. (1974). *About Behaviorism.* London: Jonathan Cape.

Skinner, B. F. (1989). *Recent Issues in the Analysis of Behavior.* Ohio: Merrill Publishing Company.

Stark, L., Collins, F., Osnes, P., & Stokes, T. (1986). Using reinforcement and cueing to increase healthy snack food choices in preschoolers. *Journal of Applied Behavior Analysis, 19,* 367-379.

Steiner, J.E. (1977). Facial expressions of the neonate infant indicating the hedonics of food-related chemical stimuli. In J.M. Weiffenbach (Ed.) *Taste and development: The genesis of sweet preference.* (DHEW Publication No. NIH 77-1068), Washington DC: U.S. Government Printing Office.

Stoneman, Z., & Brody, G. H. (1981). Peers as mediators of television food advertisements aimed at children. *Developmental Psychology, 17*, 853-858.

Sullivan, S.A., & Birch, L.L. (1994). Infant dietary experience and acceptance of solid foods. Pediatrics, *93*, 271-277.

Thelen, M. H., & Rennie, D. L. (1972). The effect of vicarious reinforcement on imitation: a review of the literature. In B.A. Maher (Ed.), *Progress in Experimental Personality Research.* New York: Academic Press.

Vaughan, M. (1989). Rule-governed behavior in behavior analysis: a theoretical and experimental history. In S. C. Hayes (Ed.), *Rule-Governed Behavior: Cognition, Contingencies, and Instructional Control* (pp. 97-115). New York: Plenum Press.

Vygotsky, L. S. (1934/1987). Thinking and speech. In R.W. Rieber & A.S. Carlton (Eds.), *The collected works of L. S. Vygotsky Volume 1* (pp. 39–285). New York: Plenum Press.

Welsh Office, (1998). Better Health-Better Wales. Command Paper CM 3922. London: The Stationery Office.

Whitehurst, G. J. (1978). Observational learning. In A. C. Catania, & T. A. Brigham (Eds.), *Handbook of Applied behavior Analysis: Social and Instructional Processes* (pp. 142-178). New York: Irvington Publishers, Inc.

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology, 9,* 1-27.

Zellner, D. A. (1991). How foods get to be liked: some general mechanisms and some special cases. In, R. C. Bolles (Ed.), *The Hedonics of Taste* (pp. 199-217). Hillsdale, NJ: Lawrence Erlbaum Associates.

Zettle, R., & Hayes, S. C. (1982). Rule-governed behavior: a potential theoretical framework for cognitive-behavioral therapy. In P.C. Kendall (Ed.) *Advances in Cognitive-Behavioral Research and Therapy Volume 1* (pp. 76-113). New York: Academic Press.

Appendix 1

Experiment 1 Statistical Analysis: Initial Randomisation Tests

The data in Experiment 1 were initially analysed using repeated measures mixed design ANOVA. However, the data was found to be non-parametric (the spread of values was bi-modal) and thus a randomisation test was carried out on the data. The randomisation procedure generated new (data appropriate F values, which were then compared with 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 – here a mixed design ANOVA. The test generates observed F ratios relating to the main factors and interactions.

2) The original data set is then randomised. For the design used in Experiment 1, the randomisation was done first with the values recorded across the four presentations within subject and then the subjects are randomly assigned to Groups (A, B, or C). This yields a data set different to the original.

3) The ANOVA is performed on the new randomised data set to give another F ratio.

4) 2 and 3 above are performed on 999 further occasions; to give a distribution of observed values each calculated on a randomisation data set generated from the original set.

5) The 95th and 99th percentiles of the generated distribution of F ratios are calculated. If the observed F ratio calculated within the original data set (prior to randomisation) exceeds the value at either percentile, it is considered significant at either the 0.05 or 0.01 level respectively. The procedures generate the equivalent of the F tables with which the normal observed F ratio is usually compared.

