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Confidence in Personal Preferences

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ABSTRACT

The first aim of this study was to test the self-consistency model (SCM) of subjective confidence as it applies to personal preferences. According to SCM, participants presented with a two-alternative forced-choice (2AFC) item draw a small sample of representations of the item. Their confidence reflects the extent to which the choice is representative of the population of representations associated with the item, and the likelihood of making that choice on subsequent occasions. The second aim was to use confidence judgment as a clue to the dynamics of online preference construction. Participants were presented with 2AFC items measuring everyday personal preferences. The task was presented five times. In line with SCM, (i) when participants changed their preferences across presentations, they were systematically more confident when they made their more frequent choice; (ii) confidence in a choice in the item's first presentation predicted the likelihood of repeating that choice in subsequent presentations; (iii) despite the idiosyncratic nature of personal preferences, confidence was higher for consensual than for nonconsensual preferences; (iv) when participants predicted the preferences of others, they were also more confident when their predictions agreed with those of others; and (v) the confidence/accuracy correlation for predictions was positive for consensually correct but negative for consensually wrong predictions. These results suggest that confidence in preferences can help separate between the stable and variable contributions to preference construction in terms of the population of representations available in memory and the representations that are accessible at the time of preference solicitation, respectively. Copyright © 2012 John Wiley & Sons, Ltd.

KEY WORDS preference construction; subjective confidence; self-consistency; response latency

INTRODUCTION

A large body of research on judgment and decision-making has concerned preferences and values. Personal preferences involve subjective value judgments for which there is no unique criterion of accuracy like that generally available for inferences. However, it has been proposed that inferences and preferences draw on the same cognitive processes (Gigerenzer & Gaissmaier, 2011; Weber & Johnson, 2006). This proposal will be examined with regard to confidence judgments in one's personal preferences by applying a theoretical model that has been found useful for confidence in general knowledge and perceptual judgments (Koriat, 2011, 2012).

A view that has dominated much of the research on preferences is that preferences are generally constructed in the process of elicitation rather than retrieved ready-made from memory (Lichtenstein & Slovic, 2006; Slovic, 1995). A similar view has been advanced with regard to social attitudes. It has been argued that attitudinal judgments are constructed on the spot, on the basis of the information that is accessible when making the judgment (Bless & Schwarz, 2010; Koriat & Adiv, 2011; Schwarz, 2007). In the study of preferences, the constructive view has received its impetus from observations indicating that normatively equivalent methods of eliciting preferences often yield systematically different preferences (Slovic, 1995). Many studies documented preference reversals by using simple gambles with monetary outcomes. However, other studies that used stimuli from a variety of domains also indicated that preferences are quite labile, sensitive to several factors including the way the choice problem is framed, the task, the context, and the goal of the respondent (see Bettman, Luce, & Payne, 1998; Shafir, Simonson, & Tversky, 1993; Warren, McGraw, & Van Boven, 2011). These findings have turned attention to the psychological processes underlying preference construction.

This study concerns the confidence that participants express in their personal preferences. In the task used in this study, participants were presented with two-alternative, forced-choice (2AFC) questions about their everyday personal preferences. For example, they were asked whether they would prefer to visit Jerusalem or Tel Aviv, whether they prefer to use a pen or a pencil, or whether they would prefer to adopt a dog or a cat. These decisions cannot be based on calculations, but reflect complex considerations that take into account peoples' subjective values. After responding to each question, participants indicated their confidence in their choice. One aim of the study was to test a model of subjective confidence in choice, but a more general aim was to use confidence judgments as a tool for obtaining some clues into the dynamics of preference construction.

Several studies indicated that people change their preferences as they go about making decisions (Simon, Krawczyk, Bleicher, & Holyoak, 2008; Slovic, 1995). In this study, we focus on the spontaneous changes in preference that often occur when the same item is presented on different occasions and use the corresponding changes in confidence judgments to track the online construction of preferences. Because many decisions are based on preferences that are fairly stable across contexts (see Simonson, 2008), we will also use confidence judgments as a tool for separating

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the variable, situation-specific components of preference construction, from the more stable components (see Payne, Bettman, & Johnson, 1992).

The self-consistency model of subjective confidence

Consider the following question: "Where would you prefer to shop for groceries, (a) a supermarket, (b) a marketplace?" A variety of clues, images, and considerations would probably run through your head, each associated with some valuation. Thus, you might recall your last shopping trip, imagine yourself strolling in the marketplace, and notice that the weather is hot and the market place is not the place to be. You might also recall that there are a few groceries that are not available in the marketplace, and you may also realize that actually you regularly shop for food at the supermarket and try to ask yourself why. The exploration of pertinent clues and considerations is probably very associative and haphazard and is contingent on many contextual factors. Next time around, other cues might come to mind and your reported preference might be different.

When you have indicated your preference, how do you assess your confidence in the choice? In this study, we test predictions from a self-consistency model (SCM) that has been proposed for 2AFC questions (Koriat, 2012). The model assumes that the process underlying confidence has much in common with that underlying statistical inference. Participants behave like intuitive statisticians who attempt to reach a conclusion about a population on the basis of a small sample of observations. SCM incorporates a sampling assumption that is common in many decision models (e.g., Juslin & Olsson, 1997; Stewart, 2009; Stewart, Chater, & Brown, 2006; Vickers & Pietsch, 2001; Vul, Goodman, Griffiths, & Tenenbaum, 2009). In each encounter with a 2AFC item, participants sample a number of representations from a population of potential representations associated with that item. The term "representation" was used as an abstract term that may apply to different domains. It refers to any consideration, framing, interpretation, or clue that may tip the balance in favor of one option or the other. Of course, many representations cannot be casted in a propositional form and may consist of images, associations, a feeling of familiarity, and so on. Because of the limitations of the cognitive system and the need to aggregate information across different representations, only a small number of representations are sampled on each occasion. Once a choice has been made, confidence in that choice is then based on feedback from the process of reaching that choice. That feedback consists primarily of mnemonic cues that disclose self-consistency—the consistency with which that choice was supported across the sampled representations. Self-consistency may be gauged from such frugal mnemonic cues as the degree of doubt and conflict experienced, or the amount of effort and time invested in making the choice.

Clearly, the type of representations retrieved in making a choice may differ depending on the domain of the question. However, SCM assumes that the gross architecture of the process is similar across a variety of 2AFC tasks including general knowledge (Koriat, 2012), perceptual judgments (Koriat, 2011), and social attitudes (Koriat & Adiv, 2011). This is particularly true of the retrospective portrayal of the process that is assumed to underlie retrospective confidence. Self-consistency is therefore conceived as a contentless indicator that reflects the balance of evidence in favor of the two options. This proposal is in the spirit of several models, particularly the reason-based perspective of Shafir et al. (1993) (see Koriat, Lichtenstein, & Fischhoff, 1980; Simonson, 1989; Slovic, 1975). Alba and Marmorstein (1987) also proposed that people might evaluate alternatives on the basis of the mere number of positive and negative attributes associated with each alternative or the number of dimensions on which one alternative is superior to another. Stewart's (2009) decision by sampling theory also assumes that the subjective value of an outcome or probability is derived from a series of binary, ordinal comparisons with a sample of other outcomes or probabilities from the decision environment.

The self-consistency model has been described in some detail elsewhere (Koriat, 2012), and therefore, only a brief outline will be presented here. The model assumes that subjective confidence is computed much like statistical level of confidence and reflects the person's assessment of reproducibility—the likelihood that a new sample of representations will yield the same choice. Thus, underlying subjective confidence is the implicit belief (common among researchers but challenged by statisticians, see Dienes, 2011; Schervish, 1996) that the statistical level of significance is diagnostic of the correctness of the tested hypothesis, as well as the likely reproducibility of the observed result.

In this article, we will use a specific instantiation of the model that assumes the following: (i) For each 2AFC item, a maximum number of representations ($n_{\max}$) is sampled randomly; (ii) each representation yields a binary subdecision, favoring one of the two options; (iii) if a preset number (n_{run}) of successively retrieved representations yields the same subdecision, the retrieval of representations is stopped, and that subdecision determines the choice; and (iv) each subdecision makes an equal contribution to the self-consistency index, which is assumed to underlie subjective confidence.

To examine the implications of the model, we ran a simulation experiment in which $n_{\max}$ was set at 7 and n_{run} was set at 3, so that the actual size of the sample (n_{act}) underlying confidence could vary between 3 and 7 (see Koriat & Adiv, 2011). Assume that p_{maj} represents the proportion of representations in support of the majority choice, a vector of 9 binomial populations that differ in p_{maj} was assumed, with p_{maj} varying from .55 to .95, at .05 steps. For each population, 90 000 iterations were run. Choices were classified as "majority" when they corresponded to the majority value in the population and as "minority" when they corresponded to the minority value in the population. A self-consistency index was calculated for each iteration, defined as $1 - \sqrt{\hat{p}\hat{q}}$ (range .5–1.0), when p and q designate the proportion of representations favoring the two choices, respectively.

