

UNIVERSITY OF BIRMINGHAM

Research at Birmingham

Examining evidence for behavioural mimicry of parental eating by adolescent females. An observational study

Sharps, Maxine; Higgs, Suzanne; Blissett, Jacqueline; Nouwen, Arie; Chechlac, Magdalena; Allen, Harriet A.; Robinson, Eric

DOI:

[10.1016/j.appet.2015.01.015](https://doi.org/10.1016/j.appet.2015.01.015)

License:

Other (please specify with Rights Statement)

Document Version

Peer reviewed version

Citation for published version (Harvard):

Sharps, M, Higgs, S, Blissett, J, Nouwen, A, Chechlac, M, Allen, HA & Robinson, E 2015, 'Examining evidence for behavioural mimicry of parental eating by adolescent females. An observational study' *Appetite*, vol 89, pp. 56-61. DOI: 10.1016/j.appet.2015.01.015

[Link to publication on Research at Birmingham portal](#)

Publisher Rights Statement:

NOTICE: this is the author's version of a work that was accepted for publication in *Appetite*. Changes resulting from the publishing process, such as peer review, editing, corrections, structural formatting, and other quality control mechanisms may not be reflected in this document. Changes may have been made to this work since it was submitted for publication. A definitive version was subsequently published in *Appetite*, Vol 89, June 2015, DOI: 10.1016/j.appet.2015.01.015.

Eligibility for repository checked April 2015

General rights

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

Take down policy

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact UBIRA@lists.bham.ac.uk providing details and we will remove access to the work immediately and investigate.

Accepted Manuscript

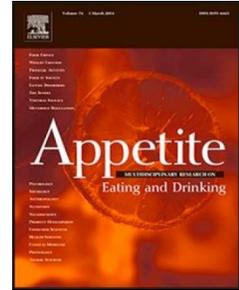
Title: Examining evidence for behavioural mimicry of parental eating by adolescent females: an observational study

Author: Maxine Sharps, Suzanne Higgs, Jackie Blissett, Arie Nouwen, Magdalena Chechlacz, Harriet A Allen, Eric Robinson

PII: S0195-6663(15)00024-0
DOI: <http://dx.doi.org/doi: 10.1016/j.appet.2015.01.015>
Reference: APPET 2419

To appear in: *Appetite*

Received date: 17-6-2014
Revised date: 16-1-2015
Accepted date: 19-1-2015



Please cite this article as: Maxine Sharps, Suzanne Higgs, Jackie Blissett, Arie Nouwen, Magdalena Chechlacz, Harriet A Allen, Eric Robinson, Examining evidence for behavioural mimicry of parental eating by adolescent females: an observational study, *Appetite* (2015), <http://dx.doi.org/doi: 10.1016/j.appet.2015.01.015>.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

1 Examining evidence for behavioural mimicry of parental eating by
2 adolescent females: an observational study

3 Maxine Sharps¹, Suzanne Higgs², Jackie Blissett², Arie Nouwen³, Magdalena Chechlacz⁴,
4 Harriet A Allen⁵, Eric Robinson¹

5
6 ¹ University of Liverpool

7 ² University of Birmingham

8 ³ Middlesex University

9 ⁴ University of Oxford

10 ⁵ University of Nottingham

11
12 **Corresponding Author:**

13 Maxine Sharps, Psychological Sciences,

14 Eleanor Rathbone Building,

15 University of Liverpool,

16 Liverpool, L69 7ZA, UK

17 Email – Maxine.sharps@liv.ac.uk

18 Funding statement: The current study was funded in part, by the European Foundation for the
19 Study of Diabetes (EFSD)/ Novo Nordisk European Clinical Research Programme in
20 Adolescents with Type 2 Diabetes.