The distributions generated by the randomisation test for each post-hoc comparison are presented in the following pages.

Comparison

Presentation 1: Group A versus Group B - Target Food

Mean Group A: 60%
Mean Group B: 13.3%

Subjects 48
Measures per individual: 6
Number of foods: 2
Number of groups: 3

Critical value:
Observed Q = 2.216

Quantile	Distribution
0.00	-1.969
0.005	-1.711
0.025	-1.250
0.25	- 0.443
0.5	0.112
0.75	0.553
0.975	1.659
0.995	2.445
1.00	3.233

—— 95% confidence interval
········ 99% confidence interval

Comparison

Presentation 1: Group B versus Group C - Target Food

Mean Group A: 57%
Mean Group B: 13%

Subjects 48
Measures per individual: 6
Number of foods: 2
Number of groups: 3

Critical value:
Observed Q = -2.080

Quantile	Distribution
0.00	-2.454
0.005	-1.982
0.025	-1.433
0.25	- 0.260
0.5	0.254
0.75	0.657
0.975	1.636
0.995	1.887
1.00	2.044

—— 95% confidence interval
········ 99% confidence interval

b

Comparison

Presentation 1: Group A versus Group C - Target Food

Mean Group A: 60%
Mean Group B: 57%

Subjects 48
Measures per individual: 6
Number of foods: 2
Number of groups: 3

Critical value:
Observed Q = 0.1357

Quantile	Distribution
0.00	-1.993
0.005	-1.418
0.025	-1.085
0.25	- 0.277
0.5	0.167
0.75	0.719
0.975	1.548
0.995	1.841
1.00	2.046

—— 95% confidence interval
········ 99% confidence interval

lc

Comparison

Presentation 1 and 2: Group A Target Food Consumption

Mean Group A: 60%
Mean Group A: 73%

Subjects 48
Measures per individual: 6
Number of foods: 2
Number of groups: 3

Critical value:
Observed Q = -1.052

Quantile	Distribution
0.00	-2.549
0.005	-1.856
0.025	-1.549
0.25	- 0.553
0.5	0.000
0.75	0.541
0.975	1.515
0.995	1.858
1.00	2.354

—— 95% confidence interval
········ 99% confidence interval

d

Comparison

Presentation 1 and 2: Group B Target Food Consumption

Mean Group B: 13%
Mean Group B: 6.6%

Subjects 48
Measures per individual: 6
Number of foods: 2
Number of groups: 3

Critical value:
Observed Q = -1.052

Quantile	Distribution
0.00	-2.056
0.005	-1.791
0.025	-1.242
0.25	- 0.544
0.5	0.000
0.75	0.539
0.975	1.654
0.995	1.805
1.00	2.231

—— 95% confidence interval
········ 99% confidence interval

e

Comparison

Presentation 2: Group A versus Group C - Target Food

Mean Group A: 80%
Mean Group B: 57%

Subjects 48
Measures per individual: 6
Number of foods: 2
Number of groups: 3

Critical value:
Observed Q = 1.085

Quantile	Distribution
0.00	--1.529
0.005	-1.244
0.025	-1.007
0.25	- 0.245
0.5	0.268
0.75	0.677
0.975	1.536
0.995	1.843
1.00	2.154

—— 95% confidence interval
.... 99% confidence interval

f

Comparison

Presentation 2: Group A versus Group B - Target Food

Mean Group A: 73%
Mean Group B: 6.67%

Subjects 48
Measures per individual: 6
Number of foods: 2
Number of groups: 3

Critical value:
Observed Q = -3.166

Quantile	Distribution
0.00	--3.211
0.005	-2.421
0.025	-1.774
0.25	- 0.564
0.5	0.112
0.75	0.417
0.975	1.422
0.995	1.785
1.00	2.219

