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A Remember/Know Analysis of the Semantic Serial Position Function

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Abstract

Did the serial position functions observed in certain semantic memory tasks (i.e., remembering the order of books or films) arise because they really tapped episodic memory? To address this issue, participants were asked to make remember/know judgments as they reconstructed the release order of (a) the seven Harry Potter books, and (b) two sets of movies. For both classes of stimuli, the "remember" and "know" serial position functions were indistinguishable and all showed the characteristic ∪ shape with marked primacy and recency effects. These results are inconsistent with a multiple memory systems view, which predicts recency effects only for "remember" responses and no recency effects for "know" responses. The data, however, were consistent with a general memory principle account—namely, the relative distinctiveness principle. According to this view, performance on both episodic and semantic memory tasks arise from the same type of processing: items that are more separated from their close neighbors in psychological space at the time of recall will be better remembered.

When people recall a list of items in an episodic memory task, they recall the first few items well (the primacy effect), the last few items well (the recency effect), but have poorer memory for mid-list items. This U-shaped serial position function has been reported for lists that span milliseconds to weeks (Neath & Brown, 2006) and even years (Sehulster, 1989). Similar-looking serial position functions have also been observed when people recall information from semantic memory. There are, to our knowledge, four types of stimuli that have been used to produce semantic serial position functions: (1) political figures, (2) lyrics, (3) books, and (4) movies. Here, we examine whether semantic serial position functions observed with the latter two stimulus types were really episodic serial position functions in disguise.

One common approach to the study of memory is to posit multiple memory systems which operate in different ways and follow different principles. The most common formulation – the modal multiple memory system model – generally follows the proposals of Tulving and colleagues (see Tulving, 1985a; Schacter & Tulving, 1994; Schacter, Wagner, & Buckner, 2000; for a recent review, see Nadel & Hardt, 2011). One distinction is between declarative and non-declarative systems, with the former responsible for remembering "that" (i.e., you remember that 2 + 2 = 4, you remember that yesterday you had pizza for lunch, etc) and the latter responsible for remembering how (i.e., you remember how to ride a bicycle). Within the declarative system, there is a further distinction between episodic and semantic memory. Although episodic and semantic memory are thought to differ in a number of important ways, one key distinction concerns whether the rememberer is aware of the learning episode (Tulving, 1972, 1983). For example, many people know that George Washington was the first president of the United States, but they are unaware of any details from the original learning episode. In contrast, when people recall a list of words immediately after hearing them, they are fully aware of the episode in which the target items were experienced. Unlike semantic memory, then, "episodic memory affords the additional capability of acquisition and retention of knowledge about personally experienced events and their temporal relations in subjective time and the ability to mentally 'travel back' in time" (Tulving, 1985a, p. 387).

In terms of semantic serial position functions, there is no debate whether such functions observed with either presidents of the United States (Roediger & Crowder, 1976; Crowder, 1993; Healy, Havas, & Parker, 2000; Healy & Parker, 2001) or Prime Ministers of Canada (Neath & Saint-Aubin, 2011) tap semantic rather than episodic memory; all theories that distinguish between episodic and semantic memory have to admit that they are tapping semantic memory. The issue of which memory system is being tapped may be slightly less clear for the serial position functions observed with either well-known hymns (Maylor, 2002), a college "fight song" (Overstreet & Healy, 2011), or theme songs from popular children's cartoons (Kelley, Neath, & Surprenant, 2013). For the two remaining classes of stimuli, books and movies, the question is quite apposite: Are such serial position functions really semantic?

Kelley et al. (2013) asked college students to reconstruct the order of the seven Harry Potter books as well as the order of two types of movies (the 9 top grossing movies from 2002 to 2010 and 9 Pixar movies) and showed U-shaped serial-position functions for both types of stimuli. The issue at hand is whether any of the participants might have used episodic memory rather than semantic memory in these tasks. For instance, a participant who read the Harry Potter books might have remembered that she had read the first book in London and the second book in Rome. Similarly, another participant may remember having seen a movie released right after he graduated from high school. The availability of such episodic contextual information is of critical importance because, if participants relied on this episodic information during the memory task, then the serial position function observed with each type of material would be rendered commonplace.

One way to address this issue is to ask participants to provide remember/know judgments (e.g., Gardiner, 1988; Tulving, 1985b) as they reconstruct the release orders of the Harry Potter books and the movies. In the typical remember/know procedure, participants are asked to give a "remember" response to all those items for which they can explicitly bring to mind the episode in which the item was learned, and a "know" response for all those items for which they cannot recall details from the specific learning episode. The idea is that if a person can remember not only the item itself, but can also "time travel" back and remember details about the episode, then that is consistent with the idea that the episodic memory system is involved. In contrast, if the semantic memory system is involved, by definition, the person will not be able to remember episodic details.

