# Social Influences on Children's and Adolescents' Eating Behaviour

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By

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## Abstract

This thesis aimed to examine how children's and adolescents' eating behaviour is socially influenced by their parents and their peers. Chapter 2 aimed to examine whether there was evidence that adolescents may mimic their parent when eating a lunchtime meal together. Chapter 2 showed that adolescents may mimic their parent when eating together, looking to their parents to determine what to eat and when. Chapters 3 – 5 aimed to examine whether perceived eating norms influenced children's eating behaviour, the mechanisms underlying this influence, and whether perceived eating norms in the form of messages may be used as an intervention tool. Across chapters 3 and 4 perceived eating norms influenced children's vegetable consumption. In addition, in Chapter 4 the perceived eating norm continued to influence children's eating behaviour in an eating session twenty-four hours later. Furthermore, Chapter 4 found that perceived eating norms may act as a form of informational social influence, through removing uncertainty about how much to eat. Finally, Chapter 5 showed that perceived eating norm messages may be a potential way of increasing children's fruit and vegetable intake. We argued that children's and adolescents' eating behaviour is socially influenced by their parents and their peers, and that interventions could make use of perceived eating norms to increase children's fruit and vegetable intake.

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## Dissemination

The contents of this thesis have been presented at the British Feeding and Drinking Group (2014-2016), the European Association for the Study of Obesity (2015) and as an invited talk at the 'Eating by the norm' workshop at Radboud University (2015). Experimental work in peer reviewed publication form:

The study in Chapter 2 has been published as:

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The studies in Chapter 4 are currently under review (revise and resubmit):

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# Chapter 1: General Introduction

## 1.1 Diet

Fruit and vegetables are rich sources of a variety of nutrients, including vitamins, minerals and dietary fibre (Slavin & Lloyd, 2012). High intake of fruit and vegetables on a daily basis has been shown to be associated with many health benefits, including the prevention of chronic diseases, such as cardiovascular disease and cancer (Boeing et al., 2012; Lock, Pomerleau, Causer, Altmann, & McKee, 2005; Wang, McPherson, Marsh, Gortmaker, & Brown, 2011). It has been estimated that increasing fruit and vegetable intake could reduce the worldwide burden of ischaemic heart disease, stroke and some cancers by approximately 19% and could also reduce the risk of hypertension and coronary heart disease (Boeing et al., 2012; Lock et al., 2005). In a longitudinal cohort study, Ness et al (2005) showed that higher childhood intake of vegetables was associated with a lower risk of stroke in later life. In addition, Maynard et al (2003) showed that childhood fruit intake may have a long term protective effect on cancer risk in adulthood. However, despite the health benefits of fruit and vegetable intake, children are consuming less than the recommended five portions of fruit and vegetables per day (Geller & Dzewaltowski, 2009). On a national scale, only 16% of boys and 17% of girls consumed five portions of fruit and vegetables a day (Roberts, 2013). Therefore, improving diets during childhood, specifically by increasing fruit and vegetable intake, is of public health importance.

## 1.2 Current approaches to increase children's fruit and vegetable intake

A variety of approaches have attempted to increase children's fruit and vegetable intake within the school environment. Children have an intensive and prolonged contact with schools from age 4, therefore, schools are recognised as being one of the best settings for interventions (Foster et al., 2008).

*Provision of fruit and vegetables*

The provision of fruit and vegetables within the school is one approach which has attempted to increase children's fruit and vegetable intake. One example is the UK government's School Fruit and Vegetable Scheme (Ransley et al., 2007; Schagen, Teeman, & Ransley, 2005). This is a current, ongoing scheme within primary schools in the UK, where children. aged 4 – 6 years old, are provided with a portion of fruit or vegetables every day (Ransley et al., 2007; Schagen et al., 2005). A review of the scheme showed that children's awareness of, and intake of fruit increased. However, there was no effect on children's vegetable intake, and 7 months following the scheme, children's fruit intake returned to baseline (Ransley et al., 2007).

Other interventions which have provided children with fruit and vegetables at school showed similar results (Eriksen, Haraldsdóttir, Pederson, & Flyger, 2003; Reinaerts, Crutzen, Candel, De Vries, & De Nooijer, 2008). For example, Eriksen et al (2003) showed that a fruit and vegetable subscription in a primary school in Denmark for 5 weeks, increased 6-10 year old children's intake of fruit by 0.4 portions per school day. However, no increase in vegetable intake was observed. In another intervention, Reinaerts et al (2008) showed that a fruit and vegetable distribution scheme in the

Netherlands increased fruit and vegetable intake in 6-10 year old children, however, the increases were small. Within these interventions, there was no wider impact on the children's diets, and the effects were not sustained once the intervention finished (Eriksen et al., 2003; Ransley et al., 2007; Reinaerts et al., 2008; Schagen et al., 2005). In a further intervention (Moore & Tapper, 2008), intervention schools set up fruit tuck shops for one academic year, while control schools did not. Intervention schools were asked to offer a choice of fruit in the tuck shop to 9-11 year old children, and to refrain from stocking sweets, crisps and other alternatives. The authors found that although children in the intervention schools were more likely to report eating fruit at school than children in the control schools, overall, the implementation of a fruit tuck shop did not increase total fruit intake. However, the authors found that when the school had an existing policy which prohibited children from bringing snacks other than fruit into school, the fruit tuck shop did increase children's fruit intake relative to schools which did not have an existing food policy. Thus, limiting availability of other foods whilst simultaneously providing more fruit and vegetables may be a more effective approach than only increasing the provision of fruit and vegetables.

*Health messages*

Another approach which has attempted to increase children's fruit and vegetable intake is the use of health messages, which state the health benefits of consuming a food. Bannon & Schwartz (2006) showed children (aged 5) one of three 60 second videos. Children either saw a video message which suggested the positive benefits of eating apples, a video message which suggested the negative consequences of not

eating apples, or a control video. Children were then offered a choice between animal crackers or an apple as a snack. The authors found that 56% of the children who saw one of the nutrition message videos chose apples rather than animal crackers, compared to 33% of the control children choosing apples. In another study, De Droog et al (2014) exposed 4-6 year old children to health messages in a picture book, which promoted carrot intake. The message stated 'eating carrots makes you fit and strong', and the character was only able to rescue his friend after eating carrots. The authors showed that children who were exposed to the carrot-promoting picture book consumed a higher proportion of carrots than children who were not exposed to the book.

There is also evidence that health messages may have unintended consequences on healthy eating. Maimaran & Fishbach (2014) showed that presenting a food as instrumental to achieving a goal, e.g. outlining the health benefits of the food, decreased intake of that food in pre-school children (aged 3-5.5 years old). In another study, 9-11 year old children were presented with either a drink which was labelled as healthy ("a new health drink") or a control drink ("a new drink") (Wardle & Huon., 2000). Wardle and Huon (2003) showed children rated the 'healthy drink' as less pleasant, and they reported being less likely to ask their parents to buy it in comparison to the same drink presented with control information. Thus, the evidence regarding the effectiveness of using health based messages to promote healthy eating in children is mixed.

*Multi-component interventions*

Multi-component interventions are another school-based approach for increasing children's fruit and vegetable intake. Multi-component interventions involve altering several aspects of the school environment, and typically involve the provision of fruit and vegetables, as well as curriculum materials and activities (Evans, Christian, Cleghorn, Greenwood, & Cade, 2012). A meta-analysis showed that multi-component interventions are more effective than single-component interventions (i.e. the provision of fruit and vegetables) (Evans et al., 2012). In one intervention which aimed to increase fruit intake (Laurence et al., 2007; The Fresh Kids Programme), 5-11 year old children engaged in nutrition education activities including tasting sessions of fresh seasonal fruits, and had scheduled fruit breaks throughout the intervention. The authors found that across the four schools running the intervention, there was a mean increase of 41% in the proportion of children bringing fresh fruit to school for up to 2 years after the initial implementation of the programme. In another intervention which aimed to increase both fruit and vegetable intake (Anderson et al., 2005), schools were provided with fruit and vegetables (both in tuck shops and school lunches), and the intervention included tasting opportunities, marketing (e.g. posters and quizzes), newsletters and curriculum materials. The authors found that children (aged 6-11 years old) in the intervention schools increased their fruit intake, however, there was no effect on vegetable intake.

One multi-component approach which has been shown to increase children's fruit and vegetable intake is the Food Dudes intervention (Horne et al., 2004, 2009; Horne et al., 2011; Lowe, Horne, Tapper, Bowdery, & Egerton, 2004). The Food Dudes intervention involved an intensive 16 day intervention, where 4-11 year old children were exposed to the Food Dudes (who were four heroic peers who gain powers from

eating fruit and vegetables) through videos and letters. During the intervention children were provided with a portion of fruit and vegetables every day and were rewarded for eating them (Lowe et al., 2004). Lowe et al (2004) found that children's intake of fruit and vegetables at snack time and lunchtime was significantly higher during the intervention than at baseline. Two further evaluations of the intervention showed similar results (Horne et al., 2004; Horne et al., 2009). In both studies the intervention was shown to increase fruit and vegetables during the intervention in comparison to baseline. In addition, both studies showed that the intervention may have longer term effects on children's fruit and vegetable consumption. Horne et al (2004) showed that children's fruit and vegetable consumption was higher at a 4 month follow –up compared to baseline. Furthermore, Horne et al (2009) showed that at 12 month follow-up, parents in the experimental school provided their children with more fruit and vegetables, and their children consumed significantly more lunchbox fruit, vegetables and juice relative to baseline and to the control school.

Although the Food Dudes intervention appears to produce promising results, another evaluation of the Food Dudes programme showed that the effects of the intervention were not maintained over a 12 month period (Upton, Upton, & Taylor, 2013). Upton, Upton, & Taylor (2013) examined children's lunchtime fruit and vegetable intake during and after the intervention. They found that there was a significant increase in children's (aged 4-11 year old) intake of fruit and vegetables in the intervention schools three months following the intervention. However, these increases were not maintained at 12 months, with children's fruit and vegetable intake decreasing to levels similar to those observed at baseline (Upton et al., 2013).

A number of multi-component interventions have not increased fruit and vegetable intake in children. Kipping et al (2014) found that the intervention, which involved curriculum materials and homework did not significantly increase self-reported fruit and vegetable intake in primary school children (aged 8-10 years old). In another intervention, (Evans et al., 2013) children (aged 7-8 years old) engaged in activities such as gardening and cooking, repeated exposure through tasting sessions and school meals, and the school environment promoted fruit and vegetable intake. The authors found that despite an intensive programme of activities, the intervention did not have an impact on children's fruit and vegetable intake.

On the whole, the current approaches which have aimed to increase children's fruit and vegetable intake are mixed in terms of their effectiveness. Therefore, due to the public health importance of increasing children's fruit and vegetable intake, understanding key influences on children's eating behaviour is crucial in order to successfully increase children's fruit and vegetable intake.

### 1.3 Understanding the development of children's eating behaviour

Eating behaviours evolve during the first years of life, where children learn what, when and how much to eat (Birch, Savage, & Ventura, 2007). One factor which has been shown to be strongly associated with children's eating patterns is their food preferences (Cooke, 2007; Gibson, Wardle, & Watts, 1998; Scaglioni, Arrizza, Vecchi, & Tedeschi, 2011). Children's liking of a food is a strong predictor of how much of it they consume (Gibson et al., 1998). For example, children and young people (aged 2-24 years old) who reported disliking fruit, vegetables, or both,

consumed significantly less fruit and vegetables than children and young people who reported liking them (Pérez-Rodrigo et al., 2003).

Food preferences have been shown to remain stable throughout childhood. For example, Skinner, Carruth, Bounds and Ziegler (2002) showed that the strongest predictors of the number of foods liked at 8 years old were the number liked at 4 years old. The number of foods which children liked did not change significantly during the 5-6 years of their study (Skinner et al., 2002). Furthermore, food preferences developed during childhood have been shown to persist into adulthood (Nicklaus, Boggio, Chabanet, & Issanchou, 2004). Nicklaus et al (2004) showed that the food preferences of 17 – 22 year old adults were linked to their preferences at 2 - 3 years old. Thus, understanding how food preferences develop is important.

*Innate vs. learned determinants of food preferences*

Food preferences have been suggested to be shaped by a combination of genetic and environmental influences (Scaglioni et al., 2011). It has been argued that there is evidence for an innate component of food preferences, as children appear to hold a preference for sweet foods and a dislike for bitter tasting foods, such as vegetables (Bellisle, 2007; Cooke & Wardle, 2005; Skinner et al., 2002). Furthermore, in a review, Ventura & Mennella (2011) showed that a heightened preference for sweet tasting foods and beverages was evident among infants and children around the world.

There is also evidence that food preferences can be modified by the environment and can be learned. Experiences with the environment have been shown to reliably shape

children's eating behaviour (Ahern, Caton, Blundell, & Hetherington, 2014; Bouhlal, Issanchou, Chabanet, & Nicklaus, 2014; De Wild, De Graaf, & Jager, 2015; Hartvig, Hausner, Wendin, Ritz, & Bredie, 2015; Lakkakula, Geaghan, Zanovec, Pierce, & Tuuri, 2010), and this has been shown to occur before the child is even born (Mennella et al., 2001). For example, Mennella et al (2001) provided pregnant women with either carrot juice or water for three weeks in their last trimester of pregnancy, and then again during the first two months of lactation. They found that the infants who had exposure to the flavour of carrots in the amniotic fluid or breast milk exhibited fewer negative facial expressions while consuming the carrot-flavoured cereal, than infants whose mother's consumed water.

A growing body of research suggests that children can learn to like novel and previously disliked foods through repeated tasting (Ahern et al., 2013, 2014; Bouhlal et al., 2014; De Wild et al., 2015; Hartvig et al., 2015; Lakkakula et al., 2010). According to the Zajonc (1968) repeated exposure may lead to increased liking for the stimuli in question, known as mere exposure. One illustrative example of this process is in a study by Lakkakula et al (2010). They exposed 9-11 year old children to four vegetables once a week for ten weeks, and found that repeated tasting of the vegetables improved liking scores for the vegetables. In another study by Wardle et al (2003), exposure to a vegetable every day for 14 days in 2-6 year old children increased liking and intake of the target vegetable in the exposure group, compared to a group who received nutrition information only, and a control group receiving no intervention.

Research has also suggested that children's learning of food preferences may be sensitive to differences in energy intake (Birch, McPhee, Steinberg, & Sullivan, 1990; Gibson & Wardle, 2003; Johnson, McPhee, & Birch, 1991). Birch et al (1990)

investigated whether children (aged 3-5 years old) could form conditioned flavour preferences based on calorie density. The authors provided children with unfamiliar drink flavours that were either high or low in caloric density. The authors showed that children were responsive to the calorie density of the drink, consistently eating more following the low calorie drink in comparison to the high calorie drink. In addition, Gibson and Wardle (2003) investigated whether children (aged 4-5 years old) would show greater preference for high energy-dense fruit and vegetables. The authors showed that children reported liking fruit and vegetables with a higher energy density. Thus, these studies suggest that children may learn to accept high energy-dense foods more readily than low energy-dense foods.

There is also evidence that children's taste preferences and eating behaviours can be shaped by a combination of exposure and witnessing adults or their peers liking and eating particular foods (Addessi, Galloway, Visalberghi, & Birch, 2005; Birch, 1980; Harper & Sanders, 1975). For example, Addessi et al (2005) paired 2 – 5 year old children with either an adult who was not eating, an adult who was eating a food of a different colour, or an adult who was eating a food of the same colour. The authors found that children were more likely to eat a new food if they were paired with an adult who was eating the food which was the same colour as theirs, in comparison to when the adult was not eating or was eating a different coloured food. In another study, Greenhalgh et al (2009) showed that children (aged 3-4 years old) ate more of a novel food when their peers made positive comments about the food, in comparison to when peers made negative comments, or when the children were alone.

Thus, although there is evidence for an innate component of food preferences, the role of the environment in shaping children's eating behaviours is of importance.

## 1.4 Environmental influences on children's eating behaviour

Understanding how factors within the environment affect children's eating behaviour is important in order to develop strategies to increase children's fruit and vegetable intake. Since children's time is primarily spent either at home or at school (Story, Nanney, & Schwartz, 2009), it is important to examine the ways in which factors within these environments can affect children's eating behaviour.

### 1.4.1 The home environment

The home environment is believed to be one of the most important environments for the development of children's eating behaviours (Birch et al., 2007). There is substantial causal evidence that parenting affects child eating (Ventura &, Birch, 2008), with parents suggested to play a direct role in children's eating patterns (Patrick & Nicklas, 2005). For example, parents either create home environments that may promote the development of healthy eating behaviours, such as fruit and vegetable intake, or create home environments that may promote overweight and disordered eating (Hendrie, Sohonpal, Lange, & Golley, 2013;Scaglioni, Salvioni, & Galimberti, 2008). Furthermore, parents determine when eating will occur, the types of food made available to their children, portion sizes, and which feeding practices are implemented (Hendrie, Sohonpal, Lange, & Golley, 2013; Scaglioni et al., 2011; Ventura & Birch, 2008). Here I will discuss how factors within the home environment can influence children's eating behaviour.

*Television viewing*

One way in which parents may shape the home environment is through the amount of television children are allowed to watch. Increased television viewing time has been found to be associated with increased energy intake, increased sweet snack and fast food intake, and decreased vegetable intake (Campbell, Crawford, & Ball, 2006; Taveras et al., 2006). For example, Boynton-Jarrett et al (2003) examined the television viewing habits of 548 10-12 year old children over a 19 month period. They found that for each additional hour of television viewed per day, the number of servings of fruit and vegetables consumed per day decreased. Further, Taveras et al (2006) showed that with each hour of television viewed per day by 2-6 year old children, the odds of eating fast food increased.

The content of the television which the children watch has also been shown to be associated with their eating behaviour (Borzekowski & Robinson, 2001; Boyland et al., 2011; Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Halford, Boyland, Hughes, Oliveira, & Dovey, 2007). For example, Halford et al (2007) found that exposure to food adverts while watching television produced a significant increase in young 5-7 year old children's total food intake, with food adverts found to promote overconsumption in young children. Furthermore, there is evidence that the content of the adverts can affect children's food preferences. In one study, Borzekowski & Robinson (2001) exposed children (aged 2-6 years old) to a videotape of a popular children's cartoon, which either contained adverts, or no adverts. Children were then asked to show their preference for pairs of similar food products, one of which was advertised during the cartoon. They showed that children who saw the adverts within their cartoon were significantly more likely to choose the advertised item than children who did not see the adverts. In another study, (Boyland et al., 2011) using a

within-subjects design, children (aged 6-13 years old) were shown a toy-related advert followed by a cartoon on one occasion, and a food advert followed by a cartoon on another occasion. Immediately after viewing children were given three food preference measures. The authors found that all children selected more branded and non-branded fat and carbohydrate rich food items after viewing the food adverts, compared to after viewing the toy cartoons.

*The availability of food*

Another way in which parents may shape children's eating behaviour is through the types of food made available within the home. In general, children tend to eat the food that they are served most often and are therefore familiar with (Birch & Marlin, 1982). The availability of fruit and vegetables within the home environment has been shown to be associated with children's intake of fruit and vegetables (Hearn et al., 1998; Wyse, Campbell, Nathan, & Wolfenden, 2011). For example, Wyse et al (2011) showed that higher fruit and vegetable intake in 3-5 year old children was significantly associated with frequent provision of fruit and vegetables to children throughout the day, having a wider variety of fruit and vegetables in the home, and having fruit and vegetables stored in a ready to eat format. Furthermore, Feldman, Eisenberg, Neumark-Sztainer and Story (2007) showed that for every additional different type of fruit or vegetable in the home, 11-18 year old children's fruit and vegetable intake increased by 5 grams.

*Family meals*

Family meals are one aspect of the home environment which has been consistently shown to be positively associated with children's fruit and vegetable intake. The frequency of shared family meals has been shown to be significantly related to nutritional health in children and adolescents (Andaya, Arredondo, Alcaraz, Lindsay, & Elder, 2011; Birch & Fisher, 2000; Carper, Orlet Fisher, & Birch, 2000; Gillman et al., 2000; Mellin, Neumarksztainer, Story, Ireland, & Resnick, 2002; Siega-Riz, Carson, & Popkin, 1998). For example, children and adolescents (aged 2.8 – 17.3 years old) who engaged in family meals three or more times per week were more likely to be healthy-weight, and have healthier dietary patterns compared to those who engaged in less than three family meals per week (Hammons & Fiese, 2011). In addition, when family meals occurred at least four times per week, children reached their recommended five portions a day (Andaya et al., 2011; Christian, Evans, Nykjaer, Hancock, & Cade, 2014).

Family meals have also been shown to have a protective effect on other aspects of the home environment. In a cross-sectional study with 3245 13-18 year old adolescents, Utter et al (2008) found that the frequency of family meals was associated with many positive aspects of the home food environment, such as limits on television use, having fruit available at home, and adolescents' intake of five fruit and vegetables a day.

*Portion sizes*

The amount of food served to children during meals has been shown to affect children's eating behaviour (Fisher, Liu, Birch, & Rolls, 2007; Looney & Raynor, 2011). It has been suggested that the most powerful determinant of the amount of food consumed at meals by 4-6 year old children is the amount served (Mrdjenovic & Levitsky, 2005). Children have been consistently shown to eat more when served a larger portion than when served a smaller portion (Fisher, Liu, Birch, & Rolls, 2007; Looney & Raynor, 2011). For example, in an observational study (Johnson et al., 2014), the amount served to, and consumed by preschool children and their parents during evening meals in the home was measured. The authors found that the amount that parents served themselves was significantly associated with the amount that they served to their children. In addition, the amount served to children was strongly associated with the amount that children consumed.

Although few studies have manipulated portion sizes within the home environment, there is evidence that the amount of fruit and vegetables that children are served at an evening meal in a laboratory environment influences their intake (Kral, Kabay, Roe, & Rolls, 2010; Mathias et al., 2012). For example, in one study (Mathias et al., 2012), children (aged 4-6 years old) visited the laboratory with a parent for an evening meal once a week for five weeks. Children were provided with fixed portions of pasta with tomato sauce, milk and a ranch dressing. The portion sizes of the broccoli and canned peaches were manipulated. Across four conditions, the peaches, the broccoli or both peaches and broccoli portions were increased from 75g (reference portion) to 150g (large portion). The authors found that children consumed 70% more peaches, and 37% more broccoli in the large portion conditions than in the reference portion conditions. In another study (Kral et al., 2010), children

(aged 5-6 years old) were served an evening meal once a week for two weeks, which consisted of pasta with tomato sauce, three fruit and vegetable side dishes (broccoli, carrots and applesauce), and milk. The portion sizes of the fruit and vegetables were doubled between the conditions. The authors found that, when the fruit and vegetable side dishes were doubled, fruit intake increased by 43%, however, there was no effect on vegetable intake.

*Feeding practices*

As well as controlling many aspects of the home environment, parents also use feeding practices with the intention of modifying their child's diet (Klesges et al., 1983). Feeding practices often include attempts to increase children's intake of nutrient dense food such as fruit and vegetables, and reduce their intake of energy-dense foods (Savage, Fisher, & Birch, 2008; Tiggemann & Lowes, 2002).

The types of feeding practices implemented by parents have been shown to affect children's eating behaviour. For example, parental control, restrictive feeding practices, and pressure to eat have been shown to be associated with overeating and poorer self-regulation of intake in children (Savage et al., 2008). In one study Johnson & Birch (1994) provided children (aged 3-5 years old) with controlled two-part meals and parents completed questionnaire measures related to their feeding styles. The authors found that parental control in the feeding situation was the best predictor of children's ability to regulate energy intake. Specifically, they found that mothers who were more controlling of their children's food intake had children who showed less ability to self-regulate their intake. In addition, higher levels of parental control and pressure to eat have been found to be associated with lower fruit and

vegetable intake in 5 year old children (Fisher, Mitchell, Smiciklas-Wright, & Birch, 2002).

There is also evidence that parental feeding practices may be associated with healthier eating behaviour. In a cross-sectional study, Sleddens, Kremers, De Vries & Thija (2010) showed that children (aged 6-7 years old) who were encouraged to be interested in food and eat a variety of foods consumed less energy-dense food. Furthermore, there is evidence that the type of parental control is associated with children's eating behaviour. Ogden, Reynolds & Smith (2006) distinguished two types of control: overt control which can be detected by the child i.e. pressuring the child to eat a food, and covert control which cannot be detected by the child, i.e. making fruit and vegetables available and accessible within the home. They found that 4-11 year old children's healthy snacking behaviour was predicted by overt control, while their unhealthy snacking behaviour was predicted by covert control. Furthermore, Brown & Ogden (2004) found that greater parental control was associated with higher intake of healthy food in 9-11 year old children.

*Parental eating behaviour*

There is also evidence that parental eating behaviour is associated with their children's eating behaviour (Rasmussen et al., 2006; Savage et al., 2008). Correlations have been consistently found between parental and child intake of fruit and vegetables (Rasmussen et al., 2006; Savage et al., 2008; Sweetman, McGowan, Croker, & Cooke, 2011; Wroten, O'Neil, Stuff, Liu, & Nicklas, 2012). Parental intake of vegetables was shown to predict children's vegetable intake due to children

(aged 2-6 years old) eating approximately the same food as their parents (Sweetman et al., 2011; Vereecken, Keukelier, & Maes, 2004; Wardle et al., 2003).

In a longitudinal cohort study, Fisk et al (2011) examined the diets of 1640 children at 3 years old, and found that one of the most important influences on the quality of the child's diet was the mother's diet. Specifically, mother's who consumed a diet which complied with the dietary recommendations were more likely to have children with similar diets. In another study, Christian et al (2014) found that when parents ate fruit and vegetables every day, children (mean age 8 years old) ate more fruit and vegetables than children whose parents rarely, or never ate fruit and vegetables.

Parents have also been shown to act as role models for children, and the addition of a parent has been shown to increase children's acceptance of a novel or previously disliked food. In one study (Blissett, Bennett, Fogel, Harris, & Higgs, 2015), 120 parent-child (aged 2-4 years old) pairs ate a standardised meal together, which contained a portion of a fruit which the child had not eaten previously. The pairs were allocated to one of three conditions: In one condition the parent was allowed to use physical prompting but was not allowed to taste the novel food (physical prompting only). In another condition the parent was allowed to use physical prompting and also to taste the novel food (physical prompting and modelling). In the other condition, the parent could eat the novel food but was not allowed to use physical prompts (modelling only condition). The authors found that children in the physical prompting and modelling condition were more accepting of the novel fruit than children in the modelling only condition, but only in food responsive children. Whereas, children in the physical prompting only condition showed higher rates of refusal for the novel fruit than children whose parents were not allowed to use physical prompting. In another study (Jansen & Tenney, 2001), 4-7 year old children

consumed a yoghurt drink, which was either high or low energy, and were either paired with a parent/ caregiver, or were alone. The authors showed that the children who had the high energy drink and were paired with a parent/ caregiver learnt a preference for the food more readily than children in the other conditions.

In the present section it is clear that aspects of the home environment are important in shaping children's eating behaviour. In particular, parents play an important role through controlling both the home environment, and the behaviour of the parents themselves also appears to be important.

### 1.4.2 The school environment

Although the home environment has been shown to be important, children spend a large proportion of their time at school. Children have an intense and prolonged contact with schools throughout their childhood (Foster et al., 2008), and are reported to spend more time at school than in any other environment away from home (Story et al., 2009). Therefore, understanding how factors within the school environment affect children's eating behaviour is crucial.

*School meals*

One of the most important aspects of the school environment regarding children's eating behaviour is school meals. Approximately 3 million school meals are served per day (Nelson, Lowes, & Hwang, 2007), with Primary-school children in England found to consume 25-33% of their daily energy intake and key nutrient intake at school during lunch time (Ruxton, Kirk, & Belton, 1996).

Due to the importance of school meals on children's diets, from 2006 every primary school in England was required to meet lunchtime food and drink provision guidelines: healthier options were introduced, and savoury snacks and confectionary were banned from schools (Statutory Instruments, 2007; Nelson, 2006). An assessment of lunchtime provision of food and drink in 136 English primary schools in 2009 showed that, in comparison to 2005, schools provided significantly more fruit and fruit based desserts, vegetables, salad, water and fruit juice. Schools also provided less sauces, starchy foods, snacks and confectionary (Haroun, Harper, Wood, & Nelson, 2011).

There is evidence that school lunches are associated with healthier eating behaviour. In particular, studies have shown that school lunches are associated with vegetable intake. For example, Golley, Pearce and Nelson (2011) found that 81% of 8-10 year old children who had a school lunch chose vegetables, in comparison to 8% of children with packed lunches. In addition, none of the children consuming school lunches had confectionary, whereas, 72% of the children bringing packed lunches did. Furthermore, Harrison et al (2013) found that 9-10 year old children who consumed school lunches consumed more vegetables than packed lunch eaters. However, both of these studies showed that children who had school lunches consumed less fruit than children who had packed lunches (Golley et al., 2011; Harrison et al., 2013). Conversely, there is also evidence to suggest that consuming school meals is not always associated with an increase in children's vegetable intake. For example, Upton, Upton, & Taylor (2012) found that of 1296 children (aged 4-11) who were observed over five consecutive lunchtimes, only 3% of children consumed at least one portion of vegetables as part of their school meal. In another study, Rogers, Ness, Hebditch, Jones and Emmett (2007) found that only half of the

recommended amount of fruit and vegetables were eaten by children (aged 7 years old) having a school meal.

