A JOURNAL OF THE ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

Research Report

Order in Choice

Effects of Serial Position on Preferences

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ABSTRACT—*When several choice options are sampled one at a time in a sequence and a single choice of the best option is made at the end of the sequence, which location in the sequence is chosen most often? We report a large-scale experiment that assessed tasting preferences in choice sets of two, three, four, or five wines. We found a large primacy effect—the first wine had a large advantage in the end-of-sequence choice. We also found that participants who were knowledgeable about wines showed a recency effect in the longer sequences. We conclude with a process model that explains our findings.*

Lives are lived serially: Experiences seem to follow one another, and when people make choices, they give their attention to one option at a time—even when all the choices are available for inspection simultaneously. Consider a person faced with selecting the best option from several options that are presented one at a time. Each one is sampled, assessed, and evaluated as it is experienced; finally, after all the options in the choice set have been evaluated, the person makes a final decision, aiming to select the best option from the set. In the study reported in this article, our primary purpose was to determine if such choices are biased toward options at particular locations in the temporal sequence—that is, whether there are *order effects on choice*. We assumed that such choices are not wholly memory based, but that on-line evaluation takes place as the options are initially sampled (Hastie & Park, 1986).

The choice task we used should be considered in light of some well-established sequence effects. First, there are serial-position effects on memory. When a person tries to recall events from the past that occurred in a conceptually related sequence—words in a to-be-remembered list, the names of the U.S. presidents, or events that occurred during the last semester at school—early items and late items have an advantage in recall (i.e., *primacy* and *recency* effects; Glanzer & Cunitz, 1966). Although these effects are different from order effects on choice, a finding of primacy or recency effects in our task might indicate that memorability plays a role in order effects on choice. For example, sensory scientists report a primacy bias in hedonic assessment of food: The first food item sampled is experienced most strongly, so it is likely to be the most memorable and preferred (MacFie, Bratchell, Greehoff, & Vallis, 1989).

Second, there are well-known primacy effects that occur when people are forming a summary impression of a single entity (e.g., a person, product, or event). When information about a single individual is presented sequentially, there is usually a primacy, or "first impression," effect, whereby the earliest information has a larger impact on the unitary impression than later information does (e.g., Anderson, 1973; Asch, 1946; see Hogarth & Einhorn, 1992, for a comprehensive review). Although the formation of a summary impression of a single option is not the same as separate evaluations of several options, what is known about primacy effects in impression-formation tasks may be relevant to interpreting the results from our sequential-choice task. Factors like biased processing of later information (driven by a confirmatory mind-set induced by the earliest information—e.g., Holyoak & Simon, 1999; Russo, Carlson, & Meloy, 2006) or a simple attention decrement may also be part of a valid theoretical account for sequence effects on choices (for a discussion of boredom effects for items sampled later in a sequence, see Sulmont-Rosse, Chabanet, Issanchou, & Köster, 2008).

Although several prior studies have investigated the effects of location in a sequence on end-of-sequence choices, there is still no clear answer to the question of which location in a sequence is most advantageous. Several researchers have concluded that there are primacy effects in choice (e.g., Carney & Banaji, 2008; Miller & Krosnick, 1998), and many descriptive studies of consumer choice have found such effects (Becker, 1954; Berg, Filipello, Hinreiner, & Sawyer, 1955; Coney, 1977; Dean, 1980). However, some researchers have predicted and observed

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recency effects in choice (e.g., de Bruine, 2005, 2006; de Bruine & Keren, 2003; Houston, Sherman, & Baker, 1989; Li & Epley, 2009; Wilson & Nisbett, 1978). We conjectured that there are both primacy and recency effects—under certain conditions.

We hypothesized that when participants sampled options knowing that they would be asked to make a choice, they would compare each new option with their current favorite. Such a pairwise competitive-evaluation strategy would produce an advantage for later items, especially in the case of longer sequences, in which an early option has to "beat" more options to become the overall favorite. Also, given the past findings for consumer choice options like the ones we studied (wines), we expected an advantage for early options driven by high levels of attention, low levels of proactive interference, and the common habit of "satisficing" (preferring early items in a series if there is no definite reason to shift to a later option; Simon, 1955; cf. Rapoport & Tversky, 1970). Thus, our basic hypothesis was that we would observe primacy effects (especially pronounced for short sequences), but that in longer sequences we would find recency effects as well.