The interpretation of remember and know judgments is not entirely straightforward because most of the research on remember/know judgments has used recognition as the task and, as such, has been influenced by ideas from signal detection theory. In particular, a number of researchers have suggested that in recognition, the data are better fit by models in which the remember/know dichotomy is seen as a continuum that maps onto a unidimensional construct such as strength (e.g., Donaldson, 1996; Wixted & Mickes, 2010). There are very few studies that use the remember/know procedure and ask for recall rather than recognition, despite the fact that Tulving (1985b) included such a study. One issue concerns whether conclusions based on recognition apply to recall. Brainerd and Reyna (2010) argue that they do not. They note that in studies involving recall (e.g., free recall, associative recall, etc), there is consistent evidence for dual retrieval processes, which is in contrast to recognition studies where there is substantial evidence for a unitary process. As such, interpretations of what a "remember" judgment means and what a "know" judgment means are likely to be quite different in the two domains (see also Hamilton & Rajaram, 2003, for a similar conclusion). We could find no studies that investigated remember/know judgments with reconstruction of order tests, the task we used, but we assumed that the conclusions surrounding interpretation of such judgments in recall paradigms are more likely to apply than conclusions made in recognition paradigms. Thus, it is plausible to assume that a remember judgment is consistent with the idea that episodic memory is involved.

Proponents of a multiple memory systems view argue that the recency effects observed when the task is thought to tap semantic memory are qualitatively different than those observed when the task is thought to tap episodic memory. According to this view, demonstrations of so-called semantic serial position functions are really due to some other factor. For example, the presidential serial position function is likely due to differential exposure (see the discussion in Healy et al., 2000) and the demonstrations with Harry Potter books and movies are really tapping episodic rather than semantic memory. This view predicts that a serial position function should be observed only for those items that are "remembered." In short, recency effects require episodic memory.

In contrast, proponents of the idea that serial positions functions are governed by a general principle of memory—the relative distinctiveness principle (see Surprenant & Neath, 2009)—offer a different prediction. According to this view, when the to-be-remembered items can be sensibly ordered along some dimension, a serial position function will be observed primarily because of two processes: Weberian compression (recent items are spaced further apart in psychological space) and edge effects (no items precede the first or follow the last items; see Brown, Neath, & Chater, 2007; Neath, 2010). Whether the participant "remembers" or just “knows” the items is not of critical importance to performance. Indeed, serial position functions, with clear primacy and recency effects, should occur following both types of responses.

Demonstrations 1 and 2

The present demonstrations explored whether the serial position functions observed when people reconstruct the order of the Harry Potter books (Demonstration 1) or nine movies (Demonstration 2) differ as a function of whether they “remember” the item in question or just “know” that the item occurred in a particular order. Participants first were asked to rate their familiarity with each book and film (from “never heard of it” to “read/seen multiple times”). Following the rating task, they were given three separate free reconstruction of order tasks—one for the books and one each for two sets of movies—in which the stimuli were shown in a random order on one side of a sheet of paper and participants were asked to place them into their appropriate release order (from oldest to most recent). They were also asked to indicate whether they “remembered” or “knew” each item in the list. The data were collected at the same time from the same participants, and therefore the methodology for both is described together, but the data for each demonstration are reported separately.

Method

Participants

One hundred and eighty undergraduate students from Lake Forest College participated for credit in various introductory courses. Participants completed the study in groups of approximately forty students in a classroom setting. Each session lasted approximately 15 minutes.

Design & Materials

The study consisted of two parts: (1) a familiarity rating task, and (2) three free reconstruction of order tasks. In Part 1, participants received a list of 7 book and 18 film titles, as well as instructions to provide a familiarity rating for each book/film on a 1-5 scale, where 1 = I've never heard of this book/film; 2 = I've heard of this book/film, but I have no other knowledge of it; 3 = I've heard of this book/film and have some knowledge of it, but I haven't read/seen it; 4 = I've read/seen this book/film once; and 5 = I've read/seen this book/film multiple times.