21 The authors report no conflicts of interest

22 **Word count:** 4419

23 **Key words:** mimicry; social modelling; social eating

24 Highlights

- 25 • Evidence of mimicry of parental eating behaviour by adolescent females is examined
- 26 • Parental consumption was associated with adolescent children eating the same food
- 27 • Mimicry of food intake may occur in a shorter timeframe than previously assumed
- 28 • Mimicry of food intake may be food item specific

29

30 **ABSTRACT**

31 Behavioural mimicry is a potential mechanism explaining why adolescents appear to be
32 influenced by their parents' eating behaviour. In the current study we examined whether there
33 is evidence that adolescent females mimic their parents when eating. Videos of thirty-eight
34 parent and female adolescent dyads eating a lunchtime meal together were examined. We
35 tested whether a parent placing a food item into their mouth was associated with an increased
36 likelihood that their adolescent child would place any food item (non-specific mimicry) or the
37 same item (specific mimicry) in their mouth at three different time frames, namely during the
38 same second or within the next fifteen seconds (+15), five seconds (+5) or two second (+2)
39 period. Parents and adolescents' overall food intake was positively correlated, whereby a
40 parent eating a larger amount of food was associated with the adolescent eating a larger meal.
41 Across all of the three time frames adolescents were more likely to place a food item in their
42 mouth if their parent had recently placed that same food item in their mouth (specific food
43 item mimicry), however there was no evidence of non-specific mimicry. This observational
44 study suggests that when eating in a social context there is evidence that adolescent females
45 may mimic their parental eating behaviour, selecting and eating more of a food item if their
46 parent has just started to eat that food.

47

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

57

58 Parents are thought to be one of the most important social influences on child and adolescent
59 eating behaviour (Salvy et al., 2011), influencing health beliefs, behaviours and dietary intake
60 (Oliveria et al., 1992; Lau et al., 1990). Moreover, parental and child food consumption tend
61 to be correlated in terms of the type and amounts of food that both eat (McGowan et al.,
62 2012; Wroten et al., 2012; Sweetman et al., 2011). Likewise, research has shown that
63 children are more likely to try a food if they observe their parent eating that same food
64 (Harper et al., 1975). More recent research has also shown, in an experimental setting, that
65 the presence of a parent shapes the amount and types of food adolescents eat (Salvy et al.,
66 2011). However, the mechanisms underlying the processes by which adolescents adapt their
67 eating to match parental behaviour when eating has received less attention.

68

69 One possibility is that adolescents mimic or synchronise to their parents' eating behaviour
70 when dining together. Behavioural mimicry refers to the process whereby a person imitates
71 the behaviour of another person without conscious awareness. This is thought to occur due to
72 a tight neural link between perception and action ([Chartrand & Bargh., 1999](#); [Chartrand et al.,](#)

73 [2009](#)), such that observing another person's movements may trigger one's own motor system
74 to perform that same movement ([Lakin & Chartrand., 2003](#); [Iacoboni., 2009](#)), e.g. taking a
75 bite of food. Mimicry has been suggested to occur for a number of behaviours (Larsen et al,
76 2009; Neumann & Strack., 2000; Bernieri., 1988) and more recently the role of behavioural
77 mimicry in social eating contexts has been examined. Hermans et al. (2012) found that when
78 two female adults ate the same meal together, participants were more likely to pick up and eat
79 the food if their eating partner had done so in the proceeding five seconds. Similarly,
80 Bevelander et al. (2013) found that when a young child (aged 6-11) picked up and ate a
81 chocolate-covered peanut, this was associated with an increased likelihood that their eating
82 partner would subsequently pick up and eat that food. Thus, previous studies have only
83 investigated behavioural mimicry in child-only or adult-only groupings (Hermans et al.,
84 2012, Bevelander et al., 2013). **Since** research supports that adolescents' eating behaviour
85 may be affected by the eating behaviour of a present parent (Salvy et al., 2011), it will be
86 important to understand whether mimicry of eating behaviour may occur between a parent
87 and an adolescent. It may be the case that mimicry of parental eating is a mechanism
88 explaining parental influence on adolescent eating behaviour.