In addition, we expected that this pattern would be moderated by choosers' sophistication. People who were more interested and knowledgeable about the choice options were expected to be more persistent and to try harder than less sophisticated evaluators to discriminate among the options (Cardello et al., 1982; Hughson & Boakes, 2001; Lawless, 1984). This means that more sophisticated choosers would be likelier than others to make the comparison between their current favorite and the new option as each new option was encountered. Thus, there would be more chances for the new option in each competition to beat the current favorite, which would produce a larger recency effect among more sophisticated choosers.

METHOD

Participants

One hundred forty-two students and members of the local community in Ontario, Canada, were recruited via advertisements to participate in a study of "attitudes and values towards wine" (54 men and 88 women, ranging in age from 19, the local legal drinking age, to 75; average age was 25.67 years). Participants received either course credit or $5 as compensation.

Design and Procedure

Participants were told that they would taste locally produced wines and were then randomly assigned to taste one sequence of two ($n = 32$), three ($n = 33$), four ($n = 33$), or five ($n = 44$) samples. Although participants expected to taste different samples of one grape varietal (e.g., Riesling), all of the samples consumed by a given participant actually consisted of 20 ml of the same wine.

Participants were given an initial description of the wine-tasting procedure and instructions on how to sample each wine. During the experimental trials, they were led through the tasting procedure by a computer-driven menu of instructions, which gave them approximately 25 s to sample each wine and a 10-s interval between wines. The sampling procedure lasted approximately 1 min for participants in the two-option treatment and up to 2.5 min for those in the five-option treatment. At the end of the tasting sequence, each participant was asked, "Which ONE of ALL the wines that you have tasted today is your favorite?" This was the focal measure of preference. Finally, participants completed a questionnaire assessing background characteristics (gender and age) and wine expertise (Hughson & Boakes, 2001). After finishing the entire procedure, participants waited 30 min and then took a Breathalyzer test to verify their sobriety before leaving the experiment.

The samples were selected from four diverse local wines representing Riesling, Chardonnay, Cabernet Franc, and Pinot Noir varietals. The samples were served in unlabeled ISO (International Organization for Standardization) wine glasses. No systematic effects of wine type or gender were observed, so these variables are not discussed further.

RESULTS

Figure 1 presents the mean probability of choice for the samples in each condition. Each serial-position curve shows a primacy effect; the first wine was preferred more than the second and third for every sequence length. Longer sequences also show a recency effect, with the last wine being preferred more than the previous two or three wines. Chi-square tests were used to verify that the observed preferences for each sequence length were reliably different from uniform preferences for all serial positions—two wines: $\chi^2(1, N = 32) = 4.50, p_{rep} = .87$; three wines: $\chi^2(2, N = 33) = 6.73, p_{rep} = .87$; four wines: $\chi^2(3, N = 33) = 12.45, p_{rep} = .95$; five wines: $\chi^2(4, N = 44) = 13.95, p_{rep} = .95$.

We divided our sample into low-knowledge ($n = 73$) and high-knowledge ($n = 69$) groups on the basis of scores on the wine-expertise questionnaire. Figures 2 and 3 display the

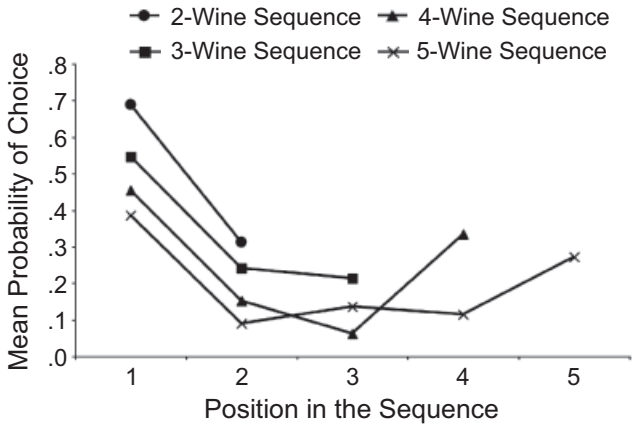

Fig. 1. Mean probability of choice for each sample as a function of serial position for set sizes of two, three, four, or five wines.