The books were the 7 titles in the Harry Potter series. US titles were used (i.e., we used *Harry Potter and the Sorcerer's Stone* rather than *Harry Potter and the Philosopher's Stone*). Two sets of films were used. The first set consisted of 9 movies from Pixar (e.g., *Toy Story, A Bug's Life, Monsters Inc.,* etc.) and the second set consisted of the 9 top grossing movies from 2002-2010 (e.g., *Iron Man, Pirates of the Caribbean, Avatar*, etc.; one from each year). For both sets of films, the first movie in a franchise was included (e.g., *Toy Story*), but any sequels were not (e.g., *Toy Story 2*). When the top grossing film was a sequel or a Pixar film, we chose the next highest grossing non-Pixar non-sequel on the list. In the end, all of the "top grossing" films in this study exceed revenue of $500 million worldwide and $180 million in the United States (all revenue in US dollars).

In Part 2, participants received three separate free reconstruction of order tasks in which they were asked to reconstruct the original order of release for the books and for the two sets of films. Each book or film was randomly reordered and paired with a letter (A-G or A-I, respectively). For the top-grossing movies, a column of years (2002-2010) and blank lines appeared next to the column of films. For the Pixar films and Harry Potter books, the numbers 1-9 and 1-7 appeared next to the blank lines, respectively.

Procedure

In each session, participants were given a packet that contained instructions, the rating task, and the reconstruction of order tasks. The study was self-paced and began with participants reading the instructions silently. In Part 1, participants were asked to make and record one familiarity rating for each of 7 books and 18 films. Next, participants read the instructions for Part 2, which asked them to reorder the scrambled books and films according to their original order of release and to make a remember or know response for each item. They were given instructions on what constituted a “remember” versus a “know” judgment (see Appendix).

Participants were asked to fill in all the blanks, even if they had to guess. All participants received identical packets with the same books and films in the same random order. Upon completion of the third reconstruction of order task, participants were debriefed and thanked for their participation.

Demonstration 1 Results

Overall, the mean familiarity rating for the 7 Harry Potter books was 3.660 (SD = 0.955), a level of familiarity comparable to the 3.617 (SD = 0.972) observed by Kelley et al. (2013). Twenty-eight out of the 180 participants gave mean ratings of less than 3, but because the main results do not differ as a function of whether these 28 data points are included or excluded, all data were included in the following analyses.

Overall accuracy in reconstructing the order of the books also was comparable to that observed by Kelley et al. (2013), with mean proportion of items correctly reconstructed 0.550 (SD = 0.498). Chance performance was 0.143. The number of “remember” judgments given by each participant for each set of books averaged 3.278 (SD = 2.825); the mean number of “know” judgments, therefore, was 3.711.

According to the multiple memory systems view, one would expect that accuracy and the number of remember judgments should correlate, given the assumption that recency (and thus higher accuracy) should be due to episodic memory. However, this did not appear to be the case. The number of "remember" judgments did not correlate with accuracy, $r = 0.010$, $p > 0.80$, or familiarity, $r = 0.103$, $p > 0.10$. The only significant correlation among these three measures was between accuracy and familiarity, $r = 0.344$, $p < 0.01$. The pattern of correlations, then, do not favor predictions of the multiple memory systems view.

One might argue that that the correlational analysis is not sufficiently sensitive because the difference due to episodic recall may be apparent only at the recency portion of the curve, whereas the correlations include data from all positions. We therefore computed the proportion of "remember" judgments for each serial position, and the values are given in the top row of Table 1. These data were analyzed by a one-way repeated measures analysis of variance (ANOVA) with position as the only factor. The main effect of position was not significant, $F(6, 1074) < 1$, $p > 0.80$, with the proportion of "remember" judgments varying only from 0.444 to 0.489 . None of the seven values differed from any of the other values. Similar to the conclusions from the correlational analysis, there is little evidence of recency being related to "remember" judgments.

INSERT TABLE 1 ABOUT HERE

A final analysis of the relation between type of judgment and accuracy looked at the mean accuracy for all items judged "Remember" compared to the mean accuracy for all items judged "Know". Consistent with the two previous analyses, there was no difference. The overall proportion correct for items given a "remember" judgment was 0.546 (SD = 0.498) compared to 0.554 (SD = 0.497) for items given a "know" judgment, $t(1258) = 0.295$, $p > 0.75$.

Out of 180 subjects, there were 45 who gave "remember" judgments to all 7 books and 56 who gave "know" judgments to all 7 books. The familiarity ratings for these "pure remember" and "pure know" lists were 3.818 (SD = 0.981) and 3.644 (SD = 1.140), respectively. These values did not differ, $t(99) = 0.811$, $p > 0.40$.

