Examining Consumer Behavior Toward Genetically Modified (GM) Food in Britain

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This study examined behavior toward genetically modified (GM) food in a British community-based sample. We used an equivalent gain task in which participants actually received the options they chose to encourage truthful responding. In conjunction with this, theory of planned behavior (TPB) components were evaluated so as to examine the relative importance of behavioral influences in this domain. Here, the TPB was extended to include additional components to measure self-identity, moral norms, and emotional involvement. Results indicated that the monetary amounts participants accepted in preference to GM food were significantly lower than those accepted in preference to non-GM food. However, the vast majority of participants were indifferent between GM and non-GM food options. All TPB components significantly predicted behavioral intentions to try GM food, with attitudes toward GM being the strongest predictor. Self-identity and emotional involvement were also found to be significant predictors of behavioral intentions but moral norms were not. In addition, behavioral intentions significantly predicted behavior; however, PBC did not. An additional measure of participants' propensity to respond in a socially desirable manner indicated that our results were not influenced by self-presentation issues, giving confidence to our findings. Overall, it appears that the majority of participants (74.5%) would purchase GM food at some price.

KEY WORDS: Behavior; contingent valuation task; GM foods; intentions; theory of planned behavior

1. INTRODUCTION

An understanding of the perceptions of, and likely reactions toward, genetically modified (GM) foods is crucial for decision making by both policymakers and biotechnology companies. This is of particular current importance within Europe. The self-imposed moratorium on importing GM food within Europe was lifted in April 2004 alongside new labeling laws meaning it is now, therefore, legal to import GM food into Europe. Although there has been little exploitation of this so far, it is likely that the quantity of GM food available in Europe will increase in the near future.

Various surveys have examined attitudes toward GM foods in Europe, the most notable of these being the Eurobarometer series of publications (e.g., Gaskell, Allum, & Stares, 2003). The most recent Eurobarometer study indicated that the majority of European countries do not support GM food, although there is considerable variation between countries. Spain, Portugal, Ireland, and Finland demonstrated weak support for GM food (Gaskell et al., 2003) while other countries examined were negative or

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3 Any food with ingredients containing more than 0.9% GM organisms must be labeled.
ambivalent (Gaskell et al., 2003). The British population was found to be quite ambivalent toward GM food overall (Gaskell et al., 2003; Poortinga & Pidgeon, 2004). People within Europe have been found to be significantly more negative toward GM food than people within the United States (Gaskell, Bauer, Durant, & Allum, 2003; Moon & Balasubramanian, 2003) and these differences may be due to a higher number of food scares that have occurred within Europe and a lower trust of governing institutions displayed by Europeans (Anderson & Jackson, 2003).

1.1. Theory of Planned Behavior

Although attitudes and behavior are strongly related, they are not directly correspondent. A variety of influences impact upon behavior and these must be considered when making predictions regarding behavioral reactions to the introduction of GM foods. The theory of planned behavior (TPB; Ajzen, 1988) is one of the most useful, and widely used, conceptual frameworks used to link attitudes and behavior. This model proposes that subjective norms (defined as perceived social pressure from those individuals whose opinion is important to the individual in question), attitudes, and perceived behavioral control (PBC) together determine intentions. Such intentions, along with PBC, are thought to determine behavior (see Fig. 1). By applying this model to a particular behavior, the total amount of variance in behavior explained by these factors can be examined, as well as the relative influence of these factors. This then facilitates the prediction of behavior and aids interventions by helping to pinpoint the most influential behavioral antecedents.

1.2. Components Added to the TPB

The TPB is amenable to the inclusion of additional components in order to better predict variance in behavioral intentions and/or actual behavior (Ajzen, 1991) and a variety of cognitive factors have been examined alongside the TPB model with this aim. Self-identity is a concept that has frequently been added to TPB models as an additional predictor of intentions and behavior. It has been described as the part of an individual’s self-identity that is salient in the context of the behavior in question (Conner & McMillan, 1999) and is suggested to encompass both personal and social identity (Sparks & Guthrie, 1998). Moral norms have also frequently been included as an additional predictor in the TPB. Moral norms are defined as personal norms regarding what is right and what is wrong (Bredahl et al., 1998). The inclusion of
self-identity and moral norms within the TPB has so far met with mixed success (Terry et al., 1999; Sparks et al., 1995; Sparks & Shepherd, 2002).

The TPB, along with other sociocognitive models of behavior, has been criticized for its failure to include affective influences (Conner & Armitage, 1998). Consequently, several researchers have added affective components, e.g., anticipated affect (Simonson, 1992; O’Connor & Armitage, 2003) to the TPB model in order to explain further variance in behavioral intentions. The slightly different affective construct of emotional involvement may also be useful within the TPB model. Emotional involvement is defined as the extent to which the individual is engaged with (or disinterested in) the behavior at hand. Level of engagement has previously been examined as a factor relating to support of biotechnologies (Gaskell et al., 2003) and it was found that individuals who are more engaged with biotechnologies are more supportive of biotechnologies. In addition, the generalizability of past survey research, examining attitudes toward GM food, is criticized due to potential biases in the samples recruited, which are largely composed of individuals who are already particularly emotionally engaged with the issue of GM (e.g., Gaskell, 2004; Campbell & Townsend, 2003; Townsend & Campbell, 2004). This again suggests that emotional involvement is an important factor relating to support of GM food. So far, however, emotional involvement has not been investigated in previous incarnations of the TPB model. Overall, it seems that the predictive validity of the TPB may be increased through the addition of further relevant cognitive and affective factors.