Thus, from the present section it is clear that the primary school environment affects children's eating behaviour. However, one aspect which is believed to be particularly important is the behaviour of children's peers. It is to this literature that is the focus of my thesis and I will turn to next.

### 1.5 Peers

Peers and friends are an important influence on children, as children increasingly spend time around their peers through attending pre-school and school (Houldcroft, Haycraft, & Farrow, 2014). A meta-analysis evaluating the similarities between children's and parents' diets (Wang et al (2011) concluded that while there is strong evidence suggesting that parental feeding practices influence children's eating attitudes and behaviour, more attention should be given to the role of other individuals, specifically peers, and their influence on children's eating (Wang et al (2011).

The presence of peers in the environment has been consistently shown to affect eating behaviour, and the presence of peers can facilitate or inhibit intake (Vartanian, 2014; Vartanian, Spanos, Herman, & Polivy, 2015). Social learning theory (Bandura, 1977) is considered key to understanding the influence of other people on an individual's behaviour. Social learning theory proposes that the majority of human behaviour is learned through the observation of others' behaviour, whereby, people look to others in order to navigate the social environment effectively and behave

appropriately. Bandura (1977) suggests that children learn appropriate behaviour through modelling or imitating the behaviour of others. However, whether a child models or imitates behaviour depends on whether the behaviour is reinforced (i.e. rewarded), or discouraged (i.e. punished). Furthermore, people are most likely to model or imitate the behaviour of others who they perceive to be similar to themselves, and with whom they associate most regularly (Bandura (1977).

Based on social learning principles, Herman, Roth, & Polivy (2003) developed the normative model of social influence on eating. The normative model was developed to explain the influence of other people in the environment on an individual's eating behaviour. According to the normative model, people are motivated to eat as much palatable food as possible. However people want to avoid eating excessively. Therefore, according to the model, in the absence of clear signals of satiety, people look to cues in the environment (i.e. the eating behaviour of others) to determine when to stop eating (Herman et al., 2003). There are three main bodies of literature which have attempted to examine the influence of present others on food intake; social facilitation, impression management, and social modelling.

*Social facilitation and impression management*

Social facilitation and impression management have been suggested to be two explanations for why people adjust their eating behaviour in the presence of others. Social facilitation research demonstrates that, in the presence of others, people eat more, in comparison to when they are alone (Herman, 2015; Salvy, de la Haye, Bowker, & Hermans, 2012). Meanwhile, impression management studies assume that under conditions in which making a good impression is important, people tend

to try and accomplish their impression management goals through their eating behaviour (Herman et al., 2003; Roth, Herman, Polivy, & Pliner, 2001).

In one study examining the effect of social facilitation on children's eating, Lumeng & Hillman (2007) examined the effect of group size on preschool-aged children (aged 2.5 – 6.5 years old) during regular snack time. Children were either in small groups (3 children) or large groups (9 children). The authors found that, when the snack duration was short (i.e. less than 11.4 minutes), there was no effect of group size on the amount of snack consumed. However, when the snack duration was longer (i.e. greater than 11.4 minutes), children eating in the large group ate significantly more than children in the small group, supporting that social facilitation operates in pre-school children.

The effect that the presence of others has on eating is not always straightforward however, and there is evidence that type of eating companion may affect whether social facilitation of eating occurs (Salvy, Howard, Read, & Mele, 2009; Salvy, Vartanian, Coelho, Jarrin, & Pliner, 2008). For example, Salvy et al (2008) either paired 9-15 year old children with a sibling, with a stranger, or children were alone. Children were instructed to play a game and were informed that they could eat cookies. The authors found that when siblings ate together, they ate more than when eating with a stranger. Furthermore, children who ate with their siblings also ate more than children who were eating alone. However, children eating with strangers did not eat more cookies than children who were eating alone, and matching of food intake was greater among the stranger pairs than among siblings. Thus, social facilitation of eating may have occurred when children were in sibling pairs, however, when children were eating with a stranger, they may have been attempting to convey a good impression to the stranger.

In another study (Salvy et al., 2011), children (aged 5-7) and adolescents (aged 13 – 15) ate a meal in a laboratory on two occasions. On one occasion they ate a meal with their mother and on the other occasion they ate a meal with a same-sex friend. Salvy, Elmo, Nitecki, Kluczynski and Roemmiuch (2011) found that children consumed less energy from unhealthy snacks when they were eating a meal with their mother, compared to when they were eating a meal with their friends. In contrast, female adolescents consumed less energy from unhealthy snacks and more energy from healthy snacks when they were eating with their friends compared to when they were eating with their mother. Therefore, children may have been more concerned with conveying a good impression to their parents, whereas, adolescent females may have been more concerned with conveying a good impression to their friends.

*Social modelling of eating behaviour*

It has been argued that one of most powerful social influences on food intake in both adults and children is social modelling of eating behaviour (Cruwys, Bevelander, & Hermans, 2015). Social modelling of eating behaviour refers to people adapting their eating behaviour to that of an eating companion, eating more when an eating companion eats a large amount, and less when an eating companion eats a small amount. Social modelling has even been found to override physiological signals of hunger when people have been food deprived for 24 hours (Goldman, Herman, & Polivy, 1991). In a recent review, Cruwys et al (2015) concluded that social modelling is a profound and robust phenomenon that can determine what and how much people consume.

Typically in modelling studies, participants are paired with a confederate who has been instructed on the amount to eat. High intake confederates who have been instructed to eat a large amount have been shown to increase participants' food intake, while low intake confederates who have been instructed to eat a small amount have been shown to reduce participants' food intake (Feeney, Polivy, Pliner, & Sullivan, 2011; Goldman et al., 1991; Hermans, Larsen, Herman, & Engels, 2009; Howland, Hunger, & Mann, 2012). This social modelling effect has been found to occur for high calorie snack foods, such as cookies (Bevelander, Anschütz, & Engels, 2012; Leone, Pliner, & Herman, 2007; Roth, Herman, Polivy, & Pliner, 2001), chocolate covered peanuts (Bevelander et al., 2012; Hermans, Larsen, Herman, & Engels, 2008), pizza (Feeney et al., 2011), and also for vegetables (Hermans et al., 2009). For example, Hermans et al (2009) showed that young adult females consumed more vegetables when exposed to a peer eating a large number of vegetables than when exposed to a peer eating a small number of vegetables.

While the majority of research has focussed on an adult population, there is also evidence that children model the eating behaviour of their peers. For example, Bevelander et al (2012) paired a child (aged 6-11 years old) with a confederate who was instructed to eat either a large or small amount of chocolate covered peanuts. Bevelander et al (2012) found that the food intake of the confederate peer strongly affected the child's own intake: children ate more when in the presence of a confederate who ate a large amount, and less when in the presence of a confederate who ate a small amount.

The social modelling effect has also been shown to occur when adolescents are exposed to a remote peer. For example, Romero, Epstein and Salvy (2009) showed 8-12 year old children a video containing a peer. The children were informed that the

peer was also taking part in the study at another school. The video peer was instructed to either eat a large or a small amount of cookies. The adolescent participant was in a similar environment to the video confederate, w here both the adolescent participant and the video confederate had a bowl of cookies and a game. The authors found that exposure to a video peer who was eating a large amount, influenced the adolescents to eat more, than exposure to a video peer who was eating a small amount.

Bevelander, Engels, Anschutz and Wansink (2013) provide further evidence that social modelling is a powerful influence in children. Bevelander et al (2013) administered an intervention which explained peer modelling to children (aged 6-11 years old). This intervention aimed to increase children's awareness of modelling, and in turn reduce the likelihood that children would adjust their food intake in the presence of a peer. Following the intervention, children took part in a social modelling session on a different day where they were paired with an instructed confederate peer. The authors found that, despite the intervention, children's eating behaviour still remained susceptible to a peer's eating.

The social modelling literature supports that adults, adolescents and children adjust their intake based on what a present or video peer has eaten. However, the mechanisms affecting eating behaviour within these studies are unclear. One factor which could be influencing children's food intake is behavioural mimicry. Behavioural mimicry refers to observing another person's movements, which triggers one's own motor system to perform that same movement (Iacoboni et al., 1999; Lakin, Jefferis, Cheng, & Chartrand, 2003). This is thought to occur due to a tight neural link between perception and action (Chartrand & Bargh, 1999). Evidence of behavioural mimicry has been found when two children eat together.

For example, Bevelander et al (2013) found that when a child (aged 6-11 years old) picked up and ate a chocolate-covered peanut, this was associated with an increased likelihood that their eating partner would subsequently pick up and eat that food within 5 seconds. However, this is the only study to examine behavioural mimicry in children. Another important social factor which may influence children's eating are perceived social norms.

### 1.6 Social norms

Social norms refer to codes of conduct which people abide by, and they provide guidance for appropriate behaviour in a situation (Cialdini & Goldstein, 2004; Higgs, 2014). There are two main types of social norms; perceived injunctive norms which inform the individual about what is typically approved of, and perceived descriptive norms which inform the individual about what how other people typically behave (Cialdini, Kallgren, & Reno, 1991; Cialdini & Trost, 1998).

There is some evidence to suggest that perceived injunctive norms may affect eating behaviour. Yun & Silk (2011) showed that peer injunctive norms were associated with intentions to have a healthy diet. In addition, Vasiljevic, Pechey, & Marteau (2015) showed that an injunctive norm logo (a smiling face) influenced perceptions of the healthiness and tastiness of foods carrying health halos (e.g. cereal bars). However, there is also evidence that injunctive norms reduce intentions to eat healthily. For example, Stok, De Ridder, De Vet, & De Wit (2014) showed adolescents an injunctive norm message which indicated that high school students thought that other high school students should eat fruit. Stok et al (2014) found that this injunctive norm message reduced adolescents' intentions to consume fruit.

Furthermore, there is additional cross-sectional and acute laboratory evidence that injunctive norms do not influence eating behaviour (Lally, Bartle, & Wardle, 2011; Robinson, Fleming, & Higgs, 2014). Thus, the role of injunctive norms in explaining eating behaviour may be minimal. A more important factor may be descriptive social norms.

*Perceived eating norms*

Perceived eating norms are a form of descriptive social norm. Perceived eating norms relate to what or how much other people typically eat and they have been shown to consistently influence adults' eating behaviour (Feeney et al., 2011; Pliner & Mann, 2004; Robinson, Benwell, & Higgs, 2013; Robinson, Sharps, Price, & Dallas, 2014; Robinson, Thomas, Aveyard, & Higgs, 2014; Roth et al., 2001). A common way in which perceived eating norms have been investigated is through a remote confederate study paradigm. In this paradigm people eat alone and are exposed to information about the eating behaviour of other people who have taken part in the experiment. For example, Robinson et al (2014) exposed young adult females to an information sheet which contained the intake information of previous (fictitious) participants. The authors found that the young adult females ate more cookies when exposed to information which suggested that the previous participants had eaten a large amount of cookies, compared to when they were exposed to information which suggested that previous participants had eaten a small amount of cookies.

Another way in which the influence of perceived eating norms has been investigated is through the use of environmental cues. In one study, Burger et al (2010) exposed

participants to a food wrapper on the table from the previous participant. The wrapper was either from a healthy snack bar (healthy condition), an unhealthy snack bar (unhealthy condition), or there was no wrapper on the table (control condition). Thus, the food wrappers were used as a subtle cue by which to communicate an eating norm. All participants were provided with a choice of four snack bars. The authors found that the participants made choices consistent with what they believed the previous participants have eaten: The participants in the healthy condition were more likely to choose the healthy snack bar relative to the participants in the unhealthy condition. In another study, Burger et al (2010) informed young adult females that they should eat three snack bars during a taste test, and again, the participants were provided with a choice of healthy and unhealthy snack bars. As in the earlier study, participants saw a snack bar wrapper on the table. Consistent with their previous study, the authors found that participants made snack choices consistent with what they believed the previous participant had chosen.

Although there is consistent evidence that perceived eating norms reliably influence eating behaviour, there are situations under which people are not influenced. For example, when participants were presented with a norm suggesting that previous participants had selected a less palatable food item (i.e. a light cookie), they were not influenced by the norm (Pliner & Mann, 2004). Furthermore, there is evidence that when the norm refers to an out-group, participants do not conform to the norm. In one study, Berger and Rand (2008) exposed undergraduate students to information which indicated the high junk food intake of either an in-group (undergraduate students), or an out-group (graduate students). Berger and Rand (2008) found that, when junk food intake was associated with an out-group, the students made healthier food choices.

An important consideration when understanding the influence of perceived eating norms on eating behaviour is social context. Goldstein, Cialdini, & Griskevicius (2008) suggested that as normative information becomes less specific to a given context, the influence that normative information has on behaviour may decrease. In the studies discussed in this section, people were exposed to information suggesting how other people had behaved in that specific social context, i.e. other people ate this amount of food in this study. However, there is evidence that people do not adjust their food intake when a peer is in a different social context to them. For example, in two studies (Hermans, Salvy, Larsen, & Engels, 2012), female participants were instructed to watch a video, which contained a video confederate. In the first study, the video confederate was eating a food which was different to the participant. In the second study, the video confederate was eating the same food as the participant. In both studies the video confederate was engaging in different tasks to the participant, and, unlike previous studies, the participants were not led to believe that the video confederate was another participant in the study. The authors found that the participants did not alter their intake to that of the video confederate. They suggested that, since the participants found themselves in a different social context to the video confederate, the video confederate's behaviour may have been viewed as irrelevant with regards to their own food intake. Therefore, from the studies discussed in this section, it is not clear whether perceived eating norms influence eating behaviour when the perceived eating norms do not refer to a specific social context.

*Perceived eating norm messages*

One way of examining the influence of perceived eating norms where social context is more ambiguous, is in the form of perceived eating norm messages. Perceived eating norm messages outline the dietary habits of other people, and have been shown to influence eating behaviour in adults and adolescents (Robinson, Fleming, et al., 2013; Robinson, Harris, Thomas, Aveyard, & Higgs, 2013; Stok, De Ridder, De Vet, & De Wit, 2014). For example, in two studies, Robinson et al (2013) exposed female university students to messages which stated the healthy eating behaviour of other students. In the first study, female students were exposed to messages on a poster and a flyer which stated that other students eat a large amount of vegetables. This was followed by a buffet lunch, where the female student was instructed to select whatever they wanted for lunch. Robinson et al (2013) found that a higher proportion of the meal was derived from vegetables in the female students who were usually low consumers of vegetables, following exposure to the perceived eating norm message, in comparison to exposure to a health message. In a second study, Robinson et al (2014) used the same design, however, the message referred to others' fruit and vegetable intake, rather than just vegetables. Consistent with study 1, the authors found that, following exposure to the perceived eating norm messages, females students who were usually low fruit and vegetable consumers ate more fruit and vegetables than low consumers who were exposed to a health messages. Furthermore, they found that low consumers of fruit and vegetables who were exposed to the perceived eating norm message had a lower mean intake of high calorie snack food than participants exposed to a health message.

In another study, Stok et al (2014) administered a norm message to 14-17 year old high school students in a booklet which contained a short informational text. The

authors found that adolescents who received the perceived eating norm message ate borderline significantly more fruit in the following two days in comparison to a control condition who just received health information about fruit intake.

However, there is evidence that perceived eating norm messages may not always be effective in increasing fruit intake (Stok, de Ridder, de Vet, & de Wit, 2012). For example, Stok et al (2012) showed that perceived eating norm messages about fruit intake which referred to a minority of people (e.g. 27% of students), actually reduced reported fruit intake compared to perceived eating norm messages which referred to a majority of people (73%). Furthermore, in other studies, perceived eating norm messages have been shown to be no more effective than a health message (Robinson, Harris, et al., 2013) or an instructive message (e.g. have a salad) (Mollen, Rimal, Ruiter, & Kok, 2013).

What is clear from the present section, is that perceived eating norms reliably influence eating behaviour in adults, and that perceived eating norm messages hold promise as a way of increasing fruit and vegetable intake. However, there is a lack of research investigating whether perceived eating norms influence eating behaviour in children. Moreover, since eating behaviours are believed to develop through social learning during childhood (Bandura, 1971), perceived eating norm messages may be a way of increasing fruit and vegetable intake in children. Further research is needed to investigate the influence of perceived eating norms on child eating behaviour and whether perceived eating norms could be used as an intervention approach to promote healthier eating habits in children.

*Mechanisms underlying the influence of perceived eating norms*

Although there is robust evidence that perceived eating norms influence eating behaviour, less research has investigated why people are motivated to conform to perceived eating norms. According to Cialdini & Goldstein (2004) people look to social norms in order to gain an accurate understanding of and effectively respond to social situations, and this is especially the case during times of uncertainty. Furthermore, Cialdini and Goldstein (2004) suggest that people also look to the behaviour of others in order to gain social approval and acceptance (Cialdini & Trost, 1998). This is consistent with Deutsch & Gerard's (1955) distinction between normative and informational influence. According to Deutsch & Gerard (1955), informational influence refers to the desire to form an accurate interpretation and behave correctly, and normative influence refers to the goal of obtaining social approval.

Although less research has examined the mechanisms which underlie the influence of perceived eating norms on eating behaviour, there is evidence to suggest that normative influence may explain the influence of present peers on eating behaviour. Research has shown that people adjust their intake when they are primed with an affiliation goal, but not when they feel affiliated with their co-eater (Hermans, Engels, Larsen, & Herman, 2009; Robinson et al., 2011). For example, Hermans, et al (2009) paired participants with either a sociable or an unsociable confederate peer who was either instructed to eat a large amount or a small amount of M&Ms. They found that young women ate more when paired with a high intake confederate than a low intake confederate, however, this only occurred when the young women were paired with an unsociable confederate. This suggests that the young women may have been altering their behaviour in order to ‘fit in’ with the confederate.

Furthermore, Robinson et al (2011) primed half of the participants with feelings of social acceptance through completing a word search task with words related to social acceptance, while the other half completed a control word search. They found that participants who completed a word search related to social acceptance were less likely to copy a confederate's eating than participants in the control condition. The authors of both of these studies suggested that the results may be explained by ingratiation attempts. Namely, people may copy the behaviour of a present peer to ingratiate themselves. However, less research has examined whether normative influence may explain the influence of perceived eating norms on eating behaviour. However, because perceived eating norms influence eating behaviour when no other peers are present (and there are therefore no targets for ingratiation), it may be the case that normative influence is not responsible for the effect that perceived eating norms have on behaviour.

Whether informational influence may explain the influence of perceived eating norms on eating behaviour has received little attention. As discussed previously in the introduction, perceived eating norms have been shown to reliably influence food intake (Burger et al., 2010; Robinson, Sharps, et al., 2014; Robinson, Thomas, et al., 2014), therefore, it is feasible that people may have used the eating behaviour of others as a guide to reduce uncertainty about how to behave. Furthermore, Herman & Polivy (2005) suggested that due to the removal of another person through the use of a remote confederate design, people must be altering their behaviour due to being uncertain about the correct way to behave in the situation. However, to date, studies which have investigated the influence of perceived eating norms on eating behaviour have generally been conducted in a laboratory environment where participants' feelings of uncertainty are likely to be heightened. Therefore, investigating the

influence of perceived eating norms in a situation where uncertainty may be reduced (i.e. in an eating context that people have eaten in previously), may provide more insight into whether informational influence explains the influence of perceived eating norms on eating behaviour.

Thus, although evidence has begun to examine mechanisms which may underlie social influences on eating behaviour, there is a lack of research examining why perceived eating norms influence eating behaviour. Further research is needed to examine why people are motivated to conform to perceived eating norms.

### 1.7 Thesis aims

This thesis consists of four experimental chapters in which six studies of children's eating behaviour are reported. The literature to date shows that the eating behaviour of other people in the social environment provides a powerful influence on eating behaviour in adolescents and children (Cruwys et al., 2015; Salvy et al., 2012). More recently, perceived eating norms have been shown to influence eating behaviour in adults, with perceived eating norm messages shown to hold the potential to increase fruit and vegetable intake in adults and adolescents (Robinson, Thomas, et al., 2014; Stok et al., 2014). Research has also started to examine the mechanisms which underlie social influences on eating behaviour (Bevelander et al., 2013; Hermans, Engels, et al., 2009; Robinson et al., 2011). However, there is a lack of research investigating the effects of perceived eating norms on children's eating behaviour. Since perceived eating norm messages may be a potential way of increasing children's fruit and vegetable intake, understanding whether perceived eating norms influence children's eating behaviour may be of value. Furthermore, less research

has examined mechanisms which underlie the effects of social influences on children's eating behaviour. Therefore, in order to increase children's fruit and vegetable intake, understanding how and why children's eating behaviour is socially influenced is of importance. This thesis begins to address these questions.

Chapter 2 investigates the relationship between parents' and adolescents' eating behaviour. Research suggests that parents are a key influence on eating behaviour during childhood and adolescence (Savage et al., 2008). However, the mechanisms underlying this influence are not clear. The study in Chapter 2 was designed to examine whether behavioural mimicry may occur between parents and their adolescent child when eating together.

Chapter 3 examines whether perceived eating norms influence vegetable intake in children. The literature has shown that children are influenced by the eating behaviour of present peers (Bevelander et al., 2012), but a number of mechanisms could account for this finding, and studies to date do not directly tell us whether children's beliefs about the eating behaviour of their peers (perceived eating norms) influence eating behaviour. Therefore, chapter 3 examines this.

Chapter 4 examines the mechanisms that underlie the effects of perceived eating norms on children's eating behaviour. Both normative and informational influence have been suggested as possible mechanisms, but very little research has examined whether these mechanisms may underlie why children's eating behaviour is influenced by perceived eating norms. Two studies reported in chapter 4 examine whether normative or informational influence can explain the influence of perceived eating norms on children's vegetable intake.

Chapter 5 examines whether perceived eating norms could be used as an intervention tool to increase fruit and vegetable intake in children. An intervention tool which has been shown to increase fruit and vegetable intake in adults, and fruit intake in adolescents, are perceived eating norm messages (Robinson, Fleming, et al., 2013; Stok et al., 2014). Two studies examine whether perceived eating norm messages, which outline the high fruit and vegetable intake of other children, are a way of increasing children's fruit and vegetable intake.

In summary the main aim of this thesis is to examine how children's and adolescent's eating behaviour is socially influenced by their parents and their peers. First, this thesis aims to identify whether there is evidence that female adolescents mimic their parent when eating together. Next, this thesis aims to examine the influence that perceived eating norms have on children's eating behaviour. Specifically, to investigate whether perceived eating norms influence children's vegetable intake, the mechanisms underlying this influence, and whether perceived eating norm messages may be a way of increasing children's fruit and vegetable intake.

# Chapter 2: Examining evidence for behavioural mimicry of parental eating by adolescent females. An observational study

## 2.1 Chapter Introduction

As discussed in the General Introduction, parents are believed to be an important influence on children's and adolescents' eating behaviour (Salvy et al., 2011) and behavioural mimicry has been proposed as one potential way that people socially influence each other when eating (Bevelander et al., 2013; Hermans et al., 2012). Chapter 2 aimed to investigate whether there is evidence that adolescent females mimic their parents when eating a meal together.

The study reported in Chapter 2 has been published as:

Sharps, M., Higgs, S., Blissett, J., Nouwen, A., Chechlacz, M., Allen, H. A., & Robinson, E. (2015) Examining evidence for behavioural mimicry of parental eating by adolescent females. An observational study, *Appetite, 89*, 56 – 61. http://doi.org/10.1016/j.appet.2015.01.015

## 2.2 Introduction

Social context has been shown to have a strong influence on eating behaviour (Goldman et al., 1991; Herman et al., 2003). Social modelling research has shown that the eating behaviour of adults and children can be influenced by the amount of food other diners are eating; eating more when others are eating more, and less when they are eating less (Bevelander, Anschütz, & Engels, 2012; Hermans, Larsen, Herman, & Engels, 2009). A variety of potential explanations of these effects have been suggested. For example, modelling may occur because the behaviour of one's peers sets a norm of what constitutes a socially appropriate amount to eat (Herman et al., 2003; Vartanian, Sokol, Herman, & Polivy, 2013), or because it acts as an informational cue to guide behaviour (Robinson, Benwell, et al., 2013).

Parents are thought to be one of the most important social influences on child and adolescent eating behaviour (Salvy et al., 2011), including influencing their health beliefs, behaviours and dietary intake (Lau, Quadrel, & Hartman, 1990; Oliveria, Garrahie, Gil, & Moore, 1992). Moreover, parental and child food intake tend to be correlated in terms of the type and amounts of food that both eat (McGowan, Croker, Wardle, & Cooke, 2012; Sweetman et al., 2011; Wroten et al., 2012). Likewise, research has shown that children are more likely to try a food if they observe their parent eating that same food (Harper & Sanders, 1975). More recent research has also shown, in an experimental setting, that the presence of a parent shapes the amount and types of food adolescents eat (Salvy et al., 2011). However, the mechanisms underlying the processes by which adolescents adapt their eating to match parental behaviour when eating has received less attention.

One possibility is that adolescents mimic or synchronise to their parents' eating behaviour when dining together. Behavioural mimicry refers to the process whereby a person imitates the behaviour of another person without conscious awareness. This is thought to occur due to a tight neural link between perception and action (Chartrand & Bargh, 1999; Chartrand, Maddux, & Lakin, 2009), such that observing another person's movements may trigger one's own motor system to perform that same movement (Iacoboni et al., 1999; Lakin & Chartrand, 2003) e.g. taking a bite of food. Mimicry has been suggested to occur for a number of behaviours (Bernieri, 1988; Larsen, Engels, Souren, Granic, & Overbeek, 2010; Neumann & Strack, 2000) and more recently the role of behavioural mimicry in social eating contexts has been examined. Hermans et al (2012) found that when two female adults ate the same meal together, participants were more likely to pick up and eat the food if their eating partner had done so in the preceding five seconds. Similarly, Bevelander, Lichtwarck-Aschoff, Anschütz, Hermans, & Engels (2013) found that when a young child (aged 6-11) picked up and ate a chocolate-covered peanut, this was associated with an increased likelihood that their eating partner would subsequently pick up and eat that food. Thus, previous studies have only investigated behavioural mimicry in child-only or adult-only groupings (Bevelander et al., 2013; Hermans et al., 2012). Since research supports that adolescents' eating behaviour may be affected by the eating behaviour of a present parent (Salvy et al., 2011), it will be important to understand whether mimicry of eating behaviour may occur between a parent and an adolescent. It may be the case that mimicry of parental eating is a mechanism explaining parental influence on adolescent eating behaviour.

In studies to date examining behavioural mimicry during social eating, participants have only been provided with a single food item to eat (Bevelander et al., 2013;

Hermans et al., 2012). From these studies it is, therefore, not possible to infer whether participants were mimicking eating of a specific food type (if you take food x, I then take food x) or whether participants were simply synchronising the rate of their food intake in a more general/non-specific manner. For example, it may be that watching another person pick up a food item triggers an automatic reaction to reach for any food item (non-specific food item mimicry) or only the same food item (specific food item mimicry). Differentiating between these two possibilities is of importance because it may signal mechanisms that underlie mimicry. If automatic synchrony of gestures is of importance (Hermans et al., 2012; Iacoboni et al., 1999) then we may expect to see evidence for non-specific mimicry, because mimicry of the action of eating is key. Conversely, if mimicry occurs because an eating partner sets a norm about which foods are and are not appropriate to eat (Herman et al., 2003; Vartanian et al., 2013), then only mimicry of congruent food items may be observed. These questions are also of importance because in naturalistic social eating contexts such as family meal times, a variety of food items are likely to be available.

In the present study, we aimed to examine whether there is evidence that female adolescents mimic the eating behaviour of their parents when eating together. In order to assess mimicry, videos of parent-adolescent dyads eating a multi-item lunchtime meal were examined. We examined whether there was evidence of both ‘non-specific food item mimicry’ and ‘specific food item mimicry’. Based on previous studies of eating mimicry (Bevelander et al., 2013; Hermans et al., 2012), it was hypothesised that a parent placing a food item in their mouth would be associated with an increased likelihood that their female adolescent child would also place a food item in their mouth. However, we reasoned that if evidence of mimicry

was observed, it may only be food item specific, as parental behaviour during a meal may primarily signal which foods are appropriate to eat and when.

