Similarities between the irrelevant sound effect and the suffix effect

J. Richard Hanley and Jake Bourgaize

(University of Essex, UK)

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Address for correspondence

Prof. J. Richard Hanley

Department of Psychology

University of Essex

Colchester CO4 3SQ

UK

EMAIL rhanley@essex.ac.uk

Telephone 0044 1206-874331

Fax 0044 1206-873598

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Abstract

Although articulatory suppression abolishes the effect of irrelevant sound (ISE) on serial recall when sequences are presented visually, the effect persists with auditory presentation of list items. Two experiments were designed to test the claim that, when articulation is suppressed, the effect of irrelevant sound on the retention of auditory lists resembles a suffix effect. A suffix is a spoken word that immediately follows the final item in a list. Even though participants are told to ignore it, the suffix impairs serial recall of auditory lists. In Experiment 1, the irrelevant sound consisted of instrumental music. The music generated a significant ISE that was abolished by articulatory suppression. It therefore appears that, when articulation is suppressed, irrelevant sound must contain speech for it to have any effect on recall. This is consistent with what is known about the suffix effect. In Experiment 2, the effect of irrelevant sound under articulatory suppression was greater when the irrelevant sound was spoken by the same voice that presented the list items. This outcome is again consistent with the known characteristics of the suffix effect. It therefore appears that, when rehearsal is suppressed, irrelevant sound disrupts the acoustic-perceptual encoding of auditorily presented list-items. There is no evidence that the persistence of the ISE under suppression is a result of interference to the representation of list items in a post-categorical phonological store.

Introduction

The irrelevant sound effect (ISE) occurs when serial recall of verbal material is disrupted by sounds that occur during list presentation (Colle & Welsh, 1976) or during the retention interval between presentation and recall (Klatte, Lee & Hellbruck, 2002). The irrelevant sound can comprise speech (e.g. Salamé & Baddeley, 1982) or auditory tones (e.g. Jones & Macken, 1993) and disrupts recall so long as the sound changes state (Jones, Madden & Miles, 1992), even though participants are instructed to ignore it.

The present study investigates the effects of irrelevant sound when rehearsal is prevented by articulatory suppression. Articulatory suppression is known to abolish the ISE when list items are presented visually (Hanley, 1997; Klatte et al., 2002; Salamé & Baddeley, 1982). This finding is consistent with several different theoretical accounts of the ISE. According to the O-OER model (Jones, Macken & Nicholls, 2004) and the feature model (e.g. Neath, 2000), an ISE should only occur in situations where participants would normally be expected to rehearse the list items. Jones and his colleagues claim that IS impairs recall because it disrupts participants' ability to rehearse target items during list presentation and during the retention interval. Disruption occurs because both irrelevant sound and list items compete for control of the speech motor process that allows articulatory rehearsal to take place. According to the feature model (Neath, 2000), articulatory suppression and IS both interfere with retention of the same modality-independent features of list items. Once these features are disrupted by articulatory suppression, irrelevant sound causes no additional interference. According to the phonological loop model (e.g. Baddeley & Larsen, 2007; Norris, Butterfield, Hall & Page, 2018; Salamé & Baddeley, 1982), irrelevant sound interferes with the representations of target items in a post-categorical phonological store. Visually presented items can enter this store only if they are articulated. If articulation is suppressed, these items are cut off from the phonological store and are immune to interference from irrelevant sound.

When, however, list items are presented auditorily, an ISE has been reported even when articulation is suppressed (Hanley & Broadbent, 1987; Klatte et al., 2002). The ISE does not occur simply because irrelevant sound masks auditorily presented list-items because it remains even when the irrelevant sound is presented during the retention interval only (Hanley & Bakopoulou, 2003). Such an outcome is consistent with the predictions of the phonological loop model because it assumes that auditorily-presented list items automatically enter the phonological store even when articulation is suppressed (Salamé & Baddeley, 1982). Irrelevant sound also enters the phonological store where it interferes with the representations of the target items. The additive effect of irrelevant sound and articulatory suppression with auditory presentation appears, therefore, to establish an important role for the phonological store in explaining serial recall of verbal material (Hanley & Bakopoulou, 2003).