—— 95% confidence interval
········ 99% confidence interval

Comparison

Presentation 2: Group C versus Group B - Target Food

Mean Group A: 57.1%
Mean Group B: 6.67%

Subjects 48
Measures per individual: 6
Number of foods: 2
Number of groups: 3

Critical value:
Observed Q = -2.397

Quantile	Distribution
0.00	--2.471
0.005	-2.150
0.025	-1.543
0.25	- 0.281
0.5	0.159
0.75	0.652
0.975	1.641
0.995	2.044
1.00	2.111

—— 95% confidence interval
········ 99% confidence interval

h

Comparison

Presentation 2: Group A versus Group B - 2nd Food

Mean Group A: 73.3%
Mean Group B: 57.1%

Subjects 48
Measures per individual: 6
Number of foods: 2
Number of groups: 3

Critical value:
Observed Q = 0.7688

Quantile	Distribution
0.00	-1.471
0.005	-1.281
0.025	-0.890
0.25	- 0.217
0.5	0.153
0.75	0.688
0.975	1.550
0.995	2.080
1.00	2.476

—— 95% confidence interval
········ 99% confidence interval

Comparison

Presentation 4: Group A versus Group C

Mean Group A: 66%
Mean Group B: 50%

Subjects 48
Measures per individual: 6
Number of foods: 2
Number of groups: 3

Critical value:
Observed Q = .7914

Quantile	Distribution
0.00	-1.361
0.005	-1.308
0.025	-0.051
0.25	- 0.270
0.5	0.166
0.75	0.651
0.975	1.466
0.995	1.822
1.00	2.180

—— 95% confidence interval
········ 99% confidence interval

J

Comparison

Presentation 1 versus Presentation 3 : Group A

Mean Group A: 60%
Mean Group B: 80%

Subjects 48
Measures per individual: 6
Number of foods: 2
Number of groups: 3

Critical value:
Observed Q = -0.1577

Quantile	Distribution
0.00	-2.442
0.005	-1.806
0.025	-1.179
0.25	- 0.536
0.5	0.000
0.75	0.544
0.975	1.193
0.995	1.718
1.00	1.907

—— 95% confidence interval
········ 99% confidence interval

K

Appendix 1

Experiment 1: Raw data

Table 1A

Table 1A shows the consumption scores for all 44 children who took part in Experiment 1, across Presentations 1 to 4. Each participants group allocation and target food (quorn or potato bread) is presented in the left column. Consumption of the second blue food at Presentation 2 and 4 is also shown.

Key:

P	Participant Number
Gp A	Group A – positive peer influence
Gp B	Group B – negative and positive peer influence
Gp C	Group C – control group
Q	Quorn presented as target food
PB	Potato bread presented as target food
Target	Target food consumption
2nd	Second blue food consumption

