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Are Identical Twins More Similar in Their Decision Making Styles Than Their Fraternal Counterparts?
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Abstract

Using a twins study paradigm the genetic basis of decision making styles was explored using

psychometric scales as well as actual choices. Study 1 compared monozygotic (MZ) and

dizygotic (DZ) twins along the General Decision Making Scale (GDMS) and the Maximizing-

Satisficing Inventory (MAX). MZ twins exhibited greater similarity than their DZ counterparts

in terms of their overall GDMS scores, three of the GDMS subscales, and the MAX inventory.

Study 2 measured key information processing metrics of actual choices that individuals made via

a computerized informational display board. MZ twins are more similar to one another than DZ

twins when it comes to the extent of information search prior to making a choice. There were no

differences between the two groups of twins in terms of the selectivity and pattern of searches.

The results of the two studies suggest that individuals' decision making styles are in part shaped

by their genes.

Keywords: twins study, behavioral genetics, Maximizing-Satisficing, General Decision Making

Scale, multi-attribute choice, information search

Humans make thousands of decisions daily from the most mundane (content of one's breakfast) to the most profound (asking one's partner into marriage). To slightly reword Descartes' famous maxim "I choose therefore I am." For nearly five decades, behavioral decision theorists have led the concerted efforts to understand the cognitive processes inherent to human decision making including the manner by which individuals search for information prior to making a final choice (a central feature of many types of decisions). In general, the overriding theme of this literature has been to demonstrate ways by which individuals violate axioms of rational choice (See Kahneman, 2011 for a broad review). For example, contrary to the tenets implicit to *Homo economicus*, individuals do not process all of the relevant and accessible information prior to making a decision. Instead, they utilize a wide range of decisional heuristics (Payne, Bettman, & Johnson, 1993; Wästlund, Otterbring, Gustafsson, & Shams, 2015) and stopping strategies (Saad, Eba, & Sejean, 2009; Saad & Russo, 1996) in arriving at a final choice. Which heuristic an individual applies depends on the task at hand (e.g., the complexity of the decision) and the specific decisional context (e.g., the correlations between the attributes of the competing alternatives). Beyond task and context effects, the manner in which decisions are made is in part determined by individual differences in cognitive styles.

A growing number of decision theorists have recognized the import of individual differences across various facets of decision making (for a review, see Appelt, Milch, Handgraaf, & Weber, 2011). In some cases, researchers establish individual differences in decision making and reasoning competence (Bruine de Bruin, Parker, & Fischhoff, 2007; Stanovich & West, 2000). In other instances, individual differences along specific personality traits are shown to affect decision making and information search (cf. Ferrari & Dovidio, 2001; Verplanken, Hazenberg, & Palenewen, 1992). However, rarely are the origins of such individual differences

addressed. Using twin registries, the current work tackles this lacuna by demonstrating that some individual differences in decision making and information search are likely rooted in our genes. The use of twins studies has proliferated in areas that until recently had largely ignored the genetic underpinnings of our choices, preferences, and behaviors. These include financial and economic decision making (Cesarini et al., 2008; Cesarini, Johannesson, Lichtenstein, Sandewall, & Wallace, 2010; Zyphur, Narayanan, Arvey, & Alexander, 2009), political participation (Fowler, Baker, & Dawes, 2008), leadership style (Johnson et al., 1998), propensity to switch jobs or occupations (McCall, Cavanaugh, Arvey, & Taubman, 1997), entrepreneurship proclivity (Nicolaou, Shane, Cherkas, Hunkin, & Spector, 2008), consumer decision making (Miller, Zhu, Wright, Hansell, & Martin, 2012; Simonson & Sela, 2011), cognitive biases and fallacies (Cesarini, Johannesson, Magnusson, & Wallace, 2012), investment biases (Cronqvist & Siegel, 2014), specific product consumption such as coffee, cigarettes, and alcohol (Perry 1973), choice of mates and friends (Rushton & Bons, 2005), and social media use (York, 2017). See Plomin, DeFries, Knopik, & Neiderhiser (2016) and Polderman et al. (2015) for broad overviews of the heritability of many human phenomena including psychological traits.