Figure 1(A) plots self-consistency for majority and minority choices and for all choices combined as a function of p_{maj}. It can be seen that self-consistency increases monotonically

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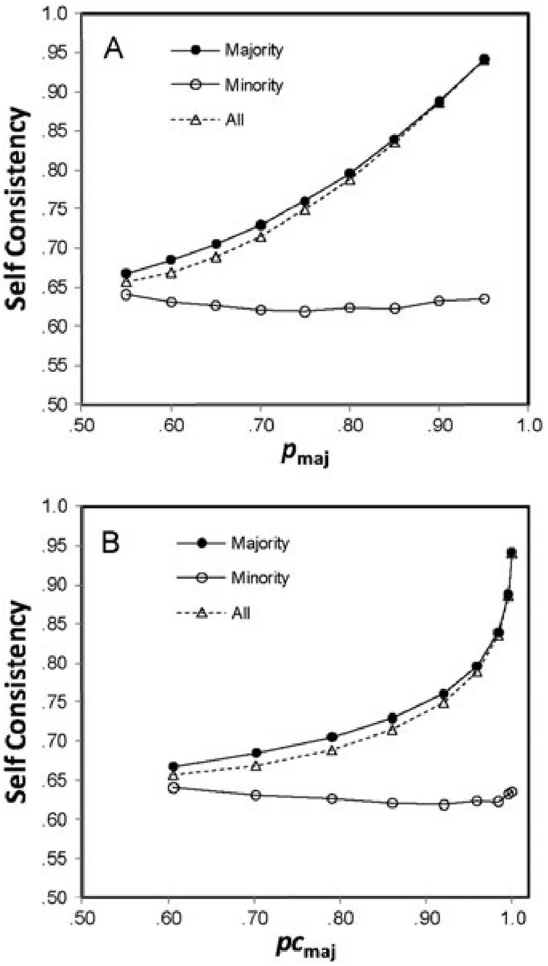

Figure 1. (A) Self-consistency scores as a function of the probability of drawing a majority representation (p_{maj}). (B) Self-consistency scores as a function of the probability of choosing the majority option (pc_{maj}). Reprinted from Panel A in Figures 1 and 2 of Koriat and Adiv (2011). Copyright by Guilford Press

with p_{maj}, but more importantly, it is systematically higher for majority than for minority choices. The reason is that as long as $p_{maj} > .50$, majority choices will be supported by a larger proportion of the sampled representations than minority choices. For example, for $p_{maj} = .70$, and sample size = 7, the likelihood that six or seven representations will favor the majority choice is .329, whereas only in .004 of the samples will six or seven representations favor the minority choice. Thus, the expectation is that confidence should be higher for majority choices than for minority choices.

How can these predictions be tested? An important assumption that guided our previous investigation of confidence in general-knowledge questions is that people sample their representations from a population of item-specific representations that is largely commonly shared. Therefore, p_{maj} for a given item can be inferred from pc_{maj}—the probability with which the majority alternative is chosen. This probability can be indexed operationally by (i) the proportion of participants who choose the preferred alternative ("item consensus") or by (ii) the proportion of times that the same participant chooses his or her most frequent alternative across several presentations of the item ("item consistency"). Figure 1(B) plots the expected results. This figure was formed by replacing the p_{maj} values in Figure 1(A) with the corresponding pc_{maj} values (which were also derived from the same simulation).

Assuming that response latency is a monotonic function of n_{act}, the results for n_{act} suggested that response speed should vary as a function of p_{maj} and pc_{maj} in much the same way as confidence judgments (see Koriat, 2012).

The functions plotted in Figure 1(B), and the respective functions for n_{act}, provided predictions that were largely confirmed for general-knowledge questions (Koriat, 2012) and perceptual judgments (Koriat, 2011). In both of these domains, there was also evidence substantiating the assumption that participants share a core of representations from which they draw the samples on which they base their choice and confidence.

Of course, the assumption of a common population of representations might not be tenable for personal preferences, which are subjective and depend on personal taste. Nevertheless, results obtained by Koriat and Adiv (2011) for social attitudes were consistent with the assumption of a shared core of representations underlying choice and confidence. To the extent that such is also true for personal preferences, the predicted pattern of results (Figure 1(B)) may be obtained when pc_{maj} is estimated not only from within-person consistency but also from cross-person consensus. In that case, predictions derived from SCM can shed light on the process underlying the construction of preferences.

Subjective confidence and the construction of preferences

What are the implications for the construction of personal preferences? A unique aspect of SCM is that it draws attention to possible systematic differences in confidence between different *choices* so that confidence judgments can help track the online construction of specific preferences. There is no question that people have characteristic, stable preferences in many domains (Simonson, 2008). At the same time, personal preferences tend to be labile, changing to some extent with various factors. The sampling assumption underlying SCM offers a conceptualization that accommodates both observations. The distinction between the stable and variable components of personal preferences can be conceptualized in terms of the distinction between availability and accessibility (see Tulving & Pearlstone, 1966). The stable components stem from the constraints imposed by the population of representations available in memory in connection with a particular 2AFC item. That population constraints the extent of fluctuation in preferences that may be expected across occasions. However, the specific preference made on each occasion is determined by the representations that are accessible on that occasion. According to SCM, confidence and response latency are sensitive to both the stable and variable contributions to the construction of preferences and can help in specifying their relative impact in each case.

THE STUDY

Participants in this study were presented with 60 2AFC items measuring personal preferences. For each item, they marked

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their preferred option and indicated their confidence. The task was administered five times (blocks) during two days that were a week apart, with filler questionnaires interspersed between blocks in each of the days. In the final, sixth block, participants were presented with the same questions, but were asked to predict for each item which of the two options is likely to be chosen by the majority of participants. (The reasons for including this condition will be explained later.)

Method

Participants

Forty-one Hebrew-speaking undergraduates from the University of Haifa (13 men) participated in the experiment, 10 for course credit and 31 for payment.

Stimulus materials

A 60-item list of 2AFC items that measure personal preferences was constructed. The items covered a wide range of domains, for example, "Which sport activity would you prefer, (a) jogging, (b) swimming?" "Which animal would you prefer to adopt, (a) dog, (b) cat?" Two self-report questionnaires were used as fillers between different blocks, the Need for Closure Scale (NFCS; Webster & Kruglanski, 1994; 42 items) and the Rational-Experiential Inventory (REI; Pacini & Epstein, 1999; 40 items).

Apparatus and procedure

The experiment was conducted on an IBM-compatible personal computer. It consisted of two sessions, with the second session taking place exactly one week after the first. Each of the sessions included three blocks in each of which the entire set of 60 items was presented. For Blocks 1–5 (Self), participants chose for each question the option that reflects best their own preference. They were told that there are no correct answers and that they should respond according to their own personal feelings. In Block 6 (Other), they were asked to guess which of the two options would be preferred by most (i.e., more than 50%) participants. Participants were further instructed that after choosing an option, they should rate on a 0–100 scale how confident they were in their choice (0 = *very unsure*, 100 = *very sure*). They were encouraged to use the full range of the confidence scale.

In each trial, the question was presented until the participants clicked a *continue* box to indicate that they had finished reading the question, at which time the response options were added beneath the question. The participants indicated their choice by clicking one of the two alternatives. Response latency was measured, defined as the interval between the *continue* press and the choice of an alternative. After pressing a *confirm* box, a horizontal confidence scale was added beneath the alternatives. Participants marked their confidence by sliding a pointer on the scale using the mouse (a number in the range 0–100 corresponding to the location of the pointer on the scale was shown in a box) and then clicked a second *confirm* box. The order of presentation of the items was random for each participant and block. Each block began with two warm-up items, similar in content and format to those of the 60 experimental items.

The first part of the NFCS scale (21 items) was administered on the computer following Block 1, and the second part following Block 2. In the second session, the first part of the REI scale (20 items) was presented after Block 4, and the second part after Block 5.

Results

One item was eliminated because the same alternative was chosen in 204 out of the 205 self trials (41 participants × 5 blocks). For the remaining items, participants tended to indicate the same preference consistently across the five self blocks. Thus, the likelihood of repeating the Block 1 response over the next four blocks averaged .97. However, all participants except one exhibited some fluctuation in responding to some of the items across blocks. Also, for 55 out of the 59 items, one or more participants exhibited some fluctuation. These two properties—stability and fluctuation—are critical for the testing of SCM.

