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Recalling and Intending to Enact Health Recommendations: Optimal Number of Prescribed Behaviors in Multibehavior Messages

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Abstract

Two experiments investigated the effects of the number of health recommendations (e.g., quit smoking; relax for a day) contained in a health-promotion message on recommendation recall and intentions to enact the recommendations. We hypothesized that if recommendations are stored individually, a higher number of presented recommendations will increase the number of recalled recommendations. As the number of recommendations increases, however, recipients are likely to summarize more recommendations as part of a single, more general theme (or header), resulting in a decrease in the proportion of recalled recommendations. Two experiments ($N = 193$ and $N = 266$) found that the total number of recalled recommendations increased and the proportion of recalled recommendations decreased with the number of presented recommendations. Experiment 2 replicated the findings with the number and the proportion of intended behaviors. The implications of these findings for future behavioral health interventions are discussed.

Keywords

memory; motivation; public health; multibehavior intervention; behavioral intervention

Although human health is contingent on multiple behaviors that must be jointly targeted by behavioral health-promotion interventions (Aguiar, Morgan, Collins, Plotnikoff, & Callister, 2014; Goldstein, Whitlock, & DePue, 2004), multibehavior intervention technology and theory are in their infancy. There are clear suggestions that interventions that try to reduce multiple detrimental behaviors (e.g., reducing alcohol abuse influences medical adherence; exercise and diet aide weight loss) are successful. A review of reviews of lifestyle

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Author Contributions

P. McDonald designed the materials and collected data for Study 1. C. Hughes modified and designed materials and collected data for Study 2. Manuscripts were prepared and edited by J. McDonald, D. Albarracín, and C. Hughes. D. Albarracín oversaw and approved the project at all stages.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

interventions, however, concluded that large gaps remain in our knowledge about the efficacy of interventions to address multiple behavioral risk factors in primary care (Goldstein et al., 2004). Some studies show that smoking decreases when exercise and/or diet are added to smoking cessation programs (Marcus et al., 1999; Perkins et al., 2001), but others report either an adverse effect or no effect of the combination (Hall, Byers, Ling, & Espinoza, 2007; Hall, Tunstall, Vila, & Duffy, 1992). Given the need for evidence-based combinatorial guidelines, an understanding of the psychological processes associated with receiving multiple health or well-being recommendations is important (Wilson et al., 2015). The current research addresses how different numbers of health recommendations influence recall and intentions to perform the recommended behaviors. Specifically, we asked two questions: Should practitioners recommend two or six behaviors that might reduce health risks? Would recipients of a higher number of recommendations recall and want to enact more of these recommendations than recipients of fewer recommendations?

Providing health recommendations is an integral part of improving public health, but their optimal selection still presents challenges to both researchers and practitioners. When multiple health recommendations are necessary, knowing the influence of the number of recommendations on recall and intended compliance is critical. In this paper, we developed a paradigm to investigate how the number of presented health recommendations affects recipients' recall and intentions to carry out those recommendations at a later time. A meta-analysis of multiple-domain health-promotion interventions suggested that moderate numbers (2–3) of recommended behaviors yield better clinical and behavioral outcomes than either fewer (0–1) or greater (4+) numbers (Wilson et al., 2015), although the decrease in outcome quality from 2–3 to 4+ is generally small. This meta-analysis, however, had no way of precisely considering the number of recommendations recipients *recalled* or *intended* to carry out, two critical psychological mechanisms of efficacy. That is, although the measures of behavior or biological and clinical endpoints in the meta-analysis are the gold standard of intervention efficacy measures, they do not gauge the psychological processes underlying the effects of recommendations. The present research was designed to fill this gap in our knowledge of the effects of health-behavior recommendations.