1.3. TPB and GM Food

The TPB has frequently been applied to health behaviors and eating behaviors, and has also been used to investigate behavioral intentions regarding GM food several times within Italy, New Zealand, and Britain. Saba and Vassallo (2002) conducted a study in Italy that examined intentions to try the specific product of GM tomatoes and Cook et al. (2002) conducted a study in New Zealand that examined intentions to try GM food generally. Regarding the British studies, Sparks et al. (1995) examined expectations, rather than intentions, with regard to GM foods (presumably it was considered that this made more sense at the time due to the relatively novel nature of the food) and Sparks and Shepherd (2002) examined individuals intentions to purchase certain specific GM food stuffs (genetically engineered pork and tomatoes) if they become available in Britain.

Within the original TPB constructs, attitudes have been consistently significant in predicting intentions toward GM food while evidence with regards to PBC and subjective norms is varied (Cook et al., 2002; Saba & Vassallo, 2002; Sparks et al., 1995; Sparks & Shepherd, 2002). All studies found that PBC was an important factor in at least one of the intention measures examined, while evidence regarding subjective norms is less substantial with only the Italian study (Saba & Vassallo, 2002) and the New Zealand study (Cook et al., 2002) finding subjective norms to be an influential factor.

These studies have variously added the components of moral norms and self-identity to the TPB, with the aim of better predicting intentions toward GM food, with mixed success. Moral norms were found to be nonsignificant in all studies in which it was included except for the British study that examined intentions to eat specific GM foodstuffs (Sparks & Shepherd, 2002). The construct of self-identity is more promising, however, and was a significant predictor of intentions to purchase GM food in New Zealand, although it only predicted certain expectations with regards to GM food in Britain (Sparks et al., 1995).

The importance of the constructs of PBC, subjective norms, moral norms, and self-identity with regard to behavior toward GM food is likely to be dependant on the specific definition of intention employed and the particular sample of participants that are recruited. Amount of variance accounted for in behavior toward GM food was fairly high in all studies varying from around 41% (Saba & Vassallo, 2002) to around 88% (Sparks et al., 1995), indicating that the TPB is a useful model with which to predict, and analyze, behavioral intentions toward GM food.

1.4. Behavior Toward GM Food

To date, TPB studies of GM food have not included any measures of actual behavior with regard to GM food. This is probably due to practical reasons in which GM food is not currently widely available in Britain. However, behavior in response to GM food has been examined in other (non-TPB) studies.

One way of examining behavior toward GM food is through the use of contingent valuation techniques. Contingent valuation techniques are ways of discovering the value of a good by asking people how much they would be willing to pay, or accept, for that good (see Venkatachalam, 2004 for a review). An
An interesting study conducted by Noussair et al. (2004) investigated willingness-to-pay information for GM foods in a representative sample of French consumers. Overall, 65% of participants in this study were willing to accept GM food at some price. The results of this study contrast quite starkly with other surveys that indicated that people in France were predominantly negative toward GM foods (Gaskell et al., 2000; Noussair et al., 2001). Noussair et al. (2004) suggest this disparity may have arisen from differences in what was measured; whereas surveys elicit responses from participants as citizens, who are likely to make judgments from the point of view of society as a whole, purchase decisions elicit responses from participants as private consumers.

A similar contingent valuation technique was employed by Moon and Balasubramanian (2003) in investigating consumer behavior in the United Kingdom. Results indicated that 13.3% of consumers were likely to accept GM technology whether there was a price reduction or not, and 13.8% of consumers were price conscious and would buy GM food if this was cheaper than other types of food. These responses were made in relation to a question regarding willingness to pay a premium for non-GM foods, however, and it is noted that responses may differ if the question was worded differently, for example, if the situation was described in regards of GM foods being cheaper than non-GM foods.

In addition, the fact that these contingent valuation studies utilized questions that addressed participants’ willingness to pay can be criticized as possibly underestimating valuations. There is a well-documented disparity between willingness-to-pay estimates and willingness-to-accept estimates (Mitchell & Carson, 1989; Shogren et al., 1994). The former producing estimates that are generally lower than the latter form of estimates. Differences may have arisen because of loss-aversion differences⁴ and if loss aversion is treated as a bias then an equivalent gain task may be a more appropriate valuation technique (Bateman et al., 1997). Equivalent gain methods treat both the money and the good symmetrically as gains, effectively removing the influence of loss-aversion effects. It is acknowledged, however, that willingness-to-pay information may be considered as an ecologically valid method of eliciting valuations.

Another problem associated with studies investigating behavior using stated preferences is the often hypothetical nature of the questions employed; this type of responding is susceptible to influence from social desirability effects and demand characteristics. In circumstances when behavior cannot be directly observed, it is beneficial to place participants in a more realistic consumer role in which the choices they make have tangible, real-life outcomes. This should encourage more honest and realistic responding.