## 2.3 Method

*Background*

The videos analysed were of adolescents and parents eating a multi-item lunchtime meal together, which were recorded as part of a test day for a larger study examining brain activations and responsiveness to food cues. In the larger study, participants arrived at the laboratory on the morning of their test day where they underwent an MRI scanning session, which was followed by a multi-item lunch. Participants were aware that their lunch time meal would be video-recorded. However, participants were not explicitly told that their food intake would be measured or that mimicry would be later examined. Three groups of participants were recruited as part of the larger study: adolescents with type 2 diabetes, overweight and obese adolescents (without type 2 diabetes), and healthy-weight adolescents (without type 2 diabetes). Participants were 15 adolescents with type 2 diabetes (T2DM), 21 obese, and 22 control adolescents. All adolescents with T2DM were referred to the study by collaborating paediatric endocrinologists from paediatric diabetes clinics in the Midlands and North-West of the UK. Obese adolescents were either referred by collaborating dieticians or responded to study advertisements; control participants were recruited from local schools. Selection criteria for type 2 diabetes patients included: (1) aged between 12-18 years, (2) being able to understand and read English and (3) being diagnosed with type 2 diabetes for at least 6 months. Obese adolescents were included if their BMI exceeded defined International Obesity Task

Force age specific cut offs for obesity (Cole et al., 2000; Cole et al., 2007). Adolescents were excluded from participation if they had (1) major medical conditions other than diabetes, polycystic ovarian syndrome, hirsutuism or learning disabilities, (2) suffering from claustrophobia, (3) any contraindication to being in a MRI scanner and (4) major changes in diabetes related medication in the past 6 months.

*Participants*

From the original data collected, we were unable to use ten videos due to equipment failure or error. A further video was excluded because the adolescent participant did not eat anything. In addition, we opted to focus on female adolescents only, due to the consistency of which social influence effects have been replicated amongst females (Hermans et al., 2012; Pliner & Mann, 2004; Roth, Herman, Polivy, & Pliner, 2001), and there being only a small number of videos of adolescent males available. Therefore, nine videos of adolescent males were not coded or analysed. Thus, the total sample for the present research consisted of 38 dyads containing female adolescents eating with a parent. See Table 2.1 for sample ethnicity and socio-economic status. There were 33 female parents and 5 male parents. The adolescents were aged 12.0 – 18.8 years, with a mean age of 15.4 years, SD = 1.9. Adolescent weight categories were classified according to the defined International Obesity Task Force age specific cut offs (Cole et al, 2000, Cole et al, 2007). Eleven of the adolescents were classed as being in the healthy-weight range (BMI 18.5-24.9), fourteen were classed as overweight and obese (BMI ≥ 25) and thirteen had type 2 diabetes (BMI = 17.3 - 57.1). For the total sample, mean adolescent BMI =

30.6, SD = 9.7, and mean parental BMI = 30.1, SD = 5.8. See Table 2.2 for adolescent and parental BMI information for the healthy-weight, overweight and obese, and diabetic groups separately.

**Table 2.1** *Demographic information of sample*

| Demographics | | Parent n = 38 | Adolescent n = 38 |
|---|---|---|---|
| Ethnicity | White | 50% | 55.3% |
| | Asian | 39.5% | 36.8% |
| | Black | 5.3% | 2.6% |
| | Chinese | 2.6% | 2.6% |
| | Other/ Mixed | 2.6% | 2.6% |
| Income* | < £15,000 | 41.7% | n/a |
| | £15,000-60,000 | 44.4% | n/a |
| | > £60,000 | 13.9% | n/a |
| Education level | Secondary school | 21.10% | n/a |
| | GCSE | 28.90% | n/a |
| | A-level/ College | 26.30% | n/a |
| | University | | |
| | Graduate | 7.90% | n/a |
| | Post-graduate | 15.80% | n/a |

*****n = 36 for income, information not available for 2 parents.

**Table 2.2** *Mean BMI (SD) for healthy-weight, overweight and obese, and diabetic adolescent groups*

| | Healthy-weight adolescents (n = 11) | Overweight and obese Adolescents (n = 14) | Type 2 diabetic adolescents (n = 13) |
|---|---|---|---|
| Adolescent BMI | 21.8 (1.7) | 33.3 (6.9) | 34.7 (11.6) |
| Parental BMI | 26.1 (4.7) | 32.1 (5.0) | 31.3 (6.0) |

For our planned analyses we did not have any hypotheses relating to whether the weight or diabetes status of adolescent participants would moderate or influence any tendency to mimic parental eating. This is because social influence on food intake has been shown to be a relatively consistent effect and has been observed to a similar degree in both healthy-weight and overweight individuals (Conger, Conger, Costanzo, Wright, & Matter, 1980; Herman et al., 2003; Robinson, Sharps, et al., 2014). We did, however, check if this was the case by conducting our planned analyses (see later section) and by including adolescent group (healthy-weight, overweight and obese, diabetic) as an additional factor. There was no evidence that adolescent group significantly moderated any mimicry effects ($p > 0.05$). Thus, as the number of adolescents in each group was relatively small and we did not have strong a-priori hypotheses, the results we report throughout are for all adolescent participants combined.

*Lunch time meal*

All sessions took place in an eating laboratory at the University of Birmingham. The room was furnished with a table and two chairs. Adolescents and parents were

served a standardized multi-item meal each on separate trays. Each lunch item was on a separate plate and the meal consisted of a cheese sandwich (369 kcals), an individual Chicago Town cheese pizza (453 kcal), a small bowl of cherry tomatoes (18 kcal), an Activia strawberry yoghurt (123 kcal), an apple (45 kcal), a Satsuma (18 kcal), 25 grams Walkers ready salted crisps (131 kcal), and two Maryland double chocolate cookies (112 kcal). A jug of water and two glasses were also provided. Participants were asked not to share food from each other's trays and told that they were not expected to eat all the food, but to eat until they were full.

## 2.4 Analysis

*Strategy of analysis for overall food intake*

Our first aim was to test whether there was evidence that parent and adolescent overall food intake was related. We did this by correlating the total amount of food adolescents ate (in kcals) with the amount of food their parent ate (kcals) using a Spearman's correlation.

*Coding of video data*

To test if adolescents mimicked the eating behaviours of their parents, we coded the video data by recording every time an adult or adolescent placed a food item into their mouth, the name of that food item (e.g. pizza), and the time that the food entered the mouth. All occurrences of eating were recorded by the first author. A random sample constituting 10% of these codings were checked independently by one of the other authors and there were no disagreements. The first author then

coded each time an adolescent placed food into their mouth during the sensitive and non-sensitive time periods of the meal (see next section '*Defining sensitive and non-sensitive periods*'). All of this coding was then cross-checked by an independent research assistant blind to the study hypotheses. The research assistant worked through every video and checked the coding of the first author. Only a small number of discrepancies were noted (7 instances of mimicry were coded incorrectly out of all 38 videos, which constituted less than 1% of total coding), and these were resolved after discussion between the research assistant and lead author.

*Defining sensitive and non-sensitive periods*

Previous studies have examined if participants are more likely to eat a food item in the 5 or 15 seconds after a dining partner has placed food in their mouth (known as a 'sensitive period'), compared to the other periods of the meal when a partner has not recently placed food into their mouth (known as a 'non-sensitive period') (Bevelander et al, 2013; Hermans et al., 2012; Larsen et al., 2010). In the present study we examined three sensitive timeframe cut off points (+2, +5, +15 seconds), because we reasoned that mimicry may also occur in a shorter time frame (i.e. within + 2 seconds of a person eating) than previous studies have tested, as mimicry has been suggested to be automatic (Iacoboni et al., 1999). The three timeframe cut off points (+2, +5, +15) were treated as *separate* timeframes. Each meal was split into sensitive (the times during the meal in which a parent had recently placed food into their mouth) and non-sensitive time periods (all other times during the meal; i.e., the times during the meal in which a parent had not recently placed food in their mouth) for each of the three *separate* time frames (+2, +5, +15). This approach allowed us to

test whether the rate at which adolescents placed food into their mouth differed between *sensitive* vs. *non-sensitive* periods for the three time frames individually (see [1] for a detailed example). We presumed that if adolescents ate at a quicker rate during sensitive vs. non-sensitive periods, this would constitute evidence of mimicry. We calculated the rate of placing food into the mouth (defined as a consumption ratio, see next section) as opposed to the number of times food was placed in the mouth. We did this to account for differences in total sensitive vs. non-sensitive time during each meal.

*Strategy of analysis for mimicry*

As noted, we coded how frequently adolescents placed food items into their mouth during the sensitive periods (times when the parent **had** recently placed food in their mouth) and during the non-sensitive periods (times when the parent **had not** recently placed food in their mouth) of the lunchtime meal, for the three time frames separately. We then quantified this formally by computing 'consumption ratios', i.e. the number of times a food item was placed into an adolescents' mouth per second[2]. Following this, we compared the consumption ratio observed for the sensitive periods vs. non-sensitive periods of the meal using a Wilcoxon signed ranks test[3] for

[1] Taking the +2 time frame as an example, the 'sensitive periods' of the meal were all seconds of the meal which occurred within the same or next 2 seconds after a parent had placed food into their mouth. The 'non-sensitive' periods of the meal were all other seconds during the meal. Likewise, for the +5 time frame, the 'sensitive periods' of the meal were all seconds of the meal which occurred within the same or next 5 seconds after a parent had placed food into their mouth. The 'non-sensitive' periods of the meal were all other seconds during the meal. Thus, for each participant the meal was split into 'sensitive' and 'non sensitive' time using three different sensitive period cut-off points (+2, +5, +15 seconds).

[2] Consumption ratios were calculated by counting the number of times that the adolescent placed food into their mouth within a period and dividing this by the total amount of seconds in that period.

[3] In the Wilcoxon signed ranks test the sensitive periods were deducted from the non-sensitive periods. The negative ranks indicate the sensitive periods whilst the positive ranks indicate the non-sensitive periods. No ties were observed in the analysis.

the three different time frames individually (+2, +5, +15). We adjusted the analyses using a Bonferroni correction to account for multiple comparisons. This allowed us to compare the consumption ratios (the number of times a food item was placed into an adolescents' mouth per second) for the periods of the meal in which a parent had recently placed into their mouth vs. periods of the meal in which the parent had not recently placed food into their mouth. Importantly, we computed these consumption ratios for both *non-specific* food item mimicry and *specific food* item mimicry.

*Non-specific food item mimicry*

In order to compute consumption ratios for **non-specific** food item mimicry, we used the aforementioned analysis strategy and examined the rate at which adolescents placed **any** food item into their mouth during the sensitive periods vs. the rate at which adolescents placed **any** food into their mouth during the non-sensitive periods. This analysis allowed us to examine whether adolescents more frequently placed **any** food item in their mouth in periods when their parent had recently placed **any** food item in their mouth, as opposed to periods of the meal when a parent had not recently placed **any** food in their mouth.

*Specific food item mimicry*

In order to compute consumption ratios for **specific** food item mimicry, here we examined the rate at which adolescents placed the **same** food item into their mouth which their parent had placed in their mouth in the preceding 2, 5, or 15 seconds (sensitive period) vs. times when the parent **had not** placed a food item into their

mouth in the preceding 2, 5, or 15 seconds (non-sensitive periods). This analysis allowed us to examine whether adolescents more frequently placed a food item in their mouth in the periods of the meal in which their parent had recently placed the **same** food item in their mouth, as opposed to all other time periods of the meal.

Thus, we were able to examine whether there was evidence of *specific* food item and *non-specific* food item mimicry using *+2, +5* and *+15* time frames individually.

## 2.5 Results

*Total food intake*

Parents ate a mean of 816.1 (± 204.8) calories during the lunchtime meal, and adolescents ate a mean of 697.6 (± 238.3) calories during the meal. A Spearman's correlation showed that the amount eaten by the parents and children was significantly correlated [$r$ (38) = .49, $p < .001$], whereby a parent eating a larger number of calories was associated with their adolescent child also eating a larger number of calories.

*Meal length and frequency of food being placed into the mouth*

Mean meal length was 18 minutes and 13 seconds (SD = 6.37). The mean number of times that parents placed any food item into their mouth was 59.50 (SD = 19.07). The mean number of times that adolescents placed any food item into their mouth was 77.84 (SD = 24.19). On average, parents placed food into their mouth every 19.88 seconds (SD = 8.98), which constitutes a mean consumption ratio = 0.06 bites

per second during the meal. Adolescents placed food into their mouth every 14.53 seconds (SD = 4.93) on average, which constitutes a mean consumption ratio = 0.08 bites per second during the meal.

*Non-specific mimicry*

There was little evidence of non-specific food item mimicry during the meal. The consumption ratios for each of the three sensitive time periods were not significantly higher than the consumption ratios observed during the equivalent non-sensitive periods; +2 (z = - .17, *p* = .26, r = - .03) +5 (z = - 1.47, *p* = .42, r = - .24), and +15 (z = - 2.27, *p* = .06, r = - .37). (See Table 2.3 for consumption ratio values). This indicates that the rate at which adolescents placed any food into their mouth (the consumption ratios) was similar during the periods of the meal in which their parent had recently placed any food into their mouth (sensitive periods) and all other periods of the meal in which their parent had not recently placed any food into their mouth (non-sensitive periods). This effect was regardless of whether 'sensitive' was defined as being within +2, +5 or +15 seconds after a parent had placed food into their mouth. Thus, it was not the case that adolescents were significantly more likely to place any food item into their mouth if their parent had recently placed a food item into their mouth.

*Specific mimicry*

For specific food items, there was evidence of mimicry for the +2 (z = -3.42, *p* < .001, r = -.55), +5 (z = - 3.90, *p* < .001, r = -.63), and +15 (z = - 3.73, *p* < .001, r = -

.60) second timeframes; consumption ratios during these sensitive time periods were higher than the consumption ratios observed during the equivalent non-sensitive periods (See Table 2.3 for consumption ratio values). This indicates that the rate at which adolescents placed a food into their mouth was greater in the periods of the meal in which their parent had recently eaten that same food item (sensitive periods) compared to the other remaining periods of the meal in which their parent had not recently eaten that same food item (non-sensitive periods). This effect was regardless of whether 'sensitive' was defined as being within +2, +5 or +15 seconds after a parent had placed food into their mouth. Thus, there was evidence that adolescents were significantly more likely to place a food item in their mouth if their parent had recently placed that same food item into their mouth.

**Table 2.3** *Consumption ratios for food item specific and non-food item specific mimicry during sensitive and non-sensitive periods (n = 38)*

| | Food item specific mimicry | | Non-food item specific mimicry | |
|---|---|---|---|---|
| | Sensitive | Non-sensitive | Sensitive | Non-sensitive |
| | | +2 seconds | | |
| Mean (SD) | 0.022 (0.018) | 0.016 (0.027) | 0.078 (0.031) | 0.080 (0.038) |
| Median | 0.018* | 0.011 | 0.070 | 0.070 |
| | | +5 seconds | | |
| Mean (SD) | 0.021 (0.017) | 0.012 (0.006) | 0.076 (0.029) | 0.085 (0.048) |
| Median | 0.018* | 0.010 | 0.068 | 0.074 |
| | | +15 seconds | | |
| Mean (SD) | 0.021 (0.018) | 0.011 (0.006) | 0.075 (0.027) | 0.109 (0.107) |
| Median | 0.015* | 0.009 | 0.069 | 0.071 |

Consumption ratios indicate the number of times per second adolescents placed a food item into their mouth within sensitive and non-sensitive periods. A higher ratio indicates a greater rate of placing food items into the mouth.
*indicates a significant difference between the sensitive and non-sensitive consumption ratios at $p < .01$.

## 2.6 Discussion

The present study examined whether there is evidence that female adolescents may mimic their parents when eating together during a lunchtime meal. In line with previous work (Story, Neumark-Sztainer, & French, 2002), there was evidence of a positive correlation between parent and adolescent food consumption; adolescents consumed more calories during their lunch when their parent consumed more calories. We also examined if behavioural mimicry may underlie the influence that parents can have on their adolescents' eating behaviour. Results indicated that a parent placing a food item into their mouth was associated with an increased likelihood that their adolescent child would subsequently pick up and eat the *same* food item during the following two, five and fifteen second periods. However, we did not find evidence that a parent placing a food item into their mouth was associated with an increased likelihood of their child placing *any* food item into their mouth in these time periods. Thus, adolescents appeared to mimic eating of specific food items only.

As in previous eating behaviour studies in adults and children (Bevelander et al., 2013; Hermans et al., 2012), this observational data appears to support behavioural mimicry of eating. However, the current study expands on these studies because we found evidence of behavioural mimicry in a different dyad than has previously been examined (adolescents and parents). We were also able to test whether adolescents mimicked the *specific* type of foods their parents were eating, or whether this process of mimicry was not food item specific, i.e. whether the parent placing a food into their mouth would simply increase the likelihood that the adolescent would place any food in their mouth. The findings of the present study suggest that adolescents were not simply synchronising their gestures or eating speed to match their parents (due to

a lack of evidence for non-specific mimicry), which has been suggested as a potential explanation for social influence on eating (Hermans et al., 2012). Instead, adolescents may have been using their parents as a reference point about which food items to eat and when, which could be interpreted through either a normative or informational account of social influence on eating (Herman et al., 2003; Robinson, Blissett, & Higgs, 2013). Further studies will, however, need to address this proposition more directly. The other main novel findings of the present work was that we found evidence of specific food item mimicry during a shorter time frame (during the same or subsequent two seconds after a parent had placed food into their mouth), and within a different relationship than has been previously tested (Bevelander et al., 2013; Hermans et al., 2012). This finding suggests that there may be evidence for mimicry of eating behaviour in a shorter time frame than has been previously assumed.

One possible reason why we did not find evidence for non-specific mimicry (i.e. a parent placing food into their mouth was not associated with an increased likelihood that the adolescent subsequently placed *any* food into their mouth) is that the rate of adolescent eating was relatively high during the meal. It could be argued that a high eating rate across all periods of the meal would make it difficult to observe differences between periods of the meal in which a parent had vs. had not recently eaten. This might be the result of a form of ceiling effect. Thus, further research examining food-item specific vs. non-food item specific mimicry in other meal settings which promote a slower pace of eating would be valuable. It is also possible that the influence parents appeared to have on adolescent eating may be, in part, explained by a form of visual attentional bias (Hardman, Scott, Field, & Jones, 2014; Laibson, 2001), such that adolescents visually followed parental gaze or hand

movement to food choices, and parents visually attending to a specific food increased the likelihood that the adolescent then followed that cue and ate the same food.

A strength of the present study was that we examined parent-adolescent child dyads eating in a semi-naturalistic environment, rather than examining behavioural mimicry when a member of the dyad (i.e., the confederate) has been instructed on how much to eat (Bevelander et al., 2013; Hermans et al., 2012). Moreover, we examined mimicry during a multi-item lunch time meal which allowed us to examine the extent to which adolescents mimicked specific food choices. It is not clear whether this finding of specific mimicry is unique to this dyad or whether it may occur in other relationships, therefore, further research is needed. Due to the cross-sectional nature of the present study one possibility that we cannot rule out is that some of the specific mimicry we observed may have been explained by the adolescents and parents already sharing similar meal/food item order preferences. Thus, further work could build on the findings reported here by examining the effect of experimentally manipulating a parent's behaviour during a meal on the extent to which their adolescent child mimics this behaviour. One limitation that could also be addressed in further work is to investigate evidence of mimicry between adolescent males and their parents. Here our sample was female. However, recently Bevelander et al (2013) found that both male and female children (6-11 years old) were more likely to eat after witnessing a peer reaching for snack food than without such a cue. Therefore, it is possible that adolescent males may model the eating behaviour of their parents, and that mimicry may underlie this modelling. In addition, the current study focussed on adolescents' mimicry of parental eating. However, a previous study found mimicry among both eating companions (Hermans et al., 2012).

Therefore, it may be of interest to investigate whether mimicry of eating is a bi-directional process within this dyad. Finally, we did not examine whether state (e.g., hunger) or trait (e.g., the quality of the relationship between the parent and adolescent) factors may have moderated the likelihood of mimicry. Further work designed to specifically explore the factors which may make mimicry more or less likely would, therefore, be valuable.

*Conclusions*

This observational study suggests that when eating in a social context, there is evidence that adolescent females may mimic their parental eating behaviour, selecting and eating more of a food item if their parent has just started to eat that food.

# Chapter 3: Perceived eating norms and vegetable consumption in children

## 3.1 Chapter Introduction

Although parents have been shown to be a key influence on children's and adolescents' eating behaviour (Salvy et al., 2011), peers are also an important influence during childhood (Birch, 1980; Houldcroft et al, 2014). Moreover, social norms are thought to be a particularly important mechanism explaining peer influence (Robinson, Thomas, et al., 2014). Thus, the remainder of this thesis focused on the influence that perceived peer eating norms have on children's eating behaviour.

Chapter 3 aimed to examine whether children were influenced by their beliefs about the vegetable intake of their peers, otherwise known as perceived eating norms.

The study reported in Chapter 3 has been published as:

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## 3.2 Introduction

Eating behaviours are believed to develop through social learning during childhood, where the presence of dining companions, including parents, peers and siblings, influences the development of food preferences and eating behaviours (Birch & Fisher, 1998; Birch et al 2007; Hendrie et al, 2013). In adulthood, the eating behaviour of other people is thought to be a strong influence on what and how much we eat (Herman et al., 2003). Research consistently supports that people are strongly influenced by the eating behaviour of peers, with adults, adolescents, and children found to adjust their intake to that of a present peer (Bevelander et al., 2012; Feeney et al., 2011; Herman et al., 2003; Robinson & Higgs, 2013).

Beliefs about the eating behaviour of others, known as perceived eating norms, have been found to influence eating behaviour in adults (Pliner & Mann, 2004; Robinson, Fleming, et al., 2014; Robinson, Sharps, et al., 2014). For example, Robinson, Fleming, and Higgs (2014) exposed adults to information about eating norms through social norm-based messages suggesting the healthier eating behaviour of peers. Adults ate more fruit and vegetables when they were led to believe that their peers had eaten a large amount of fruit and vegetables.

Although research suggests that children (aged 6-12 years old) adjust their own intake of high calorie snack foods to that of a present peer (Bevelander et al., 2012; Romero et al., 2009), no research has examined whether children are motivated by perceived eating norms. Since vegetable intake is often low in young children (Dennison, Rockwell, & Baker, 1998; Yngve et al., 2005) and dietary habits developed during childhood track into adolescence and adulthood (Kelder, Perry,

Klepp, & Lytle, 1994; Singer, Moore, Garrahie, & Ellison, 1995) investigating novel ways to increase vegetable intake is of importance.

In the present study we examined whether perceived eating norms influence vegetable intake in children. Children were exposed to information concerning the amount of carrots that other children had eaten. In line with previous studies in adults, we hypothesised that children may be motivated to eat in line with perceived eating norms and increase their vegetable intake when they believed that other children had been eating a large amount of vegetables.

## 3.3 Method

*Participants*

143 children (51% females) aged 6-11 years old (9.03 years, SD ± 1.28) were recruited from two Primary schools in North-West England. The sample consisted of 128 healthy-weight and 15 overweight children. Children were led to believe that the study was investigating their game-playing abilities. The study was approved by the University of Liverpool Research Ethics Committee. Fully-informed parental consent was provided for all children. Parents were provided with an information sheet and consent letter. Parents were required to return the consent letter to the school if they wished for their child to take part. Children with allergies or a history of allergies were excluded at the recruitment stage. On the day of the study, children were asked if they wished to take part. Only children who wished to take part participated in the study. A written debrief which explained the aims, methods and results of the study was provided to all parents and children at the end of study.

*Experimental design*

Children were randomised (using an online research randomiser; www.randomizer.org) into one of four conditions (high intake norm, no intake norm, no norm, control) in a between-subjects design. The study adopted a remote-confederate design (Pliner & Mann, 2004; Robinson, Sharps, et al., 2014), where children were exposed to a fictitious participant information sheet containing information about six previous children (participant number, date of birth and gender). In the high intake, no intake and no-norm conditions the information sheet included the column 'Carrots (amount eaten)'. In the high intake norm condition this stated 'all', in the no intake norm condition this stated 'none', and remained empty in the no-norm condition. The column was present in the no-norm condition to rule out that information suggesting that other children's intake had been monitored would affect intake, but was not present in the final condition; control condition. All children were also exposed to a bowl. In the high intake and no intake norm conditions the bowl contained a single remaining carrot, or was full, to corroborate with the amount of carrots other children had supposedly been eating. In the no-norm condition and the control condition the bowl contained an item unrelated to food (pens). Children in all conditions were provided with a bowl of carrots to eat which weighed approximately 130g (including the 7 gram weight of the bowl) of carrot batons.

*Questionnaire measures*

*Fruit and vegetable intake and liking*

To assess usual fruit and vegetable intake, the Day in the Life questionnaire (DILQ) was administered, which is a validated and reliable twenty-four hour recall measure for use in children (Edmunds & Ziebland, 2002) The DILQ is a supervised exercise which uses words and pictures to encourage the child to recall and describe a range of activities, including their entire food intake, for the previous day (Edmunds & Ziebland, 2002). We also included measures for the children's liking of fruit and vegetables (e.g. how much do you like fruit/ vegetables/ carrots?) with 5 response options ranging from 'not at all' to 'a lot', and questions about their beliefs about the fruit and vegetable intake of other children (e.g. how many fruit and vegetables do you think other children eat every day?) with response options 'none', '1', '2-3', '4', '5 or more'. These questions were assessed using smiley-face Likert-style scales, and were based on questions used by Lally et al (2011).

*Manipulation check*

To examine whether the norm manipulation was successful, i.e. it caused children to believe that other children had either eaten a large amount of carrots or no carrots, children were asked 'how many carrots do you think other children ate in the study' and were presented with three choices 'almost all', 'some' and 'none', alongside a photograph of either an empty, half full or full bowl of carrots.

*Procedure*

Children were tested individually during weekdays between 9am and 3.30pm at a primary school. Children were informed that the researcher was interested in how well they played a game. First, the researcher presented the child with the fictitious participant information sheet, and completed the date of birth and gender columns with the child. In the norm conditions the researcher pointed out the 'Carrots (amount eaten)' column and explained that this now did not need to be completed, and had only been completed previously for carrot buying purposes. The researcher then pointed out the intake of previous children in the high and no intake norm conditions. In all conditions the researcher 'noticed' the bowl on the table, and in the high and no intake norm conditions, the researcher described the intake of previous participants to the child. Next, the child was presented with a bowl of carrots and was informed that they could have as many or as few of the carrots as they wished while the researcher arranged the game. The child was left alone for 7 minutes to consume as many carrots as they wished. After the 7 minutes, the researcher explained that the game involved trying to find pairs of animal images. The carrots were removed from the table and the child was left to play the game for three minutes. On return, the researcher congratulated the child on their performance in the game, to corroborate with the cover story. Finally, the researcher asked the child what they thought the aims of the study were, completed the questionnaire measures with the child, and measured the child's height and weight. (BMI was calculated as weight (kg)/height ($m^2$). Using internationally recognised criteria for children (Cole & Lobstein, 2012) healthy-weight, overweight and obesity were defined based on age and sex-specific BMI cut-off points equivalent to adult BMI of 25-30kg/$m^2$

respectively). The bowls of carrots were weighed pre and post-consumption to determine the amount of carrots eaten (in grams).

## 3.4 Results

No differences (*p*s > .05) were found between the conditions for BMI, age or gender. See Table 3.1. Children's mean fruit and vegetable intake was 1.58 (SD = 1.53) pieces per day, and children believed that other children ate 2 - 3 pieces of fruit and vegetables a day on average (2.63, SD = .68). In addition, children tended to report that they liked carrots (4.13, SD = 1.24 on the 1 - 5 scale).

*Manipulation checks*

No children guessed, or came close to guessing the aims of the study. To check whether children believed the norm manipulation, a one-way ANOVA was conducted on children's beliefs about the amount of carrots eaten by other children. There was a significant main effect of condition [$F(3, 139) = 45.11$, $p < .001$, $\eta p^2 = .49$]. Children in the high intake norm condition believed that other children had eaten significantly more carrots than children in the other three conditions ($p < .001$). Children in the no intake norm condition believed that other children ate significantly less carrots than children in the remaining two conditions ($p < .001$). See Table 3.1.

**Table 3.1** *Mean values (SDs) and statistical test results for BMI, age, gender, and manipulation check*

| Variables | High intake norm (n = 36) | No intake norm (n = 37) | No norm (n = 35) | Control (n = 35) | Test statistic and *p*-value |
|---|---|---|---|---|---|
| BMI (*z*-score) | .30 (1.10) | .35 (.81) | .42 (.96) | .10 (.87) | F (3, 139) = .77, *p* = .51 |
| Age (years) | 9.07 (1.35) | 9.20 (1.14) | 9.01 (1.21) | 8.85 (1.50) | F (3, 139) = .45, *p* = .72 |
| Gender<br>Boys (n)<br>Girls (n) | <br>17<br>19 | <br>20<br>17 | <br>18<br>17 | <br>15<br>20 | $X^2$ (3, n = 143) = 1.04, *p* = .79 |
| Belief about other children's carrot intake (manipulation check)[a] | 2.7 (.48) | 1.6 (.55) | 2.0 (.24) | 2.0 (.24) | F (3, 139) = 45.1, *p* < .001 |

[a] Children selected one of three options regarding their beliefs about the amount of carrots eaten by other children: almost all, some, or none. A higher mean corresponds to a belief that other children had eaten a large amount of carrots.

*Carrot intake*

Using One-Way ANOVA there was a significant main effect of condition on the amount of carrots eaten (in grams) [F (3, 139) = 6.9, $p < .001$, $\eta p^2 = .13$]. Children in the high intake norm condition ate significantly more carrots than children in all other conditions (*ps* < .01). There were no other significant between-condition differences. See Table 3.2 for mean intake figures.

