On the Heritability of Consumer Decision Making: An Exploratory Approach for Studying Genetic Effects on Judgment and Choice

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While constructed preferences have received a great deal of attention, there has been virtually no research regarding the genetic basis of consumer judgment and choice. In this research, we examine a wide range of previously unexplored heritable effects on consumer choices and judgments. Moreover, whereas prior research on heritable traits has typically employed a piecemeal approach, demonstrating each heritable trait separately, we propose an alternative way to simultaneously explore common mechanisms and links among heritable traits and behaviors. Using a classic twins study design, we find a large heritable effect on preferences for (*a*) compromise (but not dominating) options, (*b*) sure gains, (*c*) an upcoming feasible, dull assignment, (*d*) maximizing, (*e*) utilitarian options, and (*f*) certain products. Conversely, we do not find significant heritable effects regarding judgment heuristics, discounting, and other decision problems. We tentatively propose that the pattern of findings might reflect a generic heritable individual difference relating to "prudence." We discuss the implications of our research with respect to the determinants of preferences and future research on heritable aspects of judgment and choice.

A great deal of research has established that consumer preferences and attitudes are often largely constructed when decisions are made, based on the decision context, the preference elicitation task, and the framing of options (for reviews, see, e.g., Bettman, Luce, and Payne [1998]; Lichtenstein and Slovic [2006]; and Schwarz [2007]). However, constructed preferences do not start from a clean slate and are likely to be influenced by inherent preference elements, whether they are dormant (e.g., a predisposition to like cilantro or a motion-sensitive video-game remote before ever trying it) or stored in memory (see Simonson 2008a, 2008b).

Probably the most inherent "inherent preferences" are those that consumers inherit. Although consumer behavior researchers have not paid much attention to genetic effects on consumer judgments, choices, and attitudes, there is a vast literature on such effects that goes back to the nineteenth century (Galton 1875). Particularly over the past 40 years or so, studies in the field of behavior genetics have demonstrated heritable effects on behaviors, such as divorce, drug addiction, voting, and altruism, and on attitudes toward targets, such as religion, death penalty, roller coasters, and jazz (e.g., Fowler, Baker, and Dawes 2008; Martin et al. 1986; Olson et al. 2001). These findings, which focus on heritable individual differences rather than on universal genetic effects shared by all humans, go well beyond earlier

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findings regarding heritable effects on intelligence, personality, and behavior (see, e.g., Bouchard et al. 1990; Plomin et al. 2008). However, there has been surprisingly little research about genetic effects pertaining to decision making, and we are not aware of any prior empirical research that specifically focused on genetic effects as they apply to consumer judgment and choice.

A main objective of this investigation is to begin exploring the magnitude of heritable effects on consumer decision making across a wide range of previously studied choice and judgment phenomena. Potentially more important, this research suggests an alternative approach for studying common underlying heritable effects on judgment and choice. Prior behavior genetics research has tended to focus piecemeal on certain behaviors and attitudes, demonstrating various specific heritable traits. This approach is limited in its ability to provide insights regarding the relative impact of nature versus nurture across different types of choices and judgments, the links among heritable effects, the underlying mechanisms, and even the meaning of such effects. In all likelihood, heritable effects across behavioral phenomena are linked (in unknown ways) and are not "organized" according to the decision problems researchers happen to test (e.g., one heritable effect for choices between safe and risky gambles and a distinct effect for choices from sets with a compromise option). Accordingly, though very challenging and probably requiring decades of further research, it is important to look for ways to investigate the links among heritable effects, the determinants of the magnitude of such effects, and the underlying mechanisms.

One option for consumer and decision researchers is to wait until genetics research makes further progress, providing the necessary biological insights on which consumer and other decision researchers can build. But, as reviewed below, despite the great progress that has already been made, it might take decades before genetics researchers will be able to pinpoint the links among heritable effects and the mechanisms underlying such effects on things such as risk aversion, divorce, or liking jazz. In this research, we propose that another approach for gaining a better understanding of links among heritable effects and the underlying mechanisms is by conducting broad-based, simultaneous studies of a wide range of choice and judgment responses. These studies, in turn, may provide insights into responses that appear to be genetically linked. Given the level of "noise" and the many unseen and unforeseen factors that are likely to affect each individual response, we do not expect any single such investigation to produce a clear, easy-to-interpret pattern. However, even tentative findings could allow us to develop tentative theories that will be refined over time with gradually more targeted investigations. Considering that this may be the first investigation of heritable behavioral effects to appear in a marketing and consumer behavior journal, we begin with a brief overview of key prior findings in the vast and rapidly evolving field of behavior genetics. Next, given that our study (like most prior research in this area) is based on a comparison of monozygotic (MZ; sometimes referred to as "identical") twins and dizygotic (DZ; "fraternal") twins, we discuss the logic and methodology of such studies. We then briefly describe the judgment and choice problems and tendencies investigated in the present research (for more details, see the online appendix B). After describing the specific methodology of our study and the findings, we identify a cluster of effects that appear to have a large heritable component. In the concluding discussion, we advance a tentative general hypothesis emerging from the findings and explore the implications of this research and directions for future research.

A BRIEF REVIEW OF PRIOR RESEARCH ON HERITABLE TRAITS AND BEHAVIORS

Prior research has found numerous traits and behaviors that have a significant heritable component, though few, if any, of these studies have identified links among different heritable traits or provided insights into the mechanisms underlying trait or behavior heritability. Going well beyond the initial focus on the heritability of intelligence and "Big Five" personality factors, recent findings include, for example, the identification of heritable influences on political orientations, party affiliation, and the tendency to vote (Alford, Funk, and Hibbing 2005; Fowler and Dawes 2008; Fowler and Schreiber 2008; Settle, Dawes, and Fowler 2009), behavior in a dictator game, entrepreneurship, risk aversion in the domain of gains (Cesarini et al. 2009; Nicolaou et al. 2008), divorce likelihood, drug addiction, altruism, religiousness, and antisocial behavior (e.g., Moffitt 2005).

The generally accepted view of behavior genetics today is captured by the terms "nurturing nature" or "nature via nurture" (e.g., Meaney 2001; Ridley 2003), indicating that nature versus nurture represents a false dichotomy and that pitting one against the other is not more sensible than asking if length or width contribute more to the area of a rectangle. Researchers have argued that all human traits and individual differences have a heritable component (e.g., Johnson et al. 2009). For example, Eric Turkheimer (2000) summarized a great deal of "nearly unanimous" prior behavior genetics findings by the following "three laws of behavior genetics": (1) all human behavioral traits are heritable, (2) the effect of being raised in the same family is smaller than the effect of genes, and (3) a substantial portion of the variation in complex human behavioral traits is not accounted for by the effects of genes or families (referred to as variation due to "unshared environment"). It is noteworthy that, unlike research on evolution and evolutionary psychology that focuses on universal human characteristics, the term "heritable" is used in the behavior genetics field (including the present research) more narrowly than the term "genetic"; it refers only to genetic-based traits and responses that are not shared by all humans and that thus produce individual differences.

Stated differently, heritability is defined as the proportion of variance in a trait that is attributable to genetic variance.

Importantly, the conclusion that all human behavioral traits have a heritable component (e.g., Johnson et al. 2009) does not inform us about the magnitude of this component. In particular, a key question that has not been answered in prior behavior genetic research relates to the types of responses/behaviors associated with a relatively large versus a small heritable component and the factors that underlie the relative impact of that component. Moreover, we still know very little about the links among heritable behaviors, decisions, and traits and the processes underlying such effects. That is, despite the great progress that has been made in the areas of molecular genetics, and especially the rapidly developing field of epigenetics (i.e., the study of heritable alterations in gene expression caused by mechanisms other than changes in DNA sequences; for a review, see, e.g., Champagne and Mashoodh [2009] and Szyf, McGowan, and Meaney [2008]), these areas are probably many years away from providing insights into the heritability of choice and judgment. A noteworthy illustration of this conclusion is provided by the influential finding of Caspi et al. (2003), who identified a specific gene-by-environment interaction whereby a genetic disposition to depression produces depression only among those experiencing great stress. While this finding appears relatively straightforward and consistent with current thinking regarding nature-nurture interactions, a recent meta-analysis (Risch et al. 2009) found that 10 out of 13 subsequent studies that investigated the interaction between bipolar depression gene disposition and stressful life could not replicate the original finding (but see Caspi's reply in Boughton [2009]).

The mere fact that finding precise answers regarding the processes underlying trait heritability, in general, and choice and judgment, in particular, may be decades away does not mean that we should just wait for genetics research to make further progress. Continuing to study isolated traits and behaviors without looking for links and underlying mechanisms has clear limitations and a diminishing value. As indicated, in this research we propose an alternative approach. Instead of studying separately various effects that have a heritable component, this study simultaneously tests many choice and judgment phenomena, most of which have been the subject of prior judgment and choice research. If a pattern emerges whereby heritable effects are particularly pronounced for certain types of choices and judgments that may reflect a common underlying source or characteristic, we might be able to derive a tentative hypothesis that can be studied further in future research.