From the perspective of the O-OER model (Jones, et al., 2004), irrelevant sound clearly cannot disrupt recall by competing for control of the speech motor processes when articulation is suppressed. Why, then, is there is an effect of irrelevant speech under articulatory suppression with auditory lists? In order to explain this finding, Jones et al. (2004) suggested that irrelevant sound produces a suffix effect rather than an ISE when articulation is suppressed. The suffix effect (e.g. Crowder, 1967) occurs when a redundant to-be-ignored spoken suffix that is heard immediately following list-presentation interferes with recall of an auditorily-presented sequence. There are several obvious differences between the effects of a spoken suffix and the ISE. For example, unlike the ISE, a spoken suffix does not affect recall of visually presented material (Morton & Holloway, 1970). In addition, the ISE affects pre-recency and recency portions of the serial position curve with both visual and auditory presentation (e.g. Klatte, et al., 2002). Conversely, a suffix impairs serial recall of only the final items in a sequence (e.g. Crowder, 1967). In terms of the phonological loop model, the suffix does not affect the storage of items in the phonological store (Baddeley, 1986). It is assumed instead that a suffix disrupts pre-categorical acoustic storage of items in relatively early stages of auditory perception. This is quite different from the type of interference that irrelevant sound should inflict on the representations of spoken words in the phonological store. From the perspective of the phonological loop model, therefore, the variables that determine the strength of the ISE under suppression should be different from those that influence the strength of the suffix effect.

There are therefore important theoretical implications for the phonological loop model and its competitors that depend on whether the effect of irrelevant sound under articulatory suppression is a suffix effect or a genuine ISE. Hanley and Hayes (2012) and Hanley and Shah (2012) examined this issue by investigating whether the ISE persisted under articulatory suppression in the presence of a spoken suffix. They observed a significant ISE that remained with a spoken suffix when participants could rehearse the list items. When articulation was suppressed, however, the presence of a spoken suffix at the end of a list completely abolished the effect of irrelevant sound. An ISE persisted under articulatory suppression when the suffix was an auditory tone. These findings support Jones et al.'s claim that the effect of irrelevant sound under articulatory suppression is a suffix effect; similar effects seem to occur regardless of whether a spoken suffix or a longer sequence of irrelevant speech appears at the start of the retention interval. According to the phonological loop model, there should have been significant effects of irrelevant sound over and above the effects of the suffix. Consequently, Hanley and Hayes argued that it is unnecessary to postulate the existence of a post-categorical phonological store (Salamé & Baddeley, 1982) to explain the persistence of the ISE under articulatory suppression.

The present study provides a further test of the claim (Jones et al., 2004; Hanley & Hayes, 2012) that the effect of irrelevant sound on the recall of auditory sequences under articulatory suppression is a suffix effect rather than a genuine ISE. If it is a suffix effect, then it should be possible to detect differences between the effects of irrelevant sound on the recall of auditory sequences when it occurs with and without articulatory suppression. For example, the auditory-perceptive similarity between the suffix and the preceding targets is important in determining the strength of the suffix effect (Morton, Crowder & Prussin, 1971). Morton et al. showed that the suffix effect is greater when it is spoken by the same voice as the list items. This does not appear to be the case with the ISE (Schlittmeier, Hellbruck & Klatte, 2008). In Experiment 2, therefore, we investigate whether the effects of irrelevant sound under articulatory suppression are greater when the same speaker presents the list items and the irrelevant sound.

In Experiment 1, recall of auditory sequences under articulatory suppression is examined when irrelevant sound comprises instrumental music.

In the previous studies that have examined the ISE under articulatory suppression, the irrelevant sound comprised spoken words. An ISE effect has, however, also been observed on the recall of auditory sequences when the IS comprises instrumental music rather than speech (Schlittmeier, Hellbruck & Klatte, 2007). Schlittmeier et al. (2007) found that staccato irrelevant music substantially reduced recall of nine-item lists of auditorily presented digits regardless of whether music was played during list presentation or in the retention interval. The critical issue in Experiment 1 is whether there will be an ISE when articulation is suppressed if the irrelevant sound is instrumental music. If the effect of irrelevant sound under articulatory suppression is really a suffix effect, then no effect of irrelevant music should be observed when articulation is suppressed because suffix effects are produced only by a voice (Crowder, 1971; Morton et al., 1971).