INSERT FIGURE 1 ABOUT HERE

The proportion of books correctly reconstructed in order in the "pure remember" and "pure know" lists is shown in the left panel of Figure 1. As can be seen, there are primacy and recency effects for both lists. The data were analyzed with a 2 list type (remember vs. know) × 7 position mixed-factor ANOVA. The main effect of list type was not significant, $F(1, 99) < 1$, $p >$ 0.90, with the proportion correct for the "pure remember" lists 0.549 compared to 0.546 for the "pure know" lists. There was a significant effect of position, $F(6, 594) = 4.390$, $MSE = 0.112$, partial $\eta^2 = 0.042$, $p < 0.001$. Of importance, there was a significant quadratic component to the main effect of serial position, $F(1, 99) = 16.158$, $MSE = 0.142$, partial $\eta^2 = 0.140$, $p < 0.001$, indicating the presence of primacy and recency. The interaction between list type and position was not significant, $F(6, 594) < 1$, $p > 0.80$.

One potential objection to relying solely on "pure" lists is that the size of the subsample is too small. For the final analysis, we focused on indicators of the recency effect—specifically, those participants who gave a "remember" judgment to items 5 and 7 (regardless of their judgments for the other 5 items) and those who gave a "know" judgment to items 5 and 7. Out of 180 subjects, 69 were included in the former group and 77 in the latter. The mean familiarity rating for the remember group (M = 3.799; SD = 0.931) did not differ significantly from that of the "know" group (M = 3.555; SD = 1.072), $t(144) = 1.456$, $p > 0.10$.

INSERT FIGURE 2 ABOUT HERE

The proportion of books correctly reconstructed at positions 5 and 7 are shown in the left panel of Figure 2 as a function of the type of judgment. As can be seen, there is clear evidence of recency—performance increases from position 5 to 7—for both "remember" and "know" responses. These data were analyzed with a 2 judgment type (remember vs. know) × 2 position (positions 5 and 7) mixed-factor ANOVA. The main effect of judgment type was not significant, $F(1, 144) < 1$, $p > 0.90$, with the proportion correct for the "remember" items 0.507 compared to 0.506 for the "know" items. There was a significant effect of position, $F(1, 144) = 4.696$, $MSE = 0.141$, partial $\eta^2 = 0.032$, $p < 0.05$, with performance significantly higher at the final position (0.555) than at position 5 (0.459). The interaction between judgment type and position was not significant, $F(1, 144) < 1$, $p > 0.80$.

All of the above analyses converge on the same conclusion: the serial position functions observed, and specifically the recency effect, do not differ as a function of whether the subject has episodic awareness of the learning episode. When reconstructing the order of the seven Harry Potter books, "remember" serial position functions are essentially indistinguishable from "know" serial position functions.

Demonstration 2 Results

One advantage of the movie data is that each subject rated and then recalled two sets of nine movies. From 180 subjects, then, we have 360 cases where 9 movies were ordered and given remember or know judgments; in effect, we double the data from Demonstration 1. Before combining the data from the two sets of movies, however, we first examined whether they differed in familiarity. The mean familiarity for the Pixar movies was 4.282 (SD = 0.667) compared to 4.236 (SD = 0.642) for the top grossing movies, which did not differ, $t(358) = 0.672$, $p > 0.50$. Nine out of 180 subjects gave ratings of less than 3 for Pixar movies compared to 7 out of 180 for the top grossing movies. Similarly, 143 gave ratings of 4 or higher for the Pixar movies compared to 136 for the top grossing movies. The main results do not differ as a function of whether the 16 data points with familiarity ratings below 3 are included or exclude; therefore, all data were included in the following analyses.

Accuracy in reconstructing the order of the movies was comparable to that observed by Kelley et al. (2013), with the mean proportion of items correctly reconstructed 0.372 (SD = 0.483). Chance performance was 0.111. The number of “remember” judgments given by each participant per 9 movies was 4.922 (SD = 3.428); the mean number of “know” judgments, therefore, was 4.078. With the books, know judgments were more common than remember but with the movies, the reverse was the case.

As with the book data, we correlated accuracy, familiarity, and the number of remember judgments, and the pattern of these correlations was the same. The number of “remember” judgments did not correlate with accuracy, $r = 0.040$, $p > 0.40$, or familiarity, $r = 0.081$, $p > 0.10$. Again, the only significant correlation among these three measures was between accuracy and familiarity, $r = 0.234$, $p < 0.01$.

The bottom row of Table 1 displays the proportion of “remember” judgments for each serial position. These data were analyzed by a one-way repeated measures ANOVA with position as the sole factor. There was no effect of position evident, with the proportion of "remember" judgments ranging from 0.528 to 0.564, $F(8, 2872) < 1$, $p > 0.80$). None of these values differed from any of the other values.