Each of the latter decisions and countless others are shaped by individual differences in decision making styles, which we are positing possess genetic underpinnings. Accordingly, our objective in this paper is to investigate differences between monozygotic (MZ; identical) and dizygotic (DZ; fraternal) twins along psychometric scales that capture decision making styles (study 1) as well as behavioral data in information search patterns using a computerized process-tracing interface (study 2).

Comparing MZ to DZ twins is one of the most effective ways to study the relative contribution of genetic and environmental factors to individual differences (Rijsdijk & Sham,

2002). In such studies, MZ twins are compared to DZ twins to extract the proportion of the variance that is explained by genes, shared environments, and non-shared environments for a given cognitive ability, behavior, attitude, or other trait in question. MZ twins share 100% of their genes, while DZ twins share only 50% of their genes, on average (just like two siblings of different ages). The assumption underlying such studies is that twins, regardless of their genetic relatedness, are raised in approximately the same environment (with no birth order influences), and thus any differences observed between pairs of MZ and DZ twins can be in part attributed to genetic similarities/differences. In other words, if our genes affect a certain trait or behavior, then we should expect MZ twins to be more similar to each other than their DZ counterparts (see Ferreira, Craig, & Hopper, 2019 for a brief summary of the pros and cons of various twin study designs.).

OVERVIEW OF THE STUDIES

Our research focuses on the antecedent processes that underlie decision making, and we take two distinct approaches to test this issue. In the first study, we examine the genetic basis of decision making styles using two psychometric scales. In the second study, we look at actual choices individuals make when they have to select a hotel from several competing alternatives, and test whether their predecisional choice processes are influenced by genetic factors.

STUDY 1 (PSYCHOMETRIC INVENTORIES)

MZ and DZ twins were administered the General Decision Making Scale (GDMS; Scott & Bruce, 1995) and the Maximizing-Satisficing inventory (MAX; Schwartz et al., 2002), as these are some of the most commonly used scales in the literature. The GDMS is a 25-item scale that captures five underlying decision making styles: rational, intuitive, dependent, avoidant, and spontaneous. Several researchers have since confirmed the five-factor structure of the GDMS (Spicer & Sadler-Smith, 2005; Thunholm, 2004), while Loo (2000) and Curşeu and Schruijer (2012) have established its construct and predictive validity respectively. The subscales are not independent of each other, but each dimension adds a unique contribution to an individual's decision making profile, hence producing an overall score that takes into account the various decision making styles of the GDMS. The MAX scale captures the extent to which individuals desire to maximize the outcome of their decision versus their willingness to accept an outcome that is good enough (i.e., satisficing). The full and original version of the scale that was administered in the current work consists of 13 items (but see Nenkov, Morrin, Ward, Schwartz, & Hulland, 2008 for a shorter form).

It is widely believed that decision making styles, including the GDMS, are learned habitual responses that depend largely on the context in which a decision is made (Driver, Brousseau, & Hunsaker, 1990; Scott & Bruce, 1995). However, recent findings have established that many judgment and decision making tasks possess a significant genetic component (Simonson & Sela, 2011). Unlike the GDMS, maximizing behavior is more stable across situations and time but the extent to which the maximizing trait has a genetic basis is unclear (Levav, Reinholtz, & Lin, 2012; Schwartz et al., 2002). Numerous studies have explored maximizing versus satisficing tendencies within the consumer realm. Maximizers are more likely to neglect the future in favor of emphasizing the present in their endless pursuit of the perfect

decision, leaving them with little resources to plan ahead or devote time to other tasks (Besharat, Ladik, & Carrillat, 2014). While maximizing individuals often do reach the best available choice, they tend to be less satisfied with their decision and suffer from more negative consequences (Iyengar, Wells, & Schwartz, 2006). Maximizers experience diminished happiness, life satisfaction, self-esteem, and optimism, and higher levels of depression, perfectionism, and regret (Schwartz et al., 2002). Compared to satisficers, maximizers are more occupied with product and social comparison, which leads to more frequent switches among alternatives (Lai, 2013). Clearly then, these two decision making scales have countless applications within the consumer realm ranging from how product choices are made to general consumer wellbeing. With that in mind, the purpose of this study is to explore the possibility that our decision making is not solely influenced by environmental and situational vagaries but also has a genetic basis. We posit two general hypotheses:

 H1: MZ twins will exhibit more similar GDMS scores (overall and across each of the five subscales) than their DZ counterparts

 H2: MZ twins will exhibit more similar MAX scores than their DZ counterparts

Sample and Results

 GDMS scale

We distributed the GDMS to two samples of twins stemming from the Montreal (Canada) twins parade (22 MZ and 6 DZ pairs respectively) and the St-Thomas' hospital twin registry in London, England[1] (30 MZ and 42 DZ pairs respectively). Thus in total, 52 MZ pairs of twins and

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[1] Within the MZ and the DZ data sets, t-tests were performed along each of the dependent variables to compare results from the Canadian and the UK samples. None of the differences

48 DZ pairs of twins were administered the GDMS scale. All twins filled out the surveys independently of one another.

The five-factor structure of the GDMS scale was confirmed via a factor analysis using varimax rotation. All of the items loaded on their expected factors except one "spontaneous" item loaded on the "intuitive" factor instead, and as such was included as part of the latter construct. All subscales showed high internal consistency scores and their respective Cronbach's alpha were: rational = .78, intuitive = .73, dependent = .81, avoidant = .76, and spontaneous = .82.

We calculated an absolute difference score for each pair of twins, on the overall GDMS scale and each of its five subscales. Additionally, we created a second overall score by computing the sum of the differences scores on each of the subscales for each pair of twins. Results are shown in Table 1 along with Cohen's d effect sizes (Cohen, 1988), which are typically classified as follows: small (d around .2), medium (d around .5), or large (d around .8). All reported t-tests are one-sided in the hypothesized direction. Identical twins exhibited statistically significantly greater similarity on both measures of the overall scores and two of the five subscales (rational and spontaneous), and marginally significantly greater similarity on the avoidant subscale (p = .06). The intuitive and dependent subscales yielded directional support for H1 but neither difference was significant, with small effect sizes. The lack of statistically significant results for two of the subscales is most likely due to the small sample sizes of the two groups of twins, as the statistical power to obtain significant results was low. Post hoc power calculations for the two non-significant findings and the one marginally significant result were

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with respect to sample origin were statistically significant, and were therefore combined in the analyses.

performed, and the probabilities of finding significant results, assuming that there are real differences between the groups, were .32, .24, and .48 for the intuitive, dependent, and avoidant subscales respectively.

Insert Table 1 about here

MAXIMIZING scale

The same sample from the St-Thomas Twins that was used for the GDMS was asked to complete the MAX scale, and most twins agreed (27 MZ pairs and 40 DZ pairs). Cronbach's alpha for the MAX scale was .67. For MZ twins, the mean difference on the overall MAX scale was 6.68 (SD = 4.84). For the DZ twins, the mean difference was 9.12 (SD = 6.29). These differences were statistically significantly different from each other (t_{64} = 1.79, p < .05), and in the hypothesized direction. In other words, MZ twins were more similar to each other in their responses compared to the DZ twins. Cohen's d effect size was .44.

Summary of Study 1

Overall, the results of study 1 support H1 and H2, namely MZ twins exhibited greater similarities in their responses along the GDMS and the MAX scales compared to the DZ twins. This suggests that genetic factors are responsible, at least in part, for decision making styles. Because sample sizes were relatively small, the probability of attaining statistically significant results, where true differences exist, was low for some of the differences that were found in the study. It is likely that with larger sample sizes of twins, most if not all of the results might have been statistically significant (given the directional support). Of note, the effect sizes for the

differences in scores between MZ and DZ twins for both the MAX and GDMS scales were similar to each other, suggesting that they both possess similar genetic influences.