	A	B	C	D	E	F	G	H
1		Subject	Pres 1	Pres 2	Pres 3	Pres 4	1st Gen	2nd Gen
2		Gp A S1 Mar	0	100	100	100	100	100
3		Gp A S2 Mar	0	100	100	100	100	100
4		Gp A S3 Mar	0	0	0	0	0	0
5		Gp A S4 Mar	100	0	100	0	0	0
6		Gp A S5 Mar	100	100	100	100	100	100
7		Gp A S6 Mar	0	0	0	0	0	0
8		Gp A S7 Tec	100	100	100	100	100	100
9		Gp A S8 Tec	0	0	0	0	0	0
10		Gp A S9 Tec	100	100	100	100	100	100
11		Gp A S10 Tec	100	100	100	0	100	0
12		Gp A S11 Tec	100	100	100	100	100	100
13		Gp A S12 Tec	0	100	100	100	100	100
14		Gp A S13 Tec	100	100	100	100	100	100
15		Gp A S14 Tec	100	100	100	100	100	100
16		Gp A S15 Tec	100	100	100	100	100	100
17								
18		Gp B S1 Mar	0	0	0	0	0	0
19		Gp B S2 Mar	0	0	0	0	0	0
20		Gp B S3 Mar	100	100	100	100	100	100
21		Gp B S4 Mar	0	0	0	0	0	0
22		Gp B S5 Mar	0	0	0	0	0	0
23		Gp B S6 Mar	0	0	0	0	0	0
24		Gp S7 Mar	0	0	0	0	0	0
25		Gp B S8 Mar	0	0	0	0	0	0
26		Gp B S9 Tec	0	0	0	0	0	0
27		Gp B S10 Tec	0	0	0	0	0	0
28		Gp B S11 Tec	0	0	0	0	100	0
29		Gp B S12 Tec	0	0	100	100	0	100
30		Gp B S13 Tec	0	0	0	0	0	0
31		Gp B S14 Tec	0	0	0	0	0	0
32		Gp B S15 Tec	100	0	0	0	0	0
33								
34		Gp C S1 Mar	100	100	100	100	100	100
35		Gp C S2 Mar	100	100	100	100	100	100
36		Gp C S3 Mar	0	0	0	0	0	0
37		Gp C S4 Mar	100	0	0	0	0	0
38		Gp C S5 Mar	100	100	100	100	100	100
39		Gp C S6 Mar	100	100	100	100	100	100
40		Gp C S7 Mar	0	100	100	100	100	100
41		Gp C S8 Tec	0	0	0	0	0	0
42		Gp C S9 Tec	100	100	100	100	100	100
43		Gp C S10 Tec	0	100	100	100	100	100
44		Gp C S11 Tec	100	100	100	0	100	0
45		Gp C S12 Tec	0	0	0	0	0	0
46		Gp C S13 Tec	100	0	0	0	0	0
47		Gp C S14 Tec	0	0	0	0	0	0

			Presentation 1	Presentation 2		Presentation 3	Presentation 4	
Grp	P	Food	Target	Target	2nd	Target	Target	2nd
A	1	PB	0	100	100	100	100	100
A	2	PB	0	100	100	100	100	100
A	3	PB	0	0	0	0	0	0
A	4	PB	100	0	0	100	0	0
A	5	PB	100	100	100	100	100	100
A	6	PB	0	0	0	0	0	0
A	7	PB	0	0	0	0	0	0
A	8	Q	100	100	100	100	100	100
A	9	Q	100	100	100	100	100	100
A	10	Q	100	100	0	100	0	0
A	11	Q	100	100	100	100	100	100
A	12	Q	0	100	100	100	100	100
A	13	Q	100	100	100	100	100	100
A	14	Q	100	100	100	100	100	100
A	15	Q	100	100	100	100	100	100
B	1	PB	0	0	0	0	0	0
B	2	PB	0	0	0	0	0	0
B	3	PB	100	100	100	100	100	100
B	4	PB	0	0	0	0	0	0
B	5	PB	0	0	0	0	0	0
B	6	PB	0	0	0	0	0	0
B	7	PB	0	0	0	0	0	0
B	8	PB	0	0	0	0	0	0
B	9	Q	0	0	0	0	0	0
B	10	Q	0	0	0	0	0	0
B	11	Q	0	0	100	0	0	0
B	12	Q	0	0	0	100	100	100
B	13	Q	0	0	0	0	0	0
B	14	Q	0	0	0	0	0	0
B	15	Q	100	0	0	0	0	0
C	1	PB	100	100	100	100	100	100
C	2	PB	100	100	100	100	100	100
C	3	PB	0	0	0	0	0	0
C	4	PB	100	0	0	0	0	0
C	5	PB	100	100	100	100	100	100
C	6	PB	100	100	100	100	100	100
C	7	PB	0	100	100	100	100	100
C	8	Q	0	0	0	0	0	0
C	9	Q	100	100	100	100	100	100
C	10	Q	0	100	100	100	100	100
C	11	Q	100	100	100	100	0	0
C	12	Q	0	0	0	0	0	0
C	13	Q	100	0	0	0	0	0
C	14	Q	0	0	0	0	0	0