USING COMPARISONS OF MONOZYGOTIC AND DIZYGOTIC TWINS TO STUDY HERITABLE EFFECTS ON JUDGMENT AND CHOICE

Considering that this may be the first empirical study in the marketing and consumer behavior literatures that relies on comparisons between monozygotic and dizygotic twins to identify heritable effects, it might be useful to review briefly the basic assumptions and concerns that have been raised regarding that approach (see also Alford et al. 2005; Fowler et al. 2008; Johnson et al. 2009; and Plomin et al. 2008). Twin studies have been shown to be very effective and are by far the most common approach for identifying heritable effects; they also provide estimates of the variance in observed traits and responses that is accounted for by genetics, the "shared environment" (e.g., growing up in the same family), and the "unshared environment" (e.g., unique relationships and life experiences).

Monozygotic (MZ) twins (about 0.35% of all human births, which is higher than in other species; Wright 1997) develop from a single egg and sperm and are thus genetically identical, whereas dizygotic (DZ) twins, like any siblings, share on average just 50% of their genes. Thus, if we assume that the environment has a similar effect on both MZ twins and DZ twins, then any finding of a higher correlation within MZ pairs compared to DZ pairs with respect to a particular trait, behavior, or response indicates a genetic effect. Accordingly, the assumption of equivalent environments (and/or that any environmental differences are randomly distributed or, at least, do not account for the observed average concordance differences between twin types) is critical. It is therefore not surprising that this assumption has received a great deal of attention.

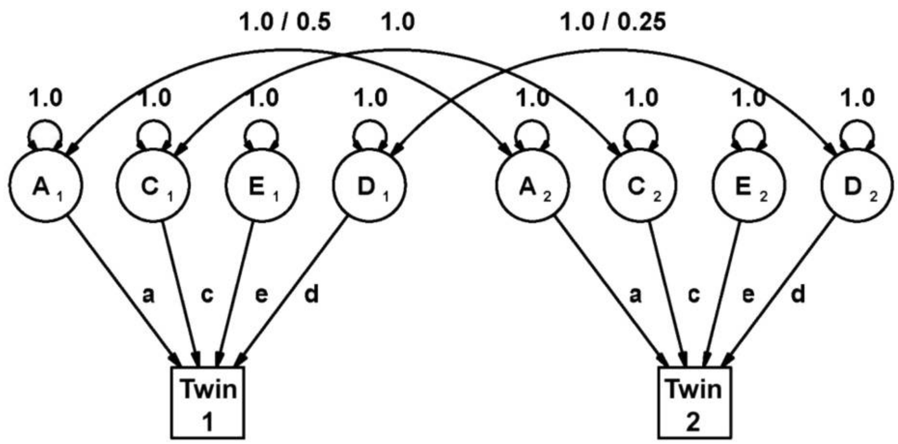
Although DZ twins are probably not a perfect control for all nurture effects, the assumption of equivalent (or sufficiently similar) environments appears to hold in general, with the environmental differences between MZ and DZ twins not having a large impact. Two primary arguments have been raised concerning the assumption of equal environment. First, there is consistent evidence (also in our study) that MZ twins tend to interact more often (after leaving the home) and to live closer to one another. Second, the parents and others may treat MZ twins differently than they treat DZ twins.

With respect to the first concern, there seems to be no evidence that frequency of contact between twins increases attitude correlations (Martin et al. 1986). Perhaps even more persuasive is the finding that MZ twins reared apart (i.e., without any contact) show about the same high correlations (at least for the tested traits) as those reared together with respect to a wide range of measures (Bouchard 1998; Bouchard et al. 1990; Segal 1999). These findings further suggest that the environment appears to play a smaller role with respect to those indicators. There is also evidence that is inconsistent with the concern relating to different social treatment of MZ twins and DZ twins (Morris-Yates et al. 1990). Even in cases where parents mistakenly believe that their DZ twins are MZ twins, the similarity between the misidentified (DZ) twins tends to be lower than that between true MZ twins (Bouchard and McGue 2003; Bouchard et al. 1990; Plomin et al. 2008).

Still, there are some documented cases where relaxing the assumption of equivalent environment (or inconse-

FIGURE 1

GRAPHIC REPRESENTATION OF THE BASIC GENETIC MODEL



SOURCE.—Neal and Maes (2004).

quential environmental differences) does make a difference. For example, Björklund, Jäntii, and Solon (2005) demonstrated that estimates of the variance components in predicting income change significantly if one relaxes the equal environment assumption. And Rose et al. (1988) showed that social contact enhances similarity on the extroversion and neuroticism personality factors, though the genetic influences remain significant even after removing the social contact effect.

As indicated, one of the advantages of the twins design is that it allows for an approximate estimation of the variance in a given behavior or response accounted for by genetic factors. Behavioral genetic analysis typically utilizes a model that focuses on four sources of variance: additive genetic effects (A); nonadditive genetic effects, such as genetic dominance (D); environmental effects shared by people living in the same family (C); and environmental effects that are unique to each individual (E). It is noteworthy that separating the variance accounted for by genetic and (un/shared) environmental influences is an oversimplification and a controversial one at that. As Meaney pointed out (2001, 52), separating the determinants of gene expression (i.e., a gene's activity level) and related traits is not feasible or meaningful given that genes and environment do not operate independently.

The most commonly used method for estimating the relative importance of the genetic and environmental components underlying observed correlations between MZ and DZ twins has been the model-fitting approach, using structural equation modeling (SEM; Falconer 1989; Neale and Cardon 1992). This approach allows researchers to estimate the share of each of the hypothesized latent variables in the model (A, D, C, or E) in the total observed phonotypical variance, as well as the confidence intervals around the estimated values. Moreover, this method can be used to test and compare the goodness of fit of different types of models, thereby leading to the most accurate and parsimonious model. In the present context, our key parameter of interest is the genetic effect (A). When the latent variable A is estimated to be significant, we conclude that the observed phenotype (e.g., choosing the compromise option) is influenced by a heritable component. We refer the interested reader to figure 1 and to the online appendix A for a more detailed explanation of this estimation approach.

TESTED PROBLEMS AND MEASURES

The present investigation focuses on judgment and decision making (JDM) by examining a wide range of JDM problems and potentially related individual difference scales. Considering that we do not begin with a well-defined theory or hypothesis concerning patterns in heritable effects on JDM, we cast a wide net. As described next, we included in the current study many choice and judgment problems that have been the subject of prior investigations in the consumer decision making and behavioral decision theory (BDT) literatures. Table 1 lists the paradigms and measures included in the study. Each paradigm was typically tested using more than one problem, and the specific stimuli we used appear in appendix B, which is available online.

To confirm the twin zygosity (MZ or DZ), we used a standard battery of items, described in online appendix C (based on Eaves, Eysenck, and Martin 1989; Heath et al. 2003; and Sarna et al. 1978; see, e.g., Swan et al. 2005, 2007). In addition, we measured (*a*) the frequency of interaction between the two, (*b*) geographic proximity, (*c*) education, (*d*) the degree to which respondents considered

TABLE 1

TESTED PARADIGMS AND MEASURES

Category/problem type	References
Context effects:	
Compromise	Simonson 1989; Simonson and Tversky 1992
Asymmetric dominance	Huber, Payne, and Puto 1982; Simonson and Tversky 1992
Trade-offs:	
Risk vs. return (in gains and losses) and loss aversion	Kahneman and Tversky 1979; Mellers, Schwartz, and Ritov 1999
Highlighting vs. balancing	Dhar and Simonson 1999
Feasibility vs. desirability (now vs. later)	Liberman and Trope 1998
Less now vs. more later	Loewenstein and Prelec 1992
Variety vs. best option	Simonson 1990
Utilitarian vs. hedonic	Dhar and Wertenbroch 2000; Kivetz and Keinan 2006; Kivetz and Simonson 2002
Satisficing vs. maximizing	Nenkov et al. 2008; Schwartz et al. 2002
Judgment heuristics:	
Anchoring	Epley and Gilovich 2001; Tversky and Kahneman 1974
Representativeness: base rate neglect	Tversky and Kahneman 1974
Representativeness: conjunction fallacy	Tversky and Kahneman 1983
Availability	Tversky and Kahneman 1974
Preferences:	
Food (e.g., cilantro, mustard, chocolate)	Olson et al. 2001
Experiences (e.g., jazz, opera, horror movies, roller coasters)	Martin et al. 1986; Olson et al. 2001; Tesser 1993
Self-expressive options (e.g., tattoos, hybrid cars, iPod, Facebook)	Belk 1988
Individual differences:	
Cognitive reflection test (CRT)	Frederick 2005
Need for cognition (NFC)	Cacioppo, Petty, and Kao 1984
Innovativeness	Manning, Bearden, and Madden 1995
Change seeking	Koopman et al. 1995; Steenkamp and Baumgartner 1995; Zuckerman 1971

themselves conservative or liberal, and (*e*) income (Taubman 1976).

SAMPLE CHARACTERISTICS AND RESULTS

Most of our respondents were members of the SRI International Northern California Twin Registry. The remaining respondents were recruited through the Business School Internet (nonstudent) subject pool. A total of 110 MZ and 70 DZ same-sex twin pairs completed a 30-minute questionnaire (via the Internet) in exchange for $10 in cash or a chance to win $50. Participants completed their sessions independently of their siblings.

Table 2 summarizes the demographic characteristics of the sample for MZ and DZ twins. The analysis indicates, consistent with prior twin studies, that the two twin types differed significantly in terms of interpersonal closeness and the frequency of meeting (MZ twins being closer and meeting more frequently). Also consistent with prior research (e.g., Taubman 1976), the average income correlation for MZ twins (.523) was much higher than for DZ twins (.156; $p < .01$), and there was also a significantly higher MZ correlation with respect to education (.720 vs. .444, respectively; $p < .01$), though the MZ-DZ difference was smaller than for income.