Behavior toward GM food has also been examined within experimental situations in which participants are simply offered a GM food sample. Within the United Kingdom, Townsend and Campbell (2004) conducted an experiment that required participants to compare the taste and appearance of apples that were purportedly grown either organically, traditionally, or using GM technology. In reality, the apples used were identical and the real purpose of the experiment was to examine how many participants would be willing to taste the (purportedly) GM apple. A vast majority of 93% of participants agreed to try the apple even though it was emphasized that they were not obliged to and the experiment could proceed without them doing so. These results differ quite dramatically from survey results, which indicated that British consumers were ambivalent toward GM food (Gaskell et al., 2003; Poortinga & Pidgeon, 2004).

Similar results were found within a study that offered participants GM cheese, conducted in Denmark, Finland, Norway, and Sweden (Lahteenmaki et al., 2002). An overwhelming majority of participants within this study agreed to try the GM cheese and around two-thirds of participants chose to take some home. Again, results contrasted with explicit attitudes, examined within the same study, which indicated that British consumers were negative toward GM food.

Overall, evidence with regards to behavior toward GM food in Britain is mixed. Experimental studies with real-life outcomes indicated that participants are likely to try GM food (Townsend & Campbell, 2004), while contingent valuation methods indicated that only a small percentage of participants would accept GM food (Moon & Balasubramanian, 2003). Differences between studies are likely to be due to a variety of differences in the methodologies used. For example, the contingent valuation study was hypothetical whereas the experimental study was not, and the contingent valuation task utilized a monetary perspective whereas the experimental study did not.

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⁴ Willingness-to-pay estimates may include a loss aversion to money effect, whereas willingness-to-accept estimates may include a loss aversion to goods effect.
Behavior toward GM food has repeatedly been found to be more positive than explicit attitudes have indicated, both in Britain and abroad. Differences in findings may be at least partly because as Noussair et al. (2004) suggest, methods used to examine attitudes and behavior put participants in different roles; participants may respond to surveys as public citizens but respond to valuation tasks as private consumers. It seems likely, however, that other factors influence behavior alongside attitudes and factors included within the TPB, such as subjective norms and PBC, may help to explain the differences noted between attitudes and behavior.

1.5. Study Aims

The aim of the current study was to apply a modified TPB model to a British sample, where an actual behavioral measure was included within the study in order to gain a more comprehensive and realistic idea of behavior with regard to GM food, and the relative importance of behavioral influences in this domain. Behavior was measured using an equivalent gain task and in order to increase the accuracy of results provided by participants they were told that they would receive the outcome of their choice as an incentive to provide truthful responses.

The TPB model that was applied here was an extended version of the original that included the constructs of self-identity, perceived moral obligation, and emotional involvement as additional predictors in order to examine their potential worth in this domain (see Fig. 1). Data collected for the TPB variables were hypothesized to provide a good fit to the theorized model. In addition, the group of participants were expected to be ambivalent toward GM foods overall and for this reason mean levels of attitudes, self-identity, and intention were anticipated to be neutral. PBC was hypothesized to be positive as previous research indicated that GM food was considered a relatively controllable issue (Townsend et al., 2004). We predicted that subjective norms and moral norms were likely to be significantly negative toward GM food because it is thought that previous negative evaluations of GM food may have been, at least partly, due to societal considerations (Noussair et al., 2004). Levels of emotional involvement were predicted to be neutral as participants were not likely to have any links, or engagement, with the issue of GM foods. With regards to behavior, we predicted that non-GM chocolates would be preferred to GM chocolates, as GM food is generally perceived more negatively than ordinary food (Noussair et al., 2001; Moon & Balasubramaniam, 2003). However, on the basis of past studies, we also predicted that most people would accept GM food at some price (Noussair et al., 2004).

2. METHOD

2.1. Design

This experiment had a within-subjects design. TPB variables were examined using direct questions with the exception of the behavioral measure, which was examined using (a) an equivalent gain task and (b) the number of participants willing to accept GM at some price.

2.2. Participants

In total, 99 participants took part in this study, recruited from two different call centers within the City of Nottingham in England. The population in this area encompasses a variety of ethnicities and is thought to represent a good cross-section of the British population. Employees at the call centers utilized were of a varying level of education, some were school leavers while others had undertaken some further education; all were employed full time. Participants were recruited topic blind in order to avoid sampling biases in favor of those individuals who are particularly interested in GM food issues (Campbell & Townsend, 2003; Townsend & Campbell, 2004; Townsend et al., 2004). In total, 63 males and 36 females took part in the study and ages ranged from 17 to 55 with a mean of 25.04 (SD = 7.24).

2.3. Materials

The materials used consisted of a questionnaire that included three sections. The first section consisted of an equivalent gain behavioral lottery task (Bateman et al., 1997). This consisted of two pages of options that asked participants to choose between a series of options consisting of a monetary amount and a box of chocolates, e.g., “We give you £0.60 or we give you a box of 8 chocolates.” One page offered a box of eight GM chocolates as an alternative to the monetary options and one page offered a box of eight non-GM chocolates as an alternative; which version was presented first was counterbalanced between participants. Twenty options were provided on each page and these increased in increments of £0.30 starting from £0.00 and finishing at £5.70. As an incentive to
be truthful in their choices, it was emphasized to participants that they would actually receive one of these options, drawn from one of the lotteries. A random number generator (Haahr, 2000) was used in order to pick which option each person actually received. These were all drawn from the page that gave non-GM chocolates as an alternative, due to the difficulty of actually obtaining GM chocolate in this country. Chocolates provided were a box of eight “Classic” chocolates bought from Thorntons Plc. at a cost of £3.00 a box.