Appendix 1

Experiment 1: Novel Food Recipes

Recipes for Novel Blue Foods:

Quorn

Boil quorn in 1/2 pint of water with 1 tbsp blue food colouring

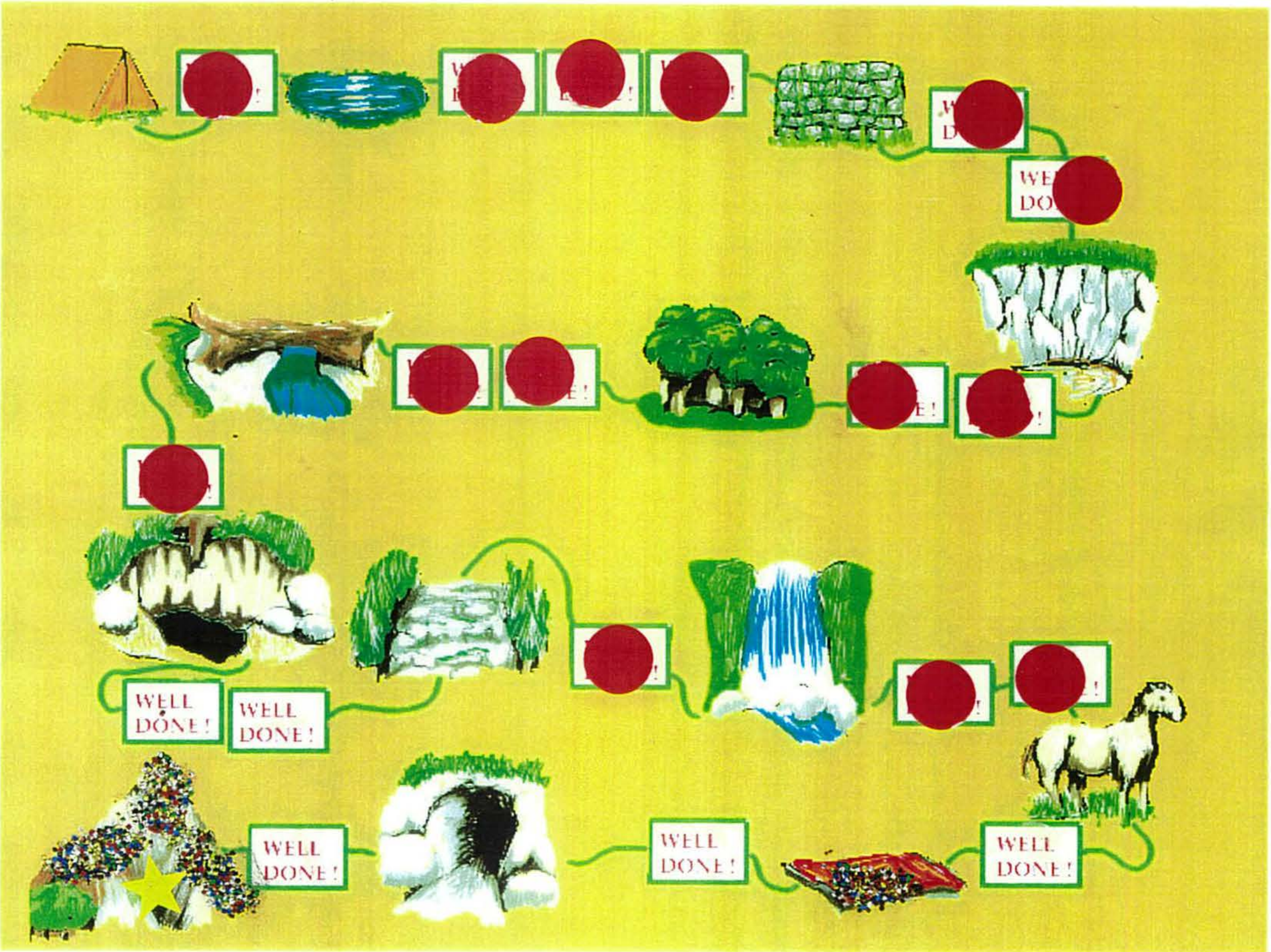
Potato Bread

3oz plain flour
1/2 tsp. Baking powder
1/2 lb mashed potato
1 oz butter
1/2 tbsp milk
2 tsp blue food colouring