We next turn to the main findings. Table 3 summarizes the mean results (for items with continuous dependent variables) or the percentage of people choosing the focal option for items with ordinal or nominal measures (e.g., the percentage of people choosing the compromise option) for each zygosity and the significance of the difference. Tables 4 and 5 present the analysis based on the inter-twin correlation. Consistent with prior research, we report tetrachoric correlations for items with binary dependent variables. Table 4 presents the results for problem types that showed statistically significant MZ-DZ differences. For each problem, we report the inter-twin correlations and parameter estimates of the latent variables from the best-fitting model. Note that additive genetic effects (A), nonadditive genetic effects (D), and shared environmental effects (C) cannot be estimated simultaneously if information is only available from twins reared together (Neal and Maes 2004). Therefore, similar to prior research, we report estimates from either an ACE or an ADE model, as appropriate (ellipses in a cell indicate that a particular variable was not estimated). We used the software package MX 1.68 to estimate the models (Neale et al. 2006). Table 4 also presents the goodness-of-fit test, with nonsignificant *p*-values representing good model fit (see online appendix A for more details).

Table 5 summarizes the correlations for various responses, including judgment heuristics (representativeness, availability, anchoring), that were not statistically significantly influenced by heritable individual differences. Because the inter-twin correlations for these items did not differ between MZ and DZ pairs in a manner that could indicated

TABLE 2

SUMMARY DEMOGRAPHICS (MEANS AND SIGNIFICANCE OF DIFFERENCE)

Demographics	MZ (n = 220)	DZ (n = 140)	p-value
Age	46.6	49.0	.10
Females (%)	77	79	.77
Closeness (1–4)	3.8	3.3	.00
Distance in miles	845	469	.20
Meeting frequency[a]	2.9	3.2	.04
Family income[b]	6.4	6.3	.68
Education[c]	4.6	4.8	.10
Liberal (1–7)	4.5	4.7	.31

[a]1 = daily, 2 = 1–4 per week, 3 = 1–3 per month, 4 = occasionally, 5 = less than once per year.

[b]1 = <$30,000, 2 = $30,000–$40,000, 3 = $40,000–$50,000, 4 = $50,000–$60,000, 5 = $60,000–$75,000, 6 = $75,000–$90,000, 7 = $90,000–$110,000, 8 = $110,000–$150,000, 9 = >$150,000.

[c]1 = Less than high school, 2 = high school, 3 = some college, 4 = 2-year college, 5 = 4-year college, 6 = postgraduate.

heritability, we do not report the genetic parameter estimates. We should again emphasize that it would be premature to conclude based on any single study that covers many effects (with a relatively small sample of 110 MZ pairs and 70 DZ pairs) that the statistical significance level obtained will apply to all other possible tests. Still, our findings could allow one to develop a hypothesis regarding the types of JDM responses associated with a relatively large heritable effect.

Preliminary analyses were conducted to test the effect of several individual covariates, including income, closeness ratings, education, and CRT (cognitive reflection test) scores, on each of the focal items. Controlling for the effects of these covariates did not affect the magnitude of the inter-twin correlations or the difference between MZ and DZ pairs. Therefore, consistent with the manner in which such covariates have been treated in prior twins research, these covariates were not included in the SEM analysis.

Preferences for Compromise Options. The mean shares of compromise options suggest that MZ twins are slightly (but consistently) more likely to compromise than DZ twins, though the difference is statistically significant in only one case (BBQ-set 1 in online appendix B). More importantly, the results indicate that the tendency to select the compromise/middle option, which served as the dependent variable, has a significant and robust heritable component, at least for the problems tested. In other words, people appear to be genetically predisposed to selecting/avoiding compromises, which, according to the value maximization criterion, means that they are born with varying susceptibility to exhibiting "irrationally" (Tversky and Simonson 1993).

Loss Aversion. We used two pairs of problems in which respondents chose between a sure gain and a gamble; in one problem, the gamble included the possibility of a loss. These problems allowed us to test the heritability of risky choice preferences, and the pattern of choices across both problems tested for loss aversion (i.e., whether a respondent chose the gamble in the gain domain and avoided the corresponding gamble that involved a possible loss). For one of the two two-problem sets (previously tested in Simonson and Nowlis [2000]), the results suggested a heritable effect on risk aversion in both losses and gains, though the heritable contribution was smaller when the gamble included the possibility of a loss. The susceptibility to loss aversion, as demonstrated by the (within-subject) choice pattern across both component problems, also suggested a significant heritable effect. As indicated earlier, this result may not extend to other problems and other manifestations of loss aversion (e.g., the endowment effect), which could involve other genetic or idiosyncratic factors. Indeed, we did not find a heritable effect for the other test of loss aversion included in the current study.

Choices between Utilitarian and Hedonic Options. The results pertaining to a choice between batteries (a utilitarian option) and chocolate (a hedonic option) showed a significant heritable effect. We also examined choices between cars that differed in terms of a more hedonic attribute (comfort rating) and a utilitarian attribute (MPG). The car sets had been previously used to test for asymmetric dominance (Huber, Payne, and Puto 1982). One of the two car choice sets (see online appendix B) produced a large heritable effect whereas the other did not. Another choice problem, involving a utilitarian versus a hedonic option (groceries vs. massage; see table 4) did not produce a significant heritable effect.

Desirability versus Feasibility in the Near and Distant Future. The analysis indicates that the tendency to focus on outcome feasibility versus desirability has a significant genetic component when making choices for the near future (e.g., tomorrow) but not necessarily when making choices for the distant future (e.g., 1 year from now).

Maximizing versus Satisficing. The analysis indicates that participants' scores on the Maximization scale (Nenkov et al. 2008) were influenced by a significant heritable component. Perhaps relatedly, "driving the extra mile" to avoid overpaying in the phone and backpack problem (adapted from Tversky and Kahneman's calculator/jacket problem) appears to be influenced by a heritable tendency (albeit, a relatively small effect).

Preferences for Asymmetrically Dominating Options. With one exception, susceptibility to the asymmetric dominance effect did not produce a statistically significant heritable effect. Specifically, the results of the mutual funds and cordless phones problems (online appendix B) suggest that the tendency to choose the asymmetrically dominating option, which served as the dependent variable, does not appear to be influenced by a heritable component. With respect to the "Car problem" sets (discussed above) that had previously been used to test the asymmetric dominance effect (Huber et al. 1982; Simonson 1989), deriving a prediction was less clear. Specifically, while perceptions of relative advantage may not be heritable, as noted, a trade-off between miles per gallon and comfort represents a straightforward

TABLE 3

SUMMARY OF FINDINGS (CHOICE RATES OF THE FOCAL OPTION AND SIGNIFICANCE OF DIFFERENCE)

	MZ (n = 220)	DZ (n = 140)	p-value
Compromise (%):			
BBQ1	47	36	.04
BBQ2	52	44	.13
Overall pattern (BBQ)	40	32	.13
Flashlights	68	62	.27
Asymetrical dominance (%):			
Cars1	69	74	.25
Cars2	50	46	.48
Overall pattern (cars)	28	27	.90
Mutual funds	77	71	.21
Cordless phones	66	74	.15
Vice and virtue (preference for virtue, %):			
Batteries/chocolate	65	59	.22
Groceries/massage	33	36	.47
Loss aversion (preference for . . . , %):			
Risky choice (loss)	69	68	.88
Risky choice (gain)	74	77	.56
Loss aversion pattern	16	12	.32
Temporal construal (preference for "desirability," %):			
Near future	75	27	.58
Far future	82	75	.12
Framing (%):			
Phone and backpack	42	45	.67
Variety seeking:			
Soups	3.46	3.49	.79
Snacks	2.69	2.65	.57
Highlighting/balancing (%):			
Meal	67	67	.94
Airport	44	44	.95
Mental accounting (%):			
Theater ticket	55	53	.74
Temporal discounting (%):			
Grocery vouchers	32	39	.22
Two future payments	48	49	.88
Three future payments	80	87	.41
Individual differences:			
Innovation	3.78	3.69	.54
Change seeking	4.32	4.31	.91
Need for cognition	3.43	3.40	.68
Availability (%):	57	59	.73
R-words			
Representativeness (%):			
Linda	68	64	.37
Engineer	83	82	.80
Professor	53	52	.91
Anchoring:			
African countries in the United Nations (Δ)	41.63	44.33	.30
Chicago population (2 million)	1,894,131	1,894,871	1.00
West Indies (1492)	1585	1570	.45
Mars orbit (365)	431.83	335.28	.18
Toaster (Δ)	29.11	26.07	.18
Individual differences:			
Maximizing	4.05	3.98	.52
CRT	.66	.78	.25
Innovation	3.78	3.69	.54
Change seeking	4.32	4.31	.91
Need for cognition	3.43	3.40	.68