The second section consisted of a series of questions examining TPB variables as well as the additional postulated factors included; see Appendix for full details of questions used. Questions were constructed by examining guidelines for assessing the TPB provided by Ajzen (2002) and by examining previous applications of the TPB to food and GM food. Questions were formulated to directly (rather than indirectly using underlying beliefs) assess factors; these questions were then piloted to examine the consistencies of responses and only those that produced consistent responses, with Cronbach’s alphas of 0.7 or higher, were included in the final questionnaire.

Intention was assessed using two questions that examined individuals’ intention to try GM food, e.g., “When eating, I intend to make sure that my food does not contain GM ingredients.” Responses were measured on seven-point, semantic differential scales with appropriate adjectives at each end; in this case “True” and “False” were used. Attitude was measured in the manner suggested by Ajzen (2002). This consisted of a question, “In general I believe that the use of gene technology in food production is” that had to be responded to six different semantic differential scales marked with a selection of adjective pairs. Adjectives were selected using a pretest from a much larger selection drawn from the list of published adjective scales that were found to load highly on the evaluative factor of attitudes (Osgood et al., 1957). The assessment of subjective norms used three direct questions that were considered to evaluate perceptions of what close friends and family feel about GM food, e.g., “The people in my life who are important to me would not mind if I ate GM food” (Agree–Disagree). PBC was evaluated using three questions designed to evaluate participants’ perceived difficulty with and control over their choice regarding whether to eat GM foods or not, e.g., “How much control do you feel you have over eating a GM free diet?” (Complete control–No control).

The component of self-identity was assessed using questions that examined the respondent’s self-belief about whether they were the kind of person who would eat GM food. This was done using two questions, e.g., “I am the type of person that would eat GM food” (True–False). Moral norms were assessed using three questions that evaluated how respondents felt morally about GM foods, e.g., “I do not consider the production of GM foods morally wrong” (Agree–Disagree). The additional component of emotional involvement was assessed using four questions, e.g., “How emotional do you feel about the decisions taken to produce GM food?” (Emotional–Not very emotional). These were designed to examine to what degree the respondent was engaged with the issue at hand.

In order to assess social desirability in participants’ responses on the TPB, a third section was also included and this contained a shortened version of the Marlowe-Crowne social desirability scale (Strahan & Gerbasi, 1972) headed with the title “Personal beliefs.” This version was included rather than the full version in order to take less time to complete and because this version was found to be of a similar internal consistency to the original measure. To our knowledge, no previous study has examined the extent to which participants present themselves in a socially desirable manner when responding to questionnaires within this domain.

2.4. Procedure

An individual at each call center was recruited in order to provide questionnaires to their colleagues. All call center staff were asked to participate, apart from managerial staff, and the majority agreed to fill in questionnaires. For recruitment purposes, individuals were simply asked whether they would fill in a questionnaire and the topic of GM food was not revealed. None of those who initially agreed to take part withdrew after starting the questionnaire and encountering the topic of GM food. The order of the questionnaire presented questions assessing TPB components first, followed by the equivalent gain task; this presentation order was consistent across participants. The equivalent gain task did not present any details about the GM chocolate utilized within the task. If questioned on the chocolates, the experimenter told participants that GM chocolates were samples obtained from a biotechnology company and that these were currently available in the United States. Participants provided their name and contact details at the
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end of the questionnaire and it was made clear that this was to provide them with their lottery prize only and that their actual responses would be associated only with a randomly assigned participant number. A random number was generated for each participant and this determined which option their prize was drawn from. Participants received the choice they had made for that numbered option. Prizes, consisting of either money or chocolates, were provided to the contact within each call center to pass on to his or her relevant colleagues and signatures were obtained to make sure that this was done. Upon receiving their prizes, participants were informed that all chocolates provided as prizes were non-GM and that the offer of GM chocolates was actually a deception in order to provoke honest responses. Participants were also told that GM chocolates are not currently available in the United Kingdom. Prizes were distributed after all data collection was completed to ensure that the deception involved in the experiment was not revealed to participants prior to completing the questionnaire.

3. RESULTS

3.1. Equivalent Gain Task

The critical value within the equivalent gain task was the lowest amount of money that a participant would accept instead of a box of chocolates. This was used as an indication of the valuation of that box of chocolates. The amounts of money participants were willing to accept in preference to a box of GM chocolates were positively skewed with a median of £1.20 and ranged up to the maximum possible valuation of £5.70. With regard to monetary amounts, participants were willing to accept in preference to a box of non-GM chocolates, again a positive skew was evident and the median amount was £2.10 with a range of £5.70. The actual difference between the monetary amounts accepted in preference to GM and non-GM chocolates was, therefore, £0.90 (£2.10 – £1.20). A Wilcoxon signed-rank test showed that the monetary amounts accepted in preference to GM chocolates were significantly lower than the monetary amounts accepted in preference to non-GM chocolates (z = −5.096, p < 0.001).