Experiment 1 was based on Schlittmeier et al.'s (2007) first experiment. The difference was that, in one condition, participants repeated the word "the" when attempting to retain lists of words that were followed by instrumental music. The key issue was whether an ISE would be observed when articulation was suppressed. Shorter list lengths (6 items per list) than those used by Schlittmeier et al. were employed. This is because Baddeley and his colleagues (e.g. Baddeley & Larsen, 2007; Campoy & Baddeley, 2008) have argued that when list lengths are too long, participants are discouraged from using the phonological loop and develop alternative mnemonic strategies. In such circumstances, Baddeley claimed, an ISE might not be observed. List length could not reasonably be used to explain a failure to find an ISE in Experiment 1, however. This is because Hanley and Hayes (2012) showed that an effect of irrelevant speech is readily observable with 6-item lists when articulation is suppressed.

Experiment 1

Method

Participants

Thirty students (21 females and 9 males) at Essex University volunteered to take part. They had a mean age of 22.3 years (sd = 4.6). They were all native English speakers who reported no speaking or hearing impairments. A sample of 30 participants was considered an appropriate size with which to observe an ISE. This was because the same number of participants took part in the corresponding condition of Schlittmeier et al.'s (2007) first experiment in which a significant effect of instrumental music on the serial recall of auditorily presented lists was observed. Significant effects of irrelevant speech on serial recall under articulatory suppression were observed by Hanley & Shah (2012) with a similar sample size (n=32).

Materials

The experimental materials comprised 60 lists of randomly ordered six-item sequences of the digits 1-9 sampled without replacement. These digits were spoken in a monotone by a female voice. The irrelevant sound was the same piece of staccato music used by Schlittmeier et al. (2007) and comprised extracts of instrumental music from the same work. Three 10-second extracts were used. Within each of the 4 conditions, the extracts of irrelevant sound were repeated in rotation 5 times. Sound levels were similar to those used by Schlittmeier et al. (LAeq ratings were 62dB for the target items and 63dB for the music). The lists and the irrelevant sounds were presented by an Apple Macintosh computer running the *iTunes* application.

Design

The experiment employed a 3-factor (2 x 2 x 6) repeated-measures design. The factors were: irrelevant sound (present versus absent), articulatory suppression (present versus absent) and serial position (1-6). Each participant therefore took part in four separate conditions. The order of the lists remained the same, but the order of the four conditions was randomized for each participant. The dependent variable was the number of digits recalled in their correct serial position.

Procedure

Participants were tested individually in a laboratory where no external sound was audible. The stimuli were presented monaurally (simultaneous presentation to the left and right ear) through headphones. Each participant listened to 60 lists, separated into four blocks containing 15 lists each, with a break between blocks whilst the new set of instructions was presented.

Each trial began with a tone that lasted for one second followed by one second of silence prior to presentation of the first list item. The inter-stimulus interval was one second. The end of the list was signalled by another one-second tone. There was then a ten-second retention interval in which there was either silence or else an extract of instrumental music was played. During this time participants were instructed to retain the target items by repeating them silently to themselves. The end of the retention interval was signalled by a tone, after which participants were allowed ten seconds to recall the list items. The music continued throughout the recall period. Participants were told to write down the target items in their order of presentation. They could leave a serial position blank, but were not allowed to change earlier items once they had written down a subsequent item. The recall sheet contained six boxes corresponding to each serial position. A one-second tone signalled the end of the recall period. The next trial commenced after three seconds of silence.

For two blocks, once in the presence of irrelevant sound, and once without, the participant had to say "the" twice per second. Articulation started as soon as the participant heard the auditory tone at the start of each trial, and continued during the retention interval and recall. Articulation was monitored to ensure that a steady rate was maintained. Participants were prompted if their repetition of "the" relented; the experimenter repeated "the" aloud at a rate of two repetitions a second until the participant regained their pace and consistency.

Results

Mean performance as a function of irrelevant sound, articulatory suppression and serial position is shown in Figure 1. A 2 x 2 x 6 within-subjects ANOVA revealed that articulatory suppression significantly reduced the number of correct responses, $F(1,29) = 155.18$, $MSE = 18.92$, $p < .001$, Cohen's $d = 2.96$. There was also a significant main effect of serial position, $F(5,145) = 108.82$, $MSE = 3.41$, $p < .001$, with more correct responses at early and late serial positions (see Figure 1).