STUDY 2 (BEHAVIORAL CHOICES)

The aim of study 2 is to build on the results from study 1 and test whether actual behaviors, and not just self-assessed decision styles, possess a genetic basis. Using process-tracing measures, we presented MZ and DZ twins with multi-attribute alternatives to choose from, and examined the amount of information processed prior to making a decision, the extent of selectivity in making a choice, and the pattern of processing (see below for a definition of these metrics). If genes influence actual choices, then we should expect MZ twins to be more similar to each other than DZ twins in their pre-decisional search and information processing behaviors.

Behavioral search data were obtained via MouseLab, a computerized process-tracing interface that presents participants with an M x N informational display board (IDB) consisting of m alternatives defined by n attributes each (Payne, Bettman, & Johnson, 1993). Each of the cells can be opened up via a click of the mouse. Participants are free to acquire as much information as they need until they are ready to choose one of the m competing alternatives.

As mentioned earlier, in addition to the amount of information acquired, two processing metrics were calculated. Selective versus consistent processing refers to the extent to which a decision rule is bound to the specific attribute values of an IDB. For example, the Weighted Additive Rule yields consistent processing because a decision maker must view all of the available information irrespective of the attribute values of a given IDB. The Elimination-by-

Aspects rule on the other hand yields more selective processing because the amount of cognitive effort that it necessitates depends on the specific attribute values of a given problem set. Search patterns refer to the extent to which the pattern of processing is alternative-based or attribute-based. By examining selectivity of processing and pattern of processing, researchers can identify the types of decision rules that were used in arriving at a choice including whether these were compensatory or non-compensatory. Hence, taken together, the three search metrics capture the extent of search as well as the likely rules that were used to arrive at a final choice. With that in mind, we posit that MZ twins will exhibit greater similarity in the amount of information processed (H3a), the selectivity of processing (H3b), and the pattern of search (H3c) as compared to their DZ counterparts.

Procedure - The Computerized Task

We instructed participants to choose a hotel for a two-week vacation from a list of six hotels, each of which was described along seven attributes. The attributes along with the utilized scales are shown in Table 2. Twins performed this task independently of one another.

Insert Table 2 about here

Each hotel was randomly assigned one of the levels for each of the seven attributes. Even though the attributes were listed alphabetically, participants were told they could view any attribute score for any hotel in any order, spend as much time as they wish to consider each option, or decide to not view a specific attribute or hotel. The 42 pieces of attribute information were initially hidden on the display matrix, and participants could click on any cell to view its

content. Only one cell could be viewed at a time. The task ended when the participants selected a hotel.

We chose this decisional domain because while it is a familiar task, most people do not perform it too frequently, so they are less likely to possess well-defined decision strategies in arriving at a final choice.

Measures

The data obtained included which cell was opened and for how long, and the sequence in which cells were viewed. From this information, we calculated several metrics to assess three decision making properties: 1) the amount of processing, 2) the selectivity of the processing, and 3) the pattern of processing as evident in the pre-decision search. A detailed description of each metric follows.

1) Following Payne, Bettman, and Johnson (1993) we employed three measures to assess the amount of information processed by an individual when searching for a hotel. First, we calculated the total number of times that information cells were opened prior to a decision. Two complimentary methods were used to assess the intra-sibling differences on this measure. One, by calculating the absolute difference in the number of cells opened by each twin. Two, by computing the proportion of cells opened by the two twins with the smaller amount of cells opened serving as the numerator. For example, if twin 1 opened 10 cells and twin 2 opened 20 cells, the proportion would be .5. The rationale behind such a relative measure is to differentiate between pairs of twins that otherwise exhibit the same absolute difference score. For instance, the difference between one pair of twins with 5 and 10 cells opened is the same as another pair of twins who opened 25

and 30 cells respectively. But for the first pair, one twin opened twice as many cells as the other, while for the second pair one twin opened only 20% more cells. These two measures provide a more complete gauge of the difference between twins.

