seit 1558

The Role of Visual Attentional Load in Adaptation to Voice Gender

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1. Introduction

Adaptation is the decreased neuronal response to a repeated presentation of the same stimulus. Adaptation to male adaptor voices causes a following target voice to be perceived as more female and vice versa (Voice Gender Aftereffect, VGAE [1]). Equivalent aftereffects had been found for numerous facial information, such as gender [2] and identity [3]. In high-level vision, aftereffects of adaptation to face identity are altered by selective attention to adaptor faces [4]. Nevertheless, it is still unresolved whether the VGAE depends upon selective attention to adaptor voices. In the present study we examined whether different types and degrees of selective attention modify the VGAE. We manipulated selective attention to male and female adaptor voices by presenting relevant visual tasks. According to Lavie's Theory of Selective Attention and Cognitive Control [5] perception has limited capacity and automatically spills over to unattended stimuli if the relevant task does not require all attentional resources. Specifically, high perceptual load in visual search tasks absorbs more capacity than low perceptual load tasks, with the latter leaving spare capacity for the processing of irrelevant stimuli. In contrast, high working memory load has the opposite effect: It disrupts active stimulus processing priorities and increases the probability of processing irrelevant stimuli.

In the present study, we investigated potentially differential effects of working and perceptual load tasks on voice gender adaptation. Participants were asked to either perform a visual search task among five different vs. five identical digits (high vs. low perceptual load) or to memorize five different digits vs. five identical digits (high vs. low working memory load) during adaptation.

We tested whether the VGAE is more pronounced under low perceptual load as opposed to high perceptual load and conversely whether the VGAE is diminished under low working memory load compared to high working memory load [6; 7].

2. Methods

Participants:

•12 female participants (mean age = 23.8 yrs, range 19-23 yrs), unfamiliar with all speakers

Stimuli:

•4 vowel-consonant-vowel syllables "aba", "aga", "ibi", "igi" (4 male/ female voices)

•Voices were paired and morphed along a male-female continuum to create androgynous test voices [8].

Tasks and Procedure:

•Voice gender classification task to androgynous voices preceded by three identical male or female adaptor voices

•In addition, during adaptation participants either performed a working memory task (WT) or a perceptual task (PT) (varied blockwise, see below). WT: five different or five identical digits (high vs. low load) were memorized during adaptation. PT: during adaptation, five different random or five identical digits (high vs. low load) were presented. Participants decided whether or not a number slide contained a "5".

