The role of semantic content and the effect on serial recall

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ABSTRACT

With relevance to auditory alarm design, we examined whether the semanticity of spoken words (negatively-valenced vs. neutral; non-words vs. words; action vs. non-action words) and their intonation-style (“urgent” vs. “non-urgent”) modulate the extent to which words capture attention from a visually-presented serial recall task and whether these behavioural effects map onto subjective ratings of the extent to which the sounds were “urgent” and “attention grabbingness”. Compared to quiet or a repeated tone, the infrequent presentation of a spoken word captured attention—as indexed by an impairment of serial recall—but there were no effects of semanticity or intonation. However, action words were rated as more urgent and attention-grabbing than neutral words which were rated as more urgent and attention-grabbing than non-words. “Urgent” words were also rated higher in urgency and attention grabbingness than “non-urgent” words regardless of valence. In conclusion it is argued there is a dissociation between subjective and objective measurements.

INTRODUCTION

- Auditory alarms are often employed in safety-critical systems: pilots, and healthcare staff, among others, are obliged to respond to warning signals in their working environment. Typically, the most critical alarms are assigned to the auditory modality on the grounds that they are harder to ignore than visual signals.

- Most research on auditory alarms has involved subjective ratings and a substantial body of data speaks to the perceived “urgency” of an auditory warning signal (e.g., Jang, 2007; Hellier, Edworthy, Weedon, Walters, & Adams, 2002)

- There are very few studies that have investigated the relationship between subjective experience of the urgency of spoken warning signals and behavioural reactions to those signals as indexed, for example, by the power of the signals to capture attention from a focal task (or *auditory distraction*; e.g. Haas & Casali, 1995; Burt, Bartolome, Burdette & Comstock, 1995).

- Given that one key aim of auditory warnings is to capture attention, research findings from studies of how infrequent auditory events can distract an individual during the performance of a prevailing mental task—through its power to involuntarily capture the focus of attention (Hughes, Vachon, & Jones, 2005, 2007) —may prove an invaluable means of assessing the effectiveness of auditory alarms in conjunction with subjective measures.

METHOD

- Three experiments were conducted using 41-43 students as participants (mean age = 20).

- A computerized serial recall task with digits (1-9) was used to measure performance (experiment 1-3) and a Borg CR-10 rating scale (Borg, 1998) was used to measure perceived “attention grabbingness” and “urgency” (in experiment 3).

- A deviant paradigm was applied using headphones for the auditory exposure and the standard was either a beep (experiment 2) or quiet (experiment 1 & 3).

AIM (Experiment 1)

The aim of Experiment 1 was to investigate whether the content—specifically, negative emotional valence words spoken urgent or non-urgent—had any effect on behaviourally-indexed attentional capture by a task-irrelevant spoken word.

RESULTS (Experiment 1)

AIM (Experiment 2)

The focus in Experiment 2 was to investigate the role that a word’s rise time (or sharpness of onset) might have on its attention capturing power. Experiment 2 contrasted the impact of both negative and neutral words with either a sharp onset (e.g., “panic”, “palace”) or a slow onset (e.g., “evil”, “even”) to examine whether the acoustic structure may have an influence on the deviation effect.

RESULTS (Experiment 2)

AIM (Experiment 3)

In Experiment 3 we examined whether action-related words are particularly potent attention capturers, using words such as e.g., “stop” and “go”. Similar sounding matched non-words and neutral words were also included in the study. Another key question was also to explore how the participants subjectively experienced the distractor stimuli and how the ratings were related to the actual performance. The participants rated the “urgency” and “attention grabbingness” of all the words used in Experiment 1-3.

RESULTS (Experiment 3)

CONCLUSIONS

- The gathered results from Experiment 1-3 suggest that there is no impairment on performance in serial recall caused by the semantic content or rise time in words. However, more clearly is the impairment on performance caused by the presence of the deviants, independent of the speaking style and independent if the standard is quiet or a repeated background beep.

- With regard to the findings in the serial recall task the subjective experiences was not related to the actual performance.

- Action words are perceived as more “urgent” and “attention grabbing” than neutral words and non-words.

- When people judge the “urgency” and “attention grabbingness” of a set of words spoken “urgent” and “non-urgent”, words spoken “urgent” will be rated more urgent and attention grabbing than words spoken “non-urgent”. For example, “salad” is perceived as urgent as “panic” if spoken urgently.