TABLE 4

GENETIC ANALYSIS USING STRUCTURAL EQUATION MODELING

	Correlations				Parameter estimates							
	MZ	DZ	*p*-value (difference)	Model	A	C	E	D	-2LL	Δx^2	Δdf	*p*-value (base model)
Compromise:												
BBQ1	.543***	−.198	.01	AE	.46 (.20, .68)	. . .	.54 (.32, .80)	.00	479.59	2.24	1	.14 (ADE)
BBQ2	.469**	−.019	.01	AE	.41 (.15, .64)	. . .	.59 (.36, .85)	.00	489.48	1.10	1	.29 (ADE)
Overall pattern (BBQ)	.585***	−.254	.01	AE	.49 (.23, .71)	. . .	.51 (.29, .77)	.00	461.48	2.75	1	.10 (ADE)
Flashlights	.389*	−.029	.01	AE	.32 (.03, .58)	. . .	.68 (.42, .97)	.00	457.15	.96	1	.33 (ADE)
Asymmetrical dominance:												
Cars1	.537**	−.393+	.01	AE	.42 (.14, .66)	. . .	.58 (.34, .86)	.00	426.32	2.43	1	.12 (ADE)
Cars2	.254+	.258	.98	CE	.00	.26 (.03, .46)	.74 (.54, .97)	. . .	493.27	.00	1	1.00 (ACE)
Overall pattern (cars)	.149	.387+	.10	E	.00	.00	1.00	. . .	419.55	3.35	2	.19 (ACE)
Mutual funds	.127	.271	.34	E	.00	.00	1.00	. . .	404.88	2.13	2	.34 (ACE)
Cordless phones	.312+	.381+	.61	CE	.00	.34 (.09, .55)	.66 (.45, .91)	. . .	437.42	.00	1	1.00 (ACE)
Vice and virtue:												
Batteries/chocolate	.489**	.199	.03	AE	.47 (.20, .69)	. . .	.53 (.31, .80)	. . .	463.02	.00	1	1.00 (ACE)
Groceries/massage	.468**	.451*	.89	CE	.00	.43 (.20, .62)	.57 (.38, .80)	. . .	449.32	.25	1	.62 (ACE)
Loss aversion:												
Risky choice (loss)	.479**	.296	.17	AE	.49 (.22, .70)	.00	.51 (.30, .78)	. . .	437.56	.08	1	.78 (ACE)
Risky choice (gain)	.391*	−.104	.01	AE	.33 (.02, .60)	. . .	.67 (.40, .98)	.00	396.04	.74	1	.39 (ADE)
Loss aversion	.685**	.260	.01	AE	.69 (.40, .88)	.00	.31 (.12, .60)	. . .	282.98	.00	1	1.00 (ACE)
Temporal:												
Near future	.470**	−.153	.01	AE	.37 (.06, .64)	. . .	.62 (.36, .94)	.00	401.52	1.36	1	.24 (ADE)
Far future	.058	.219	.29	E	.00	. . .	1.00	.00	368.45	.94	2	.63 (ACE)
Framing:												
Phone and backpack	.312*	.141	.25	AE	.30 (.03, .54)	.00	.70 (.46, .97)	. . .	487.38	.00	1	1.00 (ACE)
Individual differences:												
Maximizing	.389***	.124	.07	AE	.43 (.26, .56)	.00	.57 (.44, .74)	. . .	942.42	.00	1	1.00 (ACE)
CRT	.581***	.363**	.07	AE	.61 (.49, .69)	.00	.39 (.31, .51)	. . .	944.21	.64	1	.43 (ACE)
Products:												
Dark chocolate	.486**	.128	.05	AE	.29 (.13, .36)	.00	.71 (.64, .89)	. . .	1,605.59	.00	1	1.00 (ACE)
Milk chocolate	.448**	.060	.01	AE	.30 (.20, .39)	.00	.70 (.62, .80)	. . .	1,306.29	.00	1	1.00 (ACE)
Mustard	.374***	.081	.06	AE	.22 (.13, .30)	.00	.78 (.70, .87)	. . .	1,492.09	.00	1	1.00 (ACE)
Hybrid cars	.508**	.262*	.08	AE	.37 (.28, .46)	.00	.63 (.54, .72)	. . .	1,238.29	.43	1	.51 (ACE)
Jazz	.622***	.294*	.01	AE	.42 (.34, .48)	.00	.58 (.52, .66)	. . .	1,582.95	.00	1	1.00 (ACE)
Opera	.589***	.311*	.05	AE	.39 (.32, .46)	.00	.61 (.54, .68)	. . .	1,543.65	.08	1	.78 (ACE)
Sci-Fi	.666***	.444**	.05	AE	.46 (.40, .53)	.00	.54 (.47, .60)	. . .	1,639.71	2.43	1	.12 (ACE)

NOTE.—Only the best-fitting models are reported. For the parameter estimates, *p*-values greater than .05 indicate a good model fit. Tetrachoric correlations are reported for dichotomous (choice) variables.

$+p < .10$.

$^{*}p < .05$.

$^{**}p < .01$.

$^{***}p < .001$.

TABLE 5

CORRELATION ANALYSIS OF PROBLEMS WITH NO APPARENT HERITABLE EFFECTS

	Correlations		
	MZ	DZ	*p*-value (difference)
Judgment heuristics:			
Availability:			
R-words	.095	.291	.19
Representativeness:			
Linda	−.082	.451*	.01
Engineer	.152	.159	.96
Professor	.200	−.003	.19
Anchoring:			
African countries in UN	.436**	.384**	.69
Chicago population	.316***	.239+	.59
West Indies	.346***	.327*	.89
Mars orbit	.022	−.008	.85
WTP for toaster	.000	.186	.23
Other items:			
Variety seeking:			
Soups	.001	.195	.21
Snacks	.016	.099	.59
Highlighting/balancing:			
Meal	.016	.146	.40
Airport	.173	−.021	.21
Mental accounting:			
Theater ticket	.348*	.335+	.93
Temporal discounting:			
Grocery vouchers	.375*	.341+	.80
Two future payments	.396**	.323+	.59
Three future payments	.278**	.275*	.98
Individual differences:			
Innovation	.332***	.218+	.43
Change seeking	.446***	.317**	.33
Need for cognition	.403***	.389***	.92
Product preferences:			
Abstract art	.426***	.279*	.32
Body piercing	.318**	.336**	.91
Cilantro	.457***	.410**	.73
Coffee	.478***	.323*	.27
Facebook	.381***	.483***	.46
Horror movies	.635***	.483***	.19
iPhone	.293**	.510***	.12
iPod	.335***	.525***	.16
Ketchup	.131	.242+	.49
Licorice candy	.517***	.352**	.22
Heavy metal	.465***	.706***	.03
Motorcycle	.346***	.442***	.50
Roller coasters	.525***	.490***	.80
Extreme sport	.531***	.521***	.94
Tattoos	.481***	.559***	.53
Vinegar	.320**	.463***	.31

NOTE.—Tetrachoric correlations are reported for dichotomous (choice) variables.
+$p < .10$.
*$p < .05$.
**$p < .01$.
***$p < .001$.

choice between a utilitarian attribute and a hedonic attribute (which, as noted above, appears to reflect a significant heritable effect). Perhaps reflecting the two conflicting effects, the Car problem results were not conclusive: choices from the Car-1 set, but not from the Car-2 set, indicate a significant (and large) heritable effect. The within-subject pattern of choice across both sets (i.e., choosing the asymmetrically dominating option on both Car sets) does not appear to have a significant heritable component. Overall, the current evidence is consistent with the conclusion that a perceptual effect such as asymmetric dominance (more akin to judgment heuristics) is not significantly influenced by heritable individual differences.

Judgment Heuristics. The asymmetric dominance effect, unlike the compromise effect, represents a largely perceptual effect (see, e.g., Dhar and Simonson 2003). Similarly, the various judgment heuristics demonstrated by Tversky and Kahneman (1974) are believed to be largely perceptual. Indeed, as shown in table 5, none of our tests of these heuristics found a statistically significant heritable effect. In the well-known "Linda problem" (used to demonstrate the conjunction fallacy; see Tversky and Kahneman 1983), the responses of DZ twins were significantly correlated whereas those of MZ twins were not—this is an anomalous result without an obvious explanation. Other representativeness, availability, and anchoring (self-generated and experimenter provided; see Epley and Gilovich 2001) problems did not show significant differences between MZ and DZ twins.

Other Choice Problems. The analysis indicates that problems involving temporal discounting, variety seeking, highlighting/balancing, and mental accounting did not have a significant heritable component. Also, responses to personal difference scales that were designed to measure innovativeness, change-seeking, and need for cognition did not appear to have a significant heritable component, even though correlations among MZ twins tended to be directionally higher than among DZ twins.

As indicated, we also examined heritable effects on liking for specific products and experiences, which might be divided into a few categories. In matters of entertainment or art, we found significant heritable effects on liking for jazz music (replicating an earlier finding), opera, and science fiction, and the preferences for abstract art and horror movies were directionally consistent with a heritable pattern (i.e., higher correlations for MZ pairs). Preferences for experiences involving excitement and risk taking (e.g., roller coasters, extreme sports) showed at least a directional heritable effect. Some food items, particularly dark and milk chocolate (replicating an earlier finding regarding a preference for sweets) and, to a lesser degree, mustard (but not ketchup), licorice, and coffee showed at least a directional heritable effect. One might have also expected that self-expression would show a large heritable effect, but in our study liking for items such as tattoos and body piercing did not show any significant heritable effect.

Finally, CRT scores also showed a significant heritable effect, a result that might reflect the relation between CRT and intelligence. As an aside, the CRT score is related to other responses, including a negative correlation between the CRT score and the likelihood of selecting a compromise option.