**Table 3.2** *Mean (SDs) intake of carrots*

| Condition | Mean intake (grams) |
|---|---|
| High intake norm (n = 36) | 57.72 (39.02) |
| No intake norm (n = 37) | 27.14 (32.40)* |
| No norm (n = 35) | 31.50 (27.36)* |
| Control (n = 35) | 29.00 (31.80)* |

*indicates significant difference at $p < .01$ to high intake norm condition.

*Other variables*

We also examined whether BMI, child age, gender, liking of carrots, or usual fruit and vegetable intake moderated the effect of condition. We found no evidence that any of the other variables interacted with condition to predict carrot intake (*p*s > .05), suggesting that the effect of perceived carrot intake was observed consistently across most children. See Appendix 1.

## 3.5 Discussion

In the current study children were influenced by perceived eating norms regarding their peers' vegetable intake; when children believed that others had been eating a large amount of carrots they ate more than children in the other conditions. These results suggest that seeing information which suggests that other children have eaten a large amount of vegetables, influences children to increase their own vegetable intake.

Although previous work has suggested that children (aged 6-11 years old) may mimic the eating behaviour of a present peer (Bevelander et al., 2012), this study

provides the first evidence that children are influenced by perceived eating norms regarding the vegetable intake of their peers. These results are consistent with previous studies in adults, whereby, exposing adults to information suggesting that previous adults had eaten a large amount of food, influenced food intake (Feeney et al., 2011; Herman et al., 2003; Robinson & Higgs, 2013; Robinson, Sharps, et al., 2014). However, unlike previous studies (Feeney et al., 2011; Herman et al., 2003; Robinson & Higgs, 2013; Robinson, Sharps, et al., 2014), leading children to believe that other children had eaten no food (no intake norm) did not influence children to reduce their intake relative to the no-norm and control condition. A possible explanation may be that a floor effect was produced, whereby the low intake observed in the control conditions resulted in it not being possible to reduce the carrot intake of children any further.

One important consideration in this study is social context. We exposed children to information about the eating behaviour of previous children in a very specific social context, i.e. other children ate like this in this study. Adults appear to be influenced by social norm messages about the healthy eating habits of others (Robinson, Fleming, et al., 2014), so future studies could investigate the effectiveness of less context specific social norm messages for increasing fruit and vegetable intake in children. In addition, the current study investigated carrot intake, therefore, it is not possible to generalise these results to the intake of other, less common or liked vegetables. Moreover, our sample was predominantly healthy-weight, therefore, it is not possible to make conclusions about the behaviour of overweight children.

# Chapter 4: Perceived eating norms and children's eating behaviour: an informational social influence account

## 4.1 Chapter Introduction

In Chapter 3 we found that children were influenced by perceived eating norms which indicated the vegetable intake of their peers. However, what is less clear, is the mechanism explaining this effect. In Chapter 4 we had two aims. Our first aim was to replicate the effect that perceived eating norms had on children's vegetable intake in Chapter 3. Our second aim was to examine the mechanisms which underlie the influence of perceived eating norms on children's vegetable intake.

In Study 1 in Chapter 4, we aimed to examine whether concerns regarding social approval, otherwise known as normative social influence (Deutsch & Gerard, 1955), may underlie the influence that perceived eating norms have on children's vegetable intake. In Study 2 in Chapter 4, we aimed to examine whether perceived eating norms influence children's vegetable intake because eating norms provide information which can remove uncertainty about how to behave in a situation, otherwise known as informational social influence (Deutsch & Gerard, 1955).

The studies presented in Chapter 4 are under review (revise and resubmit):

Sharps, M. & Robinson, E. (2016). Perceived eating norms and children's eating behaviour: an informational social influence account, *Appetite, Under Review.*

## 4.2 Introduction

A substantial body of literature suggests that eating behaviour can be socially influenced. People have been shown to adapt their eating behaviour to that of a present dining companion (Kirsten E. Bevelander et al., 2012; Hermans, Larsen, et al., 2009; Robinson, Blissett, et al., 2013). Moreover, beliefs about the eating behaviour of others, otherwise known as perceived eating norms, have been consistently shown to influence eating behaviour in laboratory studies (Pliner & Mann, 2004; Robinson, 2015; Sharps & Robinson, 2015). For example, a number of studies showed that people eat more when exposed to information that suggests other people have eaten a large amount of food, compared to when exposed to information that suggests other people have eaten a small amount (Pliner & Mann, 2004; Robinson, 2015; Robinson, Blissett, et al., 2013; Robinson, Thomas, et al., 2014).

The mechanisms that explain why perceived eating norms influence behaviour have received less attention. One explanation is that perceived eating norms may act as a form of normative social influence (Deutsch & Gerard, 1955), whereby people may copy the behaviour of others when they are concerned with feeling socially accepted or establishing a relationship with the source of the influence (Cialdini & Trost, 1998; Cialdini & Goldstein, 2004; Deutsch & Gerard, 1955). Humans have a desire to be liked by others and belong (Baumeister & Leary, 1995), and there is evidence that normative social influence may be a possible explanation for why people adjust their own food intake to the intake of a present peer (Hermans, Engels, et al., 2009; Robinson et al., 2011). For example, Hermans et al (2009) found that participants only imitated the eating behaviour of a confederate when the confederate behaved in a ‘cold’ manner towards them, suggesting that participants may have imitated eating behaviour in order to persaude the confederate to accept them. In another study,

Robinson et al (2011) found that when participants were primed to feel socially accepted, they were less likely to match the intake of the confederate. This research linking normative explanations to social imitation of eating has predominantly focused on experimental paradigms which involve people eating together, however, there is also evidence that eating behaviour may be socially influenced due to a desire to 'fit in' even when peers are not present (Cruwys et al., 2012; Guendelman, Cheryan, & Monin, 2011). For example, in one study (Cruwys et al., 2012) University students encountered a confederate, and were exposed to the popcorn intake of the confederate before being left alone to eat popcorn. Cruwys et al (2012) found that the participants only adjusted their intake based on what they believed the confederate had eaten when they were led to believe that the confederate was from the same University as them (Cruwys et al., 2012). In addition, in two studies (Guendelman et al, 2011) Asian American participants were more likely to report prototypical American food as their favourite, and ordered and ate more American dishes after their American identity was challenged compared to when their identity was not challenged. Thus, these studies indicate that social factors may influence eating as a result of a desire to 'fit in'. However, little other research has examined whether normative social influence may be a potential mechanism underlying the influence that perceived eating norms have on eating behaviour. Although research has shown that perceived eating norms influence eating behaviour (Pliner & Mann, 2004; Robinson, 2015; Robinson, Blissett, et al., 2013; Robinson, Thomas, et al., 2014; Roth et al., 2001), at present we do not know whether people are influenced by perceived eating norms due to people wanting to 'fit in' and feel accepted, but it is a plausible explanation which warrants testing.

An alternative explanation to a normative account of social influence is that perceived eating norms may act as a form of informational social influence (Deutsch & Gerard, 1955). According to Cialdini & Trost (1998) people are often uncertain about how to behave in a situation, and other people's behaviour may act as a guide to determine the most appropriate course of action. Therefore, perceived eating norms which provide information about the eating behaviour of others may indicate the correct way to behave in a situation, e.g. 'if a lot of people are doing this, it's probably a wise thing to do' (Cialdini, 2007). Thus, conforming to the norm may be a way of reducing uncertainty in a situation, rather than other motives such as social acceptance or wanting to 'fit in'(Cialdini & Goldstein, 2004; Deutsch & Gerard, 1955). As discussed, adults have been shown to be influenced by perceived eating norms (Pliner & Mann, 2004; Robinson, 2015; Robinson, Blissett, et al., 2013; Robinson, Thomas, et al., 2014; Roth et al., 2001). Within these studies participants were typically exposed to perceived eating norms that suggested how others behaved in the same context (i.e. other participants in this study ate this amount of food) during a single experimental session. Since the research environment is likely to be novel and unfamiliar to the participants, it is feasible that perceived eating norms have a consistent effect on behaviour in these paradigms because they inform participants about the correct way to behave in the novel and unfamiliar eating context participants find themselves in. Therefore, it is not clear whether people are strongly influenced by perceived eating norms within these studies because the eating context may be unfamiliar and novel, or whether people would also be influenced by perceived eating norms if they have eaten in that context previously. If an informational social influence-based account of perceived eating norms is correct, then we would hypothesise that people would be most influenced by perceived

eating norms when they find themselves in a novel context vs. a context they have previously eaten in. This is because people would be more uncertain about how to behave or 'act' in a novel context, as opposed to a context that a person has previously eaten in. Thus, understanding whether perceived eating norms influence behaviour to a greater extent in novel and unfamiliar contexts, as opposed to a familiar eating context is one approach by which to test an informational social influence account.

Although there is now reliable evidence that perceived eating norms influence eating behaviour in adults (Robinson, Thomas, et al., 2014), less research has examined this in children (Sharps & Robinson, 2015). In one study reported in Chapter 3 (Sharps & Robinson, 2015), we exposed 6-11 year old children to a perceived eating norm that outlined the vegetable intake of previous (fictitious) children in that study. Consistent with the adult literature, the children were influenced by the perceived eating norm, eating more when exposed to information suggesting that previous children had eaten a large amount, compared to when exposed to information suggesting that previous children had eaten no vegetables. As this is the only study to our knowledge which has directly investigated the influence of perceived eating norms on children's eating behaviour, further research is needed to replicate this effect. Furthermore, although research has started to examine evidence for mechanisms underlying social influences on eating behaviour in adults as discussed above (Hermans, Engels, et al., 2009; Robinson et al., 2011), less research has examined evidence for the mechanisms underlying the influence of perceived eating norms on children's eating behaviour.

The present research had two aims: Our first aim was to replicate the effect that perceived eating norms have on children's vegetable consumption found in Chapter

3 (Sharps & Robinson, 2015). Our second aim was to examine evidence for possible mechanisms underlying the influence of perceived eating norms in children. In Study 1 we examined whether perceived eating norms may act as a form of normative social influence, whereby, children may be motivated to conform to a perceived eating norm in order to maintain personal feelings of social acceptance and 'fit in'. In Study 2 we examined whether perceived eating norms may act as a form of informational social influence, by shaping eating behaviour when there is uncertainty about how to behave.

## 4.3 Study 1

### 4.3.1 Method

*Participants*

100 children (53% females, 88% healthy-weight) aged 6-11 years old (9.6 years, SD = 1.5) were recruited from two Primary schools in North-West England. Children were led to believe that the study was looking at how children play games. In Chapter 3, we examined the effect of perceived eating norms on children's vegetable intake and in this study we observed a statistically large effect (Sharps & Robinson, 2015). Therefore, sample sizes of 25 children per condition provided adequate statistical power to detect similar sized main effects of perceived eating norms in the present studies. Study 1 and 2 were approved by the University of Liverpool Research Ethics Committee. As in Chapter 3 fully-informed parental consent was provided and children with allergies or a history of allergies were unable to participate in both studies.

*Study overview*

Children attended a single experimental session at a primary school. Children were either primed with feelings of peer acceptance, or with feelings of uncertainty of peer acceptance. Next, using the same remote-confederate design as Chapter 3, children were exposed to information that indicated the vegetable intake of previous (fictitious) children in the study. Dependent on condition, children either saw that previous children had eaten a large amount of vegetables, or no vegetables. All children were provided with a bowl of vegetables (carrots), and were left for 7 minutes to consume as much or as little as they liked. This design allowed us to examine whether children would be more likely to conform to a perceived eating norm if they were primed with feelings of uncertainty of peer acceptance, than when they were primed with feelings of peer acceptance.

*Experimental design*

Children were randomised (using an online research randomiser; www.randomizer.org) into a 2 x 2 between-subjects design, with factors remote-confederate intake (high vs. no intake) and peer acceptance condition (peer acceptance vs. uncertainty of peer acceptance).

*Social influence condition*

Study 1 in Chapter 4 used the same remote-confederate design as Chapter 3 whereby, children were exposed to a fictitious participant information sheet that contained information about six previous participants (participant number, date of birth, gender). The fictitious participant information sheet contained four columns; participant number, date of birth, gender, and Carrots (amount eaten). The 'Carrots (Amount eaten) column stated 'all' in the high intake condition, and 'none' in the no intake condition. Children were also presented with a bowl that appeared to be that of a previous participant. The bowl contained a single remaining carrot in the high intake condition, or was full in the no intake condition, to corroborate the fictitious information sheet. As in Chapter 3, all children were provided with a bowl of carrot batons which weighed approximately 130 grams (including the 7 gram weight of the bowl).

*Priming peer acceptance or uncertainty*

We based our manipulation on previous work by Over & Carpenter (2009). First the researcher discussed what being 'especially liked' meant with the child i.e. 'especially liked children are liked by other children, other children want to play with them, and they are always included in all of the games'. Next, every child was presented with a peer acceptance image that showed four cartoon children who were smiling and holding hands. The researcher pointed out that, in this image, one of the children was especially liked, and asked the child to explain what they thought this meant. Next, the researcher explained that not everyone can be especially liked and presented the child with the peer exclusion image, which showed the same four

cartoon children. Three of the cartoon children were holding hands, and one was away from the group. The researcher asked the child to explain what they thought was happening in the image. Following this, the researcher explained that they have tried to work out who they think the children in the school are who are 'especially liked' by other children.

*Peer acceptance:* In the peer acceptance condition, the researcher explained that they believed that the child was especially liked (i.e. "From what I found out, I think that you are one of the types of children who are especially liked. Other children want to play with you and be your friend"). The researcher asked the child to describe what being especially liked meant.

*Uncertainty of peer acceptance:* In the uncertainty of peer acceptance condition the researcher explained that they would inform the child about whether they thought the child was especially liked after a short break.

Following exposure to the remote-confederate intake manipulation (described above), all children were presented with a peer acceptance scale. In the peer acceptance condition, the researcher reiterated that they thought that the child was especially liked ("as I said, I think you are one of the especially liked children who everyone likes and wants to play with") and placed a counter ('You') under the peer acceptance image. In the uncertainty of peer acceptance condition, the researcher reiterated that they would inform the child after the break whether the researcher

thought they were especially liked. The researcher then placed the counter (‘You’) under ‘unsure’ on the scale.

*Measures*

*Fruit and vegetable intake and liking*

As in Chapter 3, usual fruit and vegetable intake was assessed using the Day in the Life questionnaire, which is a valid and reliable twenty-four hour recall measure for use in children (Edmunds & Ziebland, 2002). We included questions about children’s liking of carrots (e.g. how much do you like the carrots you were given? And how much do you like carrots in general?), with 5 response options ranging from ‘a lot’ to ‘not at all’. These questions were assessed using smiley-face Likert-style scales and were based on questions used in Chapter 3.

*Body weight*

Height was measured to the nearest 0.5cm using a Stadiometer (Seca 213, Seca GmbH & Co.) and weight was measured to the nearest 0.1kg using a digital scale (Seca 813 digital scale, Seca, GmbH & Co.). BMI was calculated as weight (kg)/ height ($m^2$). Using internationally recognised criteria for children (Cole & Lobstein, 2012) healthy-weight, overweight and obesity were defined based on age and sex-specific BMI cut-off points equivalent to adult BMI of 25-30kg/ $m^2$ respectively.

*Manipulation checks*

The same measure which was used in Chapter 3 was used to examine whether the remote-confederate intake manipulation was successful. Children were asked 'how many carrots do you think other children ate in the study', and were presented with three choices 'none', 'some', and 'almost all', alongside a photograph of either a full, half full, or empty bowl of carrots.

To examine whether the peer acceptance manipulation was successful, i.e. it caused children to believe that they were either accepted by their peers or were uncertain about whether they were accepted by their peers, children were asked 'how especially liked do you think you are?' and children were presented with a paper version of the peer acceptance scale, which was a 3-point Likert-style scale which contained the peer acceptance image as one anchor, the peer exclusion image as the other anchor, and 'unsure' in the middle.

*Procedure*

Children were tested individually during weekdays between 9am and 3.30pm at a primary school. Children were informed that the researcher was interested in how children play games. First the child was primed with feelings of peer acceptance or uncertainty of peer acceptance. Following this, the child was presented with the fictitious participant information sheet, and completed the date of birth and gender columns with the researcher. The researcher pointed out the 'Carrots (amount eaten)' column and explained that this did not need to be completed, and had only been completed previously for carrot buying purposes. The researcher then pointed out the

intake of previous children. In all conditions the researcher ‘noticed’ the bowl on the table and described the intake of previous children to the child. Next, the child was presented with a bowl of vegetables (carrots). At this point the child was presented with the peer acceptance scale as described in the priming procedure. Next, every child was then presented with a paper version of the peer acceptance scale and asked to indicate how especially liked they believed they were. The researcher then explained that they would leave the child alone while the researcher sorted out the game and that they could eat as much or as little of the snack as they wished. The child was left alone for 7 minutes to eat as many or as few vegetables as they wished. After the 7 minutes, the researcher returned. In children primed with uncertainty of peer acceptance the researcher then explained to the child that they believed that the child was especially liked. To corroborate the cover story all children were then presented with the game and the researcher explained that the game involved trying to find pairs of animal images. Both bowls were removed from the table and the child was left to play the game for three minutes. Finally, the researcher asked the child what they thought the aims of the study were, and completed the remaining questionnaire measures with the child. Height and weight were subsequently measured.

*Analysis strategy*

The main planned analysis was a 2 x 2 ANOVA, with factors remote-confederate intake (high vs. no intake) and peer acceptance condition (peer acceptance vs. uncertainty of peer acceptance). The dependent variable was children’s vegetable

intake (in grams). We planned to follow up significant effects of the manipulation checks and main analyses with Bonferroni-corrected pairwise comparisons.

### 4.3.2 Results

No differences (*p*s > .05) were found between the conditions for age, gender or BMI. See Table 4.1.

**Table 4.1** *Mean values (SDs) and statistical test results for BMI, age and gender for Study 1*

| Variables | Peer acceptance (n = 50) | | Uncertainty of peer acceptance (n = 50) | | Test statistic and *p*-value |
|---|---|---|---|---|---|
| | High intake (n = 25) | No intake (n = 25) | High intake (n = 25) | No intake (n = 25) | |
| BMI (*z*-score) | .08 (1.44) | .15 (.96) | .14 (1.20) | .34 (1.08) | Remote-confederate Intake: F (1, 96) = .33, $p$ = .57, $\eta p^2$ = .003. Peer acceptance condition: F (1, 96) = .26, $p$ = .61, $\eta p^2$ = .003. Remote-confederate intake x peer acceptance condition interaction: F (1, 96) = .08, $p$ = .79, $\eta p^2$ = .001. |
| Age (years) | 9.58 (1.48) | 9.54 (1.48) | 9.78 (1.59) | 9.57 (1.58) | Remote-confederate Intake: F (1, 96) =.17, $p$ = .68, $\eta p^2$ = .002 Peer acceptance condition: F (1, 96) = .13, $p$ = .72, $\eta p^2$ = .001. Remote-confederate intake x peer acceptance condition interaction: F (1, 96) = .08, $p$ = .78, $\eta p^2$ = .001. |
| Gender | | | | | $X^2$ (3, n = 100) = 1.41, $p$ = .70, $r$ = .12. |
| Boys (n) | 14 | 12 | 10 | 11 | |
| Girls (n) | 11 | 13 | 15 | 14 | |

*Manipulation checks*

No children guessed, or came close to guessing the aims of the study. To check whether children believed the manipulations, 2 x 2 ANOVAs were conducted on children's beliefs about the amount of vegetables (carrots) eaten by other children, and on children's beliefs about how socially accepted they believed they were.

*Remote-confederate intake manipulation*

There was a significant main effect of remote-confederate intake on children's beliefs about the amount of vegetables eaten by other children [F (1, 96) = 130.22, $p < .001$, $\eta p^2 = .58$]. There was no significant main effect of peer acceptance condition on children's beliefs about the amount of vegetables eaten by other children [F (1, 96) = 2.66, $p = .11$, $\eta p^2 = .03$]. However, a significant remote-confederate intake x peer acceptance condition interaction was observed [F (1, 96) = 5.98, $p = .02$, $\eta p^2 = .06$]. We therefore examined the effect of remote-confederate intake on children's beliefs about the amount of vegetables eaten by other children in the peer acceptance vs. uncertainty of peer acceptance conditions separately.

In the peer acceptance condition, independent samples t-tests revealed that children exposed to the high intake norm believed that other children had eaten more vegetables (n = 25, $M = 2.48$, SD = .51) than did children who were exposed to the no intake norm (n = 25, $M = 1.12$, SD = .33), t (48) = 11.18, $p < .001$, $d = 3.17$. In the uncertainty of peer acceptance condition, independent samples t-tests also revealed that children exposed to the high intake norm believed that other children had eaten more vegetables (n = 25, $M = 2.40$, SD = .58) than did children exposed to

the no intake norm (n = 25, *M* = 1.52, SD = .51), t (48) = 5.71, $p < .001$, $d = 1.61$. Thus, in both peer acceptance conditions children exposed to the high intake norm believed that previous children in the study had eaten more vegetables than children exposed to the no intake norm. However, the remote-confederate intake manipulation had a stronger effect in children primed with peer acceptance vs. uncertainty of peer acceptance.

*Peer acceptance manipulation*

There was a significant main effect of peer acceptance condition on children's beliefs about how especially liked they believed they were [F (1, 96) = 10.87, $p = .001$, $\eta p^2 = .10$]. Children in the peer acceptance condition reported feeling more especially liked (n = 50, *M* = 2.72, SD = .50), than children in the uncertainty of peer acceptance condition (n = 50, *M* = 2.38, SD = .53). There was no significant main effect of remote-confederate intake [F (1, 96) = .34, $p = .56$, $\eta p^2 = .004$], and no significant peer acceptance condition x remote confederate intake interaction was observed on children's beliefs about how especially liked they believed they were [F (1, 96) = .94, $p = .34$, $\eta p^2 = .01$].

*Vegetable intake*

Using a 2 (remote-confederate intake) x 2 (peer acceptance condition) between-subjects ANOVA, there was a significant main effect of remote-confederate intake on children's vegetable intake (in grams) [F (1, 96) = 16.93, $p < .001$, $\eta p^2 = .15$]. Children in the high intake conditions ate significantly more vegetables than children

in the no intake conditions. There was no significant main effect of peer acceptance condition on children's vegetable intake [F (1, 96) = .18, $p$ = .67, $\eta p^2$ = .002], and no significant remote-confederate intake x peer acceptance condition interaction was observed on children's vegetable intake [F (1, 96) = .92, $p$ = .34, $\eta p^2$ = .009]. See Figure 4.1 for mean vegetable intake values.

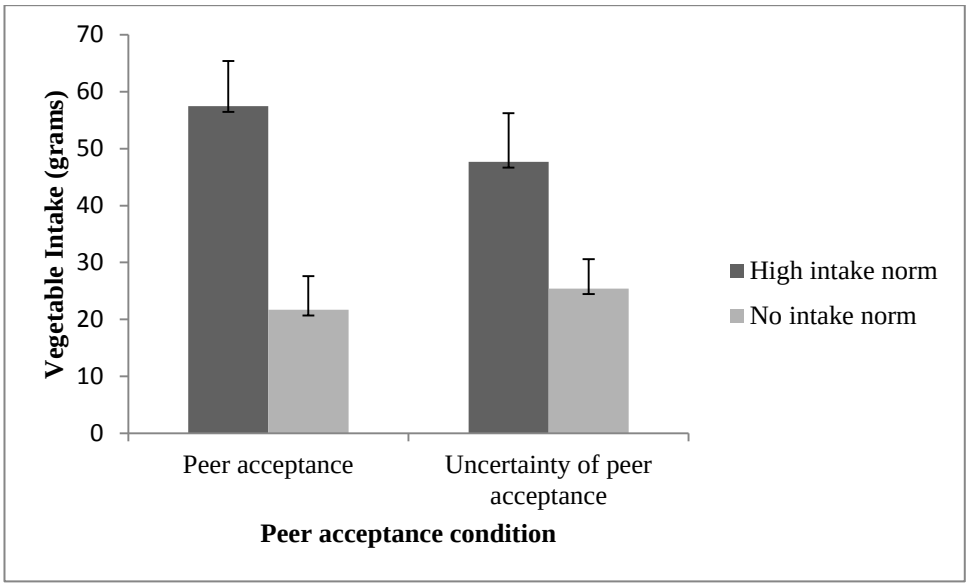



**Figure 4.1** *Mean (± SEM) vegetable intake (in grams) as a function of peer acceptance condition and remote-confederate intake.*

*Other variables*

Controlling for zBMI, child age, liking of carrots, and usual fruit and vegetable intake as covariates in separate 2 (remote-confederate intake) x 2 (peer acceptance condition) ANCOVAs, and including gender in the analyses did not alter the results of the analyses examining children's vegetable intake. See Appendix 2.

### 4.3.3 Discussion

Consistent with Chapter 3 (Sharps & Robinson, 2015), the results of Study 1 showed that children were influenced by perceived eating norms regarding other children's vegetable intake, eating more vegetables when they were led to believe that previous children had eaten a large amount of vegetables compared to when they were led to believe that previous children had eaten no vegetables. However, regardless of whether children were primed with feelings of peer acceptance or feelings of uncertainty of peer acceptance, children were similarly influenced by the perceived eating norm. The results do not support our hypothesis that priming children with feelings of peer acceptance may reduce children's conformity to the norm relative to priming children with feelings of uncertainty of peer acceptance. The results of Study 1 therefore suggest that perceived eating norms did not appear to act as a form of normative social influence. In Study 2, we aimed to test whether perceived eating norms may act as a form of informational social influence, providing a guide for how to behave in an unfamiliar eating context (Cialdini & Trost, 1998; Deutsch & Gerard, 1955). We hypothesised that children would be strongly influenced by a perceived eating norm in a novel and unfamiliar context, but be less influenced when eating in a familiar eating context they had encountered before.

## 4.4 Study 2

### 4.4.1 Method

*Participants*

Due to the repeated measures design in Study 2, we were conscious of potential dropout, and therefore opted to recruit a minimum of 30 children per experimental condition. 131 children were recruited from three Primary schools in the North-West of England. One child was excluded due to not being available for both study sessions and three children were excluded as they were unable to understand the study instructions. The final sample consisted of 127 children (54.3% females) aged 6-11 years old (M = 8.32, SD = 1.30).

*Study overview*

Children participated in two sessions, one day apart. Children were exposed to information about the about the vegetable consumption of previous children in the study in one of the sessions (perceived eating norm), and received no information about the vegetable consumption of previous children in the study in the other session. Dependent on condition children either saw the perceived eating norm during their first session (unfamiliar eating context) or in their second session (familiar eating context). As in Study 1, dependent on condition, the perceived eating norm either indicated that previous children in the study had eaten a large amount of vegetables or no vegetables. Children were given a bowl of vegetables (carrots) to eat in both sessions and their vegetable consumption was examined in both sessions. In line with an informational social influence hypothesis, this design allowed us to

test whether children would be more strongly influenced by a perceived eating norm in a novel and unfamiliar context, but be less influenced when eating in a familiar eating context that they had encountered before. Because of the design of the study we were also able to examine whether being exposed to perceived eating norm information during session 1 continued to affect vegetable consumption a day later (session 2) in the absence of that perceived eating norm information.

*Experimental design*

Participants were randomised into a 2 x 2 x 2 mixed design, with between subjects' factors; social influence condition (high vs. no intake) and familiarity of the eating context (familiar vs. unfamiliar), and a within subject's factor of eating session (session 1 and session 2). Study 2 adopted the same remote-confederate design as Study 1 and Chapter 3, whereby children were exposed to the same fictitious participant information sheet and a bowl which suggested that other children either ate a large amount of vegetables or no vegetables during one of the two sessions they participated in. In the session in which children were not exposed to social influence condition information, the column 'Carrots (Amount eaten)' remained blank, and the bowl contained an item unrelated to food (pens). As in Study 1 in Chapter 4, all children were provided with a bowl of carrot batons which weighed approximately 130 grams (including the 7 gram weight of the bowl).

*Manipulating familiarity of the eating context*

In order to manipulate familiarity of the eating context, we manipulated the session in which children were exposed to the social influence condition information. In the 'unfamiliar eating context' condition, children were exposed to the social influence condition information in session 1, and received no intake information in session 2 (see above). In the 'familiar eating context' condition children were exposed to the social influence condition information in session 2, and saw no intake information in session 1.

*Measures*

The measures were the same as in Study 1. However, we included a hunger measure in Study 2. Hunger was measured using a child hunger scale developed by Bennett and Blissett (2014). Response options ranged from 'very hungry' to 'not hungry at all/ very full' (Bennett & Blissett, 2014).

*Manipulation check*

The same remote-confederate intake manipulation check was used as Study 1.