The organization of the Results section will be as follows. The first section will concern the results from the first five blocks (Self) whereas the second will examine the results from the final (Other) block. The first section begins with examination of the relationship between confidence and response latency. We then examine the predictions regarding inter-participant consensus and then those regarding within-person consistency. These predictions will be tested for both confidence judgments and response latency. The relationship between response consistency and response consensus will then be examined as well as their relative contribution to confidence. Finally, we test the reproducibility hypothesis—that confidence represents an assessment that the same preference will be made on subsequent presentations of the item.

In the second section, we first examine the possibility that confidence in predictions, such as confidence in one's own preferences, is also based on self-consistency. We then test the predictions of SCM for the confidence/accuracy (C/A) correlation—the extent to which confidence judgments are diagnostic of the accuracy of one's predictions.

Because the analyses to be presented in the succeeding texts were carried out for both confidence and response latency, we first report the relationship between these two variables. In all the analyses of response latency, latencies that were below or above 2.5 *SD*s from each participant's mean were eliminated (3.22% for Block 1 and 3.10% across all five blocks). The results of Block 1 confirmed that confidence and response latency were negatively correlated. When all items were divided at the median of each participant's response latency, confidence was significantly higher for below-median latencies (90.28) than for above-median latencies (73.74), $t(40) = 10.25$, $p < .0001$. The Pearson correlation across all 59 items between confidence and latency averaged −.52 across participants, $t(40) = 20.70$, $p < .0001$. Thus, confidence was inversely related to response latency as has been found in previous studies (Kelley & Lindsay, 1993; Koriat, 2008; Koriat, Ma'ayan, & Nussinson, 2006; Robinson, Johnson, & Herndon, 1997).

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Confidence and latency as related to cross-person response consensus

Focusing first on cross-person consensus, we now test the predictions of SCM (Figure 1(B)) regarding the functions relating confidence and latency to inter-person consensus. The analyses will be based only on the results of Block 1.

Confidence as a function of cross-person consensus

For each of the 59 items, we determined the consensual (majority) choice and calculated item consensus—the proportion of participants who made that choice. Item consensus averaged 70.15% across items (range 51.2–97.6%). Figure 2 (A) presents mean confidence ratings for the consensual and nonconsensual choices for each of six item consensus categories (51–59%, 60–69%, 70–79%, 80–89%, 90–99%, 100%).

Mean confidence increased monotonically with item consensus, as predicted. Indeed, when mean confidence and mean item consensus were calculated for each item, the correlation between them over the 59 items was .41 ($p < .005$). However, across items, consensual choices were endorsed with higher confidence (82.09) than nonconsensual choices (76.73), $t(58) = 4.13$, $p < .0001$. For 44 items, confidence was higher for the consensual choice than for the nonconsensual choice, in comparison with 15 items in which the pattern was reversed, $p < .0005$, by a binomial test. Across items, confidence in the consensual choice correlated .46 with item consensus, $p < .0005$, and confidence in the nonconsensual choice correlated $-.29$, $p < .05$. These results are in line with the idea that participants sample representations from a commonly shared population of representations, and their confidence is relatively low when the sample drawn deviates in its implications from what follows from the entire population of representations.

Because the confidence means for consensual and nonconsensual responses were based on different participants, the possibility exists that the difference between them reflects a between-individual effect: Participants who tend to make the consensual choice tend also to use relatively high confidence judgments. Consistent with previous findings (e.g., Stankov & Crawford, 1997), there were marked and reliable individual differences in the tendency to use relatively high or relatively low confidence judgments. However, when the confidence judgments of each participant were standardized so that the mean and standard deviation of each participant were the same as those of the raw scores across all participants, the results were very similar to those depicted in Figure 2(A) (see Figure 2 (B)): Confidence judgments averaged 82.02 for consensual responses compared with 76.65 for nonconsensual responses, $t(58) = 3.76$, $p < .0005$. For 40 items, consensual responses were endorsed with higher confidence than nonconsensual responses, compared with 19 items displaying the reverse pattern, $p < .01$, by a binomial test.

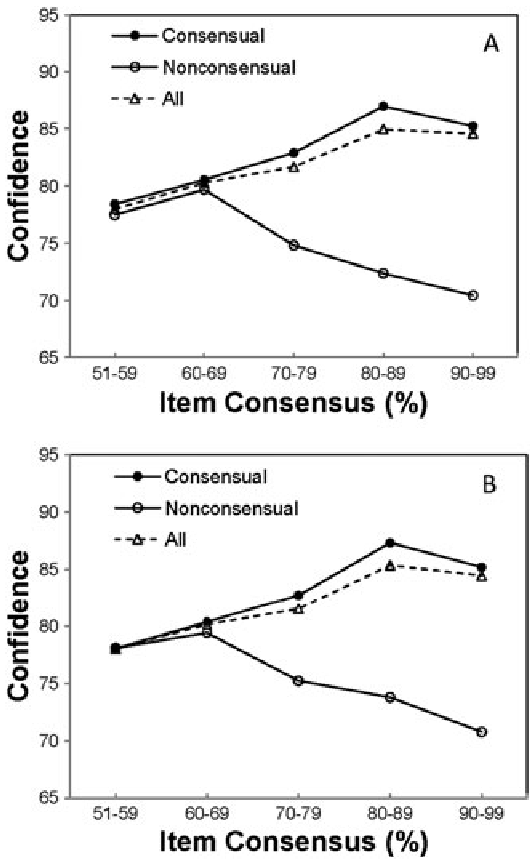

Figure 2. (A) Mean confidence judgments in Block 1 for consensual and nonconsensual choices as a function of item consensus (the percentage of participants who made the majority choice). (B) The same data after correcting confidence judgments for inter-individual differences in mean confidence judgments

Choice latency as a function of cross-person consensus

Similar analyses were conducted for choice latency, assuming that choice latency is a frugal index of self-consistency. The results (Figure 3(A)) mimicked largely the pattern obtained for confidence. Mean overall latency tended to decrease with item consensus, but response latency was longer for nonconsensual choices (4.75 seconds) than for consensual choices (3.94 seconds), $t(58) = 3.66$, $p < .0005$. For 37 items, response latency was longer for nonconsensual responses than for consensual responses, in comparison with 22 items in which the pattern was reversed, $p < .06$, by a binomial test. When response latencies were first standardized to control for individual differences, the results (see Figure 3(B)) were very similar to those for the raw scores (Figure 3(A)). These results accord with the proposition that response speed reflects self-consistency (Koriat, 2012).

In sum, confidence and response latency differed systematically depending on the preference that was constructed. Participants responded faster and expressed stronger confidence when their preference agreed with that of most others than when it did not. Note that the differences between choices were relatively consistent across items, so that for each item, consensual choices were associated with higher confidence and shorter latencies than nonconsensual choices.

Confidence and choice latency as related to within-person consistency

We now examine the predictions of SCM for within-person stability and fluctuation in confidence judgments. Confidence

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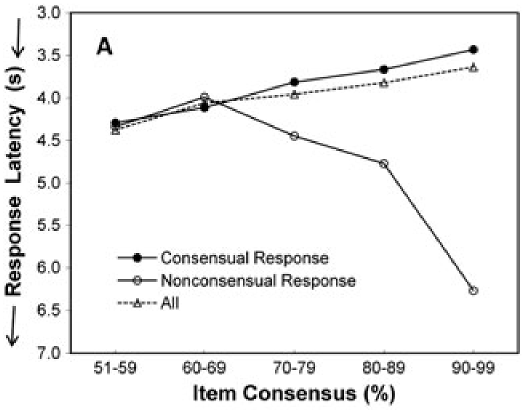


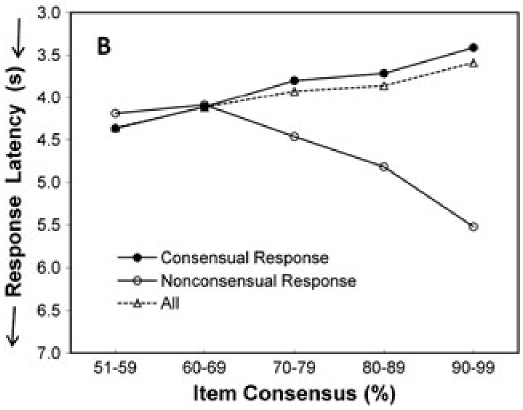
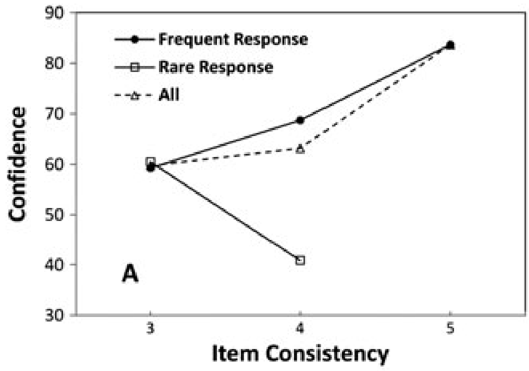