89

90 In studies to date examining behavioural mimicry during social eating, participants have only
91 been provided with a single food item to eat (Hermans et al., 2012; Bevelander et al., 2013).
92 From these studies it is, therefore, not possible to infer whether participants were mimicking
93 eating of a specific food type (if you take food x, I then take food x) or whether participants
94 were simply synchronising the rate of their food intake in a more general/non-specific
95 manner. For example, it may be that watching another person pick up a food item triggers an
96 automatic reaction to reach for any food item (non-specific food item mimicry) or only the
97 same food item (specific food item mimicry). Differentiating between these two possibilities

98 is of importance because it may signal mechanisms that underlie mimicry. If automatic
99 synchrony of gestures is of importance (Hermans et al., 2012; Iacoboni et al., 1999) then we
100 may expect to see evidence for non-specific mimicry, because mimicry of the action of eating
101 is key. Conversely, if mimicry occurs because an eating partner sets a norm about which
102 foods are and are not appropriate to eat (Vartanian et al., 2013; Herman et al., 2003), then
103 only mimicry of congruent food items may be observed. These questions are also of
104 importance because in naturalistic social eating contexts such as family meal times, a variety
105 of food items are likely to be available.

106

107 In the present study, we aimed to examine whether there is evidence that **female** adolescents
108 mimic the eating behaviour of their parents when eating together. In order to assess mimicry,
109 videos of parent-adolescent dyads eating a multi-item lunchtime meal were examined. We
110 examined whether there was evidence of both ‘non-specific food item mimicry’ and ‘specific
111 food item mimicry’. Based on previous studies of eating mimicry (Bevelander et al., 2013;
112 Hermans et al., 2012), it was hypothesised that a parent placing a food item in their mouth
113 would be associated with an increased likelihood that their **female** adolescent child would
114 also place a food item in their mouth. However, we reasoned that if evidence of mimicry was
115 observed, it may only be food item specific, as parental behaviour during a meal may
116 primarily signal which foods are appropriate to eat and when.

117

118

119 **METHOD**

120 *Background*

121 The videos analyzed were of adolescents and parents eating a multi-item lunchtime meal
122 together, which were recorded as part of a test day for a larger study examining brain

123 activations and responsiveness to food cues. In the larger study, participants arrived at the
124 laboratory on the morning of their test day where they underwent an MRI scanning session,
125 which was followed by a multi-item lunch. Participants were aware that their lunch time meal
126 would be video-recorded. However, participants were not explicitly told that their food intake
127 would be measured or that mimicry would be later examined. Three groups of participants
128 were recruited as part of the larger study: adolescents with type 2 diabetes, overweight and
129 obese adolescents (without type 2 diabetes), and healthy weight adolescents (without type 2
130 diabetes). See supplemental material for more detailed information about the selection criteria
131 for the larger study.

132

133 *Participants*

134 From the original data collected, we were unable to use ten videos due to equipment failure
135 or error. A further video was excluded because the participant did not eat anything. In
136 addition, we opted to focus on female adolescents only, due to the consistency of which
137 social influence effects have been replicated amongst females (Hermans et al., 2012; Pliner
138 and Mann., 2004; Roth et al., 2001), and there being only a small number of videos of
139 adolescent males available. Therefore, nine videos of adolescent males were not coded or
140 analyzed. Thus, the total sample for the present research consisted of 38 dyads containing
141 female adolescents eating with a parent. See Table 1 for sample ethnicity and socio-economic
142 status. There were 33 female parents and 5 male parents. The adolescents were aged 12.0 –
143 18.8 years, with a mean age of 15.4 years, $SD = 1.9$. Adolescent weight categories were
144 classified according to the defined International Obesity Task Force age specific cut offs
145 (Cole et al, 2000, Cole et al, 2007). Eleven of the adolescents were classed as being in the
146 healthy weight range (BMI 18.5-24.9), fourteen were classed as overweight and obese (BMI
147 ≥ 25) and thirteen had type 2 diabetes (BMI = 17.3-57.1). For the total sample mean

148 adolescent BMI = 30.6, SD = 9.7, and mean parental BMI = 30.1, SD = 5.8. See Table 2 for
149 adolescent and parental BMI information for the healthy weight, overweight and obese, and
150 diabetic groups separately.