*Procedure*

*Session 1*

Children were tested individually between 9am and 3.30pm at a Primary school. The sessions took place one day apart, at approximately the same time. Children were informed that the study involved two sessions and that the researcher was interested in whether playing a game in session 1 affected their performance in session 2. First, the researcher presented the child with the hunger measure, and the child was asked to rate how hungry they were. Next, the researcher presented the child with the fictitious participant information sheet. The researcher completed the date of birth and gender columns with the child. In the 'unfamiliar eating context' condition, the 'Carrots (Amount eaten)' column contained social influence condition information (i.e. it either stated 'all' or 'none' depending on which social influence condition the children were in). In the 'familiar eating context' condition this column was blank. In both conditions the researcher explained that the 'Carrots (Amount eaten)' column did not need to be completed and had only been completed previously for carrot buying purposes. In addition, in the 'unfamiliar eating context' condition the researcher pointed out the intake of the previous children. Next, in both conditions the researcher 'noticed' the bowl on the table and explained that it had been left there by accident. In the 'unfamiliar eating context' condition the bowl contained vegetables (i.e. was either full of carrots or contained a single remaining carrot to corroborate with the fictitious participant information sheet). In the 'familiar eating context' condition, the bowl contained an item unrelated to food (pens). In the 'unfamiliar eating context' condition the researcher described the intake of the previous children to the child. Next, in all conditions, the researcher explained to the child that they could have a snack while the researcher prepared the game. The

researcher presented the child with the second bowl of carrots and explained to the child that they could eat as many as they wished. The fictitious participant information sheet and the first bowl remained on the table in all conditions. The child was left alone for 7 minutes to eat as many or as few carrots as they wished. After the 7 minutes, the researcher returned. The researcher removed the bowls and the fictitious participant information sheet from the table and presented the child with a game (the game involved matching two animal images to make a pair). The researcher explained how to play the game and the child was left to play the game for 3 minutes. On return, the researcher congratulated the child on their performance in the game to corroborate the cover story. Children in the 'unfamiliar eating context' condition completed the manipulation check to examine whether the social influence condition norm manipulation influenced children's beliefs about the amount of vegetables eaten by previous children.

*Session 2*

Session 2 was identical to session 1. The only difference was that children in the 'familiar eating context' condition were now exposed to the social influence condition information (fictitious information sheet and bowl of carrots communicating the perceived eating norm), while children in the 'unfamiliar eating context' condition did not receive any social influence condition information and instead were exposed to the blank fictitious information sheet and bowl of pens. At the end of session 2, children in the 'familiar eating context' condition completed the manipulation check. All children were asked the aims of the study, and completed

the remaining questionnaire measures with the researcher at the end of session 2. Weight and height were measured at the end of session 2.

*Analysis strategy*

The main planned analysis was a 2 x 2 x 2 mixed ANOVA, with between subjects factors familiarity of the eating context and remote-confederate intake, and the within subjects factor of eating session. The dependent variable was children's vegetable intake (in grams). As in Study 1 we planned to follow up significant effects of the manipulation checks and main analyses with Bonferroni-corrected pairwise comparisons. We hypothesised a significant eating session x social influence condition x familiarity of eating context interaction. It was important to include eating session as a factor due to the possibility that the social influence information in the unfamiliar eating context condition may spill over from session 1 to session 2, and to account for any other unpredicted effects of eating session. Therefore, we did not hypothesis that we would find a social influence x familiarity of eating context interaction.

### 4.4.2 Results

No differences (*p*s > .05) were found between the conditions for age, gender or BMI. See Table 4.2.

**Table 4.2** *Mean values (SDs) and statistical test results for BMI, age and gender for Study 2*

| Variables | Unfamiliar eating context (n = 65) | | Familiar eating context (n = 62) | | Test statistic and *p*-value |
|---|---|---|---|---|---|
| | High intake (n = 32) | No intake (n = 33) | High intake (n = 32) | No intake (n = 30) | |
| BMI (*z*-score) | .21 (1.23) | .15 (1.05) | .27 (1.04) | .17 (1.20) | Remote-confederate intake: F (1, 123) = .15, $p$ = .70, $\eta p^2$ = .001<br>Familiarity of eating context: F (1, 123) = .03, $p$ = .85, $\eta p^2$ < .001.<br>Remote-confederate intake x familiarity of eating context interaction: F (1, 123) = .01, $p$ = .93, $\eta p^2$ < .001. |
| Age (years) | 8.36 (1.25) | 8.20 (1.28) | 8.40 (1.41) | 8.30 (1.31) | Remote-confederate intake: F (1, 123) = .31, $p$ = .58, $\eta p^2$ = .002.<br>Familiarity of eating context: F (1, 123) = .09, $p$ = .76, $\eta p^2$ = .001.<br>Remote-confederate intake x familiarity of eating context interaction: F (1, 123) = .01, $p$ = .92, $\eta p^2$ < .001. |
| Gender | | | | | $X^2$ (3, n = 127) = 2.35, $p$ = .50, $r$ = .14. |
| Boys (n) | 15 | 15 | 11 | 16 | |
| Girls (n) | 17 | 18 | 21 | 14 | |

*Manipulation check*

No children guessed, or came close to guessing the aims of the study. To check whether children believed the norm manipulation, a 2 x 2 ANOVA was conducted on children's beliefs about the amount of vegetables (carrots) eaten by other children. There was a significant main effect of remote-confederate intake on children's beliefs about the amount of vegetables eaten by other children [F (1, 123) = 132.23, $p < .001$, $\eta p^2 = .52$]. There was no significant main effect of familiarity of eating context on children's beliefs about the amount of vegetables eaten by other children [F (1, 123) = 1.52, $p = .22$, $\eta p^2 = .01$]. However, a significant remote-confederate intake x familiarity of the eating context interaction was observed [F (1, 123) = 5.02, $p = .03$, $\eta p^2 = .04$]. We therefore examined the effect of remote-confederate intake on children's beliefs about the amount of vegetables eaten by other children in the familiar and unfamiliar eating context conditions separately.

In the unfamiliar eating context condition, independent samples t-tests revealed that children who were exposed to the high intake norm believed that other children had eaten more vegetables (n = 32, $M = 2.81$, SD = .40) than did children who were exposed to the no intake norm (n = 32, $M = 1.58$, SD = .56), t (63) = 10.24, $p < .001$, $d = 2.53$. In the familiar eating context, independent samples t-tests also revealed that children exposed to the high intake norm believed that other children had eaten more vegetables (n = 32, $M = 2.50$, SD = .51) than did children exposed to the no intake norm (n = 30, $M = 1.67$, SD = .55), t (60) = 6.22, $p < .001$, $d = 1.56$. Thus, in both the familiar and unfamiliar eating contexts, children exposed to the high intake norm believed that other children had eaten more vegetables in comparison to children who were exposed to the no intake norm. However, the remote-confederate

intake manipulation had a stronger effect in children in the unfamiliar vs. familiar eating context.

*Vegetable intake*

Using a 2 (remote-confederate intake) x 2 (familiarity of eating context) x 2 (eating session) mixed ANOVA, there was a significant main effect of remote-confederate intake [F (1, 123) = 9.87, $p$ = .002, $\eta p^2$ = .07], no significant main effect of familiarity of eating context [F (1, 123) = .85, $p$ = .36, $\eta p^2$ = .007] and no significant main effect of eating session [F (1, 123) = 1.03, $p$ = .31, $\eta p^2$ = .01] on children's vegetable intake (in grams). There were no significant interactions between remote-confederate intake and familiarity of eating context [F (1, 123) = 2.81, $p$ = .10, $\eta p^2$ = .02], eating session and remote-confederate intake [F (1, 123) = .29, $p$ = .59, $\eta p^2$ = .002], or eating session and familiarity of the eating context on children's vegetable intake [F (1, 123) = .04, $p$ = .85, $\eta p^2$ < .001]. However, as hypothesised a significant eating session x remote-confederate intake x familiarity of eating context interaction was observed [F (1, 123) = 7.18, $p$ = .01, $\eta p^2$ = .06]. We therefore examined the effects of remote-confederate intake and eating session on children's vegetable intake in the unfamiliar and familiar eating contexts separately.

*Unfamiliar eating context*

In the unfamiliar eating context, there was a significant main effect of remote-confederate intake on children's vegetable intake [F (1, 63) = 10.70, $p$ = .002, $\eta p^2$ = .15]. There was no significant main effect of eating session on children's vegetable

intake [F (1, 63) = .71, $p$ = .40, $\eta p^2$ = .01]. There was a significant eating session x remote-confederate intake interaction [F (1, 63) = 5.05, $p$ = .03, $\eta p^2$ = .07]. Independent samples t-tests revealed that, in session 1, children who were exposed to the high intake norm ate significantly more vegetables than children who were exposed to the no intake norm, t (63) = 3.92, $p$ < .001, $d$ = .97. Furthermore, this effect persisted into session 2, whereby children who had been exposed to a high intake norm in session 1, ate significantly more vegetables in session 2 than children who had been exposed to a no intake norm in session 1, t (63) = 2.43, $p$ = .02, $d$ = .60. See Figure 4.2 for mean intake values. Thus, when children were exposed to a high vs. no intake norm in a context in which they had not previously eaten their intake of vegetables was affected by the norm information and this effect on behaviour persisted the next day when no remote-confederate intake information was present.

*Familiar eating context*

In the familiar eating context there was no significant main effect of remote-confederate intake [F (1, 60) = 1.19, $p$ = .28, $\eta p^2$ = .02] or eating session [F (1, 60) = .35, $p$ = .56, $\eta p^2$ = .01] on children's vegetable intake. There was also no significant interaction between eating session and remote-confederate intake on children's vegetable intake [F (1, 60) = 2.36, $p$ = .13, $\eta p^2$ = .04]. Thus, when children were exposed to a high vs. no intake norm in a context they had previously eaten, their intake of vegetables was not significantly affected.

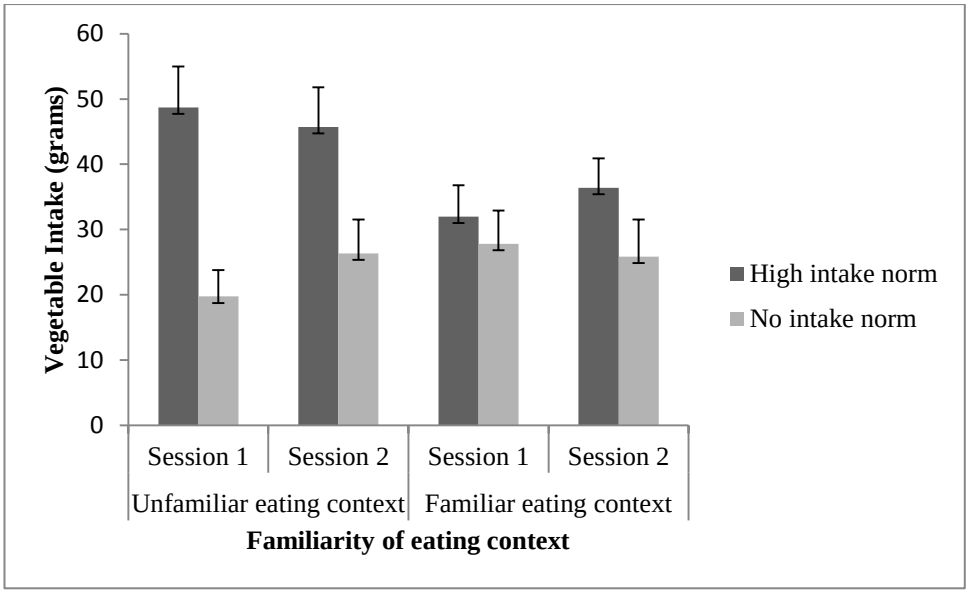



**Figure 4.2** *Mean (± SEM) vegetable intake (in grams) as a function of familiarity of the eating context and remote-confederate intake.*

*Other variables*

Controlling for *z*BMI, hunger, child age, liking of carrots, and usual fruit and vegetable intake as covariates in separate 2 (remote-confederate intake) x 2 (familiarity of eating context) x 2 (eating session) mixed ANCOVAs, and including gender in the analyses did not alter the results reported above. See Appendix 2.

## 4.5 General Discussion

The present studies had two aims: First, we aimed to replicate the effect of perceived eating norms on children's vegetable consumption in Chapter 3 (Sharps & Robinson, 2015). Second, we aimed to examine the mechanisms that underlie why children are influenced by perceived eating norms. In both studies we found that children were influenced by perceived eating norms regarding other children's vegetable consumption, eating more vegetables when they were led to believe that previous children had eaten a large amount of vegetables, compared to when they were led to believe that previous children had eaten no vegetables. Study 1 showed that children were influenced by perceived eating norms regardless of whether they were primed with feelings of peer acceptance or ambiguity of peer acceptance. Study 2 showed that children were most strongly influenced by perceived eating norms when they were exposed to a norm in an unfamiliar eating context. Moreover, this effect persisted into a second session when eating norm information was not present. However, when children were exposed to the norm when they were in an eating context that they had previously eaten in, children's vegetable consumption was not significantly influenced. The results of Study 2 are consistent with the growing body of research which suggests that perceived eating norms may act as a form of informational social influence on eating behaviour when people are uncertain of how to behave (Herman & Polivy, 2005; Robinson, Thomas, et al., 2014).

In Study 2 we found that an eating norm presented in a first session continued to influence children's eating behaviour in a session twenty-four hours later when the norm information was no longer present. This finding is consistent with a previous study investigating peer imitation of food intake in children (aged 6-11 years old) (Bevelander, Anschutz & Engels., 2012). Herman & Polivy (2005) distinguish

between situational and personal norms and suggest that situational norms are derived from the eating environment itself, such as the eating behaviour of others, whereas personal norms are based on an individual's prior experience. Consistent with Bevelander et al (2012), we suggest that the perceived eating norms may have provided the situational norm in session 1, however, children may have then internalised this to be a personal norm and therefore behaved similarly in the second session. To our knowledge, little research has investigated the persistence of perceived eating norms over time. Further research is needed to examine whether perceived eating norms learnt in one context may 'spill over' and influence eating behaviour in different contexts, or whether the long-term influence of perceived eating norms observed in the present study is specific to the context in which the norm was 'learnt'. Understanding this distinction may have important implications for interventions. If it is the case that a perceived eating norm 'learnt' in one context continues to influence eating behaviour only in that same context, then future intervention work would need to consider this.

In Study 1 we found little evidence that the influence a perceived eating norm (a norm about what others do) had on vegetable consumption was affected by ambiguity concerning social approval. A possible explanation for this may be the remote-confederate study design used in the present study, whereby the children were alone and no peers were present. Thus, it may be the case that the children did not feel a desire to 'fit in' without peers present. Another possible explanation is that since the norm information in the present studies described the behaviour of others (Cialdini, Reno, & Kallgren, 1990), they may not have provided information about what others approve of. Therefore, the children may not have been able to fulfil their social acceptance goals through adhering to this norm. One type of norm that may

exert its influence through normative social influence is an injunctive norm. Injunctive norms provide information about what other people approve of (Cialdini, Reno, & Kallgren, 1990). The influence injunctive norms have on eating behaviour is unclear. There is some evidence that injunctive norms are related to intentions to consume a healthy diet (Yun & Silk, 2011). Furthermore, there is evidence that injunctive norms may influence perceptions of the healthiness and tastiness of food carrying health halos (Vasiljevic, Pechey, & Marteau, 2015). For example, Vasiljevic et al (2015) showed that a frowning emoticon label reduced participants' perceptions of the healthiness and tastiness of cereal bars. However, there is also evidence that injunctive norms reduce healthy eating intentions (Stok et al., 2014), and in one study (Staunton, Louis, Smith, Terry, & Mcdonald, 2014) while an injunctive norm on its own did not influence intentions, when a negative descriptive norm was made salient, an injunctive norm reduced healthy eating intentions (Staunton et al., 2014). Furthermore, some studies have found little evidence that injunctive norms influence behaviour (Lally, Bartle, & Wardle, 2011; Robinson, Fleming, & Higgs, 2014). It may be that when perceived injunctive norms do affect behaviour, they exert their influence through social approval concerns and further research is needed to examine this.

One factor which has been shown to affect whether eating behaviour is socially influenced is feelings of identification with the norm reference group (Berger & Rand, 2008; Cruwys et al., 2012). According to Festinger's (1954) social comparison theory and social identity theory (Hogg & Terry, 2016), people often evaluate themselves by comparing themselves to others, and are therefore more likely to follow the behaviour of similar others they identify with (Berger & Rand, 2008; Cruwys et al., 2012; Terry, Hogg, & White, 1999). For example, Berger & Rand

(2008) showed that when participants were exposed to a perceived eating norm suggesting that an outgroup consumed junk food, participants were more likely to make healthy food choices. In another study, Cruwys et al (2012) showed that adult participants were only motivated to adjust their intake to that of a previous participant when they were led to believe that the norm came from an ingroup rather than an outgroup member. In the present studies, we informed children that the perceived eating norm information referred to previous children in the study. While it was not explicitly stated that these were other children in the school, the nature of the study design indicated to the children that other children in their school had taken part. We did not measure how strongly participants in our studies identified with the other children in the school. Future studies could manipulate identification with the norm reference group in order to determine whether this affects the extent to which children are influenced by perceived eating norms.

An important consideration in the present studies is social context. In the present studies children were exposed to information about other children's eating behaviour in a very specific social context, i.e. other children ate like this in this study, and these context specific perceived eating norms had a statistically large effect on children's vegetable consumption. However, research suggests that the influence that normative information has on behaviour decreases as norm based information becomes less specific to a given context (Goldstein, Cialdini, & Griskevicius, 2008). Hermans, Salvy, Larsen, & Engels (2012) showed that when participants were exposed to a video confederate who was in a different social context to the participant (i.e. in a university office (Study 1) or a living room (Study 2)), participants did not adjust their intake to that of the video model. The authors suggested that this may be due to the participants finding themselves in a different

social context to the video confederate. This point may be of importance, as the present studies only examined the influence of perceived eating norms in a very specific context and do not tell us about whether children's generalised beliefs about the eating behaviour of their peers influence their everyday eating behaviour.

In the present studies children believed the perceived eating norm manipulation, i.e. children exposed to the norm which suggested that previous children had eaten a large amount of vegetables, believed that other children had eaten more vegetables, than did children who were exposed to the norm which suggested that previous children had eaten no vegetables. However, in Study 1, children who were primed with peer acceptance more strongly believed the norm than children who were primed with ambiguity of peer acceptance. In Study 2, children who were presented with the norm in the unfamiliar eating context more strongly believed the norm than children presented with the norm in the familiar eating context. It is plausible that this pattern of results may be explained by the amount of attention children paid to the perceived eating norm information. In Study 1, children who were told they were socially accepted may have felt a stronger sense of identity with their fellow classmates and therefore attended more closely to the norm (Hogg & Reid, 2006; Turner, Wetherell, & Hogg, 1989). In Study 2, children who found themselves in an unfamiliar eating context may have been more likely to attend to the norm information because of uncertainty of how to behave. The latter interpretation is in fitting with the proposition that perceived eating norms may be particularly important in novel eating contexts. However, the between group differences we observed on our perceived eating norm manipulation check measures were unexpected in both studies. Understanding why these differences occurred will now be important.

The two studies presented here are the first to investigate mechanisms that may underlie the influence of perceived eating norms on children's vegetable consumption. However, the studies are not without limitations. The studies investigated whether perceived eating norms influenced children's carrot intake, therefore, it is not clear whether perceived eating norms will influence the intake of other, less liked vegetables. In Study 1 although we measured whether our manipulation to prime feelings of ambiguity of peer acceptance affected children's feelings of social acceptance we did not measure whether children were motivated to gain social approval. It may be the case that our manipulation was not strong enough to shift children's social approval motivation. Furthermore, the scale used to prime the children with feelings of peer acceptance or ambiguity was the same as the scale used to measure whether children believed the manipulation. While this may provide children with the opportunity to simply reproduce what they were told, in Study 1 our results indicate that this was not the case. However, using different measures to prime children and to measure the manipulation would be useful in future studies. In Study 2, although we manipulated whether an eating context was unfamiliar or familiar, we did not directly measure how uncertain children felt about how to behave in either eating context. Producing a measure which accurately taps into uncertainty may be particularly difficult in this age range, therefore we opted not to measure it. However, directly measuring uncertainty about how to behave and examining the effect this has on the influence perceived eating norms would produce a more accurate test of an informational social influence hypothesis. Finally, here we examined evidence for the mechanisms in two separate studies, it would however, be useful to pit the two mechanisms against each other in a single study.

In conclusion, across two studies we provide further evidence that children are influenced by perceived eating norms regarding other children's vegetable consumption. Moreover, we suggest that perceived eating norms may exert their influence on eating behaviour through informational social influence.

# Chapter 5: Encouraging children to eat more fruit and vegetables: Health vs. perceived eating norm-based messages

## 5.1 Chapter Introduction

In Chapters 3 and 4 we examined the influence that perceived eating norms have on children's vegetable intake, and the mechanisms which underlie this effect. We showed that, across Chapter 3 and 4, perceived eating norms influenced children's vegetable intake, and we identified mechanisms which may explain this influence. Building on this, in Chapter 5, we aimed to test whether perceived eating norms could be used as an intervention tool to increase children's fruit and vegetable intake.

The studies reported in Chapter 5 are published as:

Sharps, M., & Robinson, E. (2016). Encouraging children to eat more fruit and vegetables: Health vs. descriptive social norm-based messages. *Appetite*, *100*, 18–25. http://doi.org/10.1016/j.appet.2016.01.031

## 5.2 Introduction

High fruit and vegetable intake is associated with a reduced risk of major chronic diseases (Bazzano et al., 2002; Hung et al., 2004), however, children eat less fruit and vegetables than recommended (Dennison et al., 1998; Yngve et al., 2005). Eating behaviours are believed to develop through social learning during childhood (Birch & Fisher, 1998; Birch et al., 2007), with the presence of dining companions, such as parents, peers and siblings influencing the development of food preferences and eating behaviours (Birch & Fisher, 1998; Birch et al., 2007; Sharps et al., 2015). Eating behaviours developed during childhood also track into adolescence and adulthood (Kelder et al., 1994; Singer et al., 1995), therefore, understanding how we can encourage children to acquire healthy eating habits is important.

Traditional intervention approaches to encourage fruit and vegetable intake outline the health benefits of eating fruit and vegetables. However, the effectiveness of this approach is unclear. Some studies support that health messages can motivate healthier food choices in adults and children (Bannon & Schwartz, 2006; Lawatsch, 1990; Robinson, Harris, et al., 2013). For example, in one study, exposure to nutrition messages about apples in a video influenced 5 year old children to choose an apple rather than a cracker (Bannon & Schwartz, 2006). Likewise, exposing adults to information suggesting that limiting junk food intake can be beneficial to health, reduced junk food intake relative to a control condition in a recent study (Robinson, Harris, et al., 2013). However, there are also studies which suggest that, in some contexts, health messages may not be an effective way to increase fruit and vegetable intake (Maimaran & Fishbach, 2014; Musher-Eizenman et al., 2011; Wardle & Huon, 2000). For example, Maimaran and Fishbach (2014) showed that presenting food as instrumental to achieving a goal, for example, outlining the health

benefits of eating certain foods, decreased intake in pre-school children (aged 3-5.5 years old). This may be explained by a form of boomerang effect (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007; Werle & Cuny, 2012), whereby increasing the perceived healthfulness of a food reduces intake. This is also in fitting with suggestions that when a person believes a food is 'healthy' it will be less appealing and enjoyable to eat (Raghunathan, Naylor, & Hoyer, 2006).

Although there is mixed evidence regarding the effectiveness of health messages, a significant body of research indicates that eating behaviour can be socially influenced. Adults and children have been shown to adjust their food intake to that of a present peer (Bevelander et al., 2012; Feeney et al., 2011; Robinson & Higgs, 2013). There is also consistent evidence that adults adjust their food intake based on their beliefs about the eating behaviour of others (Pliner & Mann, 2004; Robinson, Sharps, et al., 2014; Robinson, Thomas, et al., 2014; Sharps & Robinson, 2015). The role that beliefs about others' eating behaviour have on eating behaviour has been less thoroughly examined in children. However, in Chapters 3 (Sharps & Robinson, 2015) and 4 6-11 year old children were exposed to information suggesting that other (6-11 year old) children taking part in the study had been eating a large amount of vegetables, and this resulted in children increasing their own vegetable intake. Growing evidence suggests that it may be possible to promote healthier eating behaviour in adults through the use of perceived eating norm-based messages. Perceived eating norm-based messages are messages which highlight the healthy eating behaviour of others, and have been shown to influence food intake in adults and adolescents (Robinson, Fleming, et al., 2014; Robinson, Harris, et al., 2013; Stok et al., 2014). For example, Robinson, Fleming, et al (2013) found that exposure to a perceived eating norm-based message suggesting that other young adults

frequently ate fruit and vegetables, influenced young adults to increase their intake of fruit and vegetables relative to a health message about the benefits of fruit and vegetable intake. However, there is some evidence that perceived eating norm-based messages may not always be effective in increasing fruit intake (Stok et al., 2012), whilst in other studies, perceived eating norm-based messages have been shown to be no more effective than a health message (Robinson, Harris, et al., 2013) or an instructive message (e.g. have a salad) (Mollen et al., 2013). The effect that perceived eating norm-based messages have on the eating behaviour of children has not been investigated. Given that perceived eating norm information (e.g. an information sheet showing the intake of the previous children) has been shown to influence vegetable intake in young children (aged 6-11 years old) in Chapters 3 (Sharps & Robinson, 2015) and 4, it is plausible that perceived eating norm-based messages about children's fruit and vegetable intake could be an effective way of encouraging children to 'fit in' and eat more fruit and vegetables.

The present studies tested the effect of messages outlining the health benefits of eating fruit and vegetables, and perceived eating norm-based messages suggesting that other children eat fruit and vegetables, on intake of fruit and vegetables in children aged 6-11years old. We focused on this age range as previous studies have shown that children of this age are socially influenced by their peers when eating (Bevelander et al., 2012; Romero et al., 2009) and conform to perceived eating norms about food intake (Chapters 3 and 4). Across two studies we exposed children to messages about fruit and vegetables as part of an interactive board-game. In line with previous studies in adults, we predicted that children exposed to perceived eating norm-based messages would increase their intake of fruit and vegetables relative to participants in a control condition. Because of inconsistent findings

concerning the effect that health messages have on eating behaviour (Bannon & Schwartz, 2006; Lawatsch, 1990; Maimaran & Fishbach, 2014; Robinson, Harris, et al., 2013), we reasoned that health messages may only have a modest influence on fruit and vegetable intake.

## 5.3 Study 1

### 5.3.1 Method

*Participants*

143 children (60% females) aged 6-11 years old, (8.75 (SD = 1.04) were recruited from two Primary schools in North-West England. The sample consisted of 93 healthy-weight and 50 overweight children. Participants were led to believe that the study was looking at how people play board games, and were randomly assigned to one of three conditions; perceived eating norm-based message vs. health message vs. control. In both studies we aimed to recruit at least 40 children per experimental condition. In Chapters 3 and 4 we identified a statistically large effect size, therefore, a sample size of 40 children per condition provided more than adequate statistical power to detect a similar sized effect. The study was approved by the University of Liverpool Research Ethics Committee. As in Chapters 3 and 4 fully-informed parental consent was obtained.

*Procedure*

Study sessions took place during week days between 9am and 3.30pm in UK primary schools. First, the researcher informed the child that the research was about the different ways in which children play games, and the child was seated next to the researcher in front of a board-game. The researcher explained the aim of the game; to move around the board, collect cards and reach the end. Both the child and the researcher had a pack of cards which contained a number and were used to move around the board. Movement around the board was identical in each condition. The child always started first and always won the game. As the child and the researcher moved around the board, they landed on three spaces where they selected a message card. Children's cards contained a message, while the researchers' cards contained an image (fruit and vegetables in the perceived eating norm-based and health message conditions, or animals in the control condition). On selecting a card, the child was required to read the message aloud and explain their interpretation to the researcher. At the end of the game the child was required to explain to the researcher what they had learned during the game, and recited the messages to ensure the researcher knew that the child understood the messages. All children were able to correctly describe the meaning of the messages. The game took approximately 7 minutes. Next, the child was informed that there would be a short break before the next game, and the child was presented with the tray of snack foods. The child was informed that they could have as many or as few of the snack foods as they wished, and was left alone for 7 minutes. Following the 'break', the researcher returned and presented the child with a second game, which involved sorting pictures of fruit and vegetables (e.g. an image of carrots) and high calorie snack foods (e.g. an image of crisps) into one of two piles; fruit and vegetables or sweets and crisps. This enabled

the researcher to identify that all children knew what fruit and vegetables were[4]. Finally, the researcher asked the child what they thought the aims of the study were, completed the questionnaire measures with the child, and measured the child's height and weight.

*Messages*

Participants were randomly assigned to play one of three board-games. One board contained images of fruit and vegetables, which was used in the perceived eating norm-based message and health message conditions, while the other board contained images of animals, which was used in the control condition. Both boards were identical, except for the images and the name of the game ('fruit and vegetable towers' for the perceived eating norm-based message condition and health message condition, and 'pet shop' for the control condition). Children were exposed to messages in the form of message cards, which were selected at pre-determined points during the game. In the perceived eating norm-based message condition the messages stated '*other children eat lots of fruit and vegetables every day and like them', 'other children eat fruit and vegetables every day as snacks',* and *'other children eat fruit and vegetables at break time'*. In the health message condition the messages stated '*fruit and vegetables are really good for you', 'fruit and vegetables have lots of vitamins',* and *'fruit and vegetables make you strong and healthy'*. In the control condition the messages stated *'all polar bears are left handed', 'snails can sleep for up to three years',* and *'penguins can jump really high in the air'*.