Figure 3. (A) Mean response latency in Block 1 for consensual and nonconsensual choices as a function of item consensus (the percentage of participants who made the majority choice). (B) The same data after correcting response latencies for inter-individual differences in response speed



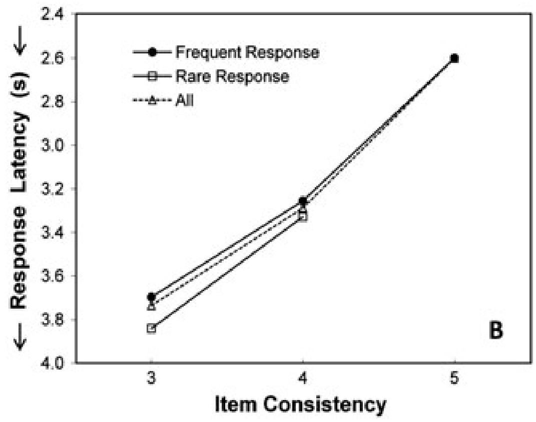


Figure 4. (A) Mean confidence judgments for the frequent and rare choices as a function of item consistency (the number of times that a choice was made across all blocks). (B) Mean response latency as a function of item consistency

is expected to increase with item consistency, but when participants change their choice from one block to another, their confidence should be higher for their more frequent choice than for their less frequent choice.

Confidence as a function of response consistency

Figure 4(A) presents confidence for the frequent and rare choices as a function of item consistency, using only 26 participants who had all means. The figure also includes the mean of the full-consistency items (item consistency = 5). As expected, confidence increased with item consistency, $F(2, 50) = 86.93$, $MSE = 50.10$, $p < .0001$. In addition, for item consistency 4, confidence was significantly higher for the frequent choices (68.72) than for the rare responses (40.88), $t(25) = 5.92$, $p < .0001$. This pattern was exhibited by all 26 participants, $p < .0001$, by a binomial test. For frequent responses, confidence tended to increase with increasing item consistency (from 3 to 4), $t(25) = 5.01$, $p < .0001$, whereas for rare responses, it tended to decrease, $t(25) = 4.32$, $p < .0005$.

Choice latency as a function of response consistency

Figure 4(B) presents response latency for the frequent and rare choices as a function of item consistency, on the basis of 25 participants who had all means (one additional participant was removed because of the removal of choice latency outliers). Although response latency decreased with item consistency, as expected, $F(2, 48) = 11.58$, $MSE = .71$, $p < .0001$, the results for item consistency 4 failed to yield the expected difference between frequent and rare choices: Response latency averaged 3.25 seconds, when participants made their frequent response and 3.33 when they made their rare response, $t(24) = .24$, $p < .82$. The reason for this departure from expectations is unclear. It should be noted that when response-latency outliers were not removed, the pattern obtained was similar to that for confidence: Response latency for item consistency = 4 averaged 3.70 and 4.74 seconds for the frequent and rare choices, respectively.

In sum, the results for the within-person consistency generally replicated those obtained for cross-person consensus. Across items, confidence and response speed increased with the consistency with which the same preference was made across blocks, and when participants fluctuated between preferences, they were more confident in their more frequent preference than in their less frequent preference.

The relationship between cross-person consensus and within-person consistency

We tested the hypothesis that properties of the items, notably, the likelihood of choosing the majority response, and confidence in that response, are reliable across participants.

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Inter-participant reliability for Block 1 was assessed using Cronbach's alpha coefficient (Crocker & Algina, 1986), which yielded a coefficient of .87 for response choice and .92 for confidence judgments. These high coefficients are in line with the assumption that participants base their choice and confidence on representations that are commonly shared.

In addition, choices that were made consistently by the same person were also more likely to be made by others. For each participant, two scores were calculated for each item: (i) The proportion of times that the choice made in Block 1 was repeated across the subsequent four blocks and (ii) the proportion of *other* participants (out of 40) who made that choice in Block 1. These two scores were then averaged for each item across participants. The correlation between them (across the 59 items) was .34, $p < .01$. Also, the confidence of a participant in the choice made in Block 1 predicted the likelihood that that choice would be made by other participants: The correlation was .37, $p < .005$. These correlations suggest that indeed consistency and consensus reflect roughly the same parameter associated with a choice, a parameter that is relevant to confidence in that choice.

Response consistency versus response consensus

Examination of the items that produced the strongest discrepancy in confidence between consensual and nonconsensual choices indicated that for these items, the distribution of choices was clearly skewed. Thus, across the 59 items, the confidence difference between consensual and nonconsensual choices correlated .49, $p < .0001$, with the proportion of participants who chose the consensual option. As expected (see Figure 1(A)), this relationship is also evident when items were divided in terms of item consensus: For the 30 items with item consensus of .71 or more, the difference in confidence between consensual and nonconsensual responses amounted to 10.74, whereas for those with item consensus below .71, it amounted only to 5.75.

These results raise the possibility that the predictions of SCM hold true only for items with a skewed distribution of preferences so that one of the preferences is clearly normative or commonly shared. To examine this possibility, we compared the items with high and low item consensus in terms of the effects of item consistency. The results, based only on item consistencies 3 and 4 (with n for each point varying between 16 and 32), are presented in Figure 5.

The effects of item consistency are similar for the two types of items. Focusing only on item-consistency 4, and using only participants who had observations for both frequent and rare choices, the results for the high-consensus items yielded higher confidence for frequent (73.77) than for rare choices (43.50), $t(18) = 3.61$, $p < .005$. For the low-consensus items, the respective means were 67.45 and 48.56, $t(18) = 3.45$, $p < .005$. These results suggest that the expected effects of cross-person consensus on confidence are particularly transparent when the distribution of preferences across items is skewed. However, confidence appears to be based on self-consistency even when the cross-person distribution is more symmetrical.

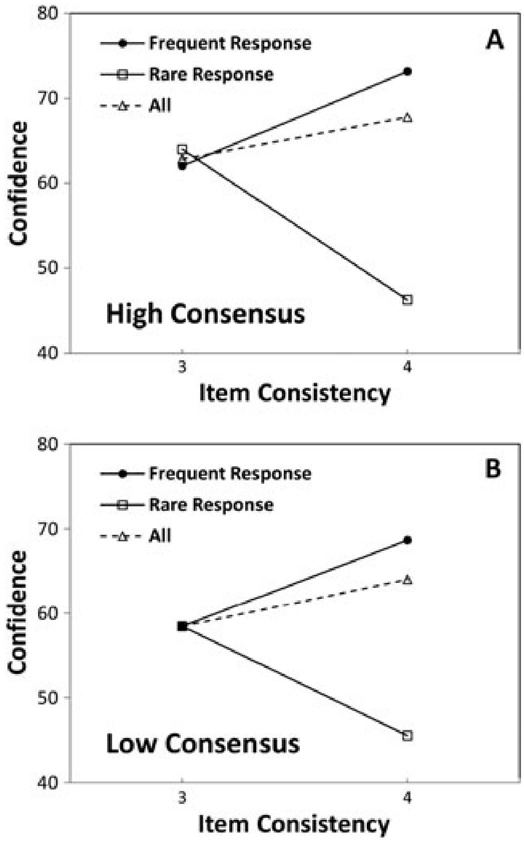

Figure 5. Mean confidence judgments for the frequent and rare choices as a function of item consistency (the number of times that a choice was made across all blocks). The results are plotted separately for items exhibiting high consensus (A) and for items exhibiting low consensus (B)

The pattern of results just presented suggests that confidence in personal preferences might be predicted better from within-person consistency than from cross-person consensus. To examine the contribution of item consistency and item consensus to confidence, the response to an item in Block 1 was classified for each participant as (i) consensual or nonconsensual based on the responses made to that item in Block 1 by the remaining 40 participants and as (ii) frequent or rare, depending on its within-participant frequency across Blocks 2–5. Focusing only on the results of 19 participants who had all four means, a Consensus × Consistency analysis of variance (ANOVA) yielded $F(1, 18) = 2.85$, $MSE = 176.96$, $p < .12$, for consensus, $F(1, 18) = 147.73$, $MSE = 63.44$, $p < .0001$, for consistency, and $F < 1$, for the interaction. Overall, response consistency had a much stronger effect than response consensus: The extent of the effect amounted to 22.21 points for consistency and 5.15 points for consensus. For the effect of consistency, the partial η^2, as an estimate of effect size, was .89, whereas that for consensus was only .14.

