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Examining the relationship between free recall and immediate serial recall: The role of list length, strategy use, and test expectancy

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ABSTRACT

Recent findings suggest that the immediate free recall (IFR) of short lists is similar to immediate serial recall (ISR). These findings were obtained using a methodology in which participants did not know the list length in advance of each list, and this uncertainty may have encouraged participants to adopt atypical recall strategies. Therefore, we examined whether prior knowledge of the list length was important in obtaining these recent findings with IFR (Experiment 1) and ISR (Experiment 2). In both experiments, we presented participants with lists of between 1 and 15 words and found that advance knowledge of the list length resulted in little or no difference in recall performance. In our final experiment (Experiment 3), we manipulated test expectancy. We found that participants who were post-cued to recall using either IFR or ISR recalled in similar ways to those who were pre-cued to recall using IFR or ISR, respectively. We argue that lists of words are encoded in similar ways on the two tasks, that the list length and task instructions determine the initial output order, and that the initial recall and the instructions determine the resultant serial position curves.

Introduction

This research examines the similarities and differences between two highly-important and widely-used tests of immediate memory: immediate serial recall (ISR) and immediate free recall (IFR). In a typical trial on these tasks, participants are presented with a sequence of items, one at a time, and at the end of the list, participants are required to recall as many items as they can, in either the same order as that presented (ISR) or in any order that they wish (IFR).

ISR is normally studied using short sequences of list items. At very short list lengths, recall is typically perfect, but as the list length increases to around 4–6 words, so perfect performance breaks down, and the subsequent serial position curves are characterised by extended *primacy* effects (the recall advantage of early list items, e.g., Drewnowski & Murdock, 1980).

By contrast, IFR is normally studied using longer sequences of 10 or more list items. At these list lengths recall is rarely, if ever, perfect, and the resultant serial position curves are characterised by modest primacy effects and larger and more extended *recency* effects (the recall advantage of later list items, e.g., Murdock, 1962; Roberts, 1972).

In a recent development, Ward, Tan, and Grenfell-Essam (2010) have appealed for greater theoretical integration between these two tasks. They noted that many accounts of ISR do not provide an explanation of IFR (e.g., Baddeley, 1986, 2007; Brown, Preece, & Hulme, 2000; Burgess & Hitch, 2006; Lee & Estes, 1981; Lewandowsky & Farrell, 2008; Lewandowsky & Murdock, 1989; Nairne, 1990; Oberauer & Lewandowsky, 2008; Page & Norris, 1998), and many accounts of IFR do not provide an account of ISR (e.g., Davelaar, Goshen-Gottstein, Ashkenazi, Haarmann, & Usher, 2005; Howard & Kahana, 2002;

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Laming, 2010; Metcalfe & Murdock, 1978; Polyn, Norman, & Kahana, 2009; Raaijmakers & Shiffrin, 1981; Sederberg, Howard, & Kahana, 2008; Tan & Ward, 2000).

Ward et al. (2010) argued that although a minority of models account for both tasks (e.g., Anderson, Bothell, Lebiere, & Matessa, 1998; Brown, Neath, & Chater, 2007; Grossberg & Pearson, 2008; see also Farrell, 2012), greater theoretical integration could be achieved by understanding more fully the effects of increasing list length on the output order and serial position curves on the two tasks. They argued that previous comparisons between the IFR and ISR tasks had been hindered by the use of different list lengths on the two tasks. When the two tasks are studied using similar methodologies and list lengths, IFR and ISR show similarities in the degree of forwards ordering in recall (e.g., Bhatarah, Ward, & Tan, 2008; Golomb, Peelle, Addis, Kahana, & Wingfield, 2008; Klein, Addis, & Kahana, 2005), and IFR and ISR show similarities in the patterns of rehearsal, and the effects of test expectancy, word length, articulatory suppression, and presentation rate (e.g., Bhatarah, Ward, Smith, & Hayes, 2009; Bhatarah et al., 2008).