[4] All children were able to correctly categorise the fruit and vegetable pictures.

*Snack food*

Children were provided with four snack foods; one fruit (green seedless grapes, 66 kcal/100g, approximately 160g including 7g bowl weight), one vegetable (carrot sticks, 42 kcal/100g, approximately 130g including 7gbowl weight), and two high calorie snack food items (chocolate chip cookies (487 kcal/100g, approximately 100g including 7g bowl weight) and ready-salted crisps (526 kcal/100g, approximately 32g including 7g bowl weight). All foods were purchased from Tesco Ltd (United Kingdom) and were presented in individual bowls. The participants were not made aware that food choice and intake would be examined during the study. The bowls of snack foods were weighed pre and post-consumption to determine the amount of fruit and vegetables, and high calorie snack foods eaten (in grams).

*Body weight*

Height was measured to the nearest 0.5cm using a stadiometer (Seca 213, Seca GmbH & Co.) and weight was measured to the nearest 0.1kg using a digital scale (Seca 813 digital scale, Seca, GmbH & Co.). BMI was calculated as weight (kg)/height ($m^2$). Using internationally recognised criteria for children (Cole & Lobstein, 2012) healthy-weight, overweight and obesity were defined based on age and sex-specific BMI cut-off points equivalent to adult BMI of 25-30kg/$m^2$ respectively.

*Self-report measures*

*Fruit and vegetable intake and liking and hunger*

As in Chapter 3 and 4 the Day in the Life Questionnaire (DILQ) was used to assess usual fruit and vegetable intake in children, as it is a valid and reliable measure for use in children (Edmunds & Ziebland, 2002). The DILQ is a supervised exercise which uses words and pictures to encourage the child to recall and describe a range of activities, including their entire food intake, for the previous day (Edmunds & Ziebland, 2002). We also included measures for the children's liking of fruit and vegetables (e.g. how much do you like fruit/ vegetables) with 5 response options ranging from 'not at all' to 'a lot'. These questions were assessed using smiley-face Likert-style scales, and were based on Lally et al (2011) and those used in Chapters 3 and 4.

*Beliefs about perceived eating norms*

To examine whether the messages children were exposed to influenced their later beliefs about other children's fruit and vegetable intake, they were asked 'how many fruit and vegetables do you think other children eat every day?' with responses 'none', '1', '2 - 3', '4', '5 or more'.

*Main analysis strategy*

We planned to conduct 3 (condition) x 2 (food type: fruit and vegetables, high calorie snack food) mixed ANOVA to test the main effects of experimental condition

and food type, and the interaction between condition and food type on the amount of fruit and vegetables, and high calorie snack food eaten in grams (dependent variables). We planned to follow up significant effects of condition with Bonferroni-corrected pairwise comparisons.

### 5.3.2 Results

No significant differences (*p*s < .05) were found between the conditions for BMI, gender or child age. See Table 5.1. No children guessed, or came close to guessing the aims of the study.

**Table 5.1** *Mean values (SDs) and statistical test results for BMI, age, gender, and beliefs about perceived eating norms for Study 1*

| Variables | Perceived eating norm-based message (n = 49) | Health message (n = 48) | Control (n = 46) | Statistical test results |
|---|---|---|---|---|
| BMI (*z*-score) | .55 (1.23) | .99 (1.28) | .72 (1.31) | F (2, 140) = 1.46, *p* = .24, $np^2$ = .02 |
| Age (years) | 8.67 (.97) | 8.70 (.87) | 8.88 (1.25) | F (2, 140) = .61, *p* = .55, $np^2$ = .01 |
| Gender (n)<br>Males<br>Females | 18<br>31 | 21<br>27 | 18<br>28 | $X^2$ (2, n = 143) = .51, *p* = .77, r = .06. |
| Beliefs about other children's fruit and vegetable intake[a] | 3.91 (.91) | 3.50 (1.19) | 3.87 (1.05) | F (2, 140) = 1.97, *p* = .14, $np^2$ = .03 |

[a] A higher mean indicates that children believe that other children eat a large amount of fruit and vegetables.

*Food intake*

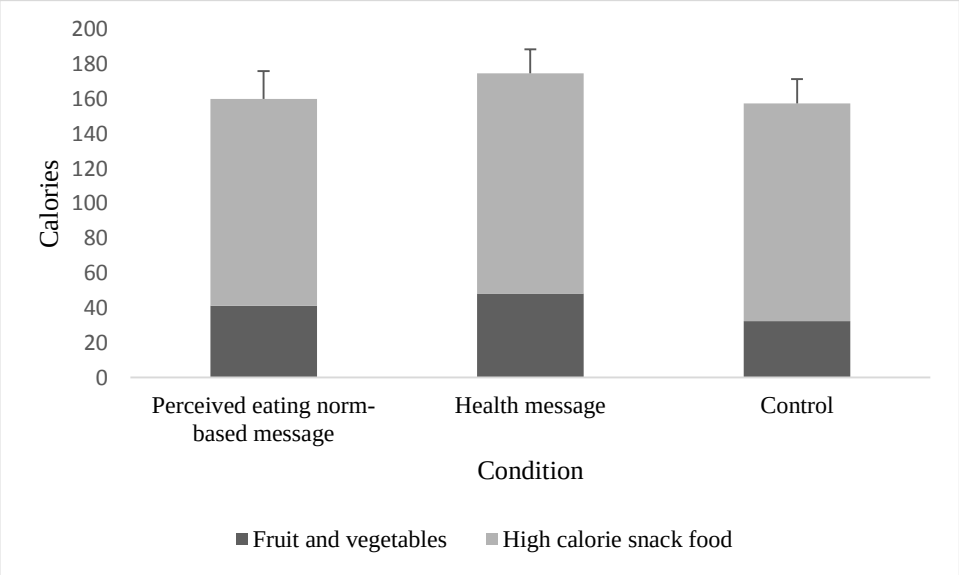
There was a significant main effect of condition on food intake [F (2, 140) = 3.16, $p$ = .046, $\eta p^2$ = .04], a significant main effect of food type [F (1, 140) = 142.68, $p$ = < .001, $\eta p^2$ = .51], and a significant condition*food type interaction [F (2, 140) =4.83, $p$ = .01, $\eta p^2$ = .06]. Thus, we conducted one-way ANOVAs on fruit and vegetables and high calorie snack food separately. A one-way ANOVA showed a significant main effect of condition on fruit and vegetable intake [F (2, 140) = 4.61, $p$ = .01, $\eta p^2$ = .06]. Children in the health message condition ate significantly more fruit and vegetables than children in the control condition, t (92) = 3.06, $p$ = .009, $d$ = .63. However, there was no significant difference between the health message condition and the perceived eating norm-based message condition, t (95) = -1.14, $p$ = .78, $d$ = .23, and no significant difference between the perceived eating norm-based message condition and the control condition, t (93) = 2.00, $p$ = .15, $d$ = .41. There was no significant main effect of condition on high calorie snack food intake [F (2, 140) = .01, $p$ = .99, $\eta p^2$ < .001]. See Table 5.2 for mean intake figures for Study 1.

**Table 5.2** *Mean (SDs) fruit and vegetable intake and high calorie snack food intake for Study 1 in grams and calories*

| Condition | Fruit and vegetable intake | | High calorie snack food intake | |
|---|---|---|---|---|
| | Grams | Calories | Grams | Calories |
| Perceived eating norm-based message (n = 49) | 65.47 (40.77) | 41.33 (26.60) | 24.94 (20.51) | 118.80 (97.92) |
| Health message (n = 48) | 75.69 (47.13)* | 48.24 (32.17) | 25.50 (16.59) | 126.57 (82.56) |
| Control (n = 46) | 50.76 (29.54)* | 32.41 (27.23) | 25.26 (17.98) | 125.18 (88.92) |

*Indicates a significant difference at $p < .01$.

**Figure 5.1** *Mean (± SEM) calorie intake for fruit and vegetables and high calorie snack food in Study 1*



*Other variables*

In order to examine whether controlling for weight-status, child age, liking of fruit and vegetables, or usual fruit and vegetable intake altered the effect of condition on fruit and vegetable and high calorie snack food intake, we included these variables as covariates in separate ANCOVAs. Controlling for these variables (and also controlling for gender) did not alter the effect of condition on the dependent variables. See Appendix 3. Furthermore, we also examined whether these variables moderated the effect of condition on fruit and vegetable intake and high calorie snack food intake. We found no evidence that any of the other variables interacted with message type (*p*s > .05). See Appendix 3.

*Beliefs about perceived eating norms*

To examine whether message type appeared to have a long-term influence on children's beliefs regarding the fruit and vegetable intake of other children (i.e. measured at the end of the study), a one-way ANOVA was conducted. There was no significant main effect of condition on children's beliefs about the amount of fruit and vegetables eaten by other children [$F(2, 140) = 1.97$, $p = .14$, $\eta p^2 = .03$]. See Table 5.1.

### 5.3.3 Discussion

Exposure to health messages influenced children to increase their fruit and vegetable intake relative to exposure to control messages. However, perceived eating norm-based messages did not significantly increase fruit and vegetable intake relative to

the control condition. There was however a tendency for participants in the perceived eating norm-based message condition to eat more fruit and vegetables than participants in the control condition (see Table 5.2), so we planned a second study to further examine whether perceived eating norm-based messages can increase fruit and vegetable intake. Although in Study 1 the children in the perceived eating norm-based message condition were exposed to multiple perceived eating norm-based messages and were able to explain what the messages meant to the researcher, our post study questionnaire in Study 1 indicated that these messages did not appear to have a long lasting influence on children's beliefs. In order to address this, in Study 2 we included an additional norm manipulation, whereby, at the end of the board game children in the perceived eating norm-based message condition were shown on a visual scale the amount of fruit and vegetables other children eat (it always indicated that others were eating more than them) as we believed such social comparison may reinforce and motivate adherence to the perceived eating norm-based messages. Another possible explanation for why the perceived eating norm-based messages did not influence fruit and vegetable intake may be due to the norm reference group in the messages i.e. 'other children'. Research has shown that social 'distance' may be an important factor that predicts whether a person conforms to an eating norm (Cruwys et al., 2012). For example, Cruwys et al (2012) showed that adults only modelled the eating behaviour of salient in group members, i.e. students from their university. Therefore, we changed the norm reference group in Study 2 to a group which was of a closer social distance to the children in the study, i.e. children like you. In addition, in Study 2 we included an extra condition (exposure condition), in order to examine whether merely providing children with information about fruit and vegetables would be sufficient to increase intake.

## 5.4 Study 2

### 5.4.1 Method

*Participants*

164 children (51% males) aged 6-11 (8.89 SD = 1.31) were recruited from three primary schools in North-West England. The study consisted of 127 healthy-weight and 37 overweight children. As in Study 1, participants were led to believe that the study was looking at how children play games. The study was approved by the University of Liverpool Research Ethics committee. Fully-informed consent was provided.

*Design and procedure*

Children were randomly assigned to one of four conditions; perceived eating norm-based message vs. health message vs. exposure vs. control. The same board games were used as Study 1. In addition, at the end of the game we included a visual scale in the perceived eating norm-based message condition only, which was a scale, with anchors 'none' and '5 or more' to indicate the amount of fruit and vegetables eaten by other children. The researcher placed a counter described as 'other children' under '5 or more' on the scale to show that other children ate a lot of fruit and vegetables, and a counter 'you' was placed under '1-2 pieces', to indicate that the child (participant) ate less than other children[5]. We used the same procedure as in

[5] We based this selection on how much children said they tended to eat in Study 1 and during the study no children disagreed or questioned the placement of the counter.

Study 1, except for the inclusion of the additional norm manipulation described above, and the inclusion of the exposure condition; within this condition, children played on the 'fruit and vegetable towers' board game, and were exposed to facts about fruit and vegetables.

*Messages*

We altered the messages slightly in the perceived eating norm-based message condition. In the perceived eating norm-based message condition the messages stated; *children like you eat lots of fruit and vegetables every day and like them, children like you eat fruit and vegetables every day as snacks, children like you eat fruit and vegetables at break time.* In the exposure condition the messages stated: *strawberries have seeds on the outside, carrots help you to see in the dark, grapes are actually a berry*. The health messages and control messages remained the same as in Study 1.

### 5.4.2 Results

No significant differences ($p$s < .05) were found between the conditions for BMI, gender or child age. See Table 5.3. No children guessed, or came close to guessing the aims of the study.

**Table 5.3** *Mean values (SDs) and statistical test results for BMI, age, gender, and beliefs about perceived eating norms for Study 2*

| Variables | Perceived eating norm-based message (n = 41) | Health message (n = 41) | Exposure (n = 41) | Control (n = 41) | Statistical test results |
|---|---|---|---|---|---|
| BMI (*z*-score) | .76 (1.19) | .54 (1.09) | .40 (1.15) | .35 (.98) | F (3, 160) = 1.14, *p* = .33, $np^2$ = .02 |
| Age (years) | 9.08 (1.25) | 9.03 (1.22) | 8.61 (1.39) | 8.82 (1.35) | F (3, 160) = 1.12, *p* = .34, $np^2$ = .02 |
| Gender (n) | | | | | |
| Males | 23 | 21 | 21 | 19 | $X^2$ (3, n = 164) = .78, *p* = .85, r = .07. |
| Females | 18 | 20 | 20 | 22 | |
| Beliefs about other children's fruit and vegetable intake[a] | 4.46 (.71) | 3.78 (.85)* | 4.15 (.91) | 3.71 (1.03)* | F (3, 160) = 6.44, *p* < .001, $np^2$ = .11 |

[a] A higher mean indicates that children believe that other children eat a large amount of fruit and vegetables.
*Indicates a significant difference at *p* < .01 to the perceived eating norm-based message condition.

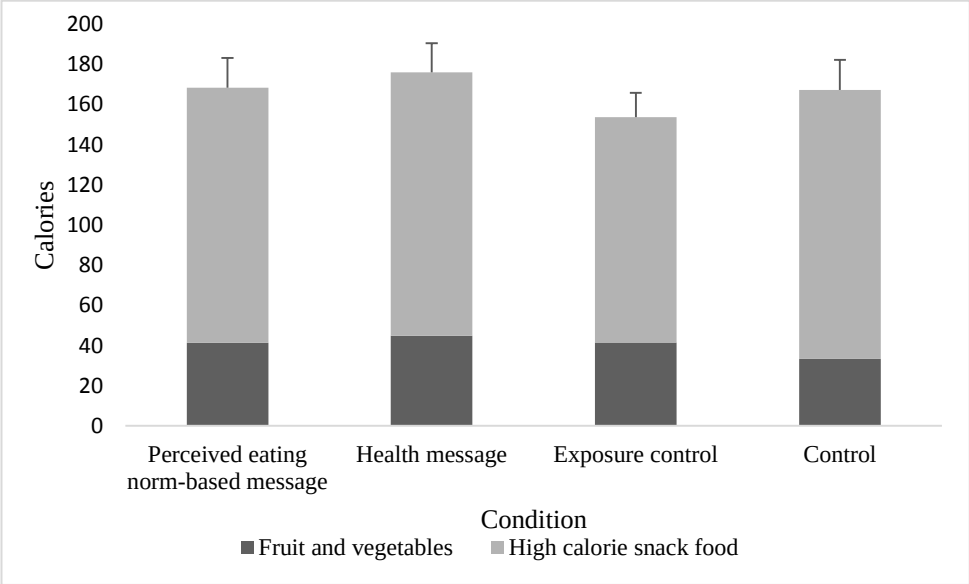
*Food intake*

Using a 4 (condition) x 2 (food type) ANOVA, there was no significant main effect of condition on food intake [F (3, 160) = .86, *p* = .46, $\eta p^2$ = .016]. There was a significant main effect of food type [F (1, 160) = 106.90, *p* = < .001, $\eta p^2$ = .40]. However there was no significant condition*food type interaction [F (3, 160) = 1.32, *p* = .27, $\eta p^2$ = .02].

**Table 5.4** *Mean (SDs) fruit and vegetable intake and high calorie snack food intake for Study 2 in grams and calories*

| Condition | Fruit and vegetables | | High calorie snack food | |
|---|---|---|---|---|
| | Grams | Calories | Grams | Calories |
| Perceived eating norm-based message (n = 41) | 66.78 (54.76) | 41.33 (36.32) | 25.71 (17.84) | 127.04 (88.06) |
| Health message (n = 41) | 70.71 (44.62) | 44.92 (29.29) | 26.51 (17.63) | 131.05 (86.86) |
| Exposure condition (n = 41) | 66.78 (37.18) | 41.57 (24.89) | 22.66 (14.47) | 112.09 (71.17) |
| Control (n = 41) | 53.20 (43.77) | 33.30 (28.04) | 27.10 (18.82) | 133.89 (92.88) |

**Figure 5.2** *Mean (± SEM) calorie intake for fruit and vegetables and high calorie snack food in Study 2*



*Other variables*

Controlling for weight-status, child age, liking of fruit and vegetables and usual fruit and vegetable intake as covariates in separate ANCOVAs did not alter the effect of condition for either fruit and vegetable intake, or high calorie snack food intake, see Appendix 3. Furthermore, we examined whether weight-status, child age, gender, liking of fruit and vegetables, or usual fruit and vegetable intake moderated the effect of condition on fruit and vegetable intake. There was no significant main effect of weight-status on fruit and vegetable intake [F (1, 156) = 1.22, $p$ = .27, $\eta p^2$ = .01], or high calorie snack food intake [F (1, 156) = .34, $p$ = .56, $\eta p^2$ = .002], however there was a significant interaction between condition and weight status on fruit and vegetable intake [F (3, 156) = 3.94, $p$ = .01, $\eta p^2$ = .07]. To follow this interaction up, we next conducted one way ANOVAs in healthy-weight and overweight children separately. There was a significant main effect of condition in healthy-weight children [F (3, 123) = 3.42, $p$ = .02, $\eta p^2$ = .08]. Healthy-weight children in the health message condition tended to eat more fruit and vegetables than healthy-weight children in the control condition, t (65) = 2.70, $p$ = .05, $d$ = .66. See Appendix 3 Table 1. However, there were no significant differences between the health message condition and the perceived eating norm-based message condition, t (59) = - 2.08, $p$ = .24, $d$ = .54, or between the health message condition and the exposure condition, t (65) = .41, $p$ > .99, $d$ = .10. In addition, the perceived eating norm-based message condition did not differ significantly from either the exposure condition, t (58) = -1.74, $p$ = .54, $d$ = .45, or the control condition, t (58) = .39, $p$ >.99, $d$ = .10. The exposure condition did not consume significantly more fruit and vegetables than the control condition t (64) = -2.33, $p$ = .12, $d$ = .57. There was no significant effect of condition on fruit and vegetable intake in overweight children [F (3, 33) = 1.46, $p$ =

.25, $\eta p^2$ = .12]. There was no significant interaction between condition and weight status on high calorie snack food intake [F (3, 160) = .54, *p* = .66, $\eta p^2$ = .01]. We found no evidence that any of the other variables interacted with condition (*p*s > .05). See Appendix 3.

*Beliefs about perceived eating norms*

To examine whether message type influenced children's beliefs regarding the fruit and vegetable intake of other children a one-way ANOVA was conducted. There was a significant main effect of condition [F (3, 160) = 6.44, *p* < .001, $\eta p^2$ = .11]. See Table 5.3. Children in the perceived eating norm-based message condition believed that other children ate more fruit and vegetables than did children in the health message condition, t (80) = 3.37, *p* = .006, *d* = .87, and children in the control condition, t (80) = 4.40, *p* < .001, *d* = .85. However, children in the perceived eating norm-based message condition did not believe that other children ate more fruit and vegetables than children in the exposure condition, t (80) = 1.76, *p* = .48, *d* = .38. In addition, there were no differences between the health message condition and the exposure condition t (80) = -1.88, *p* = .36, *d* = .42, or the control condition t (80) = .87, *p* > .99, *d* = .20, and no difference between the exposure condition and control condition, t (80) = -2.05, *p* = .24, *d* = - .45.

### 5.4.3 Discussion

Consistent with Study 1, exposure to perceived eating norm-based messages did not result in a statistically significant increase in children's fruit and vegetable intake

relative to a control condition, although there was a tendency for participants to eat slightly more fruit and vegetables in the perceived eating norm-based message condition than in the control condition. However, unlike Study 1, weight status was found to moderate the effect of message type, with healthy-weight children in the health message condition eating more fruit and vegetables than healthy-weight children in the control condition, but with no effect of message type among overweight children. Given that we had only a small number of overweight children in the sample, caution must be taken in interpreting the significant interaction observed in Study 2. Messages which simply provided information (facts) about fruit and vegetables did not significantly increase fruit and vegetable intake relative to the control condition.

### 5.5 Meta-Analysis

In both studies participants in the perceived eating norm-based message conditions did not eat statistically significantly more fruit and vegetables in comparison to the control condition, although this may have been caused by a lack of statistical power. Moreover, we found inconsistent results concerning the effect of health messages and the moderating influence of weight status on messages; in Study 1 weight status did not moderate the effect of a health message on fruit and vegetable intake, whilst in Study 2 there was evidence of this. To address these inconsistencies we combined data from the health message, perceived eating norm-based message and control message conditions across both studies. We examined the effects of health vs. control messages and perceived eating norm-based vs. control messages in two separate 2x2 ANOVAs whilst controlling for the origin of each participant's data

(factor 1: health/ perceived eating norm-based message condition vs. control condition, factor 2: healthy-weight vs. overweight, covariate: Study 1 or Study 2, dependent variable: fruit and vegetable intake).

For the health messages analysis, there was a significant main effect of condition [F (1, 171) = 6.62, $p$ = .01, $np^2$ = .04], no significant main effect of weight status [F (1, 171) = .72, $p$ = .40, $np^2$ = .004], no significant interaction between weight status and condition [F (1, 171) = 1.35, $p$ = .25, $np^2$ = .008], and no significant effect of study [F (1, 171) = .01, $p$ = .92, $np^2$ < .001] in the ANOVA. Participants in the health message condition consumed 73.39 (SD ± 45.80) grams of fruit and vegetables, compared to 51.91 (SD ± 36.72) grams in the control condition ($d$ = .52). See Table 5.5.

For the perceived eating norm-based messages analysis, there was a significant main effect of condition [F (1, 172) = 5.64, $p$ = .02, $np^2$ = .03], a significant main effect of weight status [F (1, 174) = 9.64, $p$ = .002, $np^2$ = .05], no significant interaction between weight status and condition [F (1, 172) = 1.03, $p$ = .31, $np^2$ = .006] and no significant effect of study [F (1, 172) = .07, $p$ = .79, $np^2$ < .001] in the ANOVA. Participants in the perceived eating norm-based message condition consumed 66.07 (SD ± 47.38) grams of fruit and vegetables, compared to 51.91 (SD ± 36.72) grams in the control condition ($d$ = .33). The main effect of weight status was explained by healthy-weight participants consuming 52.75 (SD ± 38.65) grams of fruit and vegetables in comparison to 75.26 (SD ± 49.11) grams by overweight participants. See Table 5.5.

**Table 5.5** *Mean (SDs) fruit and vegetable intake for pooled data from Studies 1 and 2*

| | Variables | Fruit and Vegetable intake (grams) | |
|---|---|---|---|
| | | Grams | Calories |
| Condition | Perceived eating norm-based message (n = 90) | 66.07 (47.38) * | 41.33 (31.22) |
| | Health message (n = 89) | 73.39 (45.80) * | 46.71 (30.75) |
| | Control (n = 87) | 51.91 (36.72) | 32.83 (23.68) |
| Weight-status | Healthy-weight children (n = 127) | 52.75 (38.65) | 32.60 (24.99) |
| | Overweight children (n = 50) | 75.26 (49.11) | 48.72 (31.98) |

* Indicates a significant difference at $p < .05$ to the Control condition

The results of the meta-analysis indicate that when data were pooled across both studies, there was evidence that both health messages and perceived eating norm-based messages increased fruit and vegetable intake in comparison to control condition messages. The significant effects observed in our meta-analysis (but not consistently observed in individual study analyses) may be best explained by increased statistical power. The meta-analysis did not indicate that the effect of either message type interacted with participant weight status. This, alongside the small number of overweight children in Study 2, suggests that the interaction we observed between child weight status and message condition in Study 2 should be interpreted with caution.

## 5.6 General Discussion

Across two studies we examined the effects of perceived eating norm-based messages about the fruit and vegetable intake of other children and health messages on children's fruit and vegetable intake in comparison to control messages. Although we observed inconsistent findings across the two individual studies, when the data from studies 1 and 2 were pooled we found evidence that perceived eating norm-based messages had a small effect on fruit and vegetable intake, with children exposed to these messages eating more than children exposed to control messages. Likewise, we found that messages about the health benefits of eating fruit and vegetables significantly increased children's fruit and vegetable intake relative to control messages. Results from one of our studies (Study 2) were suggestive that health messages may only increase fruit and vegetable intake among healthy-weight children, but this result was not consistent across both studies or in the overall pooled analysis.

A number of studies in adults have found that exposure to perceived eating norm-based messages significantly increases fruit and vegetable intake (Robinson, Fleming, et al., 2014; Robinson, Harris, et al., 2013; Stok et al., 2014). However, in the current studies perceived eating norm-based messages produced relatively small changes to fruit and vegetable intake. A possible explanation for these results is that children may respond more strongly to context-specific eating norms. Context is likely to be an important factor which influences whether social norms influence behaviour. Studies investigating the influence of eating norms often expose participants to information about the eating behaviour of other people in the same context or setting (Burger et al., 2010; Pliner & Mann, 2004; Robinson, 2015; Robinson, Sharps, et al., 2014; Robinson, Thomas, et al., 2014). For example,

Burger et al (2010) exposed participants to the food choice of previous participants, and found that participants chose a snack consistent with what the previous participants had chosen. However, research in social psychology suggests that as normative information becomes less specific to a given context, the influence of that normative information on behaviour may decrease (Goldstein et al., 2008). In the current studies we exposed children to perceived eating norm information which was not directly relevant to the context children found themselves in, whereas, in Chapters 3 and 4 and in previous work in which children have been socially influenced, there has been a shared context between influencers and children being influenced (Bevelander et al., 2012). Therefore, it is possible that 6-11 year old children may find it more difficult to apply generalised normative beliefs (i.e. those devoid of context) about the behaviour of others to inform their food intake. To specifically address this, future studies could investigate whether context specific perceived eating norm-based messages regarding the fruit and vegetable intake of other children provide a stronger influence on eating behaviour than messages which are not context specific. There are, of course, other potential explanations for why the perceived eating norm-based messages in the present studies appeared to have only a small effect on eating behaviour (e.g. differences in study designs between the present studies and studies in adult populations), so further work will now need to specifically test whether children are more or less responsive to perceived eating norm-based messages than adults.

One factor which has been shown to influence adherence to normative information is identification with the norm group. For example, Cruwys et al (2012) showed that university students modelled the behaviour of an in group member (a student at the same university) but did not model the behaviour of an out group member (a student

from another university). In the present studies, since perceived eating norm-based messages had not been investigated in children prior to this study, in Study 1 we examined messages regarding a general group i.e. ‘other children’. In Study 2 we altered the messages so that they referred to a group of a closer social proximity i.e. ‘children like you’. We did not measure how similar the children in the study felt to the children in the messages and this is a limitation of the present studies. It may be that a more proximal social reference group, or encouraging children to think about how they are similar to a social reference group, would provide a stronger influence of social norm-based messages on children’s fruit and vegetable intake.

Previous studies have shown that weight status may affect the extent to which children (aged 6-11 years old) copy the eating behaviour of their peers (Bevelander et al., 2012; Romero et al., 2009). It should be noted that a limitation of the present work was that we had a relatively small number of overweight participants in each of our studies, as well as when studies were combined in the meta-analysis, making it difficult to make firm conclusions about how weight status may affect how children respond to messages about fruit and vegetables. Given that childhood obesity has increased in recent times (Wang et al., 2011), future studies may benefit from understanding further differences in how healthy-weight and overweight children respond to healthy eating messages.

To date, the evidence regarding the effectiveness of health messages on promoting healthy eating is mixed (Bannon & Schwartz, 2006; Lapierre, Vaala, & Linebarger, 2011; Lawatsch, 1990; Maimaran & Fishbach, 2014; Robinson, Fleming, et al., 2014; Robinson, Harris, et al., 2013). Our findings are consistent with research which showed a positive effect of health messages on intake (Bannon & Schwartz, 2006; Lawatsch, 1990; Robinson, Harris, et al., 2013). Our findings build upon this

research through showing the effectiveness of health messages in school-aged children (aged 6 - 11), whereas previous studies showed the effectiveness of health messages on food intake in pre-school children (Bannon & Schwartz, 2006; Lawatsch, 1990) and adults (Robinson, Harris, et al., 2013). However, our findings are in contrast to other research which has shown that health messages which present food as healthy, reduced intake (Maimaran & Fishbach, 2014). Maimaran and Fishbach (2014) presented crackers as healthy, and found that exposure to this message reduced children's (aged 3.5-5 years old) selection of that food. In the current studies we presented fruit and vegetables as 'healthy', and found that these messages increased intake of fruit and vegetables. A possible explanation for this difference may relate to the type of food which was presented as healthy. Research has shown that children (aged 4-5 years old) have a good representation of the nutritional quality of food from a young age (Murphy, Youatt, Hoerr, Sawyer, & Andrews, 1995), therefore, it is plausible that health messages which reinforce the positive qualities of already assumed 'healthy' food, provide a benefit to intake, whereas labelling a less nutritionally clear food as being healthy may compromise expected enjoyment or taste (Maimaran & Fishbach, 2014; Raghunathan et al., 2006).