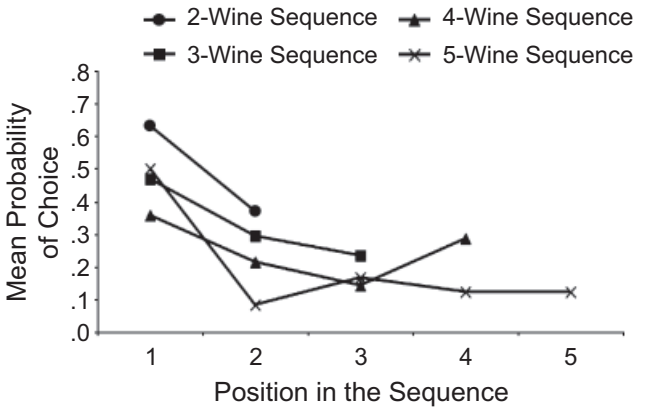

Fig. 2. Results for low-knowledge participants: mean probability of choice for each sample as a function of serial position for set sizes of two, three, four, or five wines.

serial-position preference curves for these two groups, respectively. A simple primacy-effect pattern best describes the low-knowledge participants' choices for all sequence lengths; with these smaller sample sizes, the chi-square statistic was significant only for the five-wine condition, $\chi^2(4, N = 24) = 13.91, p_{rep} = .95$. The primacy effect also held for all sequence lengths for high-knowledge participants, and a substantial recency pattern was apparent for the four-wine and five-wine sequences; the chi-square statistics were significant for all sequence lengths—two wines: $\chi^2(1, N = 13) = 4.17, p_{rep} = .87$; three wines: $\chi^2(2, N = 16) = 6.19, p_{rep} = .87$; four wines: $\chi^2(3, N = 19) = 10.26, p_{rep} = .92$; five wines: $\chi^2(4, N = 21) = 9.5, p_{rep} = .87$.

DISCUSSION

First, our measure of preference revealed a primacy advantage for all sets, and a recency effect for the four-option and five-option sets. Second, this global pattern was qualified by expertise: There was a primacy effect in all sets for both low- and high-knowledge participants, and there was also a recency effect for the high-knowledge participants (only for four-option and five-option sets).

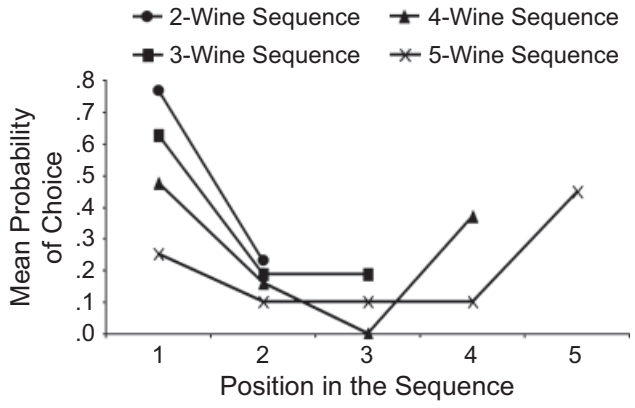

Fig. 3. Results for high-knowledge participants: mean probability of choice for each sample as a function of serial position for set sizes of two, three, four, or five wines.

Finally, the primacy effect was larger for the high-knowledge participants in the two-option and three-option choice sets.

It is important to remember that participants were evaluating each wine as they tasted it, and that all the wines tasted good and would have garnered positive evaluations if sampled by themselves; further, the wines were difficult for our participants to distinguish. Nonetheless, we were able to draw some conclusions about the sampling procedure. We assumed that the participants engaged in a "competitive" evaluation process for each pair of wines sampled. When they sampled the first wine, it became their current favorite; when they sampled the second wine, they compared their memory of the first wine's goodness with their impression of the second wine's goodness and determined which wine was their current favorite. When they sampled the third wine, they compared their memory of their current favorite with the third wine sampled, and so on.