a

Appendix 2

Experiment 2: Map of 'Taste Buddies journey given to each participant in Experiment 2


WELL DONE!
WELL DONE!
WELL DONE!
WELL DONE!
WELL DONE!
WELL DONE!

Appendix 2

Experiment 2: Parental food questionnaire

Preliminary Questionnaire

Child's Name...

D.O.B..

Address...

Telephone...

Parent's Name...

Date of Interview...

a

To discover your child's individual tastes, I have here a list of foods. It is quite a long and extensive list and it is unlikely that your child will have eaten all or even most of them.
For each food, I'd like you to tell me whether your child:
1) likes
2) will eat if asked
3) will not eat
4) has never had

Please feel free to make any comments you feel are relevant at any time during this interview.

Vegetables:

Avocado	....	....
Potatoes	....	....
Carrots	....	....
Swede	....	....
Turnip	....	....
Parsnip	....	....
Beetroot	....	....
Radish	....	....
Fennel	....	....
Artichokes	....	....
Asparagus	....	....
Broccoli	....	....
Cabbage Red	....	....
Cabbage White	....	....
Cauliflower	....	....
Celery	....	....
Chinese leaves	....	....
Coleslaw	....	....
Leeks	....	....
Lettuce	....	....
Onions	....	....
Spinach	....	....
Spring Greens	....	....
Spring Onions	....	....
Sprouts	....	....
Peppers	....	....

Beansprouts ....
Water Chestnut ....
Bamboo Shoots ....
Tomato ....
Aubergine ....
Courgette ....
Marrow ....
Cucumber ....
Mushrooms ....
Pickles ....
Broad Beans ....
Green Beans ....
Mange Tout ....
Blackeye Beans ....
Butter Beans ....
Flageolet ....
Haricot Beans ....
Kidney Beans ....
Peas ....
Lentils ....
Asparagus pea ....
Dried peas ....
Chick Peas ....
White Beans ....
Kale ....
Chinese cabbage ....
Savoy cabbage ....
Yam ....
Pumpkin ....
Chicory ....
Swiss Chard ....
Callaloo ....
Endive ....

Fruits:

Apples ....
Apricot ....
Banana ....

c

Blackberries ....
Blackcurrants ....
Cherries ....
Gooseberries ....
Grapefruit ....
Grapes ....
Greengages ....
Guava ....
Kiwi ....
Lychee ....
Mandarins ....
Mangoes ....
Melon ....
Nectarines ....
Oranges ....
Passion Fruit ....
Paw Paw ....
Peaches ....
Pears ....
Pineapple ....
Plums ....
Pomegranate ....
Raspberries ....
Redcurrants ....
Rhubarb ....
Satsumas ....
Strawberries ....
Watermelon ....
Raisins ....
Squash Acorn ....
Carambola ....
Damson ....
Feijoa ....
Figs ....
Japanese Plums ....
Kumquats ....
Loquat ....
Mangosteen ....

d

Papaya ....
Pomelo ....
Prickly Pear ....
Sapodilla ....
Soursop ....
Tamarillo ....
Ugli ....

Snack Foods:
Biscuits ....
Cake ....
Crisps ....
Chocolate ....
Sweets ....

Drinks:
Milk ....
Tea ....
Coffee ....
Water ....
Carbonated
Water ....
Squash ....
Ribena ....
Apple juice ....
Grapefruit juice ....
Orange juice ....
Pineapple juice ....
Other ....