In order to remove the influence of interindividual variation in preference for chocolates generally, the behavioral measure was calculated as the amount of money the participant preferred over a box of GM chocolates minus the amount of money the participant preferred over a box of non-GM chocolates. This measure was again very positively skewed and very kurtotic with an almost unimodal distribution at zero; the median of this measure was zero. One outlier, which was over three standard deviations away from the mean, was present in the data and this was removed.

Overall, 43.4% (43/99) of participants would accept less money instead of GM chocolates as compared to non-GM chocolates; 48.5% (48/99) of participants would accept the same amount of money instead of GM and non-GM chocolates; and 8.1% (8/99) of participants would accept more money instead of GM chocolates than instead of non-GM chocolates (see Fig. 2). In addition, of those who would accept either kind of chocolates at all (94.9%), 74.5% of participants (70/94) would prefer GM chocolates over money at some level and only 25.5% (24/94) would not. In other words, most people accepted GM chocolates at some price.

3.2. Attitudes and Intentions

Questions examining TPB components were reverse scored as necessary so that on the scale from one to seven, the middle point indicating neutrality was four, with one indicating a negative stance toward GM foods, and seven indicating a positive stance toward GM foods. With regards to emotion, one indicated a low amount and seven indicated a high amount of emotional involvement felt, and with regards to PBC, one indicated a low amount and seven a high amount of perceived control.
Table I. Mean Response Levels of Factors Examined

| Factor          | Mean Level | SD  |
|-----------------|------------|-----|
| Attitude        | 3.84       | 1.34|
| Subjective norms| 4.39*      | 1.21|
| PBC             | 3.77       | 1.37|
| Emotional involvement| 3.28*    | 1.41|
| Self-identity   | 4.38       | 1.65|
| Moral norms     | 4.48*      | 1.40|
| Intention       | 4.39       | 1.45|

*Significant at Bonferroni corrected level of significance, 0.00625 (0.05/8).

Note. Scales were continuous seven-point Likert scales, where 1 indicates negativity toward GM, 7 indicates favor toward GM, and 4 is neutral (for all variables apart from PBC and emotional involvement, for which 1 indicates a low level and 7 indicates a high level).

Internal consistencies for each component were examined using Cronbach’s alpha. All measures displayed reasonable to good levels of internal consistency, except for intention, which displayed a lower internal consistency level of 0.51, indicating that the interpretation of this factor should be treated with some degree of caution.

Means and standard deviations are shown in Table I. In order to test the significance of the levels of each factor examined, several one-way t-tests were used. Subjective norms and moral norms were significantly positive. Levels of emotional involvement were quite negative with a mean of 3.28 and mean levels of intention were 4.39, which is marginally significant (t(98) = 2.67, p < 0.009). No other differences approached significance. Correlations between TPB variables are displayed in Table II.

3.3. Predicting Intention from TPB Variables

As nonnormal distributions were evident within variables, these were standardized before further analysis. A linear regression with a forced method of entry of variables indicated that TPB variables predicted around 51% of variance in intentions, which was a significant amount of variance accounted for (see Table III). When the TPB was modified to include self-identity, emotional involvement, and moral norms, around 66% of variance in intentions was accounted for by the model (a significant increase). In the original TPB model, attitude was found to be the strongest predictor of intentions, followed by subjective norms and PBC; however, in the extended TPB model, self-identity became the strongest predictor of intentions, followed by attitude, emotional involvement, and PBC. Moral norms were not found to be a significant predictor of intentions. Subjective norms became nonsignificant when the additional components were added, indicating that some collinearity may exist between the construct of subjective norms and the components added to the original TPB model. Variance inflation factor levels were examined to check for multicollinearity and although these were fairly high they were of an acceptable level.

In a second linear regression, we regressed intentions and PBC on behavior with a forced entry method. This showed that intention was found to significantly predict behavior, when behavior was measured as the difference between amounts of money accepted instead of GM food and instead of non-GM food, see Table IV. PBC, however, did not predict behavior significantly. The regression analysis revealed that 17.7% of variance in behavior, a small but significant proportion, was predicted by intention and PBC together.

We also examined whether TPB variables could predict willingness to accept GM. To this end, whether or not people would accept GM chocolates over some amount of money or not was also used as a dichotomous measure of behavior. A logistic regression, with a forced entry method, was employed to examine how well the TPB model could predict behavior measured in this way (see Table V). Again, intention was a signif-
Table III. Linear Regression of Predictors on Intention

| Predictor               | Original VIF | Extended VIF |
|-------------------------|--------------|--------------|
|                        | TPB (TPB)    | (Extended TPB) |
| Attitude                | 0.533        | 0.234        | 2.180 |
|                         | 1.403        | 0.039        | 1.633 |
| Subjective norms        | 0.211        | 0.497        | 1.081 |
|                         | 1.424        | 0.125        | 1.081 |
| PBC                     | -0.169       | -1.983*      | 0.715 |
|                         | 1.030        | -            | 0.813 |
| Moral norms             | 0.065        |              | 1.876 |
|                         |              | 0.039        | 1.712 |
| Self-identity           | 0.393        |              | 4.449** |
|                         |              | 0.783        |       |
| Emotional involvement   | 0.202        |              | 2.119 |
|                         |              |              | 2.539* |
| $R$                     | 0.715        |              |       |
| $R^2$                   | 0.511        |              |       |
| $F$ change              | 33.141**     |              |       |

Table IV. Linear Regression of Intention and PBC on Behavior

| Predictor   | Behavior       | $\beta$ | $t$   | $\beta$ | $t$   |
|-------------|----------------|---------|-------|---------|-------|
| PBC         |                | -0.032  | -0.341|         |       |
| Intentions  |                | 0.436   |       | 4.598***|       |
| $R$         |                | 0.446   |       |         |       |
| $R^2$       |                | 0.199   |       |         |       |
| $F$ change  |                | 11.896***|       |         |       |

Note: When defined as difference in amounts of money accepted over GM or non-GM food.