DISCUSSION AND A FOLLOW-UP STUDY

The current study illustrates a different approach for studying heritability patterns that might lead eventually to a better understanding of heritable influences, at least in some cases, on decision making. In addition to examining the relative impact of heritability on a wide range of consumer choices and judgments, the present investigation explores whether we might be able to identify patterns of heritability across various JDM responses as a means for generating hypotheses for future research. A question that naturally arises is whether our preliminary investigation has identified such a pattern that deserves further study. We believe that the findings do suggest such a tentative general hypothesis, though we must emphasize that the current study relied on a small number of problems for each choice/judgment type and a relatively small sample of twins, so it is premature to reach any general conclusions.

The study reported above revealed relatively large heritable effects, at least in some cases, on (*a*) choices from sets with a compromise option, (*b*) choices between a hedonic option and utilitarian option, (*c*) choices between a sure gain and a gamble on the domain of gains, (*d*) choices between a rewarding but challenging task and a less rewarding but easier task, and (*e*) the propensity to try harder to find a better (or more economical) option as opposed to satisficing. On the other hand, the role of heritability appears to be much smaller (insignificant in our study) across a broad range of judgment heuristics, variety seeking, preferences for asymmetrically dominating options, and some other responses.

What, then, might be the underlying heritable tendency or construct (or constructs) driving these effects? Although it is possible that heritable tendencies such as choosing the compromise option, avoiding risk, or preferring utilitarian over hedonic options are associated each with its unique genetic antecedents, a more parsimonious possibility is that some or all of these different behaviors reflect a common or a related higher-order heritable tendency. Specifically, the results suggest a pattern of significant heritable effects in problems that involve variations on a dimension of "prudence." Consistent with dictionary definitions of prudence, as used here, the term can encompass aspects such as cautiousness, carefulness, discretion, moderation, being mindful, and being prepared. In some respects, it might be represented by the distinction between "living on the edge versus in the mainstream." What is prudent is a matter of perception, though in most cases, perceptions rather clearly correspond to properties of options (e.g., a safe bet vs. a risky gamble). Different people may have different perceptions of what is prudent, but there is usually a clear majority perception. It is a broad continuum that cannot be captured, accounted for, or measured by any single factor. As we show below, prudence (as conceptualized here) is not significantly correlated with any of the Big Five personality factors.

Although it is certainly premature to reach any definite conclusions, "prudence" might play a role in a wide range of heritable decisions and dilemmas that consumers and other decision makers face in everyday life (and in the BDT lab), including many problems that were not included in our study. It should be noted that such a prudence tendency does not mean that the same person always selects the prudent option or demonstrates similar prudence scores across all prudence-related problems. For example, while we found in the current study that individuals who score high on the Maximization scale were more likely to choose the compromise option (in two of three problems), maximizers may not be consistently more inclined to select utilitarian over hedonic options.

Thus, a great deal of "noise" notwithstanding (e.g., other influences not accounted for and idiosyncratic features of the specific problems we tested), such a heritable tendency may increase the likelihood of certain responses for different manifestations of the underlying prudence dilemma. That is, the heritable prudence predisposition is not deterministic, but it is assumed to affect the probability of certain responses. Of course, since the prudence predisposition is represented to varying degrees in different types of choice problems, and considering the "noise" associated with each particular choice problem and other individual differences, a prudence tendency is just one of various factors contributing to observed choices.

In contrast to prudence dilemmas, judgment heuristics as well as asymmetric dominance typically involve "perceptual" mechanisms (e.g., a condition for which exemplars come to mind easily is simply "perceived" as relatively frequent; Tversky and Kahneman 1974) and are unlikely to involve prudence tendencies or motives. Importantly, unlike heuristics that often (though not always) offer efficient and effective responses or estimates, prudence dilemmas (and prudence more generally) do not typically offer a dominant response. Although prudence often has some advantages, a chronic tendency to avoid any risk, go the extra mile for the best option, compromise, and choose the utilitarian option over indulgence, for example, can have some significant limitations. Accordingly, unlike availability and representativeness, for example, which possibly reflect more universal "perceptual" mechanisms of the human brain (noise notwithstanding), it may be reasonable to expect heritable individual differences along the prudence dimension.

Thus, as a tentative hypothesis, we propose that several of the responses characterized by a large heritable component that were identified in this research (but probably not specific product preferences, such as liking for chocolate) may be related to an underlying prudence tendency. Although there does not appear to be a previously identified heritable difference that might account for our findings, two of the Big Five personality factors (e.g., Goldberg 1992; Tupes and Christal 1961), neuroticism and conscientiousness, might be seen as related to prudence and to a tendency to compromise, select less risky options, and so on. Neuroticism (also referred to as "emotional stability") has often been measured using items such as angry-calm, tense-relaxed, and unstable-stable. Conscientiousness has been measured using items such as dis/organized, ir/responsible, negligent-conscientious, im/practical, and careless/thorough.

To examine the viability of these two factors, as well as of personality more generally, as potential explanations for the pattern of results in our twins study, we conducted a follow-up study. Two hundred and thirty-six singletons (mean age = 41; 73% females) were presented with the same set of materials described above as well as a number of additional scales pertaining to various individual differences that could potentially explain the observed cluster of heritable responses. The additional scales included a Big Five Personality Inventory (John, Naumann, and Soto 2008), Impulsivity scale (Puri 1996), Uniqueness Seeking scale (Snyder and Fromkin 1977), and a scale pertaining to the tendency to engage in Elaboration on Potential Outcomes (Nenkov, Inman, and Hulland 2008).

Preliminary analyses indicated that participants' demographics were similar to those of participants in the main study. Similarly, the mean results of the follow-up study (e.g., the percentage of participants choosing the compromise option) were not statistically different from those described in table 2 (all $t < 1.4$, NS). More importantly, the variable of interest was whether any of the personality and individual differences measured was correlated with responses on the focal judgment and decision-making problems. The analysis indicated that participants' responses were uncorrelated, with few fortuitous exceptions, with the personality and individual differences measured. Specifically, none of these individual differences emerged as a consistently significant predictor of responses to any of the judgment and choice paradigms tested (all omnibus $F(1, 204) < 1.1$, NS). The results of the follow-up study thus do not support the rival account whereby the pattern of responses we observed reflects the (already established) heritability of the Big Five personality factors.

GENERAL DISCUSSION

Understanding the links among heritable traits and behaviors, the mechanisms by which such heritable traits are created, and even what it means that people have certain heritable judgment and choice predispositions or inherent preferences is a very challenging task. Perhaps the first step is to map the types of choices and judgments that have a relatively large heritable component. The present research offers a rather comprehensive preliminary test of the role of heritability across a wide range of consumer choice problems and other JDM phenomena, most of which have not been studied previously in similar contexts.

Moreover, although (with the help of monozygotic and dizygotic twins) researchers have identified numerous heritable individual differences, identifying the heritable components and links underlying those findings may take decades because of our limited ability to observe or manipulate. Another key objective of the present exploratory research is to propose a different research program whereby we try to identify patterns in heritable judgment and choice tendencies by simultaneously studying many potentially related phenomena. Once a pattern emerges, subsequent studies can be used to test it further and attempt to identify higher-order traits and moderating factors that may underlie that pattern.

Of course, gaining insights into heritable patterns and links among various judgments and choices cannot be resolved based on one study or just a couple more studies.

While the recent advancements in the field of genetics, and, in particular, epigenetics (for a review, see, e.g., Champagne and Mashoodh [2009] and Szyf et al. [2008]) suggest that environmental (nurture) factors can affect gene expression and corresponding behavioral tendencies, the scope of our investigation and the extension to judgment and choice would require a significant extrapolation of current epigenetic research. Indeed, explaining how epigenetic (gene expression) changes might create a propensity to not/compromise appears much more complex than accounting for the impact of licking rat pups on their epigenetic characteristics (Champagne 2008). With so many moving parts, including perhaps hundreds of interacting epigenetic and other factors, it is highly unlikely that we would be able to determine in the foreseeable future how the hypothesized prudence tendency, or another construct that may fit even better, is created or influences consumer choices.

Beyond the inability to see in the epi/genetic dark or use standard process measures, as explained earlier, the problem of random noise is particularly severe with the kind of problems studied here. This includes noise related to the selection of JDM problem types and specific examples. It also refers to "genetic noise," that is, the high likelihood that many consumer and JDM problems contain more than one element that elicits heritable traits. For example, one of the problems we tested (Cars) had the surface structure of an asymmetric dominance problem, but it also involved preferences between hedonic and utilitarian dimensions (comfort and miles per gallon). Thus, the derived heritability estimates might depend on the relative weights of the two factors in determining observed preferences (which, in turn, might depend on situational factors such as temporary construct accessibility, task and contextual features, goals, and cognitive load).

Despite these challenges, the importance of understanding predispositions pertaining to consumer decision making and judgments and decisions more generally is a good reason to seek new research approaches. Indeed, while we have gained insights into the factors that make decisions malleable and the forces of preference construction (e.g., Bettman et al. 1998; Lichtenstein and Slovic 2006; Simonson 2008b), we know very little about inherent influences on preferences and decisions (Simonson 2008a).