Other Information:

Does your child have any input into what food is purchased or prepared?

....

Do you have any methods for encouraging him/her to eat?

....

....

Do you consider your child to be a fussy eater?

....

....

Ages of siblings:..

Any food allergies?...

Any special diet?..

Attendance at Tir Na n'og:
F/T ....

P/T..

Any holidays planned?
....

When will he/she be going to school?...

Appendix 3

Experiment 3 and 4: Examples of letters read to participants 'from Jarvis & Jess'

Tuesday 25th November

Hello every one!

Who knows what day it is today? Can you give us a special Tuesday wave?

We're really pleased that we have so many new friends at Tir na n'Og who are eating fruit. We're very proud of you all. You can see that lots of you are eating fruit by looking at the special energy board on the wall. Look how far up the ladders your sticker have reached. We'll soon have to leave another present in the big red box. Who can remember what the last present was?

Keep collecting stickers by eating your fruit.

And look at all the Lego on the shelf. Almost everyone has a box now. If you don't have a box of Lego yet, don't worry, we still have some more to give away. It's very easy to win one. Just eat all your fruit today.

This is today's special Jarvis and Jess Tuesday FruitEater badge. What do you think of this one?
If you win one of these you can wear it all day and everyone will know that you eat fruit. It'very easy to win a FruitEater badge. Just eat fruit!

Guess what? We've brought you another video today. Can anyone guess which yummy fruits will be in it?

Kiwi Fruit and Paw Paw

Who likes to eat kiwi fruit? Who likes to eat paw paw?

Look out for these fruits at snack time, eat them all up and win!

Don't forget, our helpers will be coming round at snack time to find children who their fruit.

a +

We'd like everyone to have fun with us, eat fruit and win prizes. So, get munching!

Remember the rhyme? Eat your fruit. It tastes yummy. It feels good inside your tummy.

We'll be back after snack to give away more prizes,

love from

Jarvis and Jess

Wednesday 19th November

Hello FruitEaters,

MMMMMM!!! Who can feel lots of special energy in their tummy?

Does Julie have any? Can you show her how to do the special energy test?

That's very good. Will Julie get a special FruitEater badge?

Who else has eaten their fruit today? Well done to everyone who tried really hard.

Here are the children who have won prizes today for eating fruit:

C

Appendix 4

Experiment 4: Example of the questionnaire sent to parents at the end of Experiment 4.

Food Research Questionnaire.

All of the information gathered is strictly confidential.

Please circle the appropriate answer.

Section one *(Your child's behaviour.)*

1. Did your child enjoy helping JESS AND JARVIS ?

YES NO

Please state reasons.

....

....

....

....

....

....

....

2. Have you noticed any recent changes in your child's eating behaviour?

YES NO

If Yes, please describe any changes that have occurred.

....

....

....

....

....

....

....

3. Has your child asked you to buy any new foods which had not previously been on your shopping list?

YES NO

If Yes, what foods have they asked for?

....

....

....

....

....

....

....

a

4. Would you say that your child now eats more fruit and vegetables than before?

Fruits	YES NO
Vegetables	YES NO

If Yes, which foods?

....

....

....

5. Is your child more, or less willing to try new foods than before the programme commenced?

MORE LIKELY
LESS LIKELY
NO DIFFERENT

Section Two *(Your thoughts about the programme)*

6. Do you feel that your child has benefited from taking part in the programme?

YES NO

7. Would you allow your child to take part in a similar study in the future?
YES NO

8. Do you have any comments about the programme? Please feel free to write down both positive **and** negative comments.

....

....

....

....

....

....

....

....

....

9. Would you be willing to be interviewed by a member of our team to provide further details? (all those participating will be presented with a small gift) YES NO

Name of Child..
Name of Parent...
Signature of Parent...

Thank you very much for your help. Please return in the envelope provided.