A final analysis of the relation between type of judgment and accuracy looked at the mean accuracy for all items judged "Remember" compared to the mean accuracy for all items judged "Know". The overall proportion correct for items given a "remember" judgment was 0.381 (SD = 0.486) compared to 0.360 (SD = 0.480) for items given a "know" judgment, $t(3238) = 1.279$, $p > 0.20$. Although the accuracy for "remember" items was numerically slightly higher than for those items given "know" judgments, the difference was not significant.

Out of 360 cases, there were 92 that received "remember" judgments for all 9 movies and 70 that received "know" judgments for all 9 movies. The familiarity ratings for these were 4.258 (SD = 0.503) and 4.176 (SD = 0.813), respectively, which did not differ, $t(160) = 0.792$, $p > 0.40$.

The proportion of movies correctly reconstructed in order as a function of type of judgment— "pure remember" or "pure know"—is shown in the right panel of Figure 1. The data clearly replicate those observed with books in that there are primacy and recency effects for both types of list. The data were analyzed with a 2 list type ("pure remember" vs. "pure know") × 9 position mixed-factor ANOVA. The main effect of list type was not significant, $F(1, 160) < 1$, $p > 0.60$, with the proportion correct for the "remember" items 0.380 compared to 0.360 for the "know" items. There was a significant effect of position, $F(8, 1280) = 8.427$, $MSE = 0.179$, partial $\eta^2 = 0.050$, $p < 0.001$. Of importance, there was a significant quadratic component to the main effect of serial position, $F(1,160) = 40.040$, $MSE = 0.258$, partial $\eta^2 = 0.200$, $p < 0.001$, indicating the presence of primacy and recency. The interaction between list type and position was not significant, $F(8, 1290) < 1$, $p > 0.75$.

A larger sample is possible if one includes all cases in which a "remember" judgment was given to both item 7 and 9 (regardless of their judgments for the other 7 items) and in which a "know" judgment was given to both item 7 and 9. Out of 360 cases, there were 158 in the former group and 114 in the latter. The mean familiarity rating was 4.289 (SD = 0.572) for the "remember" group compared to 4.100 (SD = 0.788) for the "know" group. These values were significantly different, $t(270) = 2.295$, $p < 0.05$.

The proportion of movies correctly reconstructed in order as a function of type of judgment is shown in right panel of Figure 2. Again, there is clear evidence of recency in both "remember" and "know" lists. The data were analyzed with a 2 judgment type (remember vs. know) × 2 position (positions 7 and 9) mixed-factor ANOVA. The main effect of judgment type was not significant, $F(1, 270) < 1$, $p > 0.90$), with the proportion correct for the "remember" items 0.465 compared to 0.461 for the "know" items. There was a significant effect of position, $F(1, 270) = 7.839$, $MSE = 0.164$, partial $\eta^2 = 0.150$, $p < 0.001$. This reflects the apparent recency effect in Figure 2: performance increases from Position 7 (0.341) to Position 9 (0.584). The interaction between group and position was not significant, $F(1,270) = 1.393$, $MSE = 0.164$, partial $\eta^2 = 0.005$, $p > 0.20$.

With the exception of a significant difference in familiarity ratings when considering just the second position from the end and the final position, the analyses of the data from the movies parallels the data from the books: When reconstructing the order of movies, "remember" serial position functions are essentially indistinguishable from "know" serial position functions.

General Discussion

At issue in the current paper is whether the semantic serial position functions for books and movies, reported by Kelley et al. (2013), are really episodic serial position functions in disguise. Given that the participants in were likely to have read the books in order and have watched the movies at the time of their theatrical release, the possibility existed that participants might have been consciously aware of information surrounding the original learning episode (e.g., when or where they read each book or saw each film) and that this episodic information might have been responsible for the observed serial position functions.

One key difference between episodic and semantic memory is whether the person remembers not only the information itself but also other details from the learning episode. Tulving (1985b) proposed that asking subjects to indicate whether they remembered or merely knew the information could be taken as indicating whether the person exhibited autonoetic consciousness for the event and therefore whether episodic memory was playing a role. In the present demonstrations, participants provided remember/know judgments as they reconstructed the order of the 7 Harry Potter books and the release date of two sets of 9 films (Pixar and Top-Grossing). These demonstrations replicated the serial positions functions reported by Kelley et al. (2013). In addition, the serial position functions observed did not differ as a function of whether the items were accompanied by a remember judgment or a know judgment. The presence of serial position functions for both the “remember” and “know” groups is inconsistent with the predictions of the modal multiple memory systems account, which predicts no recency effect following “know” responses.