Summary of Findings

Although behavior genetic researchers have reached the tentative conclusion that all individual differences have a heritable component (e.g., Johnson et al. 2009; Turkheimer 2000), heritability is likely to play a minor or nonsignificant role in some judgments and choices whereas it plays a major role in others. The present research has identified a pattern whereby certain choice problems, such as those involving compromise, vice and virtue, risk and loss, and maximizing, appear to have a relatively large heritable component. A follow-up study suggested that this emerging pattern is unlikely to be due to the known heritable differences in the Big Five personality factors. We have hypothesized that this emerging pattern may be attributable to an underlying tendency related to prudence. As suggested above, such a tendency may not necessarily mean that the same person always selects the prudent option or demonstrates similar prudence scores across all prudence-related problems.

The present research also identified judgment and choice problems for which heritability appears to play a relatively small role. While some of the nonsignificant findings may reflect noise, measurement error, and/or a relatively small sample (110 pairs of monozygotic twins and 70 pairs of dizygotic twins), they may also suggest, for example, that the fundamental cognitive heuristics or shortcuts identified by Tversky and Kahneman (e.g., 1974) tend to be more universal and therefore nonheritable (i.e., nondifferentiating). That is, although there are probably some individual differences with respect to the role of representativeness, availability, and anchoring, the heritable component appears to be rather small (nonsignificant in this research). Future research may also examine whether the degree of susceptibility to the affect heuristic (Slovic et al. 2002) has a significant heritable component.

Susceptibility to asymmetric dominance also appears to have a smaller heritable component than the compromise effect, which illustrates the fundamental differences between these context effects. Specifically, prior research (Dhar and Simonson 2003; Novemsky et al. 2007; Simonson 1989) suggests that the asymmetric dominance effect results directly from the perceived attractiveness of the dominating option, whereas choosing the middle option is often an explicit, conscious compromise between conflicting preferences as a means for reducing conflict and anticipated regret. Similarly, discounting, variety seeking, and other tested choice dilemmas do not appear to have a large heritable component, though future research may identify relevant moderating factors. Finally, although consumers certainly do not have genes for hybrid cars, chocolate, jazz music, or science fiction movies, the present research shows that such common preferences reflect a large heritable component. Future research might identify clusters of product and experience preferences that are genetically linked.

Heritable Consumer Preferences, BDT Effects, and the Definition of Irrationality

If we were born with no heritable preferences and never acquired stable preferences later in life, it would have been possible to interpret almost any decision or response in terms of construction. If, on the other hand, we were born with a complete set of hardwired, heritable, stable, unchanging preferences, then it would not be meaningful to rely on construction as an explanation for observed responses. Importantly, even in the latter scenario, observed responses may behave as if preferences are constructed based on the context, task, and/or frame, despite the fact that these responses were genetically "constructed." That is, preferences that meet the economic criterion for irrationality but are due in part to inherited tendencies can be regarded as "constructive predispositions," which may seem like an oxymoron.

However, the evidence that people have a predisposition to construct their preferences in certain ways (e.g., be influenced by certain context, framing, and task features) suggests that constructive dispositions can exist.

A systematic tendency to select a compromise option, which has been shown to violate value maximization (Tversky and Simonson 1993) and appears to have a significant heritable component, illustrates the point. A question that arises, assuming people are born with the tendency to prefer (or avoid) middle options, is whether it is meaningful to treat their observed preferences for/against middle options as evidence for construction. That is, if people are (partially) genetically predisposed to compromising (i.e., violate value maximization or "rationality"), with little sensitivity to absolute values, can we interpret their choices of middle options as evidence for irrationality merely because a certain field (i.e., economics) assumes that absolute values determine utility? We think that the answer is no, because "construction" refers to what was not there before the problem or decision was considered. In fact, it is preferences for absolute values that often do not preexist, whereas preferences for relative values and other construction mechanisms can be rather stable and, as suggested by the current research, even heritable (see also Simonson 2008b).

Genetic influences on consumer preferences, and judgment and choice more generally, also raise questions about our previous interpretations of a wide range of BDT effects. Most demonstrations of BDT effects (e.g., preference reversals) are based on inconsistent responses to two seemingly equivalent versions of a problem. But, in many cases, the two versions involve different psychological experiences and, hence, responses (e.g., a loss vs. gain frame in the Asian Disease problem [Tversky and Kahneman 1981]; or the addition of an asymmetrically dominated option [Huber et al. 1982]). Importantly, the current research highlights the possibility that each of these different problem versions and psychological states also have distinct genetic correlates. For example, the addition of a middle option to a set consisting of a high price/quality option and a low price/quality option may elicit different genetic predispositions, which may each be associated with other (distinct) heritable tendencies. Thus, while we often rely on conceptual commonalities to classify phenomena, genetically speaking, they may be quite different.

Loss aversion is a noteworthy example, not only because it is important and fundamental but because it has been used to explain a wide range of seemingly distinct phenomena. For example, the test of loss aversion used in this research is very different from endowment experiments and may very well involve different epi/genetic influences. And the preference invariance assumption notwithstanding, choice, separate option ratings, and matching may involve different heritable tendencies. Since our genetic makeup (DNA) is given, perhaps it deserves "priority" (especially if it could be identified) relative to conceptual considerations that have no hard-wired basis. Thus, while parsimonious accounts often simplify and unify seemingly diverse phenomena and principles, the resulting generalizations may obscure the different genetic origins of these phenomena and lead to incorrect conclusions.

Research Directions

As the above discussion and previous studies suggest, the addition of a genetic dimension to our discussion about choice, judgment, and decision making more generally could change some fundamental aspects of our perspective. However, despite the very long history of research on heritability, this area has received limited attention in the consumer decision making field. Just as we had faulted certain unrealistic assumptions of economic theory, the still evident supremacy in social psychology research of the situation over the person (Ross and Nisbett 1991) might have caused the neglect of this naturally important source of influence on decisions and consumer behavior. Also, as indicated, almost all twins studies have focused separately on just one or few heritable aspects, making it more difficult to see the big picture regarding the types of decisions and judgments that tend to have a significant heritable origin.

There are many interesting topics in this area, and the following are just a few promising directions. As noted, the currently predominant view is that our genetic makeup makes us more susceptible to specific interactions with the environment, thereby enhancing the likelihood of certain traits and behaviors. Research methods for studying such interactions have been identified (see McGowan et al. 2009; Moffitt, Caspi, and Rutter 2005). Such techniques, which require collaboration between decision researchers and experts in genetics, can be applied to the study of decision tendencies and consumer behavior. Furthermore, using fMRI and other brain response measures (e.g., Knutson et al. 2007; Schmidt et al. 2009; Shiv et al. 2005), we may be able to observe whether prudence and other heritable predispositions influence the manner in which people process choice options, frames, and other judgments and decision stimuli.

Future research needs to provide better insight into the nature and scope of both heritable and nurture influences on judgment and choice. First, while our investigation was broad in its scope, each problem type was tested with just a couple of examples, which in some cases produced inconsistent results (e.g., just one of two tests relating to loss aversion showed a heritable pattern). Accordingly, future research might further examine the robustness of our results and identify moderating factors. Second, building on our and prior findings across many domains, we advanced the prudence hypothesis. This view suggests that a broad class of problems people encounter in everyday life is susceptible, to varying degrees, to genetic influences that produce inherent individual differences in decision tendencies. Of course, this perspective offers one conceptually unifying view that generally fits the data; there are likely to be other perspectives that, with further research and attempts at replication, might prove to be more accurate depictions of the heritability of decisions.

Furthermore, we presented evidence suggesting that perceptual heuristics involve a smaller heritable component, possibly because they are more universal among human beings. Of course, there are differences among people with respect to their response to problems that elicit affective reactions or involve availability, representative, and other heuristics. We attribute such differences to "noise" relating to other elements of these problems (e.g., the Linda problem that was tested) and the individual (e.g., prior experiences and beliefs). However, much more research is needed to determine whether indeed susceptibility to judgment heuristics and affective reactions is not heritable and, if so, the factors that make such reactions more universal.

The very tentative notion of a heritable prudence predisposition suggests that we might observe cross-generational (i.e., parent-child) similarities with respect to prudence dilemmas that are greater than similarities with respect to other choice and judgment responses. This proposition might be examined in future research. Also, although investigations regarding genetic differences among ethnic group have generated a great deal of controversy, going all the way to Galton's nineteenth-century work on the genetics of geniuses, the prudence hypothesis suggests possible heritable cross-cultural differences. That is, in the domain of judgment and choice, an examination of heritable cross-cultural differences in heritable decision tendencies is a promising direction. Thus, prudence tendencies may very well vary across cultures, and such differences might be partially explained by genetic differences, perhaps reflecting interactions between people's genetic makeup and other characteristics of each culture.

Gaining a better understanding of heritable, inherent differences may also contribute to the enhancement of the effectiveness of market research techniques (see also Simonson 2008a). It is probably not controversial to conclude that (properly conducted) market research can provide useful insights regarding consumers' preferences for variations of existing and familiar products, services, and technologies. On the other hand, market research tends to be rather ineffective with respect to new products, services, and technologies, in part because respondents have difficulty foreseeing and comprehending the implications and value of very different objects and environments.

However, while heritable preferences are certainly just one factor that may influence consumers' reactions to new objects (e.g., marketing strategies and their implementation often make a difference), understanding the genetic component can provide insights regarding new products and technologies that have a better chance of being well-received by particular genetic segments. For example, genetic research could potentially reveal that a video game that uses a motion-sensitive remote (i.e., the Nintendo Wii) or a cell phone that has the features of the Apple iPhone is likely to benefit from certain genetic predispositions, perhaps even suggesting the most promising target consumer segments. Furthermore, future research might provide insights with respect to any heritable traits that make people more likely to prefer certain brands (e.g., utilitarian vs. luxury brands) or respond favorably to particular types of advertisements.