These results are expected given the individual differences in personal preferences. The implication is that an index of pc_{maj} that is based on within-person consistency in personal preferences provides better clues to the dynamics of confidence judgments than an index based on cross-person consensus. Note that in the case of perceptual judgments (Koriat, 2011), the contribution of item consensus to confidence was about

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the same as that of item consistency. In contrast, unpublished results suggest that confidence in social attitudes also exhibit a markedly stronger effect of response consistency than response consensus. Presumably, in the case of attitudes and personal preferences, within-person consistency is a better diagnostic of the self-consistency underlying confidence than is cross-person consensus.

Confidence and latency as predictors of reproducibility

We now examine the idea that confidence judgments represent an assessment of the likelihood that a new sample of representations will yield the same choice. Support for this idea was reported for general-knowledge, perceptual judgments, and attitudes (Koriat, 2011, 2012; Koriat & Adiv, 2011). To examine the possibility that such is also the case for personal preferences, the confidence judgments in Block 1 were grouped into six categories, and repetition proportion—the likelihood of making the same response over the subsequent four blocks—was calculated. The results, pooled across participants and items, are presented in Figure 6(A). Included in this figure is also the number of observations in each category. The function is generally monotonic, indicating that response repetition increases with confidence in Block 1. The Spearman rank-order correlation over the six values was .94, $p < .005$.

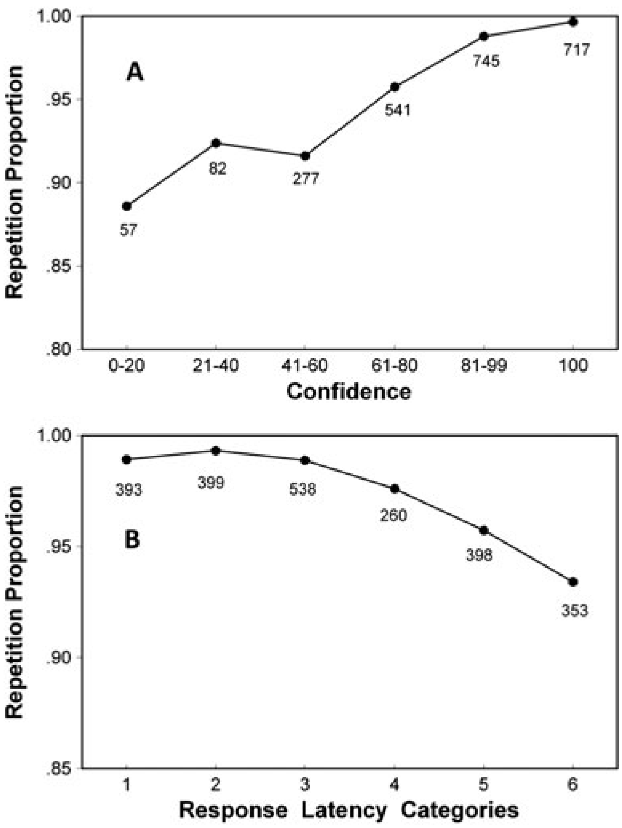

Figure 6. (A) The likelihood of repeating the Block-1 choice as a function of confidence in that choice in Block 1. Indicated also is the number of observations in each confidence category. (B) The same data for response latency

A similar analysis was carried out for response latency. The results presented in Figure 6(B) indicate that response speed is also diagnostic of the reproducibility of the choice. The Spearman rank-order correlation across the six points was −.94, significantly different from 0, $p < .005$.

The results documenting increased confidence with increased item consistency might reflect carry-over effects that occur across repeated presentations of the items. Previous research (Ariely, Loewenstein, & Prelec, 2003; Simon et al., 2008) suggested an increased tendency towards consistency. This may result in increased confidence with repetition. Indeed, there was a tendency for confidence judgments to increase from one block to the next: They averaged 81.24, 82.74, 83.62, 82.69, and 83.95, respectively, for Blocks 1–5, $F(4, 160) = 5.36$, $MSE = 8.06$, $p < .0005$. To rule out the possibility that the results on within-person consistency derive entirely from carry-over effects, we examined the extent to which the Block-1 confidence can be postdicted from the frequency with which the Block-1 choice was repeated in the subsequent blocks. Each Block-1 choice was classified for each participant according to whether it was repeated two to four times or zero to one time. Confidence in Block 1 for the two categories averaged 81.65 and 51.47, respectively, across 17 participants who had both means, $t(16) = 5.75$, $p < .0001$.

A similar analysis was carried out on choice latency. Response latency tended to decrease with block, averaging 4.03, 2.10, 1.98, 2.58, and 2.05 seconds, respectively, for Blocks 1–5, $F(4, 160) = 81.06$, $MSE = .37$, $p < .0001$. However, response latency for choices that were repeated two to four times averaged 4.42 seconds, in comparison with 7.63 seconds, for choices repeated or zero to one time across 14 participants who had both means, $t(13) = 3.28$, $p < .01$. Thus, choices that were made more often across the five blocks exhibited higher confidence and shorter response latencies even in Block 1.

The prediction of others' choices

We turn next to the results from Block 6 in which participants predicted the choice that was likely to be made by most participants. These results will be used to test two hypotheses. The first is that confidence in these predictions will yield the same pattern as that expected by SCM for confidence in one's own preferences. The second is that the C/A correlation or participants' predictions will yield results consistent with the consensuality principle (Koriat, 2008), as will be explained shortly.

SCM for the prediction of others' preferences

We examined whether the predictions of others' choices also exhibit the same pattern as that predicted by SCM (Figure 1 (B)). It is proposed that in attempting to predict the preferences of others, participants also sample a number of considerations and base their confidence in their prediction on the consistency with which that prediction was supported across the various considerations. The considerations that are retrieved in making predictions for others need not be the

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same as those that underlie the decision about one's own preference. Assuming that SCM applies to confidence in predictions, we should expect the results to yield the same pattern as that displayed in Figure 2 for confidence in one's own personal preferences.

To examine this possibility, we analyzed the results of Block 6 (Others) in the same way as we did for Block 1 (Self). For each of the 60 items, we determined the consensual prediction and calculated item consensus. Item consensus averaged 79.15% across items (range 51.2–100%). Figure 7 (A) presents mean confidence for the consensual and nonconsensual predictions for each of the six item consensus categories. Mean confidence increased monotonically with item consensus: When mean confidence and mean item consensus were calculated for each item, the correlation between them over all 60 items was .75 ($p < .0001$).

However, across 58 items (for two items, item consensus was 100%), consensual predictions were endorsed with higher confidence (73.07) than nonconsensual predictions (61.61), $t(57) = 7.91$, $p < .0001$. The pattern of higher confidence for the consensual prediction was observed for 51 items, in comparison with seven items in which the pattern was reversed, $p < .0001$, by a binomial test. Across the 58 items, confidence in the consensual response correlated .66 with item consensus, $p < .0001$. The respective correlation for the nonconsensual response was $-.14$, $p < .30$.

A similar analysis for prediction latency (eliminating 3.13% outliers) yielded the results depicted in Figure 7(B), which are similar to those observed for confidence and also to those observed for the latency of making one's own preferences (Figure 3(A)). Mean prediction latency decreased with item consensus: The correlation between mean latency and item consensus was $-.47$ across all 60 items, $p < .0005$. However, prediction latency was longer for nonconsensual (3.76 seconds) than for consensual (2.77 seconds) predictions, $t(57) = 4.30$, $p < .0001$. For 46 items, response latency was longer for nonconsensual responses than for consensual responses, in comparison with 12 items in which the pattern was reversed, $p < .0001$, by a binomial test.

In sum, participants exhibited stronger confidence and shorter response latencies when their prediction conformed to the consensual prediction than when it deviated from it. These results support the proposition that confidence in the prediction of others' preferences is also mediated by reliance of self-consistency.