One of the most basic psychological mechanisms underlying the effects of health recommendations is recall. Do recommendation recipients remember what their physician tells them to do? How many recommendations can be remembered? Or what proportion of the recommendations can be remembered? Two processes are involved in effectively communicating health recommendations to an audience. The first component is to ensure that these preventative recommendations are delivered (Kottke, Solberg, Brekke, Cabrera, & Marquez, 1997; Stange, Flocke, Goodwin, Kelly, & Zyzanski, 2000). The second component is ensuring that patients recall the provided recommendations. Factors such as the duration of the health-advice session significantly increase recall (Flocke & Stange, 2004), but the optimal number of presented recommendations remains a question. Ensuring proper recall of health advice is likely to reduce disease burden and mortality by a nontrivial margin (Martin, Williams, Haskard, & DiMatteo, 2005).

The present research investigated recall of different numbers of presented health recommendations. Health recommendations presented within a short span of time, such as a

counseling session, are likely to be processed in relation to each other. If the elements can be parsed into different though interconnected recommendations (e.g., one representation about fat, another about vegetables, etc., each linked to others), a higher number of recommendations is likely to provide a higher number of cues that will facilitate later recall (Albarracín, Kumkale, & Vento, 2017; Kim, Park, & Wyer, 2009; Srull & Wyer, 1979; Wyer & Srull, 1989/2014). This possibility is consistent with past findings that longer lists of items produce a higher number of freely recalled items (Cowan, Nugent, Elliott, Ponomarev, & Sauls, 1999). Thus, the number of health recommendations a recipient can recall may increase along with increases in the total number of presented health recommendations.

As the number of recommendations increases, however, recipients are likely to summarize more recommendations as part of a single, more general theme (or header, see Wyer & Srull, 1989/2014). In this case, there are fewer representations, each of which is heterogeneous. The summary theme or header thus reflects the multiple contents imperfectly, leading to a likely decrease in the proportion of recalled recommendations (Cowan et al., 1999; Sperling, 1960). In the health recommendations context, a large number of recommendations about fat, vegetables, and sugar intake may be grouped along with not smoking and taking a daily walk, as they all connect with the theme of *healthy lifestyle*. When recipients later remember what they heard, *healthy lifestyle* may cue the most thematically cohesive recommendations for the particular recipient, while necessarily leaving out other recommendations that are not as connected to the header of *healthy lifestyle*. As a result, a higher number of presented recommendations may ultimately reduce the proportion of recalled recommendations. Consistent with this hypothesis, past research has shown a linear decline in the proportion of correct responses as the length of the list increases (Nairne & Neath, 2000; Schweickert & Boruff, 1986).

In addition to recall, we were interested in investigating the effects of recommendations on intentions. For example, when a practitioner gives a client 2 or 10 health recommendations, will the patient intend to implement more recommendations when 2 or 10 were presented? This very simple question about intentions is consequential for the design of recommendation systems. Previous research has suggested that changes in intentions to perform a behavior yield changes in behavior (Ajzen & Fishbein, 1980; Albarracín, Cohen, & Kumkale, 2003; Albarracín, Johnson, Fishbein, & Muellerleile, 2001; Webb & Sheeran, 2006). For example, a stronger intention to use a condom during sex leads to greater likelihood of actually using condoms (Albarracín et al., 2001). In this context, forming intentions on the basis of the appropriate amount of health recommendations may affect carrying them out.

In sum, the current research considered effects of number of recommendations on recall of and intentions to implement health recommendations (Ajzen & Fishbein, 2005; Glasman & Albarracín, 2006). Previous research has indicated that patient recall of advice is critical to changing health behaviors (Flocke & Stange, 2004). Likewise, models of behavior change strongly emphasize that changes in intentions facilitate changes in behavior (Ajzen & Fishbein, 1980; Albarracín et al., 2005, 2001; Albarracín et al., 2003; Webb & Sheeran, 2006). In Experiment 1, we examined whether higher numbers of recommendations presented in an experimental setting would lead to a greater number but lower proportion of

recalled recommendations. In Experiment 2, we retested this hypothesis with some methodological refinements and also introduced a way of observing number and proportion of intended compliance with the presented health recommendations. In both experiments, participants were shown between 2 and 20 recommendations and then asked to recall as many recommendations as they could.