151

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

163

164 *Lunch time meal*

165 All sessions took place in an eating laboratory at the University of Birmingham. The room
166 was furnished with a table and two chairs. Adolescents and parents were served a
167 standardized multi-item meal each on separate trays. Each lunch item was on a separate plate
168 and the meal consisted of a cheese sandwich (369 kcals), an individual Chicago Town cheese
169 pizza (453 kcal), a small bowl of cherry tomatoes (18kcal), an Activia strawberry yoghurt
170 (123 kcal), an apple (45kcal), a Satsuma (18kcal), 25g Walkers ready salted crisps (131
171 kcal), and two Maryland double chocolate cookies (112kcal). A jug of water and two glasses

172 **were** also provided. They were asked not to share food from each other's trays and told that
173 they were not expected to eat all the food, but to eat until they were full.

174

175

176 **ANALYSIS**

177 *Strategy of analysis for overall food consumption*

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

181

182 *Coding of video data*

183 **To test if adolescents mimicked the eating behaviours of their parents, we coded the video**
184 **data** by recording every time an adult or adolescent placed a food item into their mouth, the
185 name of that food item (e.g. pizza), and the time that the food entered the mouth. All
186 occurrences of eating were recorded by the first author. A random sample constituting 10%
187 of these codings were **checked independently** by one of the other authors and there were no
188 disagreements. The first author then coded each time an adolescent placed food into their
189 mouth during the sensitive and non-sensitive time periods of the meal (see next section
190 '*Defining sensitive and non-sensitive periods*'). All of this coding was then cross-checked by
191 an independent research assistant blind to the study hypotheses. Only a small number of
192 discrepancies were noted (7 instances of mimicry were coded incorrectly, which constituted
193 less than 1% of total coding), and **these** were resolved after discussion between the research
194 assistant and lead author.

195

196 *Defining sensitive and non-sensitive periods*

197 Previous studies have examined if participants are more likely to eat a food item in the 5 or
198 15 seconds after a dining partner has placed food in their mouth (known as a ‘sensitive
199 period’), compared to the other periods of the meal when a partner has not recently placed
200 food into their mouth (known as a ‘non-sensitive period’) (Hermans et al., 2012; Bevelander
201 et al., 2013; Larsen et al., 2010). In the present study we examined three sensitive timeframe
202 cut off points (+2, +5, +15 seconds), because we reasoned that mimicry may also occur in a
203 shorter time frame (i.e. within + 2 seconds of a person eating) than previous studies have
204 tested, as mimicry has been suggested to be automatic (Iacoboni et al., 1999). The three
205 timeframe cut off points (+2, +5, +15) were treated as *separate* timeframes. Each meal was
206 split into sensitive (the times during the meal in which a parent had recently placed food into
207 their mouth) and non-sensitive time periods (all other times during the meal; i.e., the times
208 during the meal in which a parent had not recently placed food in their mouth) for each of the
209 three *separate* time frames (+2, +5, +15). This approach allowed us to test whether the rate at
210 which adolescents placed food into their mouth differed between *sensitive vs. non-sensitive*
211 periods for the three time frames individually. (See ¹ for a detailed example). We presumed
212 that if adolescents ate at a quicker rate during sensitive vs. non-sensitive periods, this would
213 constitute evidence of mimicry. We calculated the rate of placing food into the mouth
214 (defined as a consumption ratio, see next section) as opposed to the number of times food
215 was placed in the mouth. We did this to account for differences in total sensitive vs. non-
216 sensitive time during each meal.