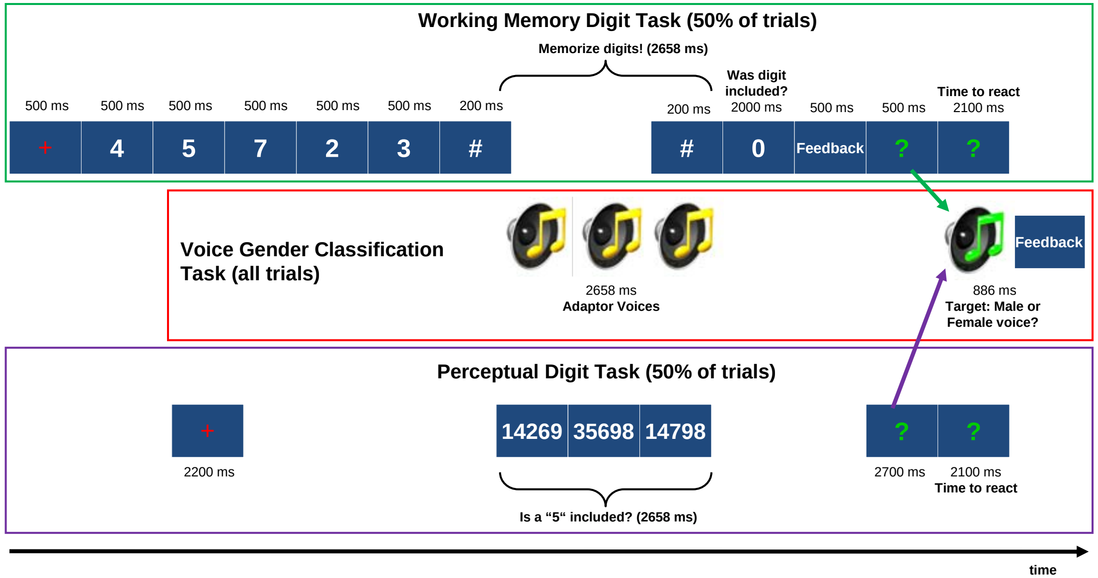

Fig. 1: Schematic illustration of trials. Both examples show a „high-load" condition

3. Results

Task difficulty was successfully manipulated:

- significant main effect of load degree for correct responses in the WT ($F[1, 11] = 5.8$, $p < .05$) as well as in the PT ($F[1, 11] = 11.13$, $p < .05$, see also Fig.2a)
- increased RTs in high load relative to low load tasks ($F[1, 11] = 37.06$, $p < .001$, $F[1, 11] = 112.06$, $p < .001$ for WTs and PTs respectively, see also Fig 2b).

Percentage of female responses to androgynous test voices was analyzed in separate ANOVAs for WT and PT with repeated measures on the factors adaptation condition (male vs. female) and load degree (high vs. low).

- significant VGAE under both selective attention tasks with more female responses following male adaptation than following female adaptation
- ($F[1, 11] = 33.59$, $p < .001$, $F[1, 11] = 25.98$, $p < .001$ for WT and PT respectively).

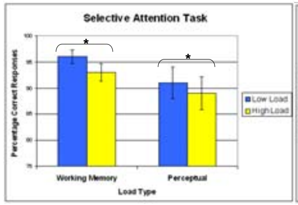

Fig. 2a

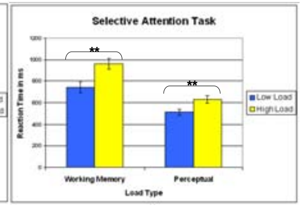

Fig. 2b

No effects of load degree in any of the selective attention tasks (all $ps > .05$)

Numerically (albeit not significantly), the aftereffect seemed to be modulated in the predicted way:

- VGAE was decreased under low working memory load compared to high working memory load, whereas the VGAE was more pronounced under low perceptual load as opposed to high perceptual load (see also Fig. 3).

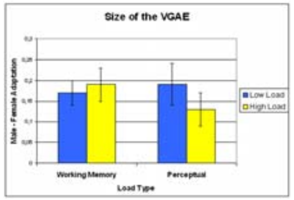

Fig.3: Size of the Voice Gender adaptation effect

(* = significant with p < .05; ** = highly significant with p < .001)

4. Discussion

Despite participants having to undertake a visual selective task during auditory adaptation, we discovered a significant VGAE [1] in the course of our experiment. This suggests that, inspite of crossmodal distraction, gender information in voices was at least to some degree processed automatically. Analogously, face identity aftereffects were found although the participants were asked to perform an auditory selective attention task [4, Exp. 4]. These findings may suggest that attentional resources from other modalities are not a necessity for high-level voice and face aftereffects to occur.

Whereas this is congruent with our observations that the degree of perceptual and working memory load does not modify the magnitude of the VGAE, it is at odds with Lavie's et al. theory (2004). Based on the latter, we expected the processing of irrelevant adaptor stimuli to be increased under low vs. high perceptual load and under high vs. low working memory load. However, seen as numerical differences support our initial prediction, we cannot exclude that the present results may be due to insufficient load manipulation or a lack of statistical power. In order to draw definite conclusions further studies will require more participants and also male participants. In conclusion, future experiments need to investigate to which degree the VGAE depends on attentional resources not absorbed from other modalities.

5. Acknowledgements

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6. Literature

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