Experiment 1

The first experiment was designed to explore the effects of varying the number of behavioral health recommendations presented to participants on subsequent recall. Participants were shown differing numbers of health recommendations on a page and then asked to recall as many as they could.

Method

Participants—Participants were 193 Amazon Mechanical Turk workers (mean age = 34.34, $SD = 11.57$, 106 males) who received a small monetary compensation for their participation. One hundred and thirty-nine participants reported that their first language was English, and the sample's mean number of years speaking English was 23.49 ($SD = 13.06$). As for country of origin, 108 participants were from India, 79 were from the United States, and 6 were from various other countries (e.g., Pakistan and Poland). Data from 28 participants were excluded due to suspicions that the participants had transcribed the recommendations from the previous screen into the section for recall, instead of recalling from memory. This possibility was prevented in Experiment 2.

Procedures—Participants were recruited online through Amazon Mechanical Turk and were directed to the study program using Qualtrics survey software. The first set of instructions indicated that the focus of the experiment concerned processing of health behavior information. Participants were further informed that the next page contained a number of health behavior recommendations for them to read and consider. Participants then viewed a screen that contained the sets of behavioral health recommendations, which varied from 2 recommendations to 20 recommendations. The recommendations were presented on a single screen, single-spaced, and separated by blank lines—clearly delineating the end of one recommendation and beginning of the next. Participants were allowed to stay as long as they wanted on the recommendations page. The number of recommendations varied between subjects in increments of two recommendations from one condition to the next, leading to the following conditions: 2, 4, 6, 8, 10, 12, 14, 16, 18, and 20. Although the wording of the recommendations varied, the first sentence always contained the primary recommendation followed by an additional sentence or two justifying its health benefit (e.g., *Wash your hands frequently throughout the day after using the toilet or touching an animal and before preparing food. Adopting this particular behavior will help you avoid germs and all the diseases that come with them*). A total of 23 recommendations, with an average of 33.61 words per recommendation, were crafted for the purpose of this experiment and their content varied (e.g., exercise at least 3 days per week; quit smoking; think positive thoughts as much as possible; when you are bored, mimic chewing with your mouth; increase your fruit and

vegetable intake). Participants were randomly assigned to recommendations from the total pool of recommendations. All conditions were between-subjects.

Measures—After the recommendations screen, participants were asked to recall the recommendations. The free recall measures were comprised of individual, numbered single lines of text entry (matching the number of recommendations they were shown earlier) for participants to list each behavior as accurately as they could remember it. Recall was coded by considering the recollection of both a clear behavior and the goal. An example of a recommendation participants could have seen is: *Quit smoking. The health benefits are innumerable. Within just 20 minutes of your last cigarette, your blood pressure, pulse rate, and temperature return to normal. The benefits of being an ex-smoker are too many to touch on here.* An example of a correct response would be: *Quit smoking.* An incorrect response would be: *About smoking.* Ambiguous recall statements that could not be mapped onto the recommendation counted as incorrect. For example, if a participant mentioned an outcome, such as *better health* without mentioning the recommendation to quit smoking, the entry was considered incorrect. Similarly, listing only the general domain of the recommendation (e.g., *smoking*) was counted as incorrect due to the lack of recall of the recommendation direction (e.g., *quitting smoking*). The proportion of recommendations recalled out of total as well as the count were used as the dependent measures.

Results

We predicted that the number of presented recommendations would increase the number of recalled recommendations but decrease the proportion of recalled recommendations. We used regression analyses to test these predictions. Number and proportion of recalled recommendations correlated $r = .42$, $p < .001$, suggesting that the measures were distinct and may be affected differently by our manipulation of number of recommendations. Relevant analyses appear in Table 1.