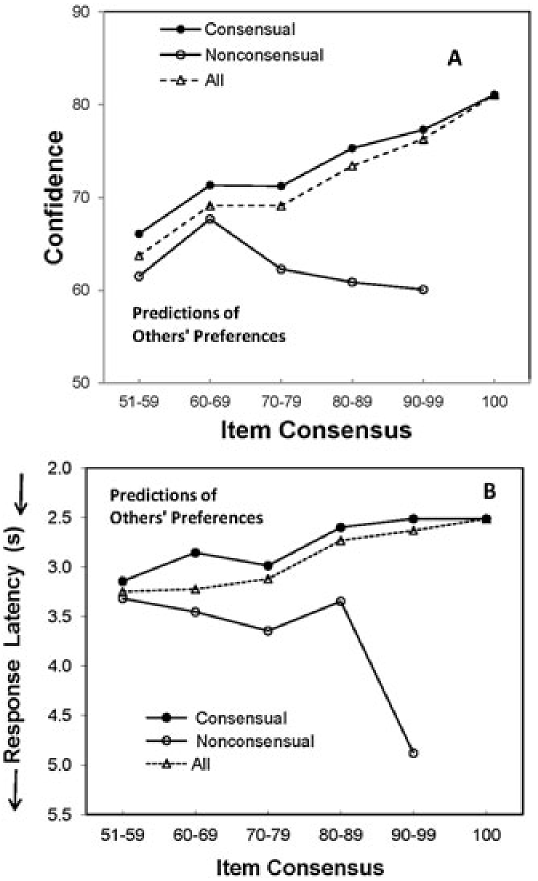

Figure 7. Mean confidence judgments and response latency for the prediction of other preferences for consensual and nonconsensual choices as a function of item consensus (the percentage of participants who made the majority prediction)

The consensuality principle for confidence judgments

A finding that has puzzled researchers (e.g., Tulving & Madigan, 1970) is that participants are generally successful in monitoring the correctness of their responses, as evidenced by a positive within-person C/A correlation. SCM was, in fact, developed primarily to answer the question of how people know that they know. According to SCM, the C/A correlation that is typically observed in studies using 2AFC general-knowledge questions derives from the fact that in virtually all of these studies, the consensual response is the correct response. Therefore, assuming that degree of cross-person consensus is diagnostic of degree of self-consistency, reliance on self-consistency is bound to yield a positive C/A correlation. However, when items were selected so that the consensual answer was the wrong answer, this correlation was consistently *negative*. This was so for word matching (Koriat, 1976), general knowledge (Koriat, 2008, 2012), and perceptual judgments (Koriat, 2011). In these tasks, the C/A correlation was positive only for consensually correct (CC) items (in which most participants choose the correct answer) but negative for consensually wrong (CW) items. These results were taken to indicate that metaknowledge accuracy is a by-product of knowledge accuracy.

The question of accuracy does not apply to personal preferences (Self). However, it does apply to the prediction of participants' preferences (Other). To test the consensuality principle for the prediction of others' preferences, we first examined the accuracy of these predictions by comparing the majority prediction for each item in Block 6 with the majority choice for that item across the first five (Self) blocks. Across all 59 items, the correlation between the two variables was .66, $p < .0001$, indicating that participants were relatively accurate in predicting the majority choices.

Of the 59 items, 49 could be classified as CC, with mean percent correct ranging from 51.22% to 100% (mean = 81.28%), and 10 items could be classified as CW, with mean percent

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correct ranging from 9.76% to 48.78% (mean = 32.20%). The confidence judgments for correct and wrong predictions were averaged for each participant for the two classes of items, and their means are plotted in Figure 8(A). The results clearly disclose a crossover interaction. A two-way ANOVA, Item Class (CC vs. CW) × Correctness (based on 40 participants; one participant had only wrong answers for all CW items) yielded $F(1, 39) = 1.76$, $MSE = 33.45$, $p < .20$, for item class; $F(1, 39) = 2.75$, $MSE = 30.66$, $p < .12$, for correctness; and $F(1, 39) = 44.23$, $MSE = 101.38$, $p < .0001$, for the interaction. For the CC items, confidence was higher for correct than for wrong predictions, $t(39) = 7.95$, $p < .0001$. This was true for 38 out of the 40 participants, $p < .0001$, by a binomial test. For the CW items, in contrast, confidence was higher for the wrong predictions than for the correct predictions, $t(39) = 4.40$, $p < .0001$. This pattern was observed for 33 out of the 40 participants, $p < .0001$, by a binomial test.

We also calculated the within-person C/A gamma correlation across items. This correlation was positive (.46) across the CC items, $t(39) = 13.33$, $p < .0001$, but negative (−.30) across the CW items, $t(39) = 4.00$, $p < .0005$.

The consensuality principle for response latency

The consensuality principle was also evaluated for response latency. The results are presented in Figure 8(B). A two-way ANOVA, Item Class (CC vs. CW) × Correctness, based on 39 participants (one additional participant was removed after removing response latency outliers) yielded $F < 1$, for both item class and correctness, but $F(1, 38) = 11.66$, $MSE = 1.07$, $p < .005$, for the interaction. For the CC items, response latency was shorter for correct than for wrong predictions, $t(38) = 4.28$, $p < .0001$. This was true for 32 out of the 39 participants, $p < .0001$, by a binomial test. In contrast, for the CW items, response latency was shorter for the wrong predictions than for the correct predictions, $t(38) = 2.33$, $p < .05$. This pattern was observed for 26 out of the 39 participants, $p < .05$, by a binomial test. The gamma correlation between response latency and correctness was negative across the CC items, (−.29), $t(38) = 6.32$, $p < .0001$, but positive (.18) across the CW items, $t(38) = 2.45$, $p < .05$.

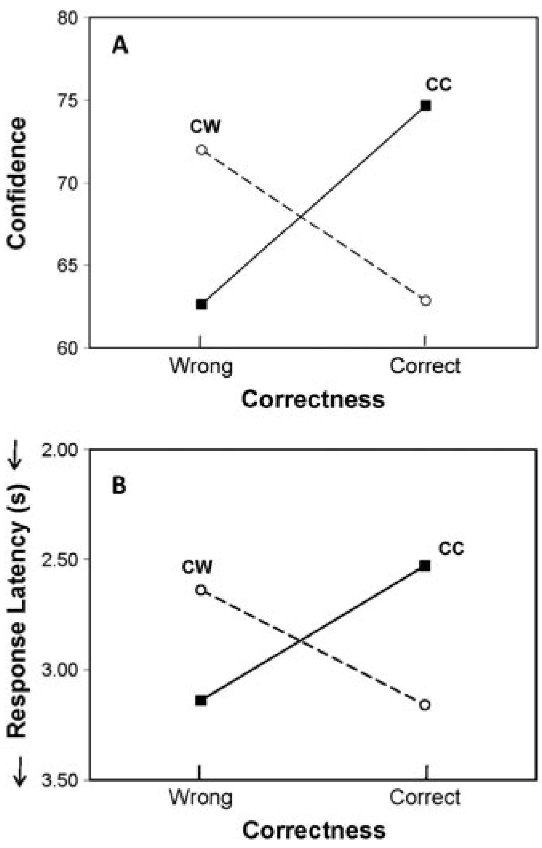

Figure 8. Mean confidence (A) and response latency (B) for correct and wrong predictions for consensually correct (CC) and consensually wrong (CW) predictions

In sum, the results for the prediction of others' preferences demonstrated a crossover interaction similar to that found for general-information questions (Koriat, 2008) and perceptual judgments (Koriat, 2011). This interaction is consistent with the idea that confidence judgments are correlated with the consensuality of the choice rather than with its correctness. In these latter studies, the consensuality principle was tested with regard to confidence in one's own answers because these answers could be scored as correct or wrong. Here, the consensuality principle could be tested only for the prediction of others' choices. The results yielded a similar pattern to that found for confidence in one's own answers.

DISCUSSION

The present study had two aims: the first was to test predictions of SCM for confidence in personal preferences and the second was to use confidence judgment as a clue to the dynamics of preference construction. I will begin by discussing the results pertaining to each of the two aims in turn.

Confidence in personal preferences

The results yielded consistent support for SCM. According to this model, confidence in a choice is based on the feedback from the process of making a choice. That feedback consists primarily of mnemonic cues that disclose self-consistency—the extent to which the various representations sampled support the choice reached.

Evidence for SCM was obtained for several different tasks (see Koriat, 2012), but it is somewhat surprising that the model was found to apply to personal preferences as well. In particular, mean confidence increased with increasing cross-person consensus, and consensual preferences were associated with higher confidence than nonconsensual preferences (Figure 2). Given that personal preferences are rather idiosyncratic, it is surprising that participants' subjective confidence in their choice was found to be systematically related to the proportion of other participants who made that choice.

In hindsight, however, there seems to be some overlap in the considerations that come to mind in constructing one's personal preferences. This was quite clear in the results of an exploratory study in which participants were presented with five items from the experiment and were asked to list all the

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considerations that they could think of that might support the choice of each of the two options. In the experiment proper too, it was found that both the preferences and the confidence associated with these preferences were quite reliable across participants, and the choices that were made consistently by the same person across blocks were more likely to be made by other participants than those that were made less consistently. The implication is that information about items that is aggregated across individuals, notably the distribution of different choices, can provide some clues regarding the processes that occur within individuals. Consistent with predictions, confidence decreased as a function of the deviation of the individual's preference from the group preference.