The finding that health messages influenced children's fruit and vegetable consumption in study 1 and the meta-analysis may be explained by the Theory of Planned Behaviour (Ajzen, 1991). According to the Theory of Planned Behaviour (Ajzen, 1991) behaviour is driven by intentions. The model argues that an intention is driven by attitudes (the degree to which the behaviour is favourable or unfavourable), subjective norms (the importance others hold about performing this behaviour, and one's willingness to comply with this) and perceived behavioural

control (perceived ease or difficulty of performing the behaviour), and the stronger the intention, the more likely that an individual will perform the behaviour. Research has shown that the Theory of Planned Behaviour variables were predictive of fruit and vegetable eating behaviour in British children (Duncan, Clarke, Birch, Bryant, & Eyre, 2014). Furthermore, in another study, perceived behavioural control and attitudes were shown to be the most important factors in predicting behavioural intentions to eat healthily in adolescents (aged 11-16 years old) (Gronjoj, Bech-Larsen, Chan, & Tsang, 2012). Thus, in the present studies, children's attitudes to fruit and vegetable consumption may have been favourable, and in the given study context children may have perceived the behaviour to be simple. This may have informed their intentions and subsequently encouraged them to eat fruit and vegetables.

In the present studies we examined the effectiveness of perceived eating norm-based messages, yet another type of norm which may be useful in behaviour change is an injunctive norm. Injunctive norms suggest the approval of others (Cialdini et al., 1990). Research has shown that injunctive norms influence behaviour, and behavioural intentions (Cheng, Tereza, Tse, Lap, Yu, Ignatius, & Griffiths, 2008; Cialdini et al., 1990; Stok et al., 2014; Van Den Putte, Yzer, & Brunsting, 2005; Zaleski & Aloise-Young, 2013). For example, in recent studies a lack of perceived parental emphasis on breakfast consumption was associated with breakfast skipping in adolescents (Cheng, Tereza et al., 2008), and injunctive norms were found to have a larger effect on intentions to stop smoking than descriptive norms (Van Den Putte et al., 2005). However, in another study no association was found between injunctive norms and fruit and vegetable, high calorie snack food, or sugar-sweetened beverage intake in adolescents (Lally et al., 2011). The majority of research investigating

injunctive norms has been cross-sectional, or relied on self-reported intake, with no studies, to our knowledge, investigating the effectiveness of injunctive norms on children's eating behaviour in an experimental design. Further research examining whether other types of social norm-based information can motivate healthier eating in children would therefore be of value.

To our knowledge, these are the first studies to investigate whether perceived eating norm-based messages influence fruit and vegetable intake in children. However, the studies are not without limitations. Although we recruited relatively large samples in each study (n = 40 or more per experimental condition) and based our sample size calculation on Chapters 3 and 4, both studies were underpowered to detect statistically small effect sizes. Based on the present findings and a recent meta-analysis of the size of effect that descriptive norms have on eating behaviour in adults (Robinson et al. 2014), future studies examining the influence of descriptive norm messages in children or adults are likely to require larger sample sizes than has been common in in this area of research. A further limitation was that the studies were conducted in a single experimental session with food intake measured immediately after message exposure, therefore, it is not possible to determine whether the effect of messages would be sustained over a longer period of time. The relatively small number of overweight children in both studies is also a limitation of the present research. We also examined intake of two types of common fruit and vegetables which we presumed 6-11 year old UK children would be happy to consume, if they felt motivated to; carrots and grapes. It may be the case that perceived eating norm-based messages or health messages would act differently on the intake of other (less liked) types of fruits and vegetables. Although our focus was on a specific age range of children (6-11 year olds) that have been shown to be

responsive to social influence on eating behaviour in Chapters 3 and 4, it may be the case that perceived eating norm-based messages about healthy eating would be more effective in older age ranges, as suggested by Stok et al (2012, 2014). Furthermore, while we examined children's general liking of fruit and vegetables, we did not examine their liking of the specific test foods, which may have influenced their intake of the food. However, test food liking was not found to interact with exposure to social norm information in Chapters 3 and 4.

*Conclusions*

In conclusion, we conducted two experimental studies and found evidence that both health messages and perceived eating norm-based messages increased children's fruit and vegetable intake relative to control messages. Whether perceived eating norm-based messages can be used to promote meaningful changes to children's dietary behaviour now warrants attention.

# Chapter 6: General Discussion

## 6.1 Introduction

The overarching aim of this thesis was to examine how children's and adolescents' eating behaviour is socially influenced by their parents and their peers. First, this thesis aimed to identify whether there is evidence that female adolescents mimic their parent when eating together. Next, this thesis aimed to examine the influence that perceived eating norms have on children's eating behaviour. Specifically, to investigate whether perceived eating norms influence children's vegetable intake, the mechanisms underlying this influence, and whether perceived eating norm messages may be a way of increasing children's fruit and vegetable intake.

First, I will provide an overview of the studies, and then I will discuss the theoretical implications of the studies presented in this thesis. Next, I will discuss the potential applications of the findings of this thesis, followed by a discussion of the limitations. Finally, I will discuss future directions, and I will make concluding comments.

## 6.2 Overview of studies

To address the first aim of this thesis, Chapter 2 examined whether there is evidence that adolescent females mimic their parents when eating a multi-item lunchtime meal together. Evidence for two types of mimicry were examined: non-specific mimicry (i.e. whether a parent eating an item was associated with an increased likelihood that their female adolescent child would eat any food item), and food item specific mimicry (i.e. whether a parent eating a food item was associated with an increased

likelihood that their adolescent child would eat the same food item as their parent). Evidence of mimicry was examined for three time points: within two, five or fifteen seconds of the parent eating a food item. It was hypothesised that there may be evidence of mimicry when a parent eats with their adolescent child. However, this mimicry may only be food item specific, since parental behaviour during the meal may signal which foods are appropriate to eat and when, rather than simply synchrony of gestures and eating speed (Hermans, Lichtwarck-Aschoff, et al., 2012). Consistent with this hypothesis, the results of Chapter 2 indicated that adolescent females may mimic their parents when eating together, with the parent eating a food item associated with an increased likelihood of their adolescent child eating the same food item (food item specific mimicry). Furthermore, this mimicry was shown to occur within the shortest time frame (i.e. within two seconds of the parent eating). However, there was no evidence that a parent eating a food item was associated with an increased likelihood of their adolescent child eating any food item (non-specific mimicry). An additional finding of Chapter 2 was the positive correlation between the intake of the parents and the adolescents, whereby, adolescents consumed more calories during their lunch when their parent consumed more calories. Although the findings of Chapter 2 are observational and therefore causality cannot be inferred, they suggest that female adolescents may mimic their parent when eating together, looking to their parent to determine what to eat and when.

In order to investigate whether perceived eating norms influenced children's eating behaviour, five studies were conducted. A preliminary test of the influence of perceived eating norms on children's eating behaviour was conducted in Chapter 3. 6-11 year old Children were exposed to a perceived eating norm (a fictitious participant information sheet and a bowl which corresponded with the information

sheet). The perceived eating norm either indicated that previous children had eaten a large amount of vegetables, no vegetables, or children received no intake information. Based on previous studies in adults (Pliner & Mann, 2004; Robinson, Thomas, et al., 2014), it was hypothesised that children may be motivated to eat in line with perceived eating norms and increase their vegetable intake when they were led to believe that other children had eaten a large amount of vegetables. Consistent with this hypothesis, the results showed that children were influenced by the perceived eating norm: children exposed to the perceived eating norm which indicated that previous children had eaten a large amount of vegetables ate more vegetables than children exposed to a perceived eating norm which indicated that previous children had eaten no vegetables, or were provided with no intake information. However, exposure to the perceived eating norm which suggested that previous children had eaten no vegetables did not reduce children's vegetable intake relative to no intake information. This finding may be due to a floor effect. In the no norm and the control condition children's vegetable intake was low, therefore, this may have made it difficult for the no intake norm to reduce children's vegetable intake further. The main conclusion drawn from Chapter 3 is that perceived eating norms may be a mechanism explaining peer influence, and may be a way of increasing children's vegetable intake.

Since Chapter 3, is the first, to our knowledge, to investigate the influence of perceived eating norms on children's vegetable intake, Chapter 4 aimed to replicate this effect. Furthermore, although there is consistent evidence that perceived eating norms influence eating behaviour in adults (Herman & Polivy, 2005; Robinson, 2015; Robinson, Thomas, et al., 2014), less research has examined the mechanisms explaining the influence of perceived eating norms. Therefore, a second aim of

Chapter 4 was to examine evidence for mechanisms which may explain the influence of perceived eating norms on children's vegetable intake.

Study 1 in Chapter 4 examined whether perceived eating norms may act as a form of normative social influence (Deutsch & Gerard, 1955), whereby, children may be motivated to conform to a perceived eating norm to maintain personal feelings of social acceptance (Cialdini & Goldstein, 2004; Cialdini & Trost, 1998; Deutsch & Gerard, 1955). In order to test this, in Study 1 children were exposed to the perceived eating norm manipulation used in Chapter 3. In addition to this, children were either primed with personal feelings of social acceptance, or with personal feelings of uncertainty of social acceptance. If perceived eating norms influence vegetable intake because children conform to perceived eating norms to maintain feelings of social acceptance, then it would be expected that priming children with feelings of uncertainty would strengthen the influence of perceived eating norms. The results showed that, consistent with Chapter 3, children conformed to the perceived eating norm; children exposed to a perceived eating norm which indicated that previous children had eaten a large amount of vegetables ate more vegetables than children exposed to a perceived eating norm which indicated that previous children had eaten no vegetables. Furthermore, this occurred regardless of whether children were primed with social acceptance or uncertainty of social acceptance. Thus, these results suggest that perceived eating norms do not appear to act as a form of normative social influence.

Study 2 in Chapter 4 aimed to examine whether perceived eating norms may act as a form of informational social influence (Deutsch & Gerard, 1955), whereby, a perceived eating norm may guide behaviour when there is uncertainty about how to behave in an unfamiliar or novel eating context (Cialdini & Goldstein, 2004; Cialdini

& Trost, 1998; Deutsch & Gerard, 1955). To investigate this, in Study 2, children participated in two sessions one day apart, in which they ate vegetables. They were exposed to the perceived eating norm information in one of the sessions: children either saw the perceived eating norm information during their first session (unfamiliar eating context) or in their second session (familiar eating context). This design allowed us to examine whether children would be more strongly influenced by a perceived eating norm in a novel and unfamiliar eating context (i.e. session 1), but be less influenced when eating in a familiar context which they had encountered before (i.e. session 2). The results of Study 2 showed that children were most influenced by a perceived eating norm if they were in the unfamiliar eating context in which they may have been uncertain of how to behave. In addition, the perceived eating norm presented in the first session (unfamiliar eating context) continued to influence children's eating behaviour in a session twenty-four hours later when the perceived eating norm was no longer present. However, when children were in an eating context that they had eaten in previously, children's eating behaviour was less influenced by the perceived eating norm. Thus, these findings suggest that perceived eating norms may act as a form of informational social influence, providing a guide for how to behave when there is uncertainty about how to behave in a novel eating context, and this influence may persist over time.

Given the consistent influence of perceived eating norms on children's vegetable intake in Chapters 3 and 4, Chapter 5 aimed to examine whether perceived eating norms could be used as an intervention tool to increase children's fruit and vegetable intake. In Study 1, children were either exposed to perceived eating norm messages (which indicated the high fruit and vegetable intake of other children), health messages (which stated the health benefits of fruit and vegetable intake) or control

messages (which were facts about animals) in an interactive board-game. Children's fruit and vegetable intake was examined shortly after playing the game. Based on the previous literature in adults (Robinson, Fleming, et al., 2014; Stok et al., 2014), it was hypothesised that perceived eating norm messages would substantially increase children's fruit and vegetable intake relative to control messages. Due to the inconsistent findings of the effect of health messages on fruit and vegetable intake (Bannon & Schwartz, 2006; Lawatsch, 1990; Maimaran & Fishbach, 2014; Robinson, Harris, et al., 2013), it was reasoned that health messages may only have a modest effect on children's fruit and vegetable intake.

In Study 1, perceived eating norm messages did not significantly influence children's fruit and vegetable intake relative to the control messages. However, children in the health messages condition did consume more fruit and vegetables relative to children in the control messages condition. There were no significant differences between the health messages condition and the perceived eating norm messages condition on children's fruit and vegetable intake. A possible explanation for the non-significant finding of the perceived eating norm messages may have been due to whether children believed the norm. Although children were able to explain the meaning of the messages to the researcher, the post study questionnaire indicated that the messages did not have a long-lasting effect on children's beliefs about other children's fruit and vegetable intake. To address this, in Study 2 we strengthened our manipulation and children were directly informed that they ate less fruit and vegetables than the other children. Another factor which may have affected whether children were influenced by perceived eating norm messages may the social group which the messages referred to (i.e. other children). Research has shown that 'social distance' affects whether people conform to a norm (Berger & Rand, 2008).

Therefore, in Study 2 the social group which the messages referred to was altered to refer to a group of a closer social proximity (i.e. children like you). Finally, from Study 1 it is not clear what effect playing a game about fruit and vegetables had on children's fruit and vegetable intake. Therefore, in Study 2 an extra condition was included, where children received messages which were facts about fruit and vegetables (exposure condition).

In Study 2, consistent with Study 1, the perceived eating norm messages did not significantly influence children's fruit and vegetable intake relative to the control messages. Furthermore, there were no significant differences between the perceived eating norm messages and the health messages on children's fruit and vegetable intake, and between the exposure condition and any of the conditions. In contrast to Study 1, the health messages only increased children's fruit and vegetable intake relative to control messages in the healthy-weight children. This finding suggests that weight-status may be a factor which affects whether children are influenced by health messages.

Although in both studies the perceived eating norm messages did not significantly increase children's fruit and vegetable intake relative to control messages, children exposed to the perceived eating norm messages did eat more fruit and vegetables than children exposed to the control messages. A possible reason for this non-significant difference may be due to a lack of statistical power. Therefore, a post-hoc decision was made to combine the two data sets. When the data from the two studies were combined in a meta-analysis, the results showed that the perceived eating norm messages did significantly influence children's fruit and vegetable intake; Children exposed to the perceived eating norm messages ate significantly more fruit and vegetables than children exposed to the control messages. However, the messages

only produced statistically small increases in children's fruit and vegetable intake, therefore, how meaningful this finding may be in an intervention is unclear from Chapter 5. In addition, the health messages also increased children's fruit and vegetable intake relative to the control messages when the data were combined.

Collectively, the findings of this thesis provide insight into the eating behaviour of children and adolescents, and provide evidence that children's and adolescents' eating behaviour is socially influenced by their parents and their peers. Thus, our findings have both theoretical and applied relevance for our current understanding of how children's and adolescents' eating behaviour is socially influenced.

## 6.3 Theoretical implications

The findings of this thesis provide important contributions to the existing literature and have several theoretical implications. The findings of Chapter 2 provide further insight into behavioural mimicry of eating behaviour. The literature to date has examined whether behavioural mimicry occurs when peers eat together (Bevelander et al 2013; Hermans et al., 2012), therefore, the findings of Chapter 2 have built upon this research through providing evidence that behavioural mimicry may occur within a different dyad (i.e. when a female adolescent ate with their parent). Furthermore, the finding of food item specific mimicry is novel. In Chapter 2 the parents and adolescents were provided with a multi-item meal, which enabled us to examine whether mimicry was food-item specific, and not simply synchrony of gestures and eating speed as has been suggested (Hermans et al., 2012). The finding of food item specific mimicry suggests that the adolescents were not simply synchronising their gestures or eating speed with their parent. Instead, adolescents

may have been using their parents as a reference point to determine what to eat and when. This finding may be interpreted through a normative or informational account of social influence on eating (Deutsch & Gerard, 1955). Thus, adolescents may be mimicking their parents in order to 'fit in' (normative social influence) (Cialdini & Goldstein, 2004; Cialdini & Trost, 1998; Deutsch & Gerard, 1955), or their parent may be acting as a guide for how to behave (informational social influence) (Cialdini & Goldstein, 2004; Cialdini & Trost, 1998; Deutsch & Gerard, 1955). However, due to the observational nature of this study, these conclusions cannot be made, therefore, future research could examine this. Finally, Chapter 2 also provides evidence that mimicry may occur within a shorter time frame than previously tested. Previous studies examined evidence for mimicry within five seconds (Bevelander et al., 2013; Hermans et al., 2012), whereas, the present study found evidence of mimicry within two seconds of a parent eating a food item. Thus, we provide the first evidence that mimicry may occur in a shorter time than previously assumed and this provides indirect evidence that mimicry of eating behaviour may be a relatively 'automatic' behaviour (Iacoboni et al., 1999), as opposed to a conscious effortful decision.

The findings of this thesis also make an important contribution into our understanding of the influence of perceived eating norms on children's eating behaviour. This thesis provides the first evidence that perceived eating norms influence children's vegetable intake. Across three studies, we provide consistent evidence that perceived eating norms which indicated that previous children had eaten a large amount of vegetables, influenced children to eat more vegetables, relative to a perceived eating norm which indicated that previous children had eaten no vegetables. These findings are consistent with previous research in adults (Pliner

& Mann, 2004; Robinson, Benwell, & Higgs, 2013; Robinson, Sharps, Price, & Dallas, 2014). Thus, collectively, the findings of these three studies suggest that perceived eating norms may be a way in which children are influenced by their peer when eating.

The findings of this thesis have also made important contributions to our understanding of the mechanisms that underlie the influence of perceived eating norms on children's eating behaviour. Chapter 4 provides evidence that perceived eating norms may exert their influence through acting as a form of informational social influence, by removing uncertainty about how much to eat in a novel or unfamiliar eating context. This finding is consistent with a growing body of research (Herman & Polivy, 2005; Robinson, Thomas, et al., 2014), and is consistent with the suggestion that social norms exert their influence through 'uncertainty reduction' (Cialdini & Goldstein, 2004; Cialdini & Trost, 1998; Deutsch & Gerard, 1955).

This thesis does not provide evidence that perceived eating norms act as a form of normative social influence. Since perceived eating norms refer to what other people do (Cialdini & Goldstein, 2004; Cialdini & Trost, 1998), they may not provide information regarding the approval of others. One type of norm which may exert its influence through social approval concerns is a perceived injunctive norm, which refers to what other people approve of (Cialdini & Goldstein, 2004; Cialdini & Trost, 1998). Although there is evidence to suggest that injunctive norms reduce healthy eating intentions (Stok et al., 2014), some research has shown that injunctive norms do not influence eating behaviour (Lally et al., 2011; Robinson, Fleming, et al., 2014). There is also evidence to suggest that injunctive norms are associated with intentions to consume a healthier diet (Yun & Silk, 2011), and have been shown to influence perceptions of the healthiness and tastiness of foods carrying health halos

(e.g. cereal bars) (Vasiljevic et al., 2015). Therefore, it may be that when perceived injunctive norms do influence behaviour, they do so through social approval concerns. Further research could now examine this.

An additional finding of this thesis was that the norm presented in a novel eating context continued to influence children's eating behaviour twenty-four hours later, when the norm was no longer present. This finding is consistent with a previous study in children, which showed that participants were influenced by the intake of a present confederate peer during the eating session, and continued to be influenced by the norm set by the peer in a later free-eating session (Bevelander, Anschutz & Engels., 2012). Herman & Polivy (2005) distinguished between situational and personal norms and suggested that situational norms are derived from the eating environment itself, whereas personal norms are based on an individual's prior experience. Consistent with Bevelander et al (2012), we suggest that the perceived eating norm may have provided the situational norm in the first session, but that the children may have internalised the norm and behaved similarly in session 2. Therefore, further research is needed to understand why perceived eating norms persist over time.

Chapter 5 in this thesis provides the first examination of the influence that perceived eating norm messages have on children's fruit and vegetable intake. The overall finding that the perceived eating norm messages influenced children's fruit and vegetable intake is consistent with previous research in adults (Robinson, Fleming, et al., 2014; Stok et al., 2014). However, unlike the previous research, the perceived eating norm messages in Chapter 5 only produced statistically small effects. This finding is also not consistent with the statistically large effects produced by the perceived eating norms in Chapters 3 and 4. A possible explanation for this

difference is social context. In Chapter 5, the perceived eating norm messages referred to the general fruit and vegetable intake of other children (i.e. other children/ children like you eat lots of fruit and vegetables every day/ at break time/ as snacks), and were not specific to the social context which the children were in, whereas, in Chapters 3 and 4, the perceived eating norms referred to the context which children were in (i.e. other children ate this many vegetables in this study). Research has suggested that as normative information becomes less specific to a given context, the influence that normative information has on behaviour may decrease (Goldstein et al., 2008). Thus, it may be the case that children find it more difficult to apply generalised normative beliefs about the eating behaviour of others to inform their own food intake. Therefore, further research could now investigate whether perceived eating norm messages which are specific to the context that children are in would produce larger increases in children's fruit and vegetable intake.

### 6.4 Applied relevance

The findings of this thesis raise an interesting question of whether there may be any potential applications for perceived eating norms to increase children's fruit and vegetable intake. The findings of Chapters 3 – 5 suggest that this may be the case. In Chapters 3 and 4, children's vegetable intake was strongly influenced following exposure to visual information which indicated previous children's vegetable intake (i.e. an information sheet and a bowl). One potential application of this finding may be a visual indication of other children's fruit and vegetable intake in that setting. In previous studies, visual cues which indicate the food choice of other people have been shown to influence food choice and intake (Burger et al., 2010; Prinsen, Ridder,

& Vet, 2013; Reicks, Redden, Mann, Mykerezi, Vickers, 2012). For example, Reicks, Redden, Mann, Mykerezi & Vickers (2012) placed photographs of carrots and green beans in school dinner trays in one school in the USA. The authors showed that, in comparison to a control day where no photographs were used, the intervention increased the percentage of children taking both carrots and green beans. Furthermore, the intervention significantly increased the amount of green beans and carrots consumed by the children exposed to the intervention. Examining this approach on a larger scale and with different types of fruit and vegetables would be of value.

Chapter 5 directly tested whether perceived eating norm messages may be used as an intervention tool. Since the perceived eating norm messages only produced small increases in children's fruit and vegetable intake, a possible application of the messages tested in this thesis is to include them as part of a larger intervention. However, as discussed in the theoretical implications section, perceived eating norm messages which are specific to the context that children are in may produce larger increases in children's fruit and vegetable intake. Therefore, another potential application of these findings is to expose children to context-specific perceived eating norm messages within the school dining hall or at the school tuck shop which indicate how other children behave. For example, "most children choose a portion of fruit and vegetables with their school lunch", or "most children choose a piece of fruit from the school tuck shop". If context specific perceived eating norm messages do influence children's eating behaviour, then these messages may also have applications outside of the school environment. For example, perceived eating norm messages could be included on restaurant menus which indicate that other children eat fruit and vegetables (e.g. "Most children eat vegetables as part of their meal at

this restaurant"). Therefore, investigating the effectiveness of context specific perceived eating norm messages is of importance.

When considering the potential applications of perceived eating norms on children's eating behaviour, the findings of Chapter 4 need to be taken into account. In Chapter 4 children were most influenced by the perceived eating norm in the novel eating context (Study 2, Chapter 4), and this norm continued to influence their eating behaviour in a later session. Since environments such as the school dining hall are likely to be familiar to children attending the school, it may be important to target interventions at children when they first start at the school, so that the eating context is novel. A norm presented in a novel eating context may then continue to influence children's behaviour once the eating context becomes familiar, and may become internalised as a personal norm (Herman & Polivy, 2005). In order to target interventions to the whole school, the schools could produce a novel eating context within the school. For example, if schools do not already have tuck shops, they could implement these, and the intervention could be targeted at children's purchasing and intake behaviour at the tuck shop when first opened.

## 6.5 Limitations

The studies in this thesis are not without limitations. First, although there was evidence of food-item specific mimicry in Chapter 2, the intake of the parent was not experimentally manipulated (i.e. the parent was not instructed on which food to eat and when). Therefore, this did not allow us to determine which food the adolescents mimicked. Understanding the types of foods that adolescents mimic, and whether a parent eating a 'healthier' item, such as fruit and vegetables, influences their

adolescent child to eat the same food item would now be of value. Next, due to the small number of available male adolescent participants we opted to only analyse videos of female adolescents. In previous research, adult males have been shown to be less socially influenced than females (Vartanian et al., 2015). However, Bevelander et al (2013) found that both male and female children (6-11 years old) were more likely to eat after witnessing a peer reaching for snack food than without such a cue. Therefore, it is possible that adolescent males may mimic their parents when eating together. Further research is needed to examine this.

In Chapters 3 – 5 we measured factors which may affect whether children are socially influenced i.e. weight-status, age, and gender. Although the groups were balanced for age and gender, the children in these studies were predominantly healthy-weight. Therefore, based on the small number of overweight children in the studies, we cannot make conclusions about the behaviour of overweight children. Thus, since previous research has shown that overweight and healthy-weight children behave differently in the presence of peers (Bevelander et al., 2012; Salvy, Romero, Paluch, & Epstein, 2007), further research is needed to recruit an adequate number of overweight children in order to examine their behaviour in relation to perceived eating norms.

In the present studies we examined children's food intake, but we did not examine food choice. Since children often need to make choices about what they are going to eat i.e. at the school tuck shop and in the dining hall, understanding whether perceived eating norms influence food choice is of importance. Furthermore, in the present studies, children were provided with popular and well-liked fruit and vegetables (grapes and carrots). Liking of fruit and vegetables has been shown to be associated with intake (Brug, Tak, te Velde, Bere, & de Bourdeaudhuij, 2008),

therefore, whether perceived eating norms would influence other less liked fruit and vegetables is unclear and requires further investigation.

In Chapter 5, the sample size in both studies was not adequate to detect a statistically small effect. Since earlier chapters showed large effects, and previous studies showed medium effects of perceived eating norm messages (Robinson, Fleming, et al., 2014; Stok et al., 2014) we opted to recruit a minimum of 40 children per condition to detect a similar sized effect. Therefore, further research investigating perceived eating norm messages in children would need to recruit a larger sample. Finally, in Chapter 5, the messages did not specify the amount of children who consumed fruit and vegetables. In previous studies, the messages referred to 'most' people (Robinson, Fleming, et al., 2014), or provided a percentage of people who engaged in the behaviour (Stok et al., 2012), and were found to influence eating behaviour. Therefore, further research is needed to address this limitation, and to determine whether providing a norm which explicitly refers to a clear majority influences children's eating behaviour.

## 6.6 Future directions

Although the studies in this thesis provide an interesting insight into how children's and adolescents' eating behaviour is socially influenced, there are several areas which require further exploration. This thesis focused on the influence of perceived descriptive eating norms, which indicate what other people do. However, this thesis did not examine the influence of perceived injunctive norms, which indicate what other people approve of. As discussed in the theoretical implications section, the evidence is mixed regarding the influence of perceived injunctive norms on eating

behaviour (Robinson, Fleming, et al., 2014; Staunton et al., 2014; Stok et al., 2014; Vasiljevic et al., 2015). However, to date, research has investigated the effects of injunctive norms on adults' and adolescents' eating behaviour (Robinson, Fleming, et al., 2014; Staunton et al., 2014; Stok et al., 2014; Vasiljevic et al., 2015), and less research has investigated whether perceived injunctive norms influence children's eating behaviour. Understanding whether perceived injunctive norms may be a potential way of increasing children's fruit and vegetable intake would now be of value.

One question this thesis did not address is whether identity with the norm reference group affected whether children were influenced by perceived eating norms. According to Festinger's (1954) social comparison theory, people evaluate themselves by comparing themselves to others, and are more likely to follow the behaviour of similar others (Berger & Rand, 2008; Cruwys et al., 2012; Terry et al., 1999). Research has shown that 'social distance' affects whether eating behaviour is socially influenced (Berger & Heath, 2008; Cruwys et al., 2012). For example, Berger & Rand (2008) showed that exposure to information which suggested that an outgroup consumed junk food, reduced participants' junk food intake. In this thesis, children were exposed to perceived eating norms which referred to previous children in the study (i.e. other children, or other children in the school). However, these studies did not measure how similar children felt to the other children in the study. Future studies could now investigate whether the similarity with the norm reference group affects the extent to which children are influenced by perceived eating norms.

The studies in this thesis focussed on increasing fruit and vegetable intake, however, reducing high calorie snack food intake is also important. Children have been shown to be influenced by the high calorie snack food (cookies) intake of a present

confederate peer (Bevelander et al., 2012), and perceived eating norm messages which indicate the lower intake of high calorie snack foods in adults influenced intake (Robinson, Harris, et al., 2013). Therefore, understanding whether perceived eating norms may be a way of reducing high calorie snack food intake in children would be of value and could be an alternative intervention approach.