Insert Figure 1 about here

The main effect of irrelevant sound was not significant (*F*<1), but, critically, there was a significant Irrelevant Sound x Articulatory Suppression interaction $F(1,29) = 5.28$, $MSE = 13.21$, $p = .029$. Tests of simple main effects revealed that when articulation was not suppressed, there were significantly more correct responses, $F(1, 29) = 5.53$, $MSE = 18.90$, $p =.026$, Cohen's $d = 1.08$, when irrelevant sound was not presented (pptn correct = .90, *sd*= .09) than when it was presented (pptn correct = .85, *SD* = .12). When articulation was suppressed, however, there was no significant difference $F(1, 29) = 2.69$, $MSE = 18.90$, $p = .112$ Cohen's $d = -.20$, between the mean number of items recalled in the presence (pptn correct = .63, *SD* = .17) or absence (pptn correct = .59, *SD* = .17) of irrelevant sound. In conclusion, these analyses show that instrumental music produces an ISE that is abolished under articulatory suppression. Although it was not significant, the effect of music under articulatory suppression was to marginally improve recall rather than to impair it. This is probably a capricious finding, but it does mean that the absence of any detrimental effect of irrelevant music on recall when articulation was supressed is unlikely to be the result of insufficient statistical power.

The Articulatory Suppression x Serial Position interaction was also significant, $F(5,145) = 33.60$, $MSE = 2.83$, $p < .001$, with the effect of articulatory suppression being greater at some serial positions than others. The Irrelevant Sound x Serial Position interaction was not significant $F(5,145) = 1.07$, $MSE = 2.02$, $p =.382$, suggesting that the irrelevant music had equivalent effects regardless of serial position. The three-way Articulatory Suppression x Irrelevant Sound x Serial Position interaction was also non-significant, $F(5,145) = 1.24$, $MSE = 1.93$, $p = .292$.

Discussion

The results replicate Schlittmeier et al.'s (2007) finding that irrelevant instrumental music interferes with serial recall of auditorily presented sequences. The experiment extends Schlittmeier et al.'s (2007) results by showing an effect of music even with sequences containing only six items. Most important, the results demonstrate that this effect is abolished when articulation is suppressed. This outcome differs from what is observed when irrelevant sound comprises speech, because irrelevant speech disrupts serial recall of 6-item lists even under articulatory suppression (e.g. Hanley & Hayes, 2012).

The findings suggest that the effect of irrelevant sound that occurs when articulation is suppressed may be different in nature from the ISE that occurs when participants are able to rehearse the list items. Only when the irrelevant sound comprises speech does it seem to have any effect on the serial recall of auditorily presented items under articulatory suppression. Like the suffix effect, it appears to occur with a voice but not with other types of sound. The results therefore provide further support for the claim that, under articulatory suppression, irrelevant sound produces a suffix effect rather than an ISE.

Experiment 2

If the effect of irrelevant sound under articulatory suppression is a suffix effect, then the magnitude of the effect should be mediated by the acoustic similarity between the suffix and the list items. For example, Morton et al. (1971) and Greenberg and Engle (1983) showed that the suffix effect was largest when the suffix and list items were spoken by the same voice. When, for example, a male voice presented the suffix and a female voice presented the list items, the suffix effect was significantly diminished (Morton et al., 1971).

Schlittmeier et al. (2008) showed that the strength of the ISE was unaffected by whether or not the voice that presented the list items also presented the irrelevant speech. They concluded that the auditory-perceptive similarity between the voice that presents the list items and the irrelevant speech appears irrelevant to the strength of the ISE. However, Schlittmeier et al. (2008) did not include an articulatory suppression condition. Experiment 2, therefore, examines whether the identity of the voice has any effect on the strength of the ISE when articulation is suppressed. If it is genuinely a suffix effect under articulatory suppression then greater disruption should be caused when the same voice presents the list items and the irrelevant sound.

Method

Participants

The participants comprised 45 students (34 females and 11 males) from the same population as Experiment 1. Their mean age was 24.7 (sd = 6.2). The sample size was larger than that used in Experiment 1. This was because the critical data in Experiment 2 comprised two serial positions (SP5 and SP6) per list rather than all six (Experiment 1).