It is possible that, contrary to Tulving’s (1985b) original hypothesis, remember/know judgments do not accurately reflect the memory system supporting performance. For example, in the recognition literature, there are a number of studies converging on the idea that remember/know judgments are more likely to indicate the strength of a memory (e.g., Donaldson, 1996; Wixted & Mickes, 2010). Although it seems unlikely that the conclusions from recognition studies would apply to reconstruction of order tests (e.g., Brainerd & Reyna, 2010, Hamilton & Rajaram, 2007), what if they did? That is, what if the remember/know procedure does reflect only the strength of the memory?

Our view is that this would be problematic for any account that distinguishes between episodic and semantic memory on the basis of autoneotic vs noetic consciousness or any similar concept. The reason is that one of the fundamental differences between the two memory systems is not amenable to testing: Although one could infer that a person remembers an event by asking the person to recall the item, one could not infer that episodic memory is supporting memory if the same person also recalls information about the encoding episode.

If remember/know judgments do allow one to infer whether episodic memory is playing a role, then our data indicate that serial position functions are observable even when episodic memory is not contributing. On the other hand, if remember/know judgments do not allow for inferences about whether episodic memory is contributing, then part of the rationale for distinguishing between the two memory systems in the first place is called into question.

In contrast, these results are consistent with the predictions of the relative distinctiveness principle (e.g., Kelley et al., 2013; Neath et al., 2006; Neath & Saint-Aubin, 2011; Surprenant, Neath & Brown, 2006). According to this view, serial position functions arise when items are ordered along one or more dimensions regardless of the hypothetical underlying memory system. The particular dimension(s) can vary: for example, in episodic tasks, the dimension is usually temporal (i.e., relative time), but need not be; items can be ordered along perceptual dimensions (Neath & Brown, 2006) or a position dimension (Surprenant et al., 2006) or any other dimension that is useful. In semantic tasks, the ordering is less likely to be temporally-based and more likely to be a nominal or logical ordering (e.g., the second verse follows the first verse); time *per se* is not a factor. Of course, if stimuli are not ordered along one or more dimensions, then serial position functions will not be observed. For instance, such functions should not be observed when recalling different breeds of dogs or the names of the 10 Canadian provinces, but will occur when recalling the Canadian prime ministers. Similarly, whereas recalling the release order of Disney films should produce such a serial position function, recalling the names of the seven dwarves in the Disney film should not (see Meyer & Hilterbrand, 1984).

The data reported here and in other semantic serial position function papers (e.g., Crowder, 1993; Healy et al., 2000; Healy & Parker, 2001; Kelley et al., 2013; Maylor, 2002; Neath & Saint-Aubin, 2011; Overstreet & Healy, 2011; Roediger & Crowder, 1976) all converge on the same conclusion: serial position functions observed when the test nominally taps semantic memory do not differ from those observed when the task nominally taps episodic memory. Whereas it is not possible to prove conclusively that the two are the same, it is easy–in principle–to prove that they are not: a multi-memory systems proponent who thinks that serial position functions in semantic memory are fundamentally different from those in episodic memory need only show one example of a meaningful difference and our claim is compromised.

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Appendix

After you re-order each book or film, we also want you to indicate whether you “remembered” or “knew” the position of that book or film in the list. Please read the following instructions to find out how to make the “remember” (or “R”) and “know” (or “K”) judgments.

Remember judgments: Please write **“R”** if your order judgment was accompanied by a conscious recollection of some aspect or aspects of what happened or what was experienced when you originally learned about the order of the book (e.g., what you were thinking and doing at the time, or when this occurred, or where you were, etc.).

- In other words, a “remember” response should bring back to mind a particular association, image, or something more personal from the time of learning about that particular book.

Know judgments: Please write **“K”** if your order judgment was *not* accompanied by a conscious recollection of any aspects of what happened or what was experienced when you originally learned about the order of the book.

- In other words, write “K” (for “know”) when you are certain of that you’ve reordered the book properly, but the reordering process failed to evoke any specific conscious recollection regarding the position of the book in the sequence.

To further clarify the difference between these two judgments (i.e., “R” vs. “K”), here are a few examples.

- Imagine that you were asked to reorder a list of US presidents. For most people, a **“know’** response would accompany the ability to reorder George Washington as the first president. They "know" he was the first president, but they are not aware of anything about when, where, or how they learned this information.

- However, some people might “remember” this information because they had a vivid recollection of learning it. For example, they might **“remember”** having a substitute teacher on one specific day who did impressions of each president.

If you have any questions regarding these judgments, please raise your hand and ask. Thank you.

Table 1: The proportion of “remember” judgments at each serial position for the 7 Harry Potter books and the 9 movies.