The significant predictor of this measure of behavior, whereas PBC was not. The model was able to correctly classify 74.7% of cases and a chi-square test indicated that the model significantly improved predictive power. McFaddens pseudo $R^2$ was also calculated and this was found to be 0.137, indicating that the inclusion of intention and PBC as predictor variables improves the model.

3.4. Self-Presentation

Self-presentation levels, as measured by a shortened version of the Marlowe-Crowne, were found to be fairly high with a mean of 9.67 ($SD = 3.54$). We carried out correlation analyses to determine whether there was a relationship between the levels of self-presentation and responses on TPB variables. No significant relationships were uncovered in this analysis.

Table V. Logistic Regression of Intention and PBC on Behavior

| Predictor | Behavior     | B | Wald | Exp(B) |
|-----------|--------------|---|------|--------|
| PBC       |              | B | 0.018| 0.005  |
| Intentions|              | B | 0.996| 12.074***|
| $\chi^2$  |              | 74.7%|       |

Note: When defined as whether the participant would accept GM food over some amount of money.

4. DISCUSSION

The proposed TPB model fitted data well and predicted a significant proportion of intentions and a small, but significant, proportion of behavior as measured by an equivalent gain task. This study indicates that behavior toward GM food may be more positive than previously thought and highlights the factors that are most important in influencing this behavior.

4.1. Acceptance of GM Food

Results indicated that participants preferred non-GM chocolates to GM chocolates and this supports findings from previous research (Moon & Balasubramanian, 2003). Despite this, the majority of participants were indifferent between GM and
non-GM alternatives. In fact, a small number of people preferred the GM alternative offered, which may be due to a general curiosity in trying GM chocolates (which are not yet available in Britain) and a propensity toward risk-seeking behavior (Bromiley & Curley, 1992). Interestingly, of those people willing to accept either type of chocolates in preference to money, around three-quarters of participants would accept GM food at some price. These results indicate that more people than previously thought are likely to accept GM food if it becomes more widely available within Britain. This finding supports results showing that a majority of British participants were willing to try GM food when offered (Townsend & Campbell, 2004). Similarly, behavior toward GM food was found to be much more positive than explicit attitudes and this is in keeping with results found by Noussair et al. (2004) in France. As Noussair et al. (2004) suggest, it is likely that participants respond to surveys as a citizen, bearing in mind social interests, but when responding to a more ecologically valid shopping task, respond as a consumer with a greater emphasis on private interests. In fact, as demonstrated within this study, a variety of other factors impact on behavior alongside attitudes.

Results are more positive than that found in the study by Moon and Balasubramanian (2003), which investigated behavior toward GM using contingent valuation methods within Britain. This disparity may have arisen because we used an equivalent gain method, which is likely to differ from previous contingent valuation tasks that have employed willingness-to-pay methods because of the loss aversion to money effects inherent in willingness-to-pay methods. In addition, differences between the behavioral task used here and the task employed by Moon and Balasubramanian (2003) may have arisen due to the enhanced reality of the situation provided by our task, which was likely to have elicited more authentic responses than the hypothetical questions utilized in previous tasks. (Here, we told participants that we would provide them with a prize selected at random from one of their preferences made within the equivalent gain task.)

It could be argued that social desirability effects and demand characteristics may still have influenced responding in this task; however, assuring participants of anonymity and providing real consequences to options made are likely to have greatly reduced these influences. We also found that participants’ responses on the shortened version of the Marlow-Crowne social desirability scale did not correlate with responses given. For these reasons, the responses provided in this task are likely to provide a more accurate idea of valuations of GM foods than previous tasks.

4.2. Theory of Planned Behavior

Our results showed that the standard TPB model accounts for around 51% of variance in intentions and all our hypothesized predictors (attitudes, subjective norms, and PBC) accounted for significant proportions of variance. The importance of attitudes supports previous research; however, the significance of the factors of subjective norms and of PBC adds to previously mixed results (Cook et al., 2002; Saba & Vassallo, 2002; Sparks & Shepherd, 2002; Sparks et al., 1995). This is the first study to have examined general intentions toward GM food in Britain, however, and it is possible that previous negative results may have been due to specifics in the contexts used.

Attitudes and subjective norms positively predicted intentions so increases in these factors indicate that positive increases in intentions will occur and PBC negatively predicted intentions, indicating that as PBC increases, the likelihood of intending to try GM food will decrease. This has interesting ramifications with regards to the current debate over the labeling of GM food. Labeling GM food increases an individual’s control over his or her behavior toward GM food, which will also increase PBC. Labeling GM food is, therefore, likely to decrease intentions to try GM food.