Nevertheless, confidence judgments were correlated more strongly with within-person consistency than with cross-person consensus. This pattern was expected given the individual differences that are typical of personal preferences. As noted, this pattern was also obtained for social attitudes (Koriat & Adiv, 2011) but not for perceptual judgments (Koriat, 2011), suggesting that in the case of personal preferences, within-person consistency is a better diagnostic of the self-consistency underlying choice and confidence than is cross-person consensus.

The results for cross-person consensus as well as those for within-person consistency yielded marked differences in confidence between majority and minority choices. These differences are consistent with the sampling assumption underlying SCM. In addition, the results yielded support for the idea that confidence judgments monitor reproducibility—the likelihood of making the same preference on future occasions (Figure 6). Confidence and latency in a choice in Block 1 predicted rather well the likelihood of repeating that choice in subsequent blocks.

Finally, the prediction of others' preferences also yielded support for SCM. First, confidence in consensual predictions was higher than confidence in nonconsensual predictions (Figure 7). Second, the positive C/A correlation that had been observed in many previous studies was confirmed only for CC items; CW items, in contrast, yielded a negative correlation (Figure 8). This result accords with the claim that confidence is correlated with the consensuality of the answer rather than with its correctness. Hence, metaknowledge accuracy is a by-product of knowledge accuracy.

The results on the whole indicate that SCM can also be applied to confidence in personal preferences. As noted earlier, SCM has much in common with other sampling models of choice and confidence (Juslin & Olsson, 1997; Stewart et al., 2006; Vickers & Pietsch, 2001; Vul et al., 2009). Unlike these models, however, it brings to the fore the possibility that a random sampling of clues and representations can result in systematic differences between different choices in both subjective confidence and response speed. These systematic differences can shed light on the online construction of preferences.

The construction of personal preferences

What are the implications of these results for the construction of personal preferences? The results are consistent with the general assumption that people construct their preferences on the spot when they must make a choice (Ariely, Loewenstein, & Prelec, 2006; see Lichtenstein & Slovic, 2006; Warren et al., 2011). Much of the evidence in support of this theme comes from observations indicating that different methods of eliciting preferences yield different preference orderings (Lichtenstein & Slovic, 1971; Tversky & Kahneman, 1986). The present study, in contrast, focused on the spontaneous fluctuations that occur in preference. It was proposed that the changes in confidence that accompany these fluctuations might provide a clue to the dynamics of preference construction.

Perhaps a comparison with the construction of social attitudes can be instructive because attitudes, like preferences, reflect personal values. There has been a debate in discussions of social attitudes regarding the way attitudes should be conceived. Traditionally, attitudes have been conceptualized as evaluative predispositions that are relatively stable over time. These dispositions account for individual differences in characteristic evaluative judgments and behavior (Allport, 1935; Eagly & Chaiken, 1993). A position that has been gaining in popularity, however, is that attitudinal judgments are constructed on the spot on the basis of the information that is accessible at the time of making a judgment (Bless & Schwarz, 2010; Schwarz & Strack, 1985; Wilson & Hodges, 1992). The results, in general, seem to provide evidence for both positions, indicating that on the one hand, most attitudes are very stable, and on the other hand, attitudinal judgments vary according to the person's current goals, mood, and social context (Krosnick & Petty, 1995; Wilson & Hodges, 1992).

Koriat and Adiv (2011) proposed that a sampling model for the construction of social attitudes can accommodate both positions. The distinction between the stable and variable components of attitudes was conceptualized in terms of the distinction between availability and accessibility. The stable components stem from the population of representations available in memory, which constraints the extent of fluctuation in attitudinal judgments that can occur across occasions. In turn, the specific attitudinal judgment expressed in a particular occasion is determined by the representations accessible on the spot.

In like manner, the application of SCM to the construction of personal preferences assumes that the confidence in one's preference and the speed of forming that preference are sensitive to both the stable and variable aspects of preference construction, providing a clue to the online construction of preferences. The stable aspects are disclosed by the function relating mean confidence judgments to item consistency and item consensus. These aspects are also reflected in the finding that confidence in a choice made in Block 1 predicted rather well the likelihood of repeating that choice in subsequent blocks. The variable aspects, in turn, which are due to sampling fluctuations, are disclosed by the systematic differences between majority and minority choices in both confidence and response latency.

Stability and variation in personal preferences

The results of the within-person analyses indicated that participants exhibited a marked reliability across blocks in

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responding to the same item, but also displayed some fluctuation in their expressed preferences. Fluctuation presumably occurs not only between different occasions but also in the course of making a choice on a single occasion, as the person deliberates between the two alternatives. This deliberation, which was modeled in terms of the sequential sampling of representations, provides the decision-maker an essential cue for confidence—the degree of consistency among the representations in supporting the expressed preference. Several factors may contribute to the variability in the sampled representations, including the deliberate attempt to explore arguments in favor of each of the two alternatives (Shafir et al., 1993; Simonson, 1989; Slovic, 1975), the structuring and restructuring that occurs during the decision (Montgomery, 1983), or the spontaneous shifts in attention (Bettman et al., 1998). Stimulus-sampling theory (Bower, 1972; Estes, 1950) also indicates some of the factors that may contribute to the variability in the representations generated from the same nominal item. It was also proposed that participants possess a variety of strategies for forming preferences and may resort to different strategies on different occasions (Payne et al., 1992).

Overall, the results accord with the assumption that people construct their attitudinal judgment on the spot by drawing a small sample of representations from the same population of representations associated with the object. Clearly, some systematic changes take place in choice and confidence across repeated presentations (see e.g., Hasher, Goldstein, & Toppino, 1977; Simon, Pham, Le, & Holyoak, 2001). However, despite these changes, the population of representations from which people draw their sample is more or less the same across different encounters with the item.

The measurement of preferences

Clearly, the conception of preferences as constructed has implications for the measurement of preferences (Payne, Bettman, & Schkade, 1999). What is the "true" preference of a person? As Payne et al. noted, in addition to random error, the expressed preferences include two different sources of systematic variance: first, stable values associated with the object being evaluated and second, a situation-specific component that reflects the effects of a variety of factors. The distinction between the two systematic components implies a distinction between "expressed" preferences and "underlying" preferences (Warren et al., 2011). How can underlying preferences be measured?

The sampling assumption underlying SCM implies that in constructing their preferences, the respondents themselves serve as measuring instruments, attempting to achieve a sensible assessment of their own preferences (Koriat & Adiv, 2011). According to SCM, participants essentially behave like intuitive statisticians who try to infer a property of a population on the basis of a sample of observations drawn from that population. Uncertainty is inherent in the sampling process underlying preference construction. Therefore, our assessment of a person's underlying preference must take into account the reliability of one's assessment of one's own preference. The results reported in this article suggest that the person's confidence in his or her own expressed preference is diagnostic of reproducibility—the likelihood of making the same preference in subsequent occasions. If reproducibility constitutes a property of what we mean by an "underlying" or "latent" preference, then confidence judgments should, perhaps, be incorporated in the assessment of peoples' preferences.

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REFERENCES

Alba, J. W., & Marmorstein, H. (1987). The effects of frequency knowledge on consumer decision making. *Journal of Consumer Research*, *14*, 14. doi: 10.1086/209089

Allport, G. W. (1935). Attitudes. In C. Murchison (Ed.), *A handbook of social psychology* (pp. 789). Worcester, MA: Clark University Press.

Ariely, D., Loewenstein, G., & Prelec, D. (2003). "Coherent arbitrariness": Stable demand curves without stable preferences. *Quarterly Journal of Economics*, *118*, 73. doi: 10.1162/00335530360535153

Ariely, D., Loewenstein, G., & Prelec, D. (2006). Tom Sawyer and the construction of value. *Journal of Economic Behavior and Organization*, *60*, 1. doi: 10.1016/j.jebo.2004.10.003

Bettman, J. R., Luce, M. F., & Payne, J. W. (1998) Constructive consumer choice processes. *Journal of Consumer Research*, *25*, 187. doi:10.1086/209535

Bless, H., & Schwarz, N. (2010). Mental construal and the emergence of assimilation and contrast effects: The inclusion/exclusion model. *Advances in Experimental Social Psychology*, *42*, 319. doi: 10.1016/S0065-2601(10)42006-7

Bower, G. H. (1972). Stimulus-sampling theory of encoding variability. In A. W. Melton & E. Martin (Eds.), *Coding processes in human memory* (pp. 85). Washington, DC: V. H. Winston.

Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*. New York, NY: Holt, Rinehart, & Winston.