A second way to assess the amount of information processed was by measuring the total amount of time it took an individual to reach a decision. An absolute difference score was computed for each pair of twins.

Third, to capture the amount of processing effort, we computed the average amount of time an individual devoted to a cell by calculating the total amount of time spent before reaching a decision divided by the number of cells opened. Afterward, an absolute difference score for each pair of twins was calculated.

2) The selectivity of processing was estimated by calculating the variance in the proportion of time each individual spent on each of the six hotels. Another variance score was calculated for the proportion of time spent on the seven attributes (Payne, Bettman, & Johnson, 1993). We computed the absolute difference in variances between each pair of twins for both the six alternatives (hotels) and for the seven attributes (of each hotel). Here is an example on a pair of twins to illustrate how the scores were calculated:

Twin 1 spent 35% of the time on alternative 1, 30% on alternative 2, 15% on alternative 3, 10% on alternative 4, 10% on alternative 5, and 0% on alternative 6.

Twin 2 spent 70% of the time on alternative 1, 20% on alternative 2, 10 % on alternative 3, and 0% on all the remaining alternatives.

Var_1 = Variance (0.35, 0.30, 0.15, 0.10, 0.10, 0) = 0.0177

Var_2 = Variance (0.7, 0.20, 0.10, 0, 0, 0) = 0.0747

To know how similar a pair of twins is, we calculate an absolute difference scored between the two variances:

$$Var_{ALT} = |\, Var_1 - Var_2 \,| = |\, 0.0177 - 0.0747 \,| = 0.057$$

A similar calculation was performed on attributes. That is, a variance score for the proportion of time spend on each attribute was calculated for each twin, and then the absolute difference score. We denote this variance score as $Var_{ATT.}$

Low variability in the search process is associated with compensatory decision rules, while high variability in the searches characterizes non-compensatory strategies.

3) To identify the pattern by which an individual searched between hotels, we compared every two consecutive cells that were opened by each subject. If an individual looked at two attributes within the same hotel, we recorded this pattern as an alternative-based transition. On the other hand, if the individual looked at two cells along the same attribute but across hotels, the search pattern is defined as an attribute-based transition. Only vertical and horizontal transitions were counted for the purpose of this analysis. Following Payne (1976), we derived the relative importance that each individual placed on each strategy as follows:

$$\frac{\text{(No. of transitions within an alternative - No. of transitions within an attribute)}}{\text{(No. of transitions within an alternative + No. of transitions within an attribute)}}$$

Ratios closer to 1 indicate an alternative-based transition pattern. Ratios close to -1 signify an attribute-based transition pattern. Subsequently, we calculated the difference between each pair of twins.

Sample

Twenty-seven MZ and 39 DZ pairs of twins, for a total of 132 individuals, from the same British registry described in study 1 (but who did not take part in study 1) participated in this study.

Results

Amount of processing

The mean differences between MZ and DZ twins on each of the metrics measuring the amount of processing are presented in Table 3, along with effect sizes and significance tests. On average, MZ twins were more similar to each other than DZ twins on the amount and proportion of information processed, and for the total time they spent evaluating the alternatives prior to a decision. The average time each pair of twins spent on each cell, a measure of how much effort is devoted to each acquired piece of information, did not differ across the two groups of twins (but was in the predicted direction). As such, the total amount of information that is processed is influenced by one's genes albeit how judiciously one examines a given piece of acquired information is not. Overall, our results support the hypothesis that MZ twins exhibit greater similarity in the amount of processing compared to DZ twins.