We propose that two biases operated within that sequential competitive evaluation process. First, a first-is-best bias accounts for the consistent primacy effect. Second, a bias in favor of each new wine among high-knowledge participants accounts for the recency effect, and for an interesting reason: Compared with the low-knowledge participants, the high-knowledge participants were more persistent in looking for a better wine later in the sequence—a plausible result of greater expertise (cf. Cardello et al., 1982; Hughson & Boakes, 2001; Lawless, 1984). Thus, high-knowledge participants were likelier to make a comparison between their current favorite and the new wine when each new wine was sampled. Thus, there was a substantial chance that each new wine would beat the current favorite, and this habit produced the pronounced recency effect in longer sequences, especially for high-knowledge participants. For example, suppose that each new wine has a .30 chance of beating the current favorite, and the current favorite remains the preferred choice with a .70 probability. Note that these values are consistent with the size of the observed primacy effects (e.g., the first wine was chosen with approximately .70 probability in the two-option sets) and with the recency effects for the high-knowledge participants (the last wine was chosen with approximately .30 probability in the four-option and five-option sets).

We account for the lack of recency effects among the low-knowledge participants by proposing that they followed the pair-wise competitive-evaluation strategy less vigorously than the high-knowledge participants, eliminating the potential recency advantage. We speculate that the low-knowledge participants were more likely to be overwhelmed by the cognitive demands of the pair-wise competitive strategy as memory load and interference increased across the sampling trials.

The pair-wise model provides an almost perfect fit to the data if we add one more assumption about the comparison process. Thus far, we have assumed that all current favorites have a .70-versus-.30 advantage in all pair-wise comparisons. But if we suppose that the current-favorite advantage increases for later favorites (e.g., if the third option wins its pair-wise competition,

its advantage increases to .75 vs. .25; if the fourth wins, its advantage is .80 vs. .20), then the model fits the data almost perfectly. This pair-wise-competition process model is impressive; its one failing is that it predicts a small recency effect for the three-option set for high-knowledge participants.

The pair-wise-competition process model is a hybrid of the two major psychological explanations for sequence effects in the literature. The basic repeated pair-wise comparison process is central in the model proposed by de Bruine and Keren (2003) and Houston et al. (1989), although our version does not commit to the specific distinctive-feature subprocess proposed by those theorists. The primacy bias is a generalization of the mechanisms that have been proposed by Carney and Banaji (2008; heightened attention to the first option plus a cultural expectation that the first option in many everyday sequences is the best), Miller and Krosnick (1998; attention decrement and satisficing), and Dean (1980; palate desensitization). The pair-wise comparison process alone can produce both primacy and recency effects, though the basic model has to be supplemented with the assumption that high-knowledge choosers are likelier to make the pair-wise comparison tests than low-knowledge choosers are.

The primary contribution of this research is that it provides an answer to the question of which serial-position locations in a sequentially presented choice set have an advantage in the final choice of a single option. We found that early items always have an advantage, and later items have an advantage in longer sequences, especially when the choosers are knowledgeable about the choice options. We submit that the combination of empirical and theoretical aspects of the present research resolves the apparent disagreement between researchers who have drawn conflicting conclusions about primacy versus recency effects in deliberate sequential evaluation and choice tasks. These findings advance both scientific understanding of human decision processes and understanding of human behavior in many everyday situations, especially consumer choice.

Acknowledgments—This research was supported by a Discovery Grant from the Natural Sciences and Engineering Research Council of Canada to the first author and by a grant from the Templeton Foundation to the last author. We wish to thank Tek Thongpapanl, Ye Li, and Gary McClelland for advice on the research; Megan Graham and Kirk Stokes for assistance with the research; and Andy Reynolds for providing us with student wines from the Cool Climate Oenology and Viticulture Institute.

REFERENCES

Anderson, N.H. (1973). Serial position curves in impression formation. *Journal of Experimental Psychology*, *97*, 8–12.

Asch, S.E. (1946). Forming impressions of personality. *Journal of Abnormal and Social Psychology*, *41*, 258–290.