217

218 *Strategy of analysis for mimicry*

219 As noted, we coded how frequently adolescents placed food items into their mouth during the
220 sensitive periods (times when the parent **had** recently placed food in their mouth) and during
221 the non-sensitive periods (times when the parent **had not** recently placed food in their mouth)

222 of the lunchtime meal, for the three time frames separately. We then quantified this formally
223 by computing ‘consumption ratios’; the number of times a food item was placed into an
224 adolescents’ mouth per second². Following this, we compared the consumption ratio
225 observed for the sensitive periods vs. non-sensitive periods of the meal using a Wilcoxon
226 signed ranks test³ for the three different time frames individually (+2, +5, +15). We adjusted
227 the analyses using a Bonferroni correction to account for multiple comparisons. This allowed
228 us to compare the consumption ratios (the number of times a food item was placed into an
229 adolescents’ mouth per second) for the periods of the meal in which a parent had recently
230 placed into their mouth vs. periods of the meal in which the parent had not recently placed
231 food into their mouth. Importantly, we computed these consumption ratios for both *non-*
232 *specific* food item mimicry and *specific food* item mimicry.

233

234 *Non-specific food item mimicry*

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

242

243 *Specific food item mimicry*

244 In order to compute consumption ratios for **specific** food item mimicry here we examined the
245 rate at which adolescents placed the **same** food item into their mouth which their parent had
246 placed in their mouth in the proceeding 2, 5, or 15 seconds (sensitive period) vs. times when

247 the parent **had not** placed a food item into their mouth in the proceeding 2, 5, or 15 seconds
248 (non-sensitive periods). This analysis allowed us to examine whether adolescents more
249 frequently placed a food item in their mouth in the periods of the meal in which their parent
250 had recently placed the **same** food item in their mouth, as opposed to all other time periods of
251 the meal.

252

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

255

256 **RESULTS**

257 *Total food intake*

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

263

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

265 Mean meal length was 18 minutes and 13 seconds ($SD = 6.37$). The mean number of times
266 that parents placed any food item into their mouth was 59.50 ($SD = 19.07$). The mean number
267 of times that adolescents placed any food item into their mouth was 77.84 ($SD = 24.19$). On
268 average, parents placed food into their mouth every 19.88 seconds ($SD = 8.98$), which
269 constitutes a mean consumption ratio = 0.06 bites per second during the meal. Adolescents
270 placed food into their mouth every 14.53 seconds ($SD = 4.93$) on average, which constitutes a
271 mean consumption ratio = 0.08 bites per second during the meal.

272

273 *Non-specific mimicry*

274 There was little evidence of non-specific food item mimicry during the meal. The
275 consumption ratios for each of the three sensitive time periods were not significantly higher
276 than the consumption ratios observed during the equivalent non-sensitive periods; +2 ($z = -$
277 $.17, p = .26, r = -.03$) +5 ($z = -1.47, p = .42, r = -.24$), and +15 ($z = -2.27, p = .06, r = -.37$). (See Table
278 3 for consumption ratio values). This indicates that the rate at which adolescents placed any
279 food into their mouth (the consumption ratios) was similar during the periods of the meal in
280 which their parent had recently placed any food into their mouth (sensitive periods) and all
281 other periods of the meal in which their parent had not recently placed any food into their
282 mouth (non-sensitive periods). This effect was regardless of whether 'sensitive' was defined
283 as being within +2, +5 or +15 seconds after a parent had placed food into their mouth. Thus,
284 it was not the case that adolescents were significantly more likely to place any food item into
285 their mouth if their parent had recently placed a food item into their mouth.

286

287 *Specific mimicry*

288 For specific food items, there was evidence of mimicry for the +2 ($z = -3.42, p < .001, r = -$
289 $.55$), +5 ($z = -3.90, p < .001, r = -.63$), and +15 ($z = -3.73, p < .001, r = -.60$) second timeframes;
290 consumption ratios during these sensitive time periods were higher than the consumption
291 ratios observed during the equivalent non-sensitive periods. (See Table 3 for consumption
292 ratio values). This indicates that the rate at which adolescents placed a food into their mouth
293 was greater in the periods of the meal in which their parent had recently eaten that same food
294 item (sensitive periods) compared to the other remaining periods of the meal in which their
295 parent had not recently eaten that same food item (non-sensitive periods). This effect was
296 regardless of whether 'sensitive' was defined as being within +2, +5 or +15 seconds after a

297 parent had placed food into their mouth. Thus, there was evidence that adolescents were
298 significantly more likely to place a food item in their mouth if their parent had recently
299 placed that same food item into their mouth.