Dienes, Z. (2011). Bayesian versus orthodox statistics: Which side are you on? *Perspectives on Psychological Science*, *6*, 274. doi: 10.1177/1745691611406920

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich College.

Estes, W. K. (1950). Toward a statistical theory of learning. *Psychological Review*, *57*, 94. doi: 10.1037/0033-295X.101.2.282

Gigerenzer, G., & Gaissmaier, W. (2011). Heuristic decision making. *Annual Review of Psychology*, *451–482*. doi: 10.1146/annurev-psych-120709-145346

Hasher, L., Goldstein, D., & Toppino, T. (1977). Frequency and the conference of referential validity. *Journal of Verbal Learning and Verbal Behavior*, *16*, 107. doi: 10.1016/S0022-5371(77)80012-1

Juslin, P., & Olsson, H. (1997). Thurstonian and Brunswikian origins of uncertainty in judgment: A sampling model of confidence in sensory discrimination. *Psychological Review*, *104*, 344. doi: 10.1037/0033-295X.104.2.344

Kelley, C. M., & Lindsay, D. S. (1993). Remembering mistaken for knowing: Ease of retrieval as a basis for confidence in answers to general knowledge questions. *Journal of Memory and Language*, *32*, 1. doi: 10.1006/jmla.1993.1001

DOI: 10.1002/bdm

Koriat, A. (1976). Another look at the relationship between phonetic symbolism and the feeling of knowing. *Memory & Cognition*, *4*, 244. doi: 10.3758/BF03213170

Koriat, A. (2008). Subjective confidence in one's answers: The consensuality principle. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *34*, 945. doi: 10.1037/0278-7393.34.4.945

Koriat, A. (2011). Subjective confidence in perceptual judgments: A test of the self-consistency model. *Journal of Experimental Psychology. General*, *140*, 117. doi: 10.1037/a0022171

Koriat, A. (2012). The self-consistency model of subjective confidence. *Psychological Review*, *119*, 80. doi: 10.1037/a0025648

Koriat, A., & Adiv, S. (2011). The construction of attitudinal judgments: Evidence from attitude certainty and response latency. *Social Cognition*, *29*, 578. doi: 10.1521/soco.2011.29.5.577

Koriat, A., Lichtenstein, S., & Fischhoff, B. (1980). Reasons for confidence. *Journal of Experimental Psychology: Human Learning and Memory*, *6*, 107. doi: 10.1037/0278-7393.6.2.107

Koriat, A., Ma'ayan, H., & Nussinson, R. (2006). The intricate relationships between monitoring and control in metacognition: Lessons for the cause-and-effect relation between subjective experience and behavior. *Journal of Experimental Psychology. General*, *135*, 36. doi: 10.1037/0096-3445.135.1.36

Krosnick, J. A., & Petty, R. E. (1995). Attitude strength: An overview. In R. E. Petty & J. A. Krosnick (Eds.), *Attitude strength. Antecedents and consequences* (pp. 1). Hillsdale, NJ: Erlbaum Associates.

Lichtenstein, S., & Slovic, P. (1971). Reversals of preference between bids and choices in gambling decisions. *Journal of Experimental Psychology*, *89*, 46–55. doi: 10.1037/h0031207

Lichtenstein, S., & Slovic, P. (Eds.), (2006). *The construction of preference*. New York, NY: Cambridge University Press.

Montgomery, H. (1983). Decision rules and the search for a dominance structure: Towards a process model of decision making. In P. C. Humphreys, O. Svenson, & A. Vari (Eds.), *Analyzing and aiding decision processes* (pp. 343). Amsterdam, North Holland and Budapest: Academic Press Hungary.

Pacini, R., & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Journal of Personality and Social Psychology*, *76*, 972. doi: 10.1037/0022-3514.76.6.972

Payne, J. W., Bettman, J. R., & Johnson, E. J. (1992). Behavioral decision research: A constructive processing perspective. *Annual Review of Psychology*, *43*, 87. doi: 10.1146/annurev.ps.43.020192.000511

Payne, J. W., Bettman, J. R., & Schkade, D. A. (1999). Measuring constructed preferences: Towards a building code. *Journal of Risk and Uncertainty*, *19*, 243. doi: 10.1177/0272989X9901900104

Robinson, M. D., Johnson, J. T., & Herndon, F. (1997). Reaction time and assessments of cognitive effort as predictors of eyewitness memory accuracy and confidence. *Journal of Applied Psychology*, *82*, 416. doi: 10.1037/0021-9010.82.3.416

Schervish, M. J. (1996). P Values: What they are and what they are not. *The American Statistician*, *50*, 203. doi: 10.2307/2684655

Schwarz, N. (2007). Attitude construction: Evaluation in context. *Social Cognition*, *25*, 638.

Schwarz, N., & Strack, F. (1985). Cognitive and affective processes in judgments of well-being: A preliminary model. In H. Brandstatter & E. Kirchler (Eds.), *Economic psychology* (pp. 439). Linz, Austria: Taubler.

Shafir, E., Simonson, I., & Tversky, A. (1993). Reason-based choice. *Cognition*, *49*, 11. doi: 10.1016/0010-0277(93)90034-S

Simon, D., Krawczyk, D. C., Bleicher, A., & Holyoak, K. J. (2008). The transience of constructed preferences. *Journal of Behavioral Decision Making*, *21*, 1.

Simon, D., Pham, L. B., Le, Q. A., & Holyoak, K. J. (2001). The emergence of coherence over the course of decision making. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *27*, 1250. doi: 10.1037//0278-7393.27.5.1250

Simonson, I. (1989). Choice based on reasons: The case of attraction and compromise effects. *Journal of Consumer Research*, *16*, 158. doi: 10.1086/209205

Simonson, I. (2008). Will I like a "medium" pillow? Another look at constructed and inherent preferences. *Journal of Consumer Psychology*, *18*, 155. doi: 10.1016/j.jcps.2008.04.002DOI:dx.doi.org

Slovic, P. (1975). Choice between equally valued alternatives. *Journal of Experimental Psychology. Human Perception and Performance*, *1*, 280. doi: 10.1037/0096-1523.1.3.280

Slovic, P. (1995). The construction of preference. *American Psychologist*, *50*, 364. doi: 10.1037/0003-066X.50.5.364

Stankov, L., & Crawford, J. D. (1997). Self-confidence and performance on tests of cognitive abilities. *Intelligence*, *25*, 93. doi: 10.1016/S0160-2896(97)90047-7

Stewart, N. (2009). Decision by sampling: The role of the decision environment in risky choice. *The Quarterly Journal of Experimental Psychology*, *62*, 1041. doi: 10.1080/17470210902747112

Stewart, N., Chater, N., & Brown, G. D. A. (2006). Decision by sampling. *Cognitive Psychology*, *53*, 1. doi: 10.1016/j.cogpsych.2005.10.003.

Tulving, E., & Madigan, S. A. (1970). Memory and verbal learning. *Annual Review of Psychology*, *21*, 437.

Tulving, E., & Pearlstone, Z. (1966). Availability versus accessibility of information in memory for words. *Journal of Verbal Learning and Verbal Behavior*, *5*, 381. doi: 10.1016/S0022-5371(66)80048-8

Tversky, A., & Kahneman, D. (1986). Rational choice and the framing of decisions. *Journal of Business*, *59*, S251. doi: 10.1016/S0022-5371(66)80048-8

Vickers, D., & Pietsch, A. (2001). Decision making and memory: A critique of Juslin and Olsson's (1997) sampling model of sensory discrimination. *Psychological Review*, *108*, 789. doi: 10.1037/0033-295X.108.4.789

Vul, E., Goodman, N. D., Griffiths, T. L., & Tenenbaum, J. B. (2009). One and done? Optimal decisions from very few samples. *Proceedings of the 31st Annual Conference of the Cognitive Science Society*, (148–153).

Warren, C., McGraw, A. P., & Van Boven, L. (2011). Values and preferences: Defining preference construction. *Interdisciplinary Reviews: Cognitive Science*, *2*, 193. doi: 10.1002/wcs.98

Weber, E. U., & Johnson, E. J. (2006). Constructing preferences from memory. In S. Lichtenstein & P. Slovic (Eds.), *The construction of preference* (pp. 397). New York, NY: Cambridge University Press.

Webster, D. M., & Kruglanski, A. W. (1994). Individual differences in need for cognitive closure. *Journal of Personality and Social Psychology*, *67*, 1049. doi: 10.1037/0022-3514.67.6.1049

Wilson, T. D., & Hodges, S. D. (1992). Attitudes as temporary constructions. In L. L. Martin & A. Tesser (Eds.), *The construction of social judgment* (pp. 37). Hillsdale, NJ: Erlbaum.

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