When the TPB was extended to include the additional predictors of self-identity, moral norms, and emotional involvement, the amount of variance in intentions accounted for increased significantly to around 66%. Here, emotional involvement and self-identity accounted for significant proportions of variance in intentions, along with attitudes and PBC. The importance of self-identity in predicting behavior toward GM food supports findings from previous studies, all of which found self-identity to be a valuable construct in at least some of the intentions examined (Cook et al., 2002; Sparks et al., 1995). This was the first ever study to examine the construct of emotional involvement within the TPB and results showed that it was a useful factor with which to predict behavioral intentions toward GM food; it is recommended that this concept be examined in other future TPB
All of the additional factors had positive influences on intentions, indicating that as levels of these factors increase, so would intentions to try GM food. Moral norms did not predict intentions, which adds to previously mixed results (Saba & Vassallo, 2002; Sparks & Shepherd, 2002; Sparks et al., 1995) and indicates that this factor may only be a useful predictor in particular contexts or within particular populations in which morality plays a larger role, e.g., religious groups and environmental groups. In addition, subjective norms dropped out of the model as a predictor of intentions when the additional components were added. This may have been due to some collinearity between subjective norms and the new components added and future research should examine possible collinearities between predictor constructs utilized within the TPB.

Intentions were also found to positively, and significantly, predict behavior both when this was characterized as the difference in amounts of money participants were willing to accept in preference to GM chocolates in comparison to non-GM chocolates and when this was characterized as whether participants were prepared to accept GM food over any amount of money. This means that as behavioral intentions to try GM food increase, approach behavior toward GM food is more likely.

4.3. Levels of Individual TPB Model Components

Results suggest that overall attitudes of those in our sample are fairly neutral toward GM foods and this is in line with Eurobarometer studies that indicate that explicit measures of attitudes in the British population generally find people to be ambivalent toward GM foods (Gaskell et al., 2003). In addition, levels of self-identity were neutral, indicating that participants did not identify themselves, particularly, as people who would try GM food or who would avoid GM food. Contrary to our predictions, levels of subjective norms were significantly positive toward GM foods, demonstrating that participants felt that their close friends and family would not object to them eating GM foods. Similarly, moral norms were found to be significantly positive, suggesting that participants felt no moral obligation to avoid eating GM foods. This suggests that the negative results found by previous examinations of attitudes and intentions toward GM foods are unlikely to be attributable to wider social considerations, which contradicts previous research (Magnusson & Hursti, 2002; Shepherd, 1999). The difference in findings may be due to differences in study methods; in particular, the topic-blind recruiting procedure, which ensured that individuals who were particularly interested and engaged with the issue of GM foods did not self select themselves for the study. In fact, levels of emotional involvement within this study were found to be significantly negative, suggesting that participants felt significantly uninvolved in the topic and are not concerned about GM. Again, this contrasts with past studies reporting high levels of hostility toward GM (Grant et al., 2003).

Participants’ levels of PBC were neutral, so people did not appear to feel either particularly in control or not in control over their choice in eating GM foods. This differs from previous research that finds GM foods to be rated as a relatively controllable concern (Townsend et al., 2004). However, Townsend et al. (2004) examined controllability quite generally, rather than personal controllability, and also presented GM food in the context of other issues, which may explain differences in findings between these studies.

For our participants, the overall intention to try GM food was marginally positive. This contrasts with the behavioral measure employed here that was defined as the monetary amount participants were willing to accept in preference to GM food subtracted from the monetary amount participants were willing to accept in preference to non-GM food. Intentions were in line with the other behavioral measure employed, though that was defined as whether participants were willing to accept GM food at some cost. This makes intuitive sense as intentions were measured as a willingness to try GM food in a similar way to the latter behavioral measure, whereas the former behavioral measure examined the value of GM foods in comparison to non-GM foods.

4.4. Generalizability of Findings

It is acknowledged that the sample examined here was not truly representative of the British population. To this end, it would be beneficial for future research to examine a stratified sample of the British population in the same way in order to draw reliable conclusions as to valuations of GM foods. But of critical importance to the reliability of our results was the
fact that a community-based sample was used, which
was recruited topic blind. Crucially, this means that
the results of this study were unlikely to have been
influenced by self-selection biases that have plagued
prior research on GM and will, therefore, give a
good indication as to behavior toward GM food. It
is noted, however, the recruitment of naïve respond-
ents for this survey may also led to responses
that were not very well thought out. In fact, the sim-
ple act of completing this survey may have provoked
further thought, and perhaps discussion, about GM
food that may stimulate a change in potential future
responses.

We also acknowledge that our results are lim-
ited by the situation in which they are examined. The
generalizability of behavioral results found within
this study is limited to purchase situations involv-
ing GM food; it is likely that behavior toward GM
food in different situations may differ (e.g., if encoun-
tered at a dinner party). Further to this, it is possi-
ble that differences may be found between different
food products. Chocolate may be considered a lux-
ury good and it is quite possible that people may re-
spond differently to GM versions of more basic food
products. It is noted, however, that previous research
has shown that a majority of participants would ac-
cept GM cheese (Lahteenmaki et al., 2001) and a
GM apple (Townsend & Campbell, 2004), indicating
that results may be similar with regards to other food
products.