300

301

302 **DISCUSSION**

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

315

316 As in previous eating behaviour studies in adults and children (Hermans et al., 2012;
317 Bevelander et al., 2013), this observational data appears to support behavioural mimicry of
318 eating. However, the current study expands on these studies **because** we found evidence of
319 behavioural mimicry in a different dyad than has previously been examined (adolescents and
320 parents). **We** were **also** able to test whether adolescents mimicked the *specific* type of foods
321 their parents were eating, or whether this process of mimicry was not food item specific, i.e.

322 whether the parent placing a food into their mouth would simply increase the likelihood that
323 the adolescent would place any food in their mouth. The findings of the present study suggest
324 that adolescents were not simply synchronising their gestures or eating speed to match their
325 parents (due to a lack of evidence for non-specific mimicry), **which** has been suggested as a
326 potential explanation for social influence on eating (Hermans et al., 2012). Instead,
327 adolescents may have been using their parents as a reference point about which food items to
328 eat and when, which could be interpreted through either a normative or informational account
329 of social influence on eating (Robinson et al., 2013; Herman et al., 2003). **F**urther studies
330 will, **however**, need to address this proposition more directly. The main novel finding of the
331 present work was that we found evidence of specific food item mimicry during a shorter time
332 frame (during the same or subsequent two seconds after a parent had placed food into their
333 mouth), and within a different relationship than has been previously tested (Hermans et al.,
334 2012; Bevelander, 2013). **This finding** suggests that there may be evidence for mimicry of
335 eating behaviour in a shorter time frame than has been previously assumed.

336
337 One **possible reason why** we did not find evidence for non-specific mimicry (i.e. a parent
338 placing food into their mouth was not associated with an increased likelihood that the
339 adolescent subsequently placed *any* food into their mouth) **is that** the rate of adolescent eating
340 was relatively high during the meal. It could be argued that a high eating **rate** across all
341 periods of the meal would make it difficult to observe differences between periods of the
342 meal in which a parent had vs. had not recently eaten. **This might be the result of** a form of
343 ceiling effect. **Thus**, further research examining food-item specific vs. non-food item specific
344 mimicry in other meal settings which promote a slower pace of eating would be valuable. It is
345 also possible that the influence parents appeared to have on adolescent eating may be, in part,
346 explained by a form of visual attentional bias (Laibson, 2001; Wardle, 2007; Hardman et al.,

2014), **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.

350

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 (Hermans et al., 2012; Bevelander et al., 2013). 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

372 examine whether state (e.g., hunger) or trait (e.g., the quality of the relationship between the
373 parent and adolescent) factors may have moderated the likelihood of mimicry. Further work
374 designed to specifically explore the factors which may make mimicry more or less likely
375 would, *therefore*, be valuable.

376

377 *Conclusions*

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

381

382 **Notes**

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

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

394 ³ In the Wilcoxon signed ranks test the sensitive periods were deducted from the non-
395 sensitive periods. The negative ranks indicate the sensitive periods while the positive ranks
396 indicate the non-sensitive periods. No ties were observed in the analysis.

397

398 **REFERENCES**

399

400 Addessi, E., Galloway, A.T., Visalberghi, E., Birch LL. (2005) Specific social influences on
401 the acceptance of novel foods in 2-5 year old children. *Appetite*, 45, 264-71.

402 Bernieri, F.J. (1988) Coordinated movement and rapport in teacher-student interactions,
403 *Journal of Nonverbal Behaviour*, 12, 120-138.

404 Bevelander, K. E., Anschutz., D.J., Engels, R.C.M.E (2012) Social norms in food intake
405 among normal weight and overweight children. *Appetite*, 58, 864-872.

406 Bevelander, K.E., Lichtwarck-Aschoff, A., Anschutz, D.J., Hermans, R.C.J., Engels,
407 R.C.M.E. (2013) Imitation of snack food intake among normal-weight and overweight
408 children. *Frontiers in Psychology*, 4, 949.