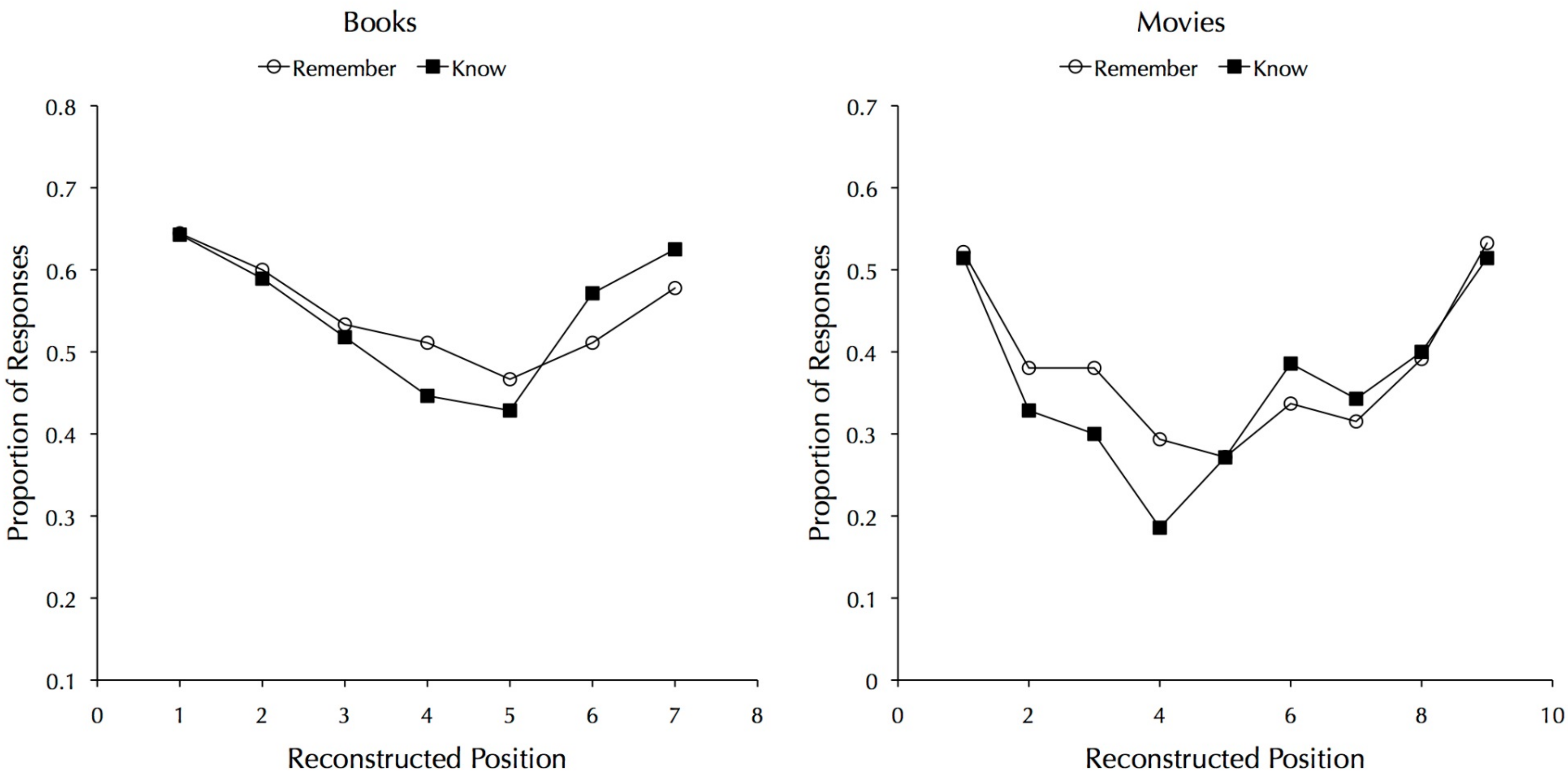
	1	2	3	4	5	6	7	8	9
Books	0.489	0.467	0.456	0.444	0.475	0.475	0.478		
Movies	0.542	0.531	0.558	0.550	0.544	0.528	0.561	0.544	0.564

Figure Caption

Figure 1. The proportion of times the Harry Potter books (left panel) and each movie (right panel) were remembered as occurring in each possible serial position in a free reconstruction of order task as function of whether the every item in the list was given a "remember". Note: for the books, *N* = 45 and 56 for the remember and know judgments, respectively, and for the movies, *N* = 92 and 70, respectively.