Number of recalled recommendations—Our results (see Table 1) indicated that, as hypothesized, the number of presented recommendations predicted the number of recalled recommendations in a positive fashion (see Table 1; $R^2 = 0.299$).¹ This result implied that more material resulted in more recalled pieces.

Proportion of recalled recommendations—We also predicted that introducing a greater number of recommendations would reduce the proportion of recalled material. This pattern received support. Using regression analysis, the number of recommendations correlated negatively with percent of recall (see Table 1; $R^2 = 0.93$).² That is, as the number of presented recommendations increased, recommendation recall was less complete. Of note, however, there was an apparent increase from two to four recommendations (see Fig.

¹Supplementary analyses of number of recalled recommendations using nonlinear regression indicated that only the linear was significant. Specifically, the linear term explained $R^2 = .299$, whereas the quadratic and cubic terms explained, respectively, an additional negligible $R^2 = .006$ and $R^2 = .002$.

²Again, a supplementary analysis of proportion of recall was conducted using nonlinear regression to verify the adequacy of the main analysis. All terms were significant, and the R^2 changes were as follows: linear, .093; quadratic, .114; and cubic, .051. The curves revealed the flattening and losses of the decrease in proportion of recall that are apparent in Figure 1. However, these patterns were not significant in Experiment 2.

1), which was unexpected. Upon inspection, a planned contrast revealed that the difference between the two conditions was not significant, $F(1, 37) = 3.55, p = 0.067$.

Discussion

Experiment 1 provided support for the prediction that the amount of presented recommendations has a positive influence on the number of recalled recommendations as well as a negative influence on the proportion of recalled recommendations. Thus, presenting a large amount of recommendations would be appropriate if the goal is for recipients to remember a large amount of potentially interchangeable behaviors. However, if the goal is for recipients to remember a complete set of important recommendations, then the best strategy should be to present relatively few recommendations.

Experiment 2

The goals of Experiment 2 were to replicate and extend the findings of Experiment 1.

Specifically, Experiment 2 allowed us to consider number and proportion of intended behavior in addition to recall.

Method

Participants—Participants were 266 (135 male, 127 female, 4 missing) Amazon Mechanical Turk workers (mean age = 36.02, $SD = 12.6$) who received \$1.25 compensation for their participation. Two hundred and fortythree participants reported that their first language was English; the mean number of years speaking English was 26.05 ($SD = 13.87$). With regard to country of origin, 22 participants were from India, 233 from the United States, and 6 from various other countries. Data from three participants were deleted because they left 50% or more of the questions unanswered. Data from four participants were excluded because they reported having already implemented the health recommendations.

Procedure—The design of Experiment 2 remained similar to Experiment 1, except that the number of recommendations was limited from 2–12 in increments of 2. All conditions were between-subjects. The recommendations used in this experiment concerned only physical health (e.g., *Drink more tea. You will consume ample amounts of antioxidants from tea that will help prevent cancer and reduce stress.*). In total, there were 24 recommendations with an average of 31.58 words per recommendation. Departing from Experiment 1, the recommendations were presented one at a time on individual pages, the free recall question format was changed to a single essay text entry box, and an open-ended essay question for intentions (i.e., *Describe which, if any, of the recommendations you read that you plan to implement in your life and why you plan to follow these recommendations*) was added to measure intentions to perform each recommended behavior. To measure intentions to implement presented recommendations, the number and proportion of recommendations that participants described as wanting to implement in their own life was counted—analogue to counting the number and proportion of specific, individual recommendations the participants were able to recall. Responses such as *all of them* and *I already implement all of these behaviors* were not included in the count as the recommendation behavior had to be

specifically mentioned (e.g., *I want to choose new ways to exercise*). If a participant only had this type of response and no other specific recommendations were mentioned, that participant was excluded from this analysis and not given a zero value, so as not to conflate persons not intending to change their behavior with successful behavior change or unspecific behavior change.