Insert Table 3 about here

Selectivity of the processing

MZ and DZ twins did not statistically differ on either variability scores, Var_{ALT} or Var_{ATT}. The mean intra-twin Var_{ALT} for MZ and DZ twins was .028 (SD = .04) and .020 (SD = .03) respectively (p = .23 albeit directionally opposite to our expectation, d = -.19). The mean intra-twin Var_{ATT} for MZ and DZ twins was .015 (SD = .02) and .021 (SD = .03) respectively, again a non-significant difference (p = .18, d = .22). In other words, the variances in the proportion of time devoted to assess each alternative and attribute did not vary across pairs of twins, irrespective of how genetically close they were to each other.

Patterns of processing

MZ and DZ twins[2] exhibited similar patterns of processing yielding a non-significant difference (albeit directionally opposite to our expectation). MZ twins scored on average .52 (SD = .40) on the processing pattern metric, compared to an average of .48 (SD = .47) for the DZ twins (p = .33, d = -.11).

Summary of Study 2

Our results indicate that the amount of processing, both in terms of the amount of information collected prior to making a choice and the time it took to reach a decision, has a genetic basis. On the other hand, the average time spent on each cell yielded no difference, which suggests that there is no genetic component to how judicious an individual is in processing a piece of information once he/she has chosen to acquire it. Additionally, the selectivity and pattern of processes yielded similar results for MZ and DZ pairs of twins, suggesting that environmental and situational factors play a bigger role on these processes (see below for a detailed discussion).

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[2] The data stemming from one MZ pair and one DZ pair were unusable for this variable so the operative sample sizes for this test alone were 26 MZ pairs and 38 DZ pairs.

General Discussion

We sought to examine whether there is a genetic basis to decision making using two complementary approaches. First, we examined the underlying decision making styles that determine how individuals make choices. We found that MZ twins exhibited greater resemblance to each other's styles compared to DZ twins. Specifically, the rational and spontaneous subscales of the GDMS, as well as the overall GDMS score, and the Max scale yielded significant results. The current study reaffirms the premise that decision making has, at least in part, a genetic basis and suggests that some elements of decision making are stable across situations.

Second, we looked at actual choices that individuals make when facing multi-attribute decisions. The results provide further support for our underlying general hypothesis regarding the partial influence that genes carry when it comes to some aspects of decision making. Out of three properties of decision making (amount, selectivity, and pattern), only amount of processing revealed a genetic basis. The types of decision rules used in arriving at a choice (as measured by selectivity and patterns of processing) do not seem to possess a genetic basis. Participants exhibited small variability along these two metrics, which suggests that individuals applied similar decision rules, specifically, a more compensatory approach indicative of a more systematic and exhaustive process (Payne, Bettman, & Johnson, 1993). The meta-decision of which rule to use (e.g., Lexicographic, Conjunctive, Elimination-by-Aspects, or Weighted Additive) is contingent on the tasks and contexts at hand (Payne, Bettman, & Johnson, 1993). As such, the selectivity and patterns of processing are shaped much more by situational realities rather than enduring genetic factors.

Our application of the twins study paradigm was unique in two ways. First, it is the first to include a realistic decision making task, consisting of several alternatives and attributes. Second, while a few heritability studies have focused on specific behaviors, heuristics, and cognitive biases, our study emphasized the underlying processes affecting decision making as a whole. Using process-tracing measures (see Saad, Eba, & Sejean, 2009; Saad & Russo, 1996 for other process-tracing approaches in behavioral decision making) we were able to identify specific mechanisms related to the amount of processing that is affected by genetic factors but found no evidence for genetic influences on metrics pertaining to the selectivity and pattern of information processing. These results suggest that even within the same choice, genetic components carry a differential role across the various cognitive processes utilized to execute the decision. The current work is the first within the marketing literature to have disentangled the effects of genetic and situational factors, as relating to various decisional metrics (amount of processing versus selectivity and pattern of processing).