409 Chartrand, T.L., & Bargh, J.A. (1999) The chameleon effect: The perception-behaviour link
410 and social interaction, *Journal of Personality and Social Psychology*, 76, 893-910.

411 Chartrand, T. L., Maddux, W. W., and Lakin, J. L. (2009). "Beyond the perception-behavior
412 link: the ubiquitous utility and motivational moderators of nonconscious mimicry
413 2005," in *The New Unconscious, Oxford Series in Social Cognition and Social
414 Neuroscience*, eds R. R. Hassin, J. S. Uleman, and J. A. Bargh (New York, NY:
415 Oxford University Press), 334–361.

416 Cole, T. J., Bellizzi, M. C., Flegal, K. M., & Dietz, W. H. (2000). Establishing a standard
417 definition for child overweight and obesity worldwide: international survey. *BMJ*,
418 320(7244), 1240-1243.

419 Cole, T. J., Flegal, K. M., Nicholls, D., & Jackson, A. A. (2007). Body mass index cut offs to
420 define thinness in children and adolescents: international survey. *BMJ*, 335(7612),
421 194.

- 422 Conger, J.C., Conger, A.J., Philip, R., K.L., Matter, J.A. (1980). The effect of social cues on
423 the eating behaviour of obese and normal subjects, *Journal of Personality*, 48, 258-
424 271.
- 425 Goldman, S.J., Herman, C.P., Polivy, J. (1991) Is the effect of a social model attenuated by
426 hunger? *Appetite*, 17, 129-140.
- 427 Hardman, C.A., Scott, J., Field, M., & Jones, A. (2014) To eat or not to eat; the effects of
428 expectancy on reactivity to food cues. *Appetite*, 76, 153-160.
- 429 Harper, L.V., Sanders, K.M (1975). The effect of adults' eating on young children's
430 acceptance of unfamiliar foods. *Journal of Experimental Child Psychology*, 20, 206-
431 214
- 432 Herman, C.P, Roth, D.A, Polivy, J. (2003). Effects of the presence of others on food intake:
433 A normative interpretation. *Psychological Bulletin*, 129, 873-886.
- 434 Hermans, R.C.J., Larsen, J.K., Herman, C.P., Engels, R.C.M.E. (2009) Effects of social
435 modelling on young women's nutrient dense food intake. *Appetite*, 53, 135-138
- 436 Hermans, R.C.J., Lichtwarck-Aschoff, A., Bevelander, K.E, Herman, C.P, Larsen, J.K,
437 Engels, R.C.M.E. (2012) Mimicry of food intake: The dynamic interplay between
438 eating companions. *PLoS ONE*, 7:e31027. Doi:10.1371/journal.pone.0031027
- 439 Iacoboni, M., Woods, R.P., Brass, M., Bekkering, H., Mazzoitta, J.C. et al (1999) Cortical
440 mechanisms of human imitation, *Science*, 286, 2526-2528.
- 441 Laibson, D. (2001) A cue-theory of consumption, *The Quarterly Journal of Economics*, 116,
442 81-119.
- 443 Lakin, J.L. & Chartrand, T.L. (2003) Using Nonconscious Behavioural Mimicry to Create
444 Affiliation and Rapport, *Psychological Science*, 14, 334-339.