Results

As in Experiment 1, we conducted separate regression analyses on the two variables of interest. Results appear in Table 1.

Number of recalled recommendations—As in Experiment 1, the sheer number of recalled recommendations was positively associated with the number of presented recommendations (see Table 1; $R^2 = .197$).³ This finding again suggested that a higher number of recommendations offered a higher number of retrieval cues and allowed participants to recall more material.

Proportion of recalled recommendations—As in Experiment 1, the proportion of recalled recommendations out of total was negatively correlated with the number of presented recommendations (see Table 1, $R^2 = .271$).⁴ This result supported the prediction that a higher number of recommendations would lead to greater difficulty storing the information under headers that effectively cued all of the contents.

Number of health intentions—A regression analysis revealed that the number of presented recommendations was positively associated with the number of reported intentions (see Table 1; $R^2 = .047$).⁵ As with recall, the number of presented recommendations influenced number of intentions.

Proportion of health intentions—The proportion of freely reported intentions out of the total number was also negatively correlated with the number of presented recommendations (see Table 1; $R^2 = .194$).⁶ These results replicated the pattern obtained for recall.

Correlations between recommendation recall and health intentions—As an additional set of analyses, we performed correlations between the recall and intention measures. The number of recalled recommendations correlated positively with the number of recommendations participants reported intending to follow ($r = .199$, $p < .001$). Further, the proportion of recalled recommendations correlated positively with the proportion of health intentions participants reported intending to follow ($r = .369$, $p < .001$). These results thus confirmed that intentions were largely based on the recalled information.

³.Supplementary analysis revealed that linear, quadratic, and cubic predictors were all significant and had R^2 changes of .197, .015, and .073, respectively.

⁴.Supplementary nonlinear regression analysis revealed that only the linear and quadratic predictors were significant. The R^2 changes were as follows: linear, .271; quadratic, .104; and cubic, 0. The quadratic effect reflects a flattening in the gains with a higher number of recommendations but was not present in Experiment 1.

⁵.Supplementary nonlinear regression analysis revealed that only the linear predictor was significant. The R^2 changes were as follows: linear, .047; quadratic, .007; and cubic, 0.

⁶.Supplementary nonlinear regression analysis revealed that only the linear predictor was significant. The R^2 changes were as follows: linear, .194; quadratic, .006; and cubic, .002.

Discussion

Experiment 2 was a successful replication of the results from Experiment 1. Overall, the number of recalled recommendations increased as number of presented recommendations increased, whereas the proportion of recalled recommendations decreased as the number of presented recommendations increased. Experiment 2's additional contribution was providing data on intentions to carry out the health recommendations. We found that participants' intention to follow the received recommendation correlated with recall. The number of both recalled and intended recommendations increased as the number of presented recommendations increased. Similarly, the proportion of recalled and intended recommendations both decreased as the number of presented recommendations increased. This experiment thus reinforced our hypothesis by corroborating our data on raw recall and proportion of recall. It also allowed us to reach similar conclusions about whether it is better to present many or few recommendations based on the recommender's goals. If recommenders wish to instill intentions to perform the highest possible number of equally beneficial behaviors, then many recommendations are optimal. However, if recommenders wish to instill intentions to perform a relatively complete set of behaviors, then fewer recommendations are more desirable.

General Discussion

The implication of our findings and reasoning for assessing both recall number and recall proportion is that the best number of behaviors to recommend seems to depend on the goal of an intervention. If the goal of an intervention is to effectively communicate as many behavioral recommendations as possible, then our findings suggest that the best strategy is to recommend a higher number of behaviors—according to our data, the greatest number of recalled recommendations (roughly 7 in total) occurs at 14+ presented recommendations. Conversely, if the goal of an intervention is to effectively communicate a complete set of behaviors (e.g., *Diet and exercise are both important to living a healthy lifestyle*), then our findings suggest that the best strategy is to recommend a low number of behaviors.