Materials

The experimental materials comprised 60 lists of randomly ordered sequences of the digits 1-9 sampled without replacement. Each list contained six digits. These digits were spoken in a monotone by a female voice. Each segment of irrelevant sound involved ten seconds of random letters from A to Z being spoken aloud in either a female voice (the same voice that presented the lists of target items) or a male voice. There were 200 milliseconds of silence between each irrelevant word. LAeq ratings were 62dB for the target items and 60dB for the irrelevant sound.

Design

The experiment used a two-factor (3x6) within-subjects design. The independent variables were irrelevant sound (absent, same voice, different voice) and serial position (1-6). The order of the lists remained the same, but the order of the three conditions was randomized for each participant. The dependent variable was the number of digits recalled in their correct serial position.

Procedure

All participants heard 60 lists, separated into three blocks containing 20 lists each, with a break between blocks whilst the new set of instructions was presented. For all 60 lists, participants had to repeat the word "the" at a rate of approximately two repetitions per second during presentation, retention interval and recall. The procedure was otherwise identical to Experiment 1.

Results

Insert Figure 2 about here

Mean performance as a function of irrelevant sound and serial position is shown in Figure 2. There was a significant effect of irrelevant sound, $F(2, 88) = 6.29$, $MSE = 32.01$, $p = .003$. Newman-Keuls tests revealed that recall was significantly better (both $p < .05$) when no irrelevant sound was heard (pptn correct = .66, $SD = .18$) than in both the same (pptn correct = .57, $SD = .17$) Cohen's $d = .47$, and different voice conditions (pptn correct = .61, $SD = .18$) Cohen's $d = .30$. There was, therefore, once again a significant effect of irrelevant speech when articulation was suppressed (e.g. Hanley & Hayes, 2012). There was also a significant effect of serial position, $F(5, 220) = 97.35$, $MSE = 12.07$, $p < .001$, and a significant interaction between serial position and irrelevant sound, $F(10, 440) = 7.22$, $MSE = 4.00$, $p < .001$. The interaction shows that irrelevant speech had a bigger effect at the terminal list positions (see Figure 2). In other words, irrelevant speech influenced recall by reducing the size of the recency effect.

To compare performance directly in the same and different voice conditions in the terminal positions, a further ANOVA was conducted that examined serial positions 5 and 6 only. The analysis was restricted to these items because previous research (e.g. Jones et al., 2004) suggests that suffix effects are confined to the last two serial positions in a list. This analysis revealed a significant effect of irrelevant sound $F(2, 88) = 16.70$, $MSE = 16.68$, $p <.001$. Newman-Keuls tests revealed that significantly fewer items ($p < .05$) were recalled in the same voice condition (pptn correct = .46, $SD = .22$) than in the different voice condition (pptn correct = .52, $SD = .24$), Cohen's $d = .32$. The effect of irrelevant sound was therefore greatest when the same voice presented the irrelevant sound and the list items. There was also a significant effect of serial position $F(1, 44) = 114.20$, $MSE = 6.83$, $p <.001$, and a significant interaction between irrelevant sound type and serial position $F(2, 88) = 8.34$, $MSE = 3.57$, $p < .001$. The significant interaction suggests that the effect of irrelevant sound was larger at serial position 6 than 5 (see Figure 2).

Discussion

Several findings from this experiment support the view that the effect of irrelevant sound that was observed under articulatory suppression was a suffix effect rather than a genuine ISE. First, of all the effect was confined to the terminal serial positions and was greatest in the final serial position. A reduction in performance in the last two serial positions is consistent with the kind of interference that a suffix would be expected to produce on recall of auditorily presented list items (e.g. Jones et al., 2004). Second, and most important, the effect of irrelevant sound was larger when it was spoken by the same voice as the target items than by a different voice. Suffix effects are known to increase when the suffix is spoken in the same voice as the list items (Morton et al., 1971; Greenberg & Engle, 1983).

Crucially, therefore, the results of this experiment provide further evidence that the disruption that is caused by irrelevant speech to the recall of auditory lists is a suffix effect when articulation is supressed. The outcome is quite different from what occurs when participants are allowed to rehearse list items. There is then a significant ISE regardless of the congruency between the voice that presented the irrelevant sounds and the list items (Schlittmeier et al., 2008).