In the foreseeable future, research in this area will have obvious limitations in terms of our ability to pinpoint the underlying biological effects and reach unambiguous conclusions regarding the genetics of decisions, as opposed to mere hypotheses that deserve further study. Although the recent advances in epigenetics and molecular genetics provide hints regarding possible mechanisms that could affect mental processes and resulting behaviors, concrete, precise, complete evidence is unlikely to be obtained any time soon. However, it would be a mistake to continue our neglect of the role of genetics and heritability in judgment and choice given that there is little doubt that such effects represent a major influence that deserves a great deal more research.

REFERENCES

Alford, John, Carolyn Funk, and John Hibbing (2005), "Are Political Orientations Genetically Transmitted?" *American Political Science Review*, 99 (2), 153–67.

Belk, Russell (1988), "Possessions and the Extended Self," *Journal of Consumer Research*, 15 (September), 139–68.

Bettman, James, Mary Frances Luce, and John Payne (1998), "Constructive Consumer Choice Processes," *Journal of Consumer Research*, 25 (4), 187–217.

Björklund, Anders, Markus Jäntii, and Gary Solon (2005), "Influences of Nature and Nurture on Earnings Variation: A Report on a Study of Various Sibling Types in Sweden," in *Unequal Chances: Family Background and Economic Success*, ed. Samuel Bowles, Herbert Gintis, and Melissa Osborne, New York: Russell Sage Foundation, 145–65.

Bouchard, Thomas J. (1998), "Genetic and Environmental Influences on Adult Intelligence and Special Mental Abilities," *Human Biology*, 70 (2), 257–79.

Bouchard, Thomas J., David T. Lykken, Matthew McGue, Nancy L. Segal, and Auke Tellegen (1990), "Sources of Human Psychological Differences: The Minnesota Study of Twins Reared Apart," *Science*, 250 (4978), 223–28.

Bouchard, Thomas J. and Matthew McGue (2003), "Genetic and Environmental Influences on Human Psychological Differences," *Journal of Neurobiology*, 54 (1), 4–45.

Boughton, Barbara (2009), "Serotonin Gene, Even When Combined with Life Events, Has No Effect on Depression," *Medsape Medical News* (http://www.medscape.com/viewarticle/704520), June 17, updated June 25.

Cacioppo, John T., Richard E. Petty, and Chuan Feng Kao (1984), "The Efficient Assessment of Need for Cognition," *Journal of Personality Assessment*, 48 (3), 306–7.

Caspi, Avshalom, Karen Sugden, Terrie E. Moffitt, Alan Taylor, Ian W. Craig, HonaLee Harrington, Joseph McClay, Jonathan Mill, Judy Martin, Antony Braithwaite, and Richie Poulton (2003), "Influence of Life Stress on Depression: Moderation by a Polymorphism in the 5-HTT Gene," *Science*, 301 (5631), 386–89.

Cesarini, David, Christopher T. Dawes, Magnus Johannesson, Paul Lichtenstein, and Bjorn Wallace (2009), "Genetic Variation in Preference for Giving and Risk-Taking," *Quarterly Journal of Economics*, 124 (2), 809–42.

Champagne, Frances A. (2008), "Epigenetic Mechanisms and the Transgenerational Effects of Maternal Care," *Frontiers in Neuroendocrinology*, 29 (3), 386–97.

Champagne, Frances A. and Rahia Mashoodh (2009), "Genes in Context: Gene-Environment Interplay and the Origins of Individual Differences in Behavior," *Current Directions in Psychological Science*, 18 (3), 127–31.

Dhar, Ravi and Itamar Simonson (1999), "Making Complementary Choices in Consumption Episodes: Highlighting versus Balancing," *Journal of Marketing Research*, 36 (February), 29–44.

——— (2003), "The Effect of Forced Choice on Choice," *Journal of Marketing Research*, 40 (May), 146–60.

Dhar, Ravi and Klaus Wertenbroch (2000), "Consumer Choice between Hedonic and Utilitarian Goods," *Journal of Marketing Research*, 37 (February), 60–71.

Eaves, Lindon J., Hans J. Eysenck, and Nicholas G. Martin (1989), *Genes, Culture and Personality: An Empirical Approach*, San Diego, CA: Academic Press.

Epley, Nicholas and Thomas Gilovich (2001), "Putting Adjustment Back in the Anchoring and Adjustment Heuristic: Differential Processing of Self-Generated and Experimenter-Provided Anchors," *Psychological Science*, 12 (5), 391–96.

Falconer, Douglas S. (1989), *Introduction to Quantitative Genetics*, New York: Longman.

Fowler, James H., Laura A. Baker, and Christopher T. Dawes (2008), "Genetic Variation in Political Participation," *American Political Science Review*, 102 (2), 233–48.

Fowler, James H. and Christopher T. Dawes (2008), "Two Genes Predict Voter Turnout," *Journal of Politics*, 70 (3), 579–94.

Fowler, James H. and Darren Schreiber (2008), "Biology, Politics, and the Emerging Science of Human Nature," *Science*, 322 (5903), 912–14.

Frederick, Shane (2005), "Cognitive Reflection and Decision Making," *Journal of Economic Perspectives*, 19 (4), 25–42.

Galton, Francis (1875), "The History of Twins as a Criterion of the Relative Powers of Nature and Nurture," *Fraser's Magazine*, 92, 566–76.

Goldberg, Lewis (1992), "The Development of Markers for the Big-Five Factor Structure," *Psychological Assessment*, 4 (1), 26–42.

Heath, Andrew C., Valerie S. Knopik, Pamela A. Madden, Rosalind J. Neuman, Michael J. Lynskey, Wendy S. Slutske, Theodore Jacob, and Nicholas G. Martin (2003), "Accuracy of Mothers' Retrospective Reports of Smoking during Pregnancy: Comparison with Twin Sister Informant Ratings," *Twin Research*, 6 (4), 297–301.

Huber, Joel, John W. Payne, and Christopher Puto (1982), "Adding Asymmetrically Dominated Alternatives: Violations of Regularity and the Similarity Hypothesis," *Journal of Consumer Research*, 9 (June), 90–98.

John, Oliver P., Laura P. Naumann, and Christopher J. Soto (2008), "Paradigm Shift to the Integrative Big Five Trait Taxonomy: History, Measurement, and Conceptual Issues," in *Handbook of Personality: Theory and Research*, ed. Oliver P. John, Richard W. Robins, and Lawrence A. Pervin, New York: Guilford, 114–56.

Johnson, Wendy, Eric Turkheimer, Irving Gottesman, and Thomas Bouchard (2009), "Beyond Heritability: Twin Studies in Behavioral Research," *Current Directions in Psychological Science*, 18 (4), 217–20.

Kahneman, Daniel and Amos Tversky (1979), "Prospect Theory: An Analysis of Decision under Risk," *Econometrica*, 47 (March), 263–91.

Kivetz, Ran and Anat Keinan (2006), "Repenting Hyperopia: An Analysis of Self Control Regrets," *Journal of Consumer Research*, 33 (2), 273–82.

Kivetz, Ran and Itamar Simonson (2002), "Self-Control for the Righteous: Toward a Theory of Precommitment to Indulgence," *Journal of Consumer Research*, 29 (September), 199–217.

Knutson, Brian, Scott Rick, G. Elliott Wimmer, Drazen Prelec, and George Loewenstein (2007), "Neural Predictors of Purchase," *Neuron*, 53 (1), 147–56.

Koopman, Judith, Dorret Boomsma, Andrew Heath, and Lorenz van Doornen (1995), "A Multivariate Genetic Analysis of Sensation Seeking," *Behavior Genetics*, 25 (4), 349–56.

Liberman, Nira and Yaacov Trope (1998), "The Role of Feasibility and Desirability Considerations in Near and Distant Future Decisions: A Test of Temporal Construal Theory," *Journal of Personality and Social Psychology*, 75 (1), 5–18.

Lichtenstein, Sarah and Paul Slovic (2006), *The Construction of Preference*, Cambridge: Cambridge University Press.

Loewenstein, George and Drazen Prelec (1992), "Anomalies in Intertemporal Choice: Evidence and Interpretation," *Quarterly Journal of Economics*, 107 (2), 573–97.

Manning, Kenneth C., William O. Bearden, and Thomas J. Madden (1995), "Consumer Innovativeness and the Adoption Process," *Journal of Consumer Psychology*, 4 (4), 329–45.

Martin, N. G., L. J. Eaves, A. C. Heath, R. Jardine, L. M. Feingold, and H. J. Eysenck (1986), "Transmission of Social Attitudes," *Proceedings of the National Academy of Sciences,* 83 (June), 4364–68.

McGowan, Patrick O., Aya Sasaki, Ana C. D'Alessio, Sergiy Dymov, Benoit Labonté, Moshe Szyf, Gustavo Turecki, and Michael J. Meaney (2009), "Epigenetic Regulation of the Glucocorticoid Receptor in Human Brain Association with Childhood Abuse," *Nature Neuroscience*, 12 (3), 342–48.

Meaney, Michael J. (2001), "Nature, Nurture, and the Disunity of Knowledge," *Annals of New York Academy of Sciences*, 935 (1), 50–61.