Our results lend increasing support to a growing number of studies that have highlighted the importance of genetic factors across several consumption domains. For example, in a study using middle aged through elderly adults twins, 30% of the variation in individuals' search for variety of food was explained by additive genetic factors (Scheibehenne et al., 2014). Other studies have shown moderate heritable influences in the use of various heuristics and biases ranging from small to large heritable contributions, though estimates differ depending on the size of samples, ages, and nationality of twins (Cesarini et al., 2012; Simonson & Sela, 2011). Establishing that a certain decision making style has a genetic basis is only the first step in understanding the role that biology plays in people's decisions. The larger question is to examine why should decisions be shaped by our biological heritage in the first place? The key to

understanding the biological roots of consumer decision making is in recognizing the evolutionary forces that have shaped our behaviors and preferences across various domains of evolutionary import (see Saad, 2011; Saad, 2007). Many of the decisions that we make have had a profound effect on our reproductive fitness (e.g., mate choice), and as such it should not be surprising that some elements of decision making are heritable and hence possess a genetic basis (see Kanazawa & Segal, 2019 for an evolutionary analysis of twinning). A promising area for future research is to investigate the interaction between culture and biology and explore the contexts in which each factor is likely to be more dominant in shaping consumer choice.

For much of the past forty years, marketing scholars have largely ignored the biological, genetic, and evolutionary roots of consumer decision making (but see Colarelli & Dettmann, 2003; Durante & Griskevicius, 2018; Griskevicius et al., 2009; Griskevicius & Kenrick, 2013; Saad, 2011; Saad, 2007; Saad, 2013; Saad, 2017; Saad & Gill, 2000; Saad & Stenstrom, 2012; Saad & Vongas, 2009). Consumers have largely been viewed as products of their environments that otherwise transcend their biological heritage (Saad, 2008). The current work is a reminder that when asked whether consumers are born or made, the veridical answer is that they are both the products of nature and nurture.

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Table 1

Mean differences on the GDMS scale between MZ twins (52 pairs) and DZ twins (48 pairs), and

effect sizes (d)

	MZ	DZ	t	d
	Mean (SD)	Mean (SD)		
Rational	2.19 (2.41)	3.48 (2.43)	2.66**	.53
Intuitive	2.90 (2.53)	3.48 (2.22)	1.21	.24
Dependent	2.85 (2.68)	3.42 (3.23)	.96	.19
Avoidant	3.06 (2.37)	3.96 (3.26)	1.57^	.32
Spontaneous	2.29 (2.02)	3.52 (2.48)	2.71**	.55
GDMS total	5.71 (5.21)	8.10 (6.72)	1.98*	.40
GDMS Sum Differences	13.29 (7.24)	17.85 (6.08)	3.42***	.68

^ $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

Table 2

Attributes and scales for the task of choosing a hotel for a two-week vacation (Study 2)

Attribute	Scales				
Cleanliness	Poor	Fair	Good	Very Good	
Fun	Dull	Fun	Very Fun		
Location	Poor	Nice	Very Nice		
Restaurant	2 Stars	3 Stars	4 Stars		
Security	Poor	Fair	Good	Very Good	
Service	Poor	Fair	Good	Very Good	
Weather	Rainy	Showers	Cloudy	Windy	Sunny

Table 3

Mean differences in the amount of processing metrics between MZ twins (27 pairs) and DZ

twins (39 pairs), and effect sizes (d)

	MZ	DZ	t	d
	Mean (SD)	Mean (SD)		
Total no. of Cells Opened	13.7 (12.8)	26.7 (19.6)	3.25***	.78
Proportion of Total Cells	.68 (.263)	.55 (.266)	1.97*	.49#
Total Time to Reach Decision (in Seconds)	15.4 (16.7)	28.0 (29.9)	2.18*	.52
Average Time Spent On Each Cell (in Seconds)	1.26 (3.65)	1.54 (4.35)	.29	.07

* p < .05

** p < .01

*** p < .001

The actual value is -0.49, which supports our hypothesized effect, (a reflection of which of the two means is subtracted from the other when calculating the d metric). For expository clarity, we report the absolute value here to be consistent with the other d values in this table.