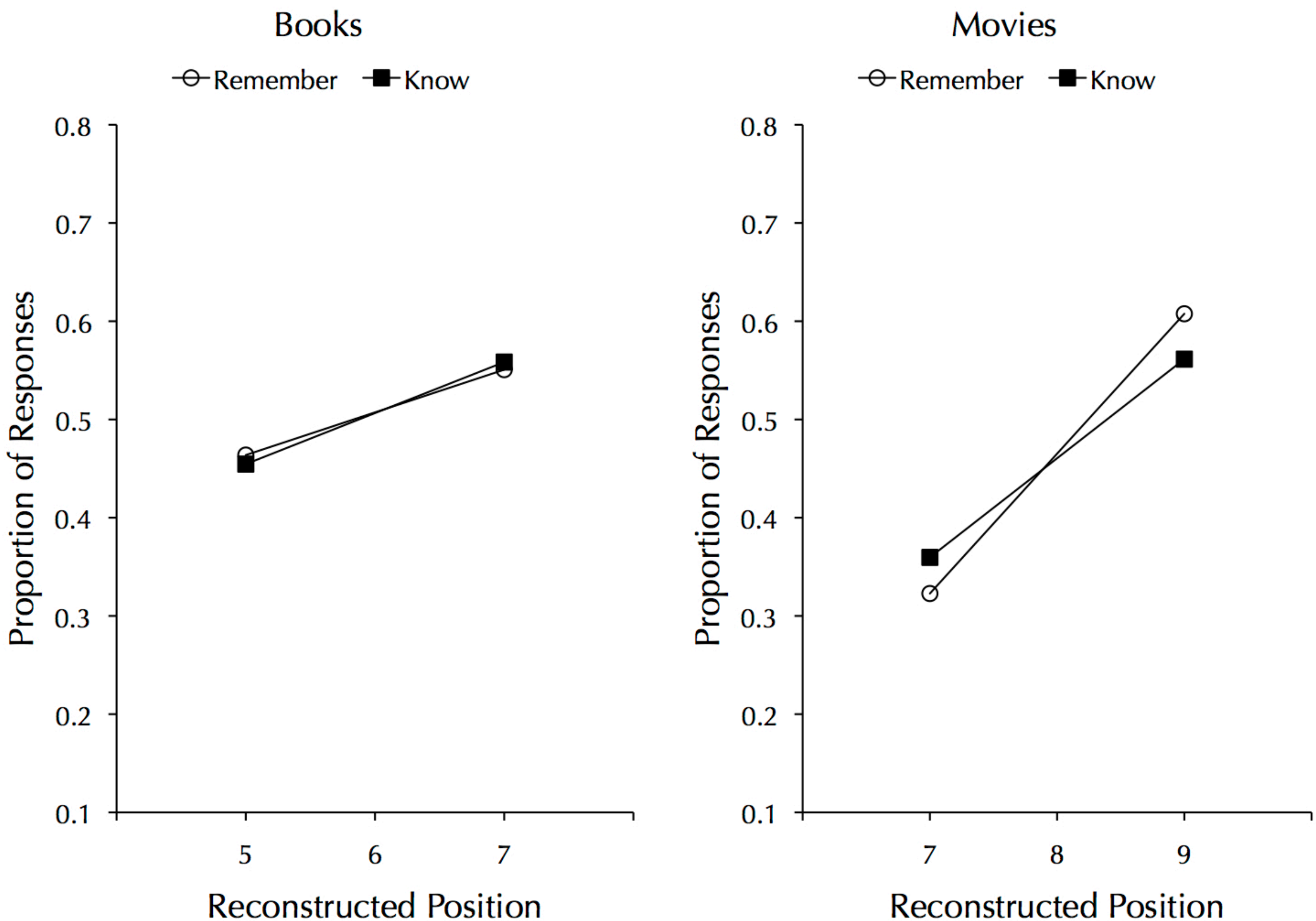
Figure 2. The proportion of times the Harry Potter books (left panel) and each movie (right panel) were remembered as when the items at positions 5 and 7 (left panel) and positions 7 and 9 (right panel) were both given a "remember" or a "know" judgment. Note: for the books, *N* = 69 and 77 for the remember and know judgments, respectively, and for the movies, *N* = 158 and 114, respectively.

Figure 1



Books
Remember
Know
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Proportion of Responses
0
1
2
3
4
5
6
7
8
Reconstructed Position
Movies
Remember
Know
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Proportion of Responses
0
2
4
6
8
10
Reconstructed Position

Figure 2



Books
Remember
Know
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Proportion of Responses
5
6
7
Reconstructed Position
Movies
Remember
Know
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Proportion of Responses
7
8
9
Reconstructed Position