Becker, S.L. (1954). Why an order effect? *Public Opinion Quarterly*, *18*, 271–278.

Berg, H.W., Filipello, F.E., Hinreiner, E., & Sawyer, F.M. (1955). Consumer wine-preference methodology studies at California fairs. *Food Technology*, *9*, 90–93.

Cardello, A.V., Maller, O., Kapsalis, J.G., Segars, R.A., Sawyer, F.M., Murphy, C., et al. (1982). Perception of texture by trained and consumer panelists. *Journal of Food Science*, *47*, 1186–1197.

Carney, D.R., & Banaji, M.R. (2008). *First is best in rapid social judgment and consumer decision*. Unpublished manuscript, Harvard University, Cambridge, MA.

Coney, K.A. (1977). Order bias: The special case of letter preference. *Public Opinion Quarterly*, *41*, 385–388.

Dean, M.L. (1980). Presentation order effects in product taste tests. *Journal of Psychology*, *105*, 107–110.

de Bruine, W.B. (2005). Save the last dance for me: Unwanted serial position effects in jury evaluations. *Acta Psychologica*, *118*, 245–260.

de Bruine, W.B. (2006). Save the last dance for me II: Unwanted serial position effects in figure skating judgments. *Acta Psychologica*, *123*, 299–311.

de Bruine, W.B., & Keren, G. (2003). Order effects in sequentially judged options due to the direction of comparison. *Organizational Behavior and Human Decision Processes*, *92*, 91–101.

Glanzer, M., & Cunitz, A.R. (1966). Two storage mechanisms in free recall. *Journal of Verbal Learning and Verbal Behavior*, *5*, 351–360.

Hastie, R., & Park, B. (1986). The relationship between memory and judgment depends on whether the judgment is memory-based or on-line. *Psychological Review*, *93*, 258–268.

Hogarth, R.M., & Einhorn, H.J. (1992). Order effects in belief updating: The belief-adjustment model. *Cognitive Psychology*, *24*, 1–55.

Holyoak, K.J., & Simon, D. (1999). Bidirectional reasoning in decision making by constraint satisfaction. *Journal of Experimental Psychology: General*, *128*, 3–31.

Houston, D.A., Sherman, S.J., & Baker, S.M. (1989). The influence of unique features and direction of comparison on preferences. *Journal of Experimental Social Psychology*, *25*, 121–141.

Hughson, A.L., & Boakes, R.A. (2001). Perceptual and cognitive aspects of wine expertise. *Australian Journal of Psychology*, *53*, 103–108.

Lawless, H. (1984). Flavour discrimination of white wine by "expert" and non-expert wine consumers. *Journal of Food Science*, *49*, 120–123.

Li, Y., & Epley, N. (2009). When the best appears to be saved for last: Serial position effects on choice. *Journal of Behavioral Decision Making*, *22*, 1–12.

MacFie, H.J., Bratchell, N., Greehoff, K., & Vallis, L.V. (1989). Design to balance the effect of order of presentation and first-order carry-over effect in hall tests. *Journal of Sensory Studies*, *4*, 129–148.

Miller, J.M., & Krosnick, J.A. (1998). The impact of candidate name order on election outcomes. *Public Opinion Quarterly*, *62*, 291–330.

Rapoport, A., & Tversky, A. (1970). Choice behavior in an optional stopping task. *Organizational Behavior and Human Performance*, *5*, 105–120.

Russo, J.E., Carlson, K.A., & Meloy, M.G. (2006). Choosing an inferior alternative. *Psychological Science*, *17*, 899–904.

Simon, H.A. (1955). A behavioral model of rational choice. *Quarterly Journal of Economics*, *69*, 99–118.

Sulmont-Rosse, C., Chabanet, C., Issanchou, S., & Köster, E.P. (2008). Impact of the arousal potential of uncommon drinks on the repeated exposure effect. *Food Quality and Preference*, *19*, 412–420.

Wilson, T.D.C., & Nisbett, R.E. (1978). The accuracy of verbal reports about the effects of stimuli on evaluations and behavior. *Social Psychology*, *41*, 118–131.

(Received 1/22/09; Revision accepted 4/6/09)