When giving health recommendations to improve public health, we must also consider how seriously people will take the recommendations. This objective was the main concern when we measured intention to follow through in Study 2. That data showed that people's intentions correlated significantly with the corresponding recall measure. If interventionists wish to instill intentions for recipients to follow a high but incomplete number of recommendations from a larger set, then presenting many recommendations is the way to go. Such a strategy, however, may backfire if interventionists wish to instill intentions for a complete set of behaviors, such as taking a target medication along with other medications to control its side effects. If all recommendations from a set are important, then practitioners should target a low but well-rehearsed number of behaviors.

One limitation of our experiments is that we did not collect any behavioral data to follow up on the intentions we recorded. Although intentions do tend to be a good predictor of later behavior, other research indicates that intentions become a poorer predictor over longer periods of time (Albarracín et al., 2001; Norcross & Vangarelli, 1989). One potential solution to this problem when recommenders present information could be to emphasize

short-term benefits in addition to longer term ones. Research has indicated that people are more likely to follow through with intended behavior if it has some short-term benefit (Woolley & Fishbach, 2017).

Our findings can most clearly be used by anyone wishing to improve the health of others. It may be better, for example, if a program wishing to stop smoking focused solely on a few recommendations (*smoke one less pack per day*, etc...), rather than trying to bombard smokers with many potential courses of action. Therefore, a recommender that strongly prefers certain recommendations should focus only on those that are preferred and potentially not mention others. Alternatively, if the goal is to get a client to lose weight, for example, and various recommendations are equally important (e.g., eat less sugar and exercise for diabetics), then it would be best to provide a higher number of recommendations. This strategy would ensure that recipients recall and intend to implement a large number of the recommendations.

These results could be used by psychotherapists who wish to change the behavior of their patients in specific ways. If psychotherapists assign homework, for example, they may create an assignment that addresses one behavior that is important to change. Therapists may also give recommendations in small bursts (over text messaging during a longer time period), for example, to help maximize the proportion of recalled recommendations while minimizing cost to the patient (Kazdin & Blase, 2011). Alternatively, psychotherapists could also utilize homework to recommend many equally beneficial behaviors in the hopes that patients will remember as many of these behaviors as possible, without a concern for complete recall. These homework-style approaches to therapy have been shown to contribute significantly to the patient's treatment (Kazantzis, Whittington, & Dattilio, 2010). If therapists tailor how much information is presented on homework based on their desired outcome, homework effectiveness may increase further.

An interesting direction future research could explore is how the number of recommendations affects how strong people's intentions are. For example, intentions to follow through a large number of recommendations may be weaker than intentions that represent a commitment to a single action. The generalizability of our data across recommendation domains is also a question. Our experiments included recommendations from various domains, but the trend may be stronger or weaker depending on the specific domain. Domains may be better suited for a particular style of recommending. Weight loss, for example, may have a particular advantage when attempting to give many recommendations simply because there are numerous ways to lose weight. Smoking, on the other hand, may be particularly effective when giving few recommendations because it is important for a patient to follow a few, but very important, recommendations. Future researchers may also wish to test our findings in a clinical setting. If our results of recall and intentions replicate in clinical settings, then we could safely say that our strategy of picking whether to advocate for few or greater numbers of behaviors based on intervention goals is reliable and can improve public health.