General discussion

The results of Experiment 1 showed that the significant ISE that is observed with auditorily presented sequences when irrelevant sound comprises instrumental music (Schlittmeier et al., 2007) is abolished when articulation is supressed. It therefore appears that, under suppression, it is necessary for the irrelevant sound to be presented by a voice for it to have any effect on recall. Sensitivity to a voice is consistent with what is known about the suffix effect (Crowder, 1971; Morton et al., 1971), but inconsistent with what is known about the ISE when participants are able to rehearse the list items (Schlittmeier et al., 2007).

The results of Experiment 2 showed that, under articulatory suppression, the effects of irrelevant sound are largest when irrelevant sound and list items are presented by the same voice, and are confined to the terminal items in the sequence. Sensitivity to the identity of the voice is consistent with the known characteristics of the suffix effect (Morton et al., 1971; Greenberg & Engle, 1983), but inconsistent with what is known about the ISE when articulation is not supressed (Schlittmeier et al., 2008). These results of Experiments 1 and 2 therefore support those of Hanley and Hayes (2012) who showed that a speech suffix eliminated the ISE under articulatory suppression. Overall, there now appears to be overwhelming evidence to support the claim (Jones et al., 2004) that the effect of irrelevant sound under articulatory suppression is really a suffix effect.

The conclusion that a genuine ISE is not observed when articulation is supressed with either visual or auditory list-presentation is consistent with the predictions of both the feature model and the O-OER model. According to these models, an ISE should only be observed when participants are able to rehearse the list items. The phonological loop model (Salamé & Baddeley, 1982), however, predicts that there should be a genuine ISE under articulatory suppression when lists are presented auditorily. The irrelevant sound should enter the phonological store and impair recall by interfering with the representations of the list items. It would therefore have been expected that, under suppression, irrelevant sound would produce an ISE and that the variables influencing the strength of this effect should be different those that elicit a suffix effect.

According to one account of the suffix effect (e.g. Frankish, 2008), the terminal item(s) in an auditory sequence is stored in a modality-specific but relatively unprocessed form at the time of recall. Pre-categorical auditory storage of this kind can provide a supplementary source of information to improve recall of the terminal item(s). As Frankish (2008) points out, this account is consistent with Penney's (1989) proposal that auditory and visual inputs are represented in a modality-independent form (the P code), but that there is an additional acoustic form of representation that retains auditorily presented material (the A code) in unprocessed form. Pre-categorical acoustic storage appears to be unaffected by articulatory suppression (Surprenant, LeCompte & Neath, 2000), and so it can contribute to the recall of auditory material even when articulation is suppressed so long as the list is not followed by a spoken suffix. From this perspective, therefore, when articulation is suppressed, irrelevant sound interferes with auditory representations of list items in pre-categorical acoustic storage. Although pre-categorical acoustic storage is by definition confined to the auditory modality, there appears no reason to believe that the earlier items in a sequence are held in a post-categorical phonological store (e.g. Salamé & Baddeley, 1982). It seems more parsimonious to assume that, at the time of recall, these items are encoded as modality-independent representations regardless of whether presentation was auditory or visual.

The most influential contemporary account of the suffix effect (e.g. Hughes & Marsh, 2017; Nicholls & Jones, 2002; Macken et al., 2016; Maidment, Macken & Jones, 2013) holds that a spoken suffix reduces the enhanced temporal distinctiveness of the final list item. From this perspective, the position at the end of the sequence provides automatic order encoding that allows the terminal item to be better recalled than earlier items. Interference from a suffix occurs because it is perceived as being part of the same perceptual stream as the target items. This account can readily explain why the strength of the suffix effect is determined by the perceptual similarity between the list items and the suffix (e.g. Morton et al., 1971). This is because perceptual similarity increases the probability that the listener will group together the list items and the suffix (Nicholls & Jones, 2002). When articulation is supressed, therefore, irrelevant sound acts as a suffix and the temporal distinctiveness of the final list item(s) is weakened as a consequence.

In conclusion, the results of this study provide further support for the claim (Jones et al., 2004; Hanley & Hayes, 2012) that, under articulatory suppression, irrelevant sound interferes with recall but does not elicit a genuine ISE. The interference can be interpreted as disrupting pre-categorical acoustic storage (e.g. Frankish, 2009) or as diminishing the temporal distinctiveness of the terminal list items (e.g. Nicholls & Jones, 2002). A post-categorical phonological store (e.g. Salamé & Baddeley, 1982) is not required to explain the effect.