4.5. Future Research

Participants within this study exhibited mainly
neutral or positive perceptions of GM food. An in-
teresting point made by an anonymous reviewer was
that this may be due to either a lack of knowledge
about GM or indeed a great deal of considered knowl-
edge about GM. Due to the low emotional involve-
ment with the topic of GM noted within the partic-
ipants within this study, it is likely that the sample
observed here had low knowledge about GM; how-
ever, this is an interesting point for future research. It
would have been useful to have measured knowledge
as a separate factor, alongside the other constructs
here, to examine the impact that this might have on
behavior.

Results within this study found that behavior
within a British sample was much more positive than
their attitudes indicated and this supports previous re-
search by Noussair et al. (2004) in France. It is likely
that a similar disparity between attitudes and behav-
ior toward GM food will exist within other coun-
tries and future research should examine this possi-
ability. Although attitude surveys indicate that the
majority of European countries are negative or am-
bivalent toward GM food, actual consumer behavior
toward GM food is likely to be more positive than
this and GM food may be widely accepted if intro-
duced.

Although our model fitted data well, the variance
in behavior accounted for in our models remains fairly
low. Some may be attributed to error variance; how-
ever, it is likely that further portions of variance may
be explained by further factors that were not exam-
ined here. Constructs such as the perceived benefits
of GM food or the individuals’ trust of policymakers
and industry may help to explain additional variance
in intentions and behavior (Siegrist, 2000; Poortinga
& Pigeon, 2004).

In addition, behavior is likely to consist of both
deliberative and spontaneous processes. Only delib-
erative processes are examined by explicit questions,
such as those asked during this study; hence, it is pos-
sible that spontaneous processes account for some
of the variance in behavior unaccounted for in the
present study. Indeed, research has demonstrated that
spontaneous processes are better predictors of ac-
tual behavior than deliberative processes in some
circumstances (Dovidio et al., 2002). Spontaneous
processes can be measured using such tools as re-
action time tasks, e.g., the Implicit Association Test
(Greenwald et al., 1998), and results from tasks of
this type have proved useful in predicting behavior
(Fazio & Olson, 2003). Future research into choices
relating to GM food should utilize a combination of
tasks that evaluate deliberative processes and tasks
that evaluate spontaneous processes in predicting
behavior.

5. Conclusions

In conclusion, we found that most participants
would choose GM food over some amount of money.
GM food was found to be valued significantly less than
non-GM food, though the majority of our sample was
indifferent between GM and non-GM options. Re-
sults from this experiment indicated that a higher pro-
portion of individuals were prepared to accept GM
foods than some previous studies have indicated. Dif-
fences can be attributed to the fact that (a) in the
present study a private, rather than a public, decision
was made with regards to GM food (using an equivalent gain task to avoid loss aversion effects), and (b) this study used a real-choice situation, rather than hypothetical questions. Hence, this method of measuring valuations may be considered to have yielded more realistic responses than previous measures. With regard to important behavioral influences, we found that attitudes, subjective norms, PBC, self-identity, and emotional involvement were all significant determinants of behavioral intention and behavioral intention was a significant predictor of actual behavior.

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### APPENDIX

| Construct          | Items                                                                 | Scale                |
|--------------------|----------------------------------------------------------------------|----------------------|
| Subjective norms   | “The people in my life whose opinions I value would not mind if the food they eat was GM.” | “True–False”         |
|                    | “Most people who are important to me consider GM food to be:”          | “Pleasant–Unpleasant”|
|                    | “The people in my life who are important to me would not mind if I ate GM food:” | “Agree–Disagree”     |
| PBC                | “How confident are you that it is possible to avoid eating GM food?”   | “Very confident–Not very confident” |
|                    | “Do you consider yourself able to monitor your diet and avoid GM foods?” | “Not at all able–Very able” |
|                    | “How much control do you feel you have over eating a GM free diet?”   | “Complete control–No control” |
| Attitude           | “In general I believe that the use of gene technology in food production is:” | “Good–Bad”          |
|                    |                                                                       | “Positive–Negative” |
|                    |                                                                       | “Safe–Dangerous”    |
|                    |                                                                       | “Beneficial–Harmful”|
|                    |                                                                       | “Right–Wrong”       |
|                    |                                                                       | “Wise–Foolish”      |
| Self-identity      | “I am the type of person that would eat GM food.”                     | “True–False”        |
|                    | “I am the kind of person who will only eat food that has been grown naturally without genetic modification.” | “True–False”        |
| Moral norms        | “I shouldn’t really eat GM foods for moral reasons.”                  | “Strongly agree–Strongly disagree” |
|                    | “Morally, I have no problem with GM food stuffs.”                    | “Agree–Disagree”    |
|                    | “I do not consider the production of GM foods morally wrong.”         | “Agree–Disagree”    |
| Emotional involvement | “Do you feel that decisions about GM food are largely irrelevant to you?” | “Definitely–Definitely not” |
|                    | “Might decisions taken by governing bodies about the future of GM foods upset you?” | “Not at all–Very much” |
|                    | “To what extent do you feel like you’re emotionally involved in whether GM food should be produced or not?” | “Very much–Not at all” |
|                    | “How emotional do you feel about the decisions taken to produce GM food?” | “Not very emotional–Emotional” |
| Intention          | “When eating, I intend to make sure that my food does not contain GM ingredients.” | “True–False”        |
|                    | “I intend to eat GM food at some time.”                               | “True–False”        |
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