Mellers, Barbara, Alan Schwartz, and Ilana Ritov (1999), "Emotion-Based Choice," *Journal of Experimental Psychology: General*, 128 (3), 332–45.

Moffitt, Terrie E. (2005), "The New Look of Behavioral Genetics in Developmental Psychopathology: Gene-Environment Interplay in Antisocial Behaviors," *Psychological Bulletin*, 131 (4), 533–54.

Moffitt, Terrie E., Avshalom Caspi, and Michael Rutter (2005), "Strategy for Investigating Interactions between Measured Genes and Measured Environments," *Archives of General Psychiatry*, 62 (May), 473–81.

Morris-Yates, A., G. Andrews, P. Howie, and S. Henderson (1990), "Twins: A Test of the Equal Environment Assumption," *Acta Psychiatry Scandinavia*, 81 (4), 322–26.

Neale, Michael, Steven Boker, Gary Xie, and Hermine Maes (2006), *MX: Statistical Modeling*, 7th ed., Richmond: Virginia Commonwealth University Department of Psychiatry.

Neale, Michael C. and Lon R. Cardon (1992), *Methodology for Genetic Studies of Twins and Families*, Dordrecht: Kluwer.

Neale, Michael C. and Hermine Maes (2004), *Methodology for Genetic Studies of Twins and Families*, Dordrecht: Kluwer.

Nenkov, Gergana Y., J. Jeffery Inman, and John Hulland (2008), "Considering the Future: The Conceptualization and Measurement of Elaboration on Potential Outcomes," *Journal of Consumer Research*, 35 (June), 126–41.

Nenkov, Gergana, Maureen Morrin, Andrew Ward, Barry Schwartz, and John Hulland (2008), "A Short Form of the Maximization Scale: Factor Structure, Reliability, and Validity Studies," *Judgment and Decision Making*, 3 (5), 371–88.

Nicolaou, Nicos, Lynn Cherkas, Janice Hankin, and Tim D. Spector

(2008), "Is the Tendency to Engage in Entrepreneurship Genetic?" *Management Science*, 54 (1), 167–79.

Novemsky, Nathan, Ravi Dhar, Norbert Schwarz, and Itamar Simonson (2007), "Preference Fluency in Choice," *Journal of Marketing Research*, 44 (August), 347–56.

Olson, James M., Philip A. Verson, Julie Aitkin Harris, and Kerry L. Jang (2001), "The Heritability of Attitudes: A Study of Twins," *Journal of Personality and Social Psychology*, 80 (6), 845–60.

Plomin, Robert, John C. DeFries, Gerald E. McClearn, and Peter McGuffin (2008), *Behavioral Genetics*, 5th ed., New York: Worth.

Puri, Radhika (1996), "Measuring and Modifying Consumer Impulsiveness: A Cost-Benefit Accessibility Framework," *Journal of Consumer Psychology*, 5 (2), 87–113.

Ridley, Matt (2003), *Nature via Nurture: Genes, Experience, and What Makes Us Human*, New York: Harper Collins.

Risch, Neil, Richard Herrell, Thomas Lehner, Kung-Yee Liang, Lindon Eaves, Josephine Hoh, Andrea Griem, Maria Kovacs, Jurg Ott, and Kathleen Merikangas (2009), "Interaction between the Serotonin Transporter Gene (5-HTTLPR), Stressful Life Events, and Risk of Depression: A Meta-analysis," *Journal of the American Medical Association*, 301 (23), 2462–70.

Rose, Richard J., Markku Koskenvuo, Jaakko Kaprio, Seppo Sarna, and Heimo Langinvainio (1988), "Shared Genes, Shared Experiences, and Similarity of Personality: Data from 14,288 Adult Finnish Co-Twins," *Journal of Personality and Social Psychology*, 54 (1), 161–71.

Ross, Lee and Richard E. Nisbett (1991), *The Person and the Situation: Perspectives of Social Psychology*, New York: McGraw-Hill.

Sarna, Seppo, Jaakko Kaprio, Pertti Sistonen, and Markku Koskenvuo (1978), "Diagnosis of Twin Zygosity by Mailed Questionnaire," *Human Heredity*, 28 (4), 241–54.

Schmidt, Louis A., Nathan A. Fox, Koraly Perez-Edgar, and Dean H. Hamer (2009), "Linking Gene, Brain, and Behavior: DRD4, Frontal Asymmetry, and Temperament," *Psychological Science* 20 (7): 831–37.

Schwartz, Barry, Andrew Ward, John Monterosso, Sonja Lyubomirsky, Katherine White, and Darrin R. Lehman (2002), "Maximizing versus Satisficing: Happiness Is a Matter of Choice," *Journal of Personality and Social Psychology*, 83 (5), 1178–97.

Schwarz, Norbert (2007), "Attitude Construction: Evaluation in Context," *Social Cognition*, 25 (5), 638–56.

Segal, Nancy L. (1999), *Entwined Lives*, New York: Plume.

Settle, Jaime E., Christopher T. Dawes, and James H. Fowler (2009), "The Heritability of Partisan Attachment," *Political Research Quarterly*, 63 (3), 601–13.

Shiv, Baba, George Loewenstein, Antoine Bechara, Hanna Damasio, and Antonio Damasio (2005), "Investment Behavior and the Negative Side of Emotion," *Psychological Science*, 16 (6), 435–39.

Simonson, Itamar (1989), "Choice Based on Reasons: The Case of Attraction and Compromise Effects," *Journal of Consumer Research*, 16 (September), 158–74.

——— (1990), "The Effect of Purchase Quantity and Timing on Variety-Seeking Behavior," *Journal of Marketing Research*, 27 (May), 150–62.

——— (2008a), "Regarding Inherent Preferences," *Journal of Consumer Psychology*, 18 (3), 191–96.

——— (2008b), "Will I Like a 'Medium' Pillow? Another Look at Constructed and Inherent Preferences," *Journal of Consumer Psychology*, 18 (3), 155–69.

Simonson, Itamar and Stephen M. Nowlis (2000), "The Role of Explanations and Need for Uniqueness in Consumer Decision Making: Unconventional Choices Based on Reasons," *Journal of Consumer Research*, 27 (June), 49-68.

Simonson, Itamar and Amos Tversky (1992), "Choice in Context: Tradeoff Contrast and Extremeness Aversion," *Journal of Marketing Research*, 29 (August), 281–95.

Slovic, Paul, Melissa L. Finucane, Ellen Peters, and Donald G. MacGregor (2002), "Rational Actors or Rational Fools? Implications of the Affect Heuristic for Behavioral Economics," *Journal of Socio-Economics*, 31 (4), 329–42.

Snyder, C. Richard and Howard L. Fromkin (1977), "Abnormality as a Positive Characteristic: The Development and Validation of a Scale Measuring Need for Uniqueness," *Journal of Abnormal Psychology*, 86 (5), 518–27.

Steenkamp, Jan-Benedict E. M. and Hans Baumgartner (1995), "Development and Cross-Cultural Validation of a Short Form of CSI as a Measure of Optimum Stimulation Level," *International Journal of Research in Marketing*, 12 (2), 97–104.

Swan, Gary E., Neal L. Benowitz, Christina N. Lessov, Peyton Jacob III, Rachel F. Tyndale, and Kirk C. Wilhelmsen (2005), "Nicotine Metabolism: The Impact of CYP2A6 on Estimates of Additive Genetic Influence," *Pharmacogenetics and Genomics*, 15 (2), 115–25.

Swan, Gary E., Christina N. Lessov-Schlaggar, Ruth E. Krasnow, Kirk C. Wilhelmsen, Peyton Jacob III, and Neal L. Benowitz (2007), "Genetic and Environmental Sources of Variation in Heart Rate Response to Infused Nicotine in Twins," *Cancer Epidemiology Biomarkers and Prevention*, 16 (6), 1057–64.

Szyf, Moshe, Patrick McGowan, and Michael J. Meaney (2008), "The Social Environment and the Epigenome," *Environmental and Molecular Mutagenesis*, 49 (1), 46–60.

Taubman, Paul (1976), "The Determinants of Earnings: Genetics, Family, and Other Environments; A Study of White Male Twins," *American Economic Review*, 66 (5), 858–70.

Tesser, Abraham (1993), "The Importance of Heritability in Psychological Research: The Case of Attitudes," *Psychological Review*, 100 (1), 129–42.

Tupes, Ernest C. and Reymond C. Christal (1961), *Recurrent Personality Factors Based on Trait Ratings*, Lackland Air Force Base, TX: US Air Force.

Turkheimer, Eric (2000), "Three Laws of Behavior Genetics and What They Mean," *Current Directions in Psychological Science*, 9 (5), 160–64.

Tversky, Amos and Daniel Kahneman (1974), "Judgment under Uncertainty: Heuristics and Biases," *Science*, 185 (4157), 1124–31.

——— (1981), "The Framing of Decisions and the Psychology of Choice," *Science*, 211 (4481), 453–58.

——— (1983), "Extensional versus Intuitive Reasoning: The Conjunction Fallacy in Probability Judgment," *Psychological Review*, 90 (1983), 293–315.

——— (1993), "Context-Dependent Preferences," *Management Science*, 39 (10), 1179–89.

Wright, Lawrence (1997), *Twins and What They Tell Us about Who We Are*, New York: Wiley.

Zuckerman, Marvin (1971), "Dimensions of Sensation Seeking," *Journal of Consulting and Clinical Psychology*, 36 (1), 45–52.