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Fig. 1 The effects of irrelevant sound and articulatory suppression on the recall of auditorily presented 6-item sequences in Experiment 1.

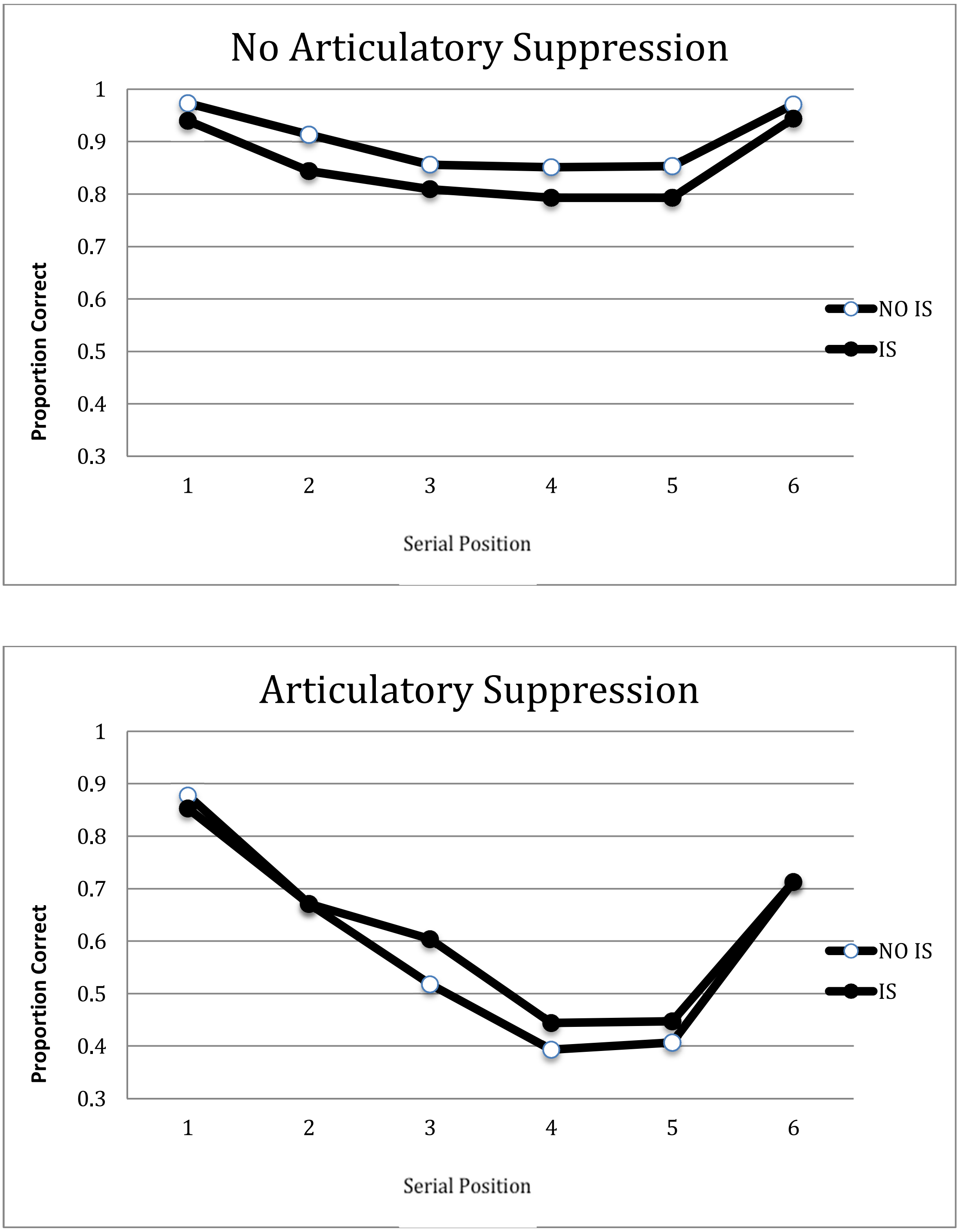

Fig. 2 The effects of different and same-voice irrelevant sound (IS) on the recall of auditorily presented 6-item sequences in Experiment 2.