- 445 Larsen, H., Engels, R.C.M.E., Souren, P.M., Overbeek, G.J., Granic, I. (2010) Peer influence
446 in the micro-perspective: imitation of alcoholic and non-alcoholic beverages,
447 *Addictive behaviours*, 35, 49-52.
- 448 Lau, R.R., Quadrel, M.J, Hartman, K.A (1990) Development and change of young adults'
449 preventive health beliefs and behaviour: influence from parents and peers. *Journal of*
450 *Health and Social Behaviour*, 31, 240-59
- 451 McGowan, L., Croker, H., Wardle, J., Cooke, L.J (2012) Environmental and individual
452 determinants of core and non-core food and drink intake in preschool-aged children in
453 the United Kingdom. *European Journal of Clinical Nutrition*, 66, 322-328.
- 454 Neumann, R., & Strack, F. (2000) "Mood contagion": The automatic transfer of mood
455 between persons, *Journal of Personality and Social Psychology*, 79, 211-223.
- 456 Oliveria, S., Ellison, R., Moore, L., Gillman, M., Garrahie, E., Singer, M. (1992) Parent-child
457 relationships in nutrient intake: The Framingham children's study. *American Journal*
458 *of Clinical Nutrition*, 56, 593-8
- 459 Pliner, P. & Mann N (2004) Influence of social norms and palatability on amount consumed
460 and food choice. *Appetite*, 42, 227-237
- 461 Robinson, E., Tobias, T., Shaw, L., Freeman, E., Higgs, S. (2011) Social matching of food
462 intake and the need for social acceptance. *Appetite*, 56, 747-752.
- 463 Robinson, E., Benwell, H., Higgs, S. (2013) Food intake norms increase and decrease snack
464 food intake in a remote confederate study. *Appetite*, 65, 20-24
- 465 Robinson, E., Blissett, J., Higgs, S. (2013) Social influences on eating: implications for
466 nutritional interventions, *Nutritional Research Reviews*, 26, 166-176.
- 467 Robinson, E., Sharps, M., Price, N., Dallas, R. (2014) Eating like you are overweight: The
468 effect of overweight models on food intake in a remote confederate study, *Appetite*,
469 82, 119-123.

- 470 Roth, D.A., Herman, C.P., Polivy, J., Pliner, P. (2001) self-presentational conflict in social
471 eating situations: A normative perspective. *Appetite*, 36, 165-171
- 472 Salvy, S.J., Elmo, A., Nitecki, L.A., Kluczynski, A., Roemmich, J.N. (2011) Influence of
473 parents and friends on children's and adolescents' food intake and food selection.
474 *American Journal of Clinical Nutrition*, 93, 87-92.
- 475 Salvy, S-J., de la Haye, K., Bowker, J.C., Hermans, R.C.J. (2012) Influence of peers and
476 friends on children's and adolescents' eating and activity behaviours. *Physiology and*
477 *Behavior*, doi:10.1016/j.physbeh.2012.03.022
- 478 Story, M., Neumark-Sztainer, D., French, S. (2002) Individual and environmental influences
479 on adolescent eating behaviours, *Journal of the American Dietetic Association*,
480 102,40-51.
- 481 Sweetman, C., McGowan, L., Croker, H., Cooke, L. (2011) Characteristics of family
482 mealtimes affecting children's vegetable consumption and liking. *Journal of the*
483 *American dietetic association*, 111, 269-273
- 484 Vartanian LR, Sokol N, Herman CP, Polivy J (2013) Social Models Provide a Norm of
485 Appropriate Food Intake for Young Women. *PLoS ONE* 8(11): e79268.
486 doi:10.1371/journal.pone.0079268
- 487 Wardle, J. (2007) Eating Behaviour and Obesity, *Obesity Reviews*, 8, 73-75.
- 488 Wroten, K.C., O'Neil, C.E., Stuff, J.E., Liu, Y., Nicklas, T.A. (2012) Resemblance of dietary
489 intakes of snacks, sweets, fruit and vegetables among mother-child dyads from low
490 income families. *Appetite*, 59, 316-323.
- 491

492 **Table 1.** Demographic information of sample

493

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

494

495

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

496

497

498

499

500

501

502 **Table 2.** Mean BMI (SD) for healthy weight, overweight and obese, and diabetic adolescent
 503 groups

504

	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)

505

506

507

508

509

510 **Table 3.** Consumption ratios for food item specific and non-food item specific mimicry
 511 during sensitive and non-sensitive periods (n=38)

512

	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

513

514 Consumption ratios indicate the number of times per second adolescents placed a food item
 515 into their mouth within sensitive and non-sensitive periods. A higher ratio indicates a greater
 516 rate of placing food items into the mouth.

517 *indicates a significant difference between the sensitive and non-sensitive consumption ratios
 518 at $p < 0.01$.

519

520