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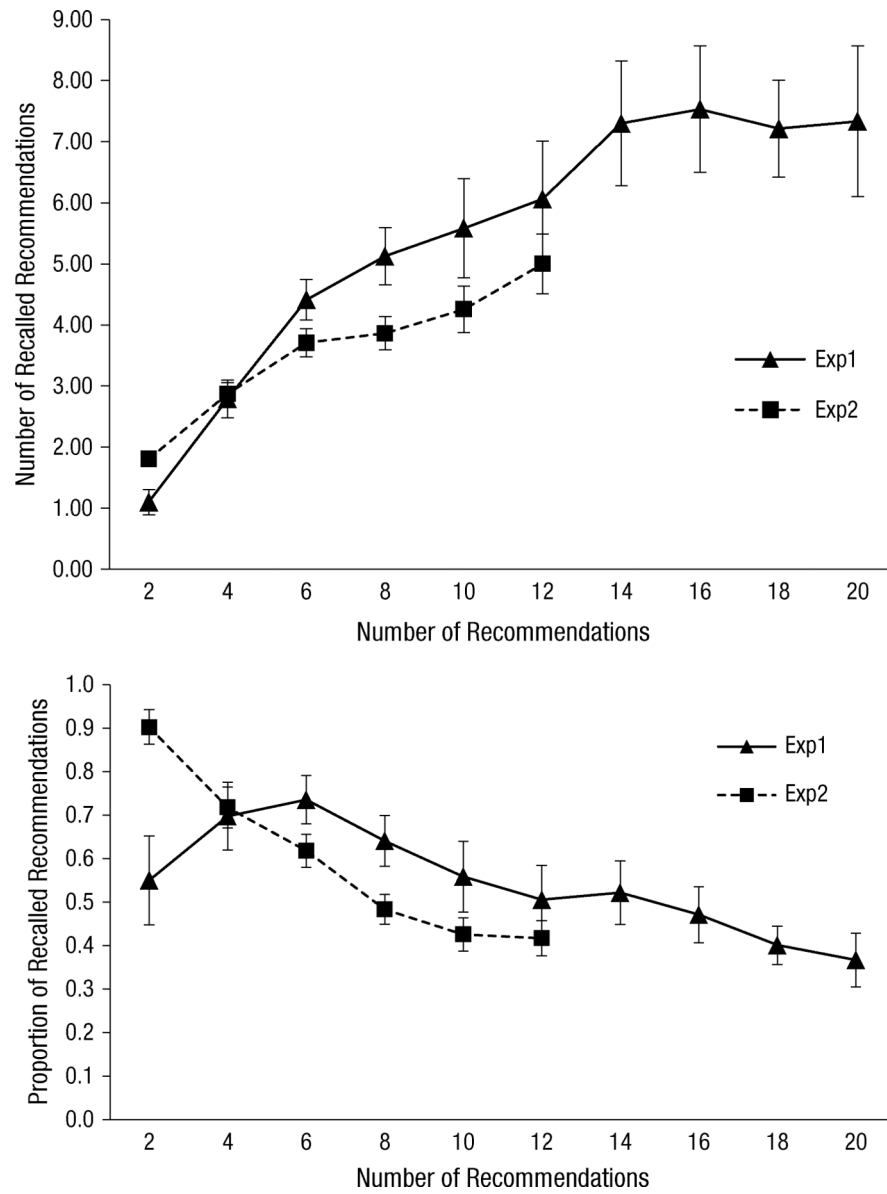


Fig. 1. Means and SEs of the number and proportion of recalled recommendations in Experiments 1 and 2.

Simple Linear Regressions Testing Effects of Number of Presented Recommendations on Number and Proportion of Recall

Table 1.

	<i>B</i>	<i>SE (B)</i>	<i>β</i>	<i>t</i>	95% CI
Experiment 1					
Recall number	0.333	.040	.547***	8.340	[.254, .412]
Recall proportion	-0.016	.004	-.305***	-4.094	[-.024, -.008]
Experiment 2					
Recall number	0.291	.037	.444***	7.895	[0.219, 0.364]
Recall proportion	-0.049	.005	-.520***	-9.711	[-0.059, -0.039]
Intentions number	0.060	.017	.218***	3.556	[0.027, 0.094]
Intentions proportion	-0.030	.004	-.441***	-7.826	[-0.037, -0.022]

* $p < .05$.

** $p < .01$.

*** $p < .001$.