### 6.7 Conclusions

Collectively, data in this thesis suggests that children's and adolescents' eating behaviour is socially influenced by their parents and their peers. First, this thesis provides evidence to suggest that behavioural mimicry may occur when female adolescents eat with their parent, and that adolescents may look to their parents to determine what to eat and when. Furthermore, this thesis makes important contributions regarding the influence that perceived eating norms have on children's eating behaviour. We provide consistent evidence that perceived eating norms influence children's vegetable intake, and there is evidence that perceived eating norms may persist into a later free eating session. Furthermore, the findings of this thesis suggest that perceived eating norms may exert their influence by acting as a form of informational social influence, whereby, children may look to the perceived eating norm to guide their behaviour to remove uncertainty about how to behave. Finally, this thesis provides evidence that perceived eating norm messages may be a potential way of increasing children's fruit and vegetable intake, however, further research is needed to investigate how best to make use of perceived eating norms to promote healthier eating behaviour.

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# Appendices

## Appendix 1: Supplemental material Chapter 3

In order to examine whether BMI (*z*-score), age, gender, carrot liking, or usual fruit and vegetable intake moderated the effect of condition on the amount of carrots eaten, we conducted a series of further analyses. We found no evidence that any of these variables moderated the effect of condition on amount of carrots eaten. Across all three appendices reported in this thesis the continuous variables were dichotomised in order to split children into groups based on their liking, usual intake, age group and hunger. This approach has been used in previous research (Robinson, Fleming and Higgs, 2014) and allowed us to examine the behaviour of groups of children.

*BMI (z-score)*

A 4 (condition) x 2 (BMI: healthy-weight, overweight) ANOVA was conducted. There was a significant main effect of condition [$F (3, 132) = 2.91$, $p = .04$, $\eta p^2 = .06$] and no significant main effect of BMI (*z*-score) on the amount of carrots eaten [$F (2, 132) = .98$, $p = .38$, $\eta p^2 = .02$], and no significant interaction between condition and BMI on the amount of carrots eaten [$F (5, 132) = .43$, $p = .83$, $\eta p^2 = .02$].

*Age (year group)*

A 4 (condition) x 2 (age: infants, juniors) ANOVA was conducted. There was a significant main effect of condition [$F (3, 130) = 7.40$, $p = < .001$, $\eta p^2 = .15$], and no significant main effect of age on the amount of carrots eaten [$F (1, 130) = 3.45$, $p =$

.07, $\eta p^2 = .03$], and no significant interaction between condition and age on the amount of carrots eaten [F (3, 130) = .53, $p = .66$, $\eta p^2 = .01$].

*Gender*

A 4 (condition) x 2 (gender) ANOVA was conducted. There was a significant main effect of condition [F (1, 135) = 6.75, $p = < .001$, $\eta p^2 = .13$], and no significant main effect of gender on the amount of carrots eaten [F (1, 135) = .05, $p = .83$, $\eta p^2 < .001$] and, there was no significant interaction between condition and gender on the amount of carrots eaten [F (3, 135) = .18, $p = .91$, $\eta p^2 = .004$].

*Carrot Liking*

A 4 (condition) x 2 (carrot liking: like, dislike) ANOVA was conducted. There was a significant main effect of condition [F (3, 135) = 4.59, $p = .004$, $\eta p^2 = .09$] and carrot liking on the amount of carrots eaten [F (1, 135) = 21.43, $p < .001$, $\eta p^2 = .14$], whereby, children who liked carrots ate significantly more carrots than children who did not like carrots. However, there was no significant interaction between condition and carrot liking on the amount of carrots eaten [F (3, 135) = .45, $p = .72$, $\eta p^2 = .01$].

*Usual fruit and vegetable intake*

A 4 (condition) x 2 (usual intake: high, low) ANOVA was conducted. There was a significant main effect of condition [F (3, 135) = 6.20, $p = .001$, $\eta p^2 = .12$], and no significant main effect of usual fruit and vegetable intake on the amount of carrots

eaten [F (1, 135) = .05, $p$ = .82, $\eta p^2 < .001$], and there was no significant interaction between condition and usual fruit and vegetable intake on the amount of carrots eaten [F (3, 135) = .41, $p$ = .74, $\eta p^2 = .009$].

## Appendix 2: Supplemental material Chapter 4

In order to examine whether *z*BMI, age, liking of carrots, or usual fruit and vegetable intake affected the effect of remote-confederate intake or peer acceptance condition on children's vegetable consumption, these variables were included as covariates in separate 2 (remote-confederate intake) x 2 (peer acceptance condition) ANCOVAs. To examine the effects of gender, gender was included as a factor within a 2 (remote-confederate intake) x 2 (peer acceptance condition) x 2 (gender) ANOVA.

### Study 1

*zBMI*

When controlling for *z*BMI there was a significant main effect of remote-confederate intake [F (1, 95) = 17.19, $p < .001$, $\eta p^2 = .15$] on children's vegetable consumption. There was no significant main effect of peer acceptance condition [F (1, 95) = .22, $p = .64$, $\eta p^2 = .002$], and no significant interaction between remote-confederate intake and peer acceptance condition on children's vegetable consumption [F (1, 95) = .87, $p = .35$, $\eta p^2 = .01$].

*Age*

When controlling for age there was a significant main effect of remote-confederate intake [F (1, 95) = 17.25, $p < .001$, $\eta p^2 = .15$] on children's vegetable consumption. There was no significant main effect of peer acceptance condition [F (1, 95) = .15, $p = .70$, $\eta p^2 = .002$], and no significant interaction between remote-confederate intake

and peer acceptance condition on children's vegetable consumption [F(1, 95) = .87, $p$=.35, $\eta p^2$ =.01].

*Carrot liking*

When controlling for carrot liking there was a significant main effect of remote-confederate intake on children's vegetable consumption [F (1, 95) = 18.49, $p < .001$, $\eta p^2 = .16$]. There was no significant main effect of peer acceptance condition [F (1, 95) = .20, $p = .66$, $\eta p^2 = .002$], and no significant interaction between remote-confederate intake and peer acceptance condition on children's vegetable consumption [F (1, 95) = 1.99, $p = .16$, $\eta p^2 = .02$].

*Usual intake*

When controlling for usual fruit and vegetable intake level, there was a significant main effect of remote-confederate intake on children's vegetable consumption [F (1, 95) = 14.83, $p < .001$, $\eta p^2 = .14$]. There was no significant main effect of peer acceptance condition [F (1, 95) = .10, $p = .76$, $\eta p^2 = .001$], and no significant interaction between remote-confederate intake and peer acceptance condition on children's vegetable consumption [F (1, 95) = .68, $p = .41$, $\eta p^2 = .01$].

*Gender*

There was a significant main effect of remote-confederate intake [F (1, 92) = 17.18, $p$ = < .001, $\eta p^2$ = .16]. There were no other significant main effects or interactions ($p$ > .05).

**Study 2**

In order to examine whether *z*BMI, hunger, child age, liking of carrots, or usual fruit and vegetable intake affected the effect of remote-confederate intake or familiarity of the eating context condition on children's vegetable consumption, these variables were included as covariates in separate 2 (remote-confederate intake) x 2 (familiarity of eating context condition) x 2 (eating session) mixed ANCOVAs. In order to examine whether gender affected the results, gender was included in a 2 (remote-confederate intake) x 2 (familiarity of eating context condition) x 2 (gender) x 2 (eating session) mixed ANOVA.

*zBMI*

When controlling for *z*BMI, there was a significant main effect of remote-confederate intake [F(1, 122) = 9.99, $p$ = .002, $\eta p^2$ = .08]. There were no significant main effects of eating session [F(1, 122) = 1.04, $p$ = .31, $\eta p^2$ = .01], or familiarity of eating context [F(1, 122) = .82, $p$ = .38, $\eta p^2$ = .01] on children's vegetable consumption. There were no interactions between eating session and remote-confederate intake [F (1, 122) = .29, $p$ = .59, $\eta p^2$ = .002] or familiarity of eating context condition on children's vegetable consumption [F (1, 122) = .04, $p$ = .85, $\eta p^2$

< .001]. There was also no significant interaction between remote-confederate intake and familiarity level [F(1, 122) = 2.78, $p$ = .10, $\eta p^2$ = .02]. As expected, there was a significant interaction between eating session, remote-confederate intake and familiarity of eating context condition on children's vegetable consumption [F (1, 122) = 7.13, $p$ = .01, $\eta p^2$ = .06].

*Hunger in session 1*

When controlling for hunger, there was a main effect remote-confederate intake [F(1, 122) = 9.48, $p$ = .003, $\eta p^2$ = .07]. There were no main effects of eating session [F (1, 122) = 1.09, $p$ = .30, $\eta p^2$ = .01], or familiarity of eating context [F(1, 122) = .86, $p$ = .36, $\eta p^2$ = .01]. There were no interactions between eating session and remote-confederate intake [F (1, 122) = .22, $p$ = .64, $\eta p^2$ = .002] or familiarity of eating context condition on children's vegetable consumption [F (1, 122) = .03, $p$ = .86, $\eta p^2$ < .001]. There was no interaction between remote-confederate intake and familiarity of eating context [F (1, 122) = 1.04, $p$ = .10, $\eta p^2$ = .02]. As expected there was a significant interaction between eating session, remote-confederate intake and familiarity of eating context condition on children's vegetable consumption [F (1, 122) = 7.00, $p$ = .01, $\eta p^2$ = .06].

*Hunger in session 2*

When controlling for hunger, there was a main effect of remote-confederate intake [F(1, 122) = 9.52, $p$ = .003, $\eta p^2$ = .07]. There were no main effects of eating session [F (1, 122) = .80, $p$ = .37, $\eta p^2$ = .007], or familiarity of eating context [F (1, 122) =

.92, $p$ = .34, $\eta p^2$ = .01]. There were no interactions between eating session and remote-confederate intake [F (1, 122) = .32, $p$ = .57, $\eta p^2$ = .003] or familiarity of eating context condition on children's vegetable consumption [F (1, 122) = .04, $p$ = .84, $\eta p^2$ < .001]. There was also no interaction between remote-confederate intake and familiarity of eating context [F (1, 122) = 3.73, $p$ = .07, $\eta p^2$ = .03]. As expected, there was a significant interaction between eating session, remote-confederate intake and familiarity of eating context condition on children's vegetable consumption [F (1, 122) = 6.88, $p$ = .01, $\eta p^2$ = .05].

*Age*

When controlling for age, there was a significant main effect of remote-confederate intake [F(1, 122) = 9.48, $p$ = .003, $\eta p^2$ = .07]. There were no main effects of eating session [F (1, 122) = 1.21, $p$ = .27, $\eta p^2$ = .01], or familiarity of eating context [F (1, 122) = 1.01, $p$ = .31, $\eta p^2$ = .01]. There were no significant interactions between eating session and remote-confederate intake [F (1, 122) = .24, $p$ = .62, $\eta p^2$ =.002], or familiarity of eating context condition on children's vegetable consumption [F (1, 122) = .03, $p$ = .87, $\eta p^2$ < .001]. In addition, there was no significant interaction between remote-confederate intake and familiarity of eating context [F (1, 122) = 2.85, $p$ = .09, $\eta p^2$ = .02]. As expected there was a significant interaction between eating session, remote-confederate intake and familiarity of eating context condition on children's vegetable consumption [F (1, 122) = 7.13, $p$ = .01, $\eta p^2$ = .06].

*Study carrot liking*

When controlling for the study carrot liking, there was a significant main effect of remote-confederate intake [F (1, 122) = 7.31, $p$ = .01, $\eta p^2$ = .06]. There was a significant main effect of eating session [F (1, 122) = 4.75, $p$ = .03, $\eta p^2$ = .04]. There was no significant main effect of familiarity of eating context [F(1, 122) = 2.37, $p$ = .13, $\eta p^2$ = .02]. There were no significant interactions between eating session remote-confederate intake level [F (1, 122) = .63, $p$ = .43, $\eta p^2$ = .005] or familiarity of eating context condition on children's vegetable consumption [F (1, 122) = .12, $p$ = .73, $\eta p^2$ = .001]. As expected, there was a significant interaction between eating session, remote-confederate intake and familiarity of eating context condition on children's vegetable consumption [F (1, 122) = 7.12, $p$ = .01, $\eta p^2$ = .06]. There was a significant interaction between remote-confederate intake and familiarity of eating context [F(1, 122) = 4.08, $p$ = .046, $\eta p^2$ = .03] when controlling for study carrot liking. However, when this interaction was followed up, the results did not differ from the main study results (In the unfamiliar eating context, there was a significant main effect of remote-confederate intake [F (1, 62) = 10.84, $p$ = .002, $\eta p^2$ = .15], no significant main effect of eating session [F (1, 62) = 1.90, $p$ = .17, $\eta p^2$ = .03], and there was a significant interaction between eating session and remote-confederate intake [F (1, 62) = 5.53, $p$ = .02, $\eta p^2$ = .03]. In the familiar eating context, there was no main effect of remote-confederate intake [F (1, 59) = .32, $p$ = .57, $\eta p^2$ = .005] or eating session [F(1, 59) = 3.25, $p$ = .08, $\eta p^2$ = .05]. There was also no significant interaction between eating session and remote-confederate intake [F (1, 59) = 1.58, $p$ = .21, $\eta p^2$ = .03]).

*General carrot liking*

When controlling for general liking of carrots, there was a significant main effect of remote-confederate intake [F (1, 122) = 8.10, $p$ = .003, $\eta p^2$ =.07]. There was no main effect of eating session [F (1, 122) = .12, $p$ = .73, $\eta p^2$ =.001] or familiarity of eating context, [F (1, 122) = 2.82, $p$ = .10, $\eta p^2$ =.02]. There were no significant interactions between eating session and remote-confederate intake [F (1, 122) = .27, $p$ = .60, $\eta p^2$ = .002] or familiarity of eating context condition on children's vegetable consumption [F (1, 122) = .03, $p$ = .87, $\eta p^2$ = < .001]. As expected, there was a significant interaction between eating session, remote-confederate intake and familiarity of eating context condition on children's vegetable consumption [F (1, 122) = 7.11, $p$ = .01, $\eta p^2$ = .06]. Furthermore there was a significant interaction between remote-confederate intake and familiarity of eating context [F (1, 122) = 6.61, $p$ = .01, $\eta p^2$ =.05]. However, when this interaction was followed up, the results did not differ from the main study results (In the unfamiliar eating context there was a significant main effect of remote-confederate intake [F (1, 62) = .13.60, $p$ = < .001, $\eta p^2$ =.27]. There was no main effect of eating session [F (1, 62) = .70, $p$ = .41, $\eta p^2$ =.01]. As expected, there was a significant interaction between eating session and remote-confederate intake [F (1, 62) = 5.03, $p$ = .03, $\eta p^2$ =.08]. In the familiar eating context, there was no significant main effect of eating session [F (1, 59) = .11, $p$ = .73, $\eta p^2$ =.002], or remote-confederate intake [F (1, 59) = .38, $p$ = .54, $\eta p^2$ =.01]. There was also no significant interaction between eating session and remote-confederate intake [F (1, 59) = 1.95, $p$ = .17, $\eta p^2$ =.03]).

*Usual intake*

When controlling for usual fruit and vegetable intake, there was a significant main effect of remote-confederate intake [F (1, 122) = 10.67, $p$ = .001, $\eta p^2$ =.08]. There was no main effect of eating session [F (1, 122) = .005, $p$ = .95, $\eta p^2$ < .001], or familiarity of eating context [F (1, 122) = .66, $p$ = .42, $\eta p^2$ =.005]. There were no interactions between eating session and usual intake [F (1, 122) = .73, $p$ = .40, $\eta p^2$ = .01], remote-confederate intake [F (1, 122) = .24, $p$ = .63, $\eta p^2$ = .002], or familiarity of eating context condition on children's vegetable consumption [F(1, 122) = .02, $p$ = .89, $\eta p^2$ < .001]. There was no significant interaction between remote-confederate intake and familiarity of eating context [F (1, 122) = 3.57, $p$ = .07, $\eta p^2$ = .03]. As expected, there was a significant interaction between eating session, remote-confederate intake and familiarity of eating context condition [F (1, 122) = 6.50, $p$ = .01, $\eta p^2$ = .05].

*Gender*

There was a significant main effect of remote-confederate intake [F (1, 119) = 10.35, $p$ = .002, $\eta p^2$ = .08], and a significant interaction between eating session, remote-confederate intake and familiarity of the eating context [F (1, 119) = .7.13, $p$ = .009, $\eta p^2$ = .06]. There was a marginally significant main effect of gender [F (1, 119) = 3.84, $p$ = .05, $\eta p^2$ = .03], whereby, males ate more vegetables than females. However, there were no other significant main effects or interactions ($p$ > .05).

## Appendix 3: Supplemental material Chapter 5

In order to examine whether weight-status, usual fruit and vegetable intake, and fruit and vegetable liking affected the effect of condition on the dependent variables, these variables were included as covariates in an ANCOVA. Furthermore, in order to examine whether child age, gender, fruit and vegetable liking, or usual fruit and vegetable intake moderated any effects of message type on fruit and vegetable or high calorie snack food intake, we conducted a series of further analyses. We found no evidence that any of these variables moderated the effect of condition on fruit and vegetable, or high calorie snack food intake in any of the studies.

### Study 1

One way ANCOVAs were conducted to examine the effect of condition on fruit and vegetable intake and high calorie snack food, when controlling for weight-status, usual fruit and vegetable intake, and fruit and vegetable liking in separate analyses. There was a significant main effect of condition on fruit and vegetable intake after controlling for weight-status, [$F (2, 139) = 4.27$, $p = .02$, $\eta p^2 = .06$], usual fruit and vegetable intake [$F (2, 139) = 4.56$, $p = .01$, $\eta p^2 = .06$], and fruit and vegetable liking [$F (2, 139) = 4.47$, $p = .01$, $\eta p^2 = .06$]. There was a no significant main effect of condition on high calorie snack food intake when controlling for weight-status [$F (2, 139) = .002$, $p = .99$, $\eta p^2 < .001$], usual fruit and vegetable intake [$F (2, 139) = .01$, $p = .99$, $\eta p^2 < .001$], and fruit and vegetable liking [$F (2, 139) = .007$, $p = .99$, $\eta p^2 < .001$]. Therefore, controlling for these variables did not alter the effect of condition on fruit and vegetable or high calorie snack food intake.

*Weight-status*

Two 3 (conditions) x 2 (weight-status; healthy-weight, overweight) ANOVAs were conducted. There was a significant main effect of condition [F (2, 137) = 4.07, $p$ = .02, $\eta p^2$ = .009], but no significant main effect of weight-status on fruit and vegetable intake, [F (1, 137) = 1.19, $p$ = .28, $\eta p^2$ = .009]. There was no significant main effect of condition [F (2, 137) = .01, $p$ = .99, $\eta p^2$ = < .001] or weight-status on high calorie snack food intake [F (1, 137) = .39, $p$ = .53, $\eta p^2$ = .003]. There was no significant interaction between condition and weight-status on fruit and vegetable intake [F (2, 137) = .17, $p$ = .84, $\eta p^2$ = .003], or high calorie snack food intake [F (2, 137) = .08, $p$ = .92, $\eta p^2$ = .001].

*Age*

Two 3 (condition) x 2 (age; younger (6-8 years), older (9-11 years) ANOVAs were conducted. There was a significant main effect of condition [F (2, 137) = 4.85, $p$ = .01, $\eta p^2$ = .07], but no significant main effect of age on fruit and vegetable intake [F (1, 137) = .89, $p$ = .35, $\eta p^2$ = .006]. There was no significant main effect of condition [F (2, 137) = .01, $p$ = .99, $\eta p^2$ = < .001] or age on high calorie snack food intake [F (1, 137) = 1.45, $p$ = .23, $\eta p^2$ = .01]. There was no significant interaction between condition and age on fruit and vegetable intake [F (2, 137) = .43, $p$ = .65, $\eta p^2$ = .006] or high calorie snack food intake [F (2, 137) = 1.68, $p$ = .19, $\eta p^2$ = .02].

*Gender*

Two 3 (condition) x 2 (gender) ANOVAs were conducted. There was a significant main effect of condition on fruit and vegetable intake [F (2, 137) = 4.33, $p$ = .02, $\eta p^2$ = .06] and no significant main effect of gender on fruit and vegetable intake [F (1, 137) = .09, $p$ = .76, $\eta p^2$ = .001]. There was no significant main effect of condition [F (2, 137) = .05, $p$ = .96, $\eta p^2$ = .001], or gender on high calorie snack food intake [F (1, 137) = 1.47, $p$ = .23, $\eta p^2$ = .01]. There was no significant interaction between condition and gender on fruit and vegetable intake, [F (2, 137) = .01, $p$ = .99, $\eta p^2$ < .001], or high calorie snack food intake [F (2, 137) = .47, $p$ = .63, $\eta p^2$ = .01].

*Fruit and vegetable liking*

Two 3 (condition) x 2 (fruit and vegetable liking; like (4 or 5 on the Likert scale) vs. dislike (1-3 on the Likert scale) ANOVAs were conducted. There was a significant main effect of condition [F (2, 137) = 3.85, $p$ = .03, $\eta p^2$ = .05], no significant main effect of fruit and vegetable liking on fruit and vegetable intake [F (1, 137) = .89, $p$ = .35, $\eta p^2$ = .006]. There was a significant main effect of fruit and vegetable liking on high calorie snack food intake [F (2, 137) = 3.34, $p$ = .04, $\eta p^2$ < .001], whereby, children who disliked fruit and vegetables, ate more high calorie snack food, t (141) = -2.06, $p$ = .04]. There was no significant interaction between condition and fruit and vegetable liking on fruit and vegetable intake, [F (2, 137) = .10, $p$ = .90, $\eta p^2$ = .001], or high calorie snack food intake [F (2, 137) = 1.40, $p$ = .25, $\eta p^2$ = .02].

*Usual fruit and vegetable intake*

Two 3 (condition) x 2 (usual fruit and vegetable intake; high (2 or more pieces of fruit and vegetables per day) vs. low (1 or no pieces of fruit and vegetables per day) ANOVAs were conducted. There was a significant main effect of condition [F (2, 137) = 4.47, $p$ = .01, $\eta p^2$ = .06], a significant main effect of usual fruit and vegetable intake on fruit and vegetable intake [F (1, 137) = 4.30, $p$ = .04, $\eta p^2$ = .03], whereby, usually high consumers of fruit and vegetables ate more fruit and vegetables than usually low consumers of fruit and vegetables, t (141) = 2.11, $p$ = .04, $d$ = .35. There was no significant main effect of condition [F (2, 137) = .07, $p$ = .94, $\eta p^2$ = .001], and no significant main effect of usual fruit and vegetable intake on high calorie snack food intake [F (1, 137) = 3.42, $p$ = .07, $\eta p^2$ = .02]. In addition, there was no significant interaction between condition and usual fruit and vegetable intake on fruit and vegetable intake, [F (2, 137) = .60, $p$ = .55, $\eta p^2$ = .009], or on high calorie snack food intake [F (2, 137) = .56, $p$ = .58, $\eta p^2$ = .008].

**Study 2**

One way ANCOVAs were conducted to examine the effect of condition on fruit and vegetable intake and high calorie snack food intake, when controlling for weight-status, usual fruit and vegetable intake, and fruit and vegetable liking. There was no significant main effect of condition on fruit and vegetable intake when controlling for weight-status [F (3, 159) = 1.05, $p$ = .37, $\eta p^2$ = .02], usual fruit and vegetable intake [F (3, 159) = 1.24, $p$ = .30, $\eta p^2$ = .02], or fruit and vegetable liking [F (3, 159) = 1.25, $p$ = .29, $\eta p^2$ = .02].

There was no significant main effect of condition on high calorie snack food intake when controlling for weight-status [F (3, 159) = .53, $p$ = .66, $\eta p^2$ = .01], usual fruit and vegetable intake [F (3, 159) = .59, $p$ = .62, $\eta p^2$ = .01], or fruit and vegetable liking [F (3, 159) = .49, $p$ = .69, $\eta p^2$ = .01]. Therefore, controlling for these variables did not alter the effect of condition on either fruit and vegetable, or high calorie snack food intake.

*Age*

Two 4 (condition) x 2 (age; younger (6-8 years), older (9-11 years) ANOVAs were conducted. There was no significant main effect of condition [F (3, 156) = 1.16, $p$ = .33, $\eta p^2$ = .02] or age on fruit and vegetable intake [F (1, 156) = .07, $p$ = .80, $\eta p^2$ < .001]. There was no significant main effect of condition on high calorie snack food intake [F (3, 156) = .93, $p$ = .43, $\eta p^2$ = .02]. However, there was a significant main effect of age on high calorie snack food intake [F (1, 156) = 4.83, $p$ = .03, $\eta p^2$ = .03], whereby, younger children ate more high calorie snack foods than older children, t (162) = 1.97, $p$ = .05, $d$ = .32. There was no significant interaction between condition, and age on fruit and vegetable [F (3, 156) = 1.11, $p$ = .35, $\eta p^2$ = .02] or high calorie snack food intake [F (3, 156) = 1.37, $p$ = .25, $\eta p^2$ = .03].

*Gender*

Two 4 (condition) x 2 (gender) ANOVAs were conducted. There was no significant main effect of condition [F (3, 156) = 1.16, $p$ = .33, $\eta p^2$ = .02] or gender on fruit and vegetable intake [F (1, 156) = .002, $p$ = .97, $\eta p^2$ < .001]. There was no significant

main effect of condition on high calorie snack food intake [F (3, 156) = .58, $p$ = .63, $\eta p^2$ = .01]. However, there was a significant main effect of gender on high calorie snack food intake [F (1, 156) = 7.28, $p$ = .008, $\eta p^2$ = .05], whereby, males ate more high calorie snack food than females, t (162) = 2.68, $p$ = .008, $d$ = .42. There was no significant interaction between condition and gender on fruit and vegetable intake, [F (3, 156) = .92, $p$ = .43, $\eta p^2$ = .02], or high calorie snack food intake [F (3, 156) = .72, $p$ = .54, $\eta p^2$ = .014].

*Fruit and vegetable liking*

Two 4 (condition) x 2 (fruit and vegetable liking; like (4 or 5 on the Likert scale), vs. dislike (1-3 on the Likert scale) ANOVAs were conducted. There was no significant main effect of condition [F (3, 156) = 1.51, $p$ = .22, $\eta p^2$ = .03] or fruit and vegetable liking on fruit and vegetable intake [F (1, 156) = .23, $p$ = .63, $\eta p^2$ = .001]. There was no significant main effect of condition [F (3, 156) = .37, $p$ = .77, $\eta p^2$ = .01] or fruit and vegetable liking on high calorie snack food intake [F (1, 156) = .36, $p$ = .55, $\eta p^2$ = .002]. There was no significant interaction between condition and fruit and vegetable liking on fruit and vegetable intake, [F (3, 156) = 1.53, $p$ = .21, $\eta p^2$ = .03], or high calorie snack food intake [F (3, 156) = .74, $p$ = .53, $\eta p^2$ = .014].

*Usual fruit and vegetable intake*

Two 4 (condition) x 2 (usual fruit and vegetable intake; high (2 or more pieces of fruit and vegetables per day), low (1 or no pieces of fruit and vegetables per day) ANOVAs were conducted. There was no significant main effect of condition [F (3,

156) = 1.29 $p$ = .30, $\eta p^2$ = .03] or usual fruit and vegetable intake on fruit and vegetable intake [F (1, 156) = 2.15, $p$ = .15, $\eta p^2$ = .01]. There was no significant main effect of condition [F (3, 156) = .35, $p$ = .79, $\eta p^2$ = .01] or usual fruit and vegetable intake on high calorie snack food intake [F (1, 156) = .16, $p$ = .69, $\eta p^2$ = .001]. There was no significant interaction between condition and usual fruit and vegetable intake on fruit and vegetable intake, [F (3, 156) = .29, $p$ = .83, $\eta p^2$ = .006], or high calorie snack foods intake [F (3, 156) = .32, $p$ = .81, $\eta p^2$ = .006].

**Appendix 3 Table 1** *Mean (SDs) for fruit and vegetable intake and high calorie snack food intake in healthy-weight and overweight children for study 2*

| Condition | Healthy-weight (n = 127) | | Overweight (n = 37) | |
|---|---|---|---|---|
| | Fruit and vegetables | High calorie snack food | Fruit and vegetables | High calorie snack food |
| Descriptive social norm-based message (n = 41) | 51.56 (42.58) | 22.70 (19.31) | 96.14 (64.75) | 31.50 (13.36) |
| Health message (n = 41) | 74.12 (41.67)* | 25.53 (16.34) | 54.14 (57.73) | 31.29 (22.76) |
| Exposure condition (n = 41) | 70.06 (39.82) | 25.00 (14.13) | 53.25 (19.75) | 13.00 (12.31) |
| Control (n = 41) | 47.42 (39.14)* | 26.10 (18.37) | 77.00 (55.97) | 31.25 (21.35) |

*Indicates a significant difference at $p < .05$