Consistent with the importance of understanding the effects of list length in explanations of these tasks, Ward et al. (2010) reported an important empirical finding: when a participant was presented with a short list of words for IFR, there was a strong tendency to initiate recall with the very first list item, and when they did so, recall tended to proceed in a forward order, and the resultant serial position curves showed elevated recall of the early list items. This was taken to demonstrate that participants performed IFR on short lists in an "ISR-like" manner (see also Corballis, 1967; Neath & Crowder, 1996). Moreover, they found that when a participant was presented with a long list of words for ISR (and its variants), they often failed to access the first item, tending instead to initiate recall with one of the last four list items, and when they did so, the resultant serial position curves showed extended recency effects. These findings were taken to demonstrate that participants performed ISR on long lists in an "IFR-like" manner. Thus, it was claimed, that many of the differences previously attributed to ISR and IFR could actually be due to the differences in the list lengths that were used rather than due to differences in the memory mechanisms that were used on the two tasks.

However, a potential concern is that the novel findings reported by Ward et al. (2010) were obtained using a methodology in which participants did not know the list length in advance of each list, and it could be argued that this uncertainty may have encouraged participants to adopt atypical recall strategies. We have heard three objections to our unknown list length methodology. First, when the list length is known in advance, participants are able to group the list more effectively, and grouping has been shown to affect the output order and the serial position curves in both IFR (e.g., Gianutsos, 1972) and ISR (e.g., Frankish, 1995; Frick, 1989; Hitch, Burgess, Towse, & Culpin, 1996; Maybery, Parmentier, & Jones, 2002; Ng & Maybery, 2002; Ryan, 1969).

Second, when the list length is known in advance, the end of list items can be identified at encoding, and so may be treated differently to earlier list items. In IFR, when the list length is known in advance, the early list items but not the end of list items are affected by presentation rate (e.g., Glanzer & Cunitz, 1966) and show reduced recall on a test of final free recall (the *negative recency effect*, e.g., Craik, 1970). However, when the list length is varied such that the end of list items cannot be identified, there is no negative recency effect (e.g., Watkins & Watkins, 1974), and there is an effect of presentation rate on all list items including the last (Bernbach, 1975). In ISR, participants may be able to make use of an "end of list marker" (Henson, 1998, 1999; but see also Farrell & Lelièvre, 2009) if the end of the list can be identified by using a known list length, but assigning values to an end of list marker has been criticised under conditions in which the list length is unknown (e.g., Murdock, 2001).

Finally, there is a concern that participants may abandon a preferred encoding strategy if they are concerned that the list may be too long. In IFR, Mulligan and Lozito (2007) have argued that participants may encode and retrieve short lists of items for delayed free recall using both item and order information (the item-order hypothesis, Nairne, Riegler, & Serra, 1991; Serra & Nairne, 1993), but evidence for this strategy appears to break down at longer lists. In ISR, it has been shown that participants can be instructed to adopt different strategies (e.g., phonological or semantic strategies, Campoy & Baddeley, 2008; Hanley & Bakopoulou, 2003), and it has been suggested that participants spontaneously use a phonological strategy at short list lengths, but naturally abandon the phonological strategy at longer list lengths (e.g., Baddeley, 2000, 2007; Baddeley & Larsen, 2003, 2007; Larsen & Baddeley, 2003).

In addition, there is also evidence from the metamemory literature for IFR that suggests that participants who have had some practice at the task are reasonably well-calibrated in estimating the number of items that they can retrieve from short (10 item) and long (100 item) lists (e.g., Tauber & Rhodes, 2010). Participants are also reasonably well-calibrated in estimating the number of items that they will retrieve from different serial positions when the serial position of the words is highlighted at encoding (Castel, 2008). It is therefore reasonable to expect that participants' retrieval may be influenced by the knowledge of the list length.

All these lines of evidence promote concern that the uncertainty surrounding list length in the experiments by Ward et al. (2010) could make participants abandon their "first-choice" *list length-specific strategies*, leading to output orders and serial position curves that were atypical of standard IFR or ISR performance at that list length. In the worse case scenario, the similarities between ISR and IFR proposed by Ward et al. (2010) may then be limited only to the special circumstances in which participants have been forced to abandon their "first-choice" list length-specific strategies, and instead have made use of a common "back-up" strategy. Put another way, it would be reassuring to see the Ward et al. findings replicated and extended to situations in which the list length is known prior to encoding, such that the changes in initial output order and the resultant