Determining preference with eye tracking – a systematic evaluation

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Introduction

Gaze behavior is considered to reflect preferences and preference formation. For instance, preferred objects are fixated longer and more often compared to less preferred objects and the intensity or strength of preference is mirrored in behavioral and gaze data. With an increased preference strength, the reaction time for a decision decreases (Krajbich & Smith, 2015) – suggesting generally shorter gaze time for and less comparisons between the presented objects. Furthermore, various eye tracking studies have shown that not only preferences but also relevant tasks and corresponding behavioral goals affect gaze behavior. Van der Laan and colleagues (2015), for example, investigated the effects of preferences and task goals (i.e., 'choose product you like most/least') on total fixation durations. In their study, total fixation durations were mainly determined by the task goal and only partly by the preference formation (total fixation duration were longer for chosen product – i.e., in 'like least'-condition for less preferred product).

These contradicting findings raise the question: how different types of gaze behavior are affected by relative preference, preference strength, and task goals. So far no integrative and/or systematic evaluation was conducted, even though the research question was already partially addressed – for individual aspects or for specific eye tracking measures. Such a systematic evaluation is necessary to better understand the underlying affecting factors and needs to include distinct types of stimuli for being able to generalize findings to other research areas. With our study, we aim to better understand the effect of relative preferences (i.e., preference for one stimulus over another), preference strength, and task goals (i.e., free-viewing, most-liking choice, and least-liking choice) on distinct eye tracking measures.

Method

We implemented a 3 (task goals: free-viewing vs. most-liking vs. least-liking) x 2 (stimulus types: faces vs. objects) within-participants design, for details see Figure 1. All participants (N = 38) completed three blocks: free-viewing task (Block A), most-liking choice task (Block B), least-liking choice task (Block C). Each block consisted of several trials and during each trial a pair of stimuli (e.g., two faces) was presented for either 4000ms (Block A) or until participants made their choice (Block B and C). At the end of the experiment, explicit preferences were assessed for each stimulus individually on a 7-point Likert scale.

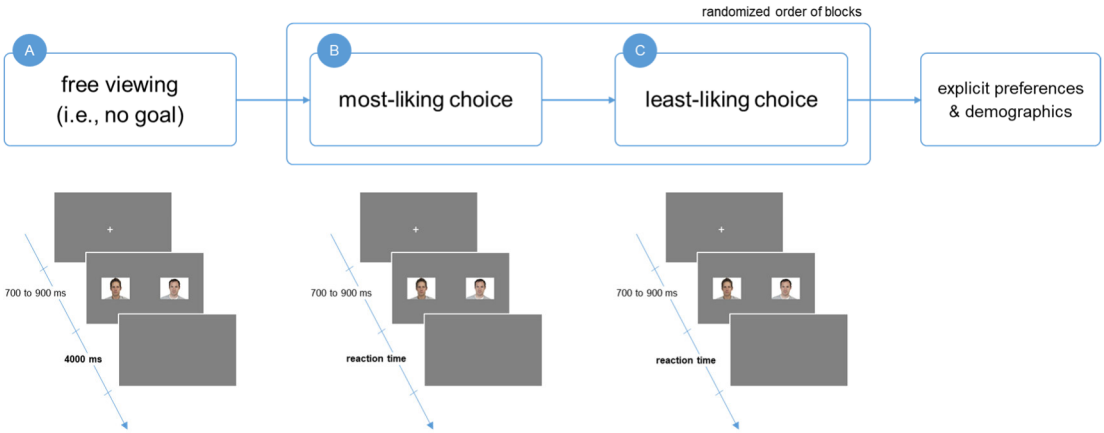

Figure 1. *Experiment procedure: the experiment consisted of three blocks (Block A, B, C) and a questionnaire. Block A was always presented first and the order of Block B and C was randomized. Each trial consisted of a fixation cross (presented for 700 to 900ms), the presentation of a stimulus pair, and a blank screen. Within Block A (free-viewing task), participants were asked to freely view the stimuli (each stimulus pair was presented for 4000ms). Within Block B (most-liking choice task), participants were asked to choose the face/object they like most and the presentation of the stimulus pair ended with their reaction (i.e., when the choice was made). Within Block C (least-liking choice task), participants were asked to choose the face/object they like least and the presentation of the stimulus pair ended with their reaction (i.e., when the choice was made). In each block new stimulus pairs were presented to control for the effect of familiarization. Within the questionnaire at the end of the experiment, participants provided their explicit preferences for each of the presented stimuli and their demographical data.*

Results

Relative preferences and gaze behavior. To investigate the effect of preferences on gaze behavior (i.e., relative total fixation duration and total fixation count per stimulus), we fitted linear mixed models with a fixed effect for preference and a random effect for participants. The models indicate that the relative total fixation duration is 4.98% higher [4.31%;5.65%][1] for the preferred stimulus compared to the not-preferred stimulus and that the preferred stimulus receives 0.68 [0.54;0.82][1] more fixations compared to the not-preferred stimulus. Presented with pairs of stimuli, participants fixated the preferred compared to the not-preferred stimulus longer and more often.

Preference strength and gaze behavior. To investigate the effect of preference strength on gaze behavior (i.e., average fixation duration, relative total fixation duration, switches between AOIs, pupil dilation, average saccade velocity; and in the two choice-tasks: reaction times), we fitted linear mixed models with a fixed effect for preference strength (i.e. difference between the explicit preference ratings for the two presented stimuli ranging from 0 to 6 – 'no preference' to 'strong preference') and a random effect for participants. The models indicate that a stronger preference is related to a significantly reduced number of switches between AOIs for all tasks (i.e., the number of switches between AOIs is reduced by 0.02 [0.01;0.03][1] per strength point), and to a significantly shorter reaction time in the two choice tasks (Block B and Block C; i.e., the reaction time is reduced by 90ms [57ms;124ms][1] per strength point). All other measures are not affected by preference strength. Presented with pairs of stimuli, participants switched less often between the stimuli and reacted faster when they had a stronger preference for one stimulus over the other.

Relative preferences, task goals, and gaze behavior. To investigate the effect of preferences and task goals on gaze behavior (i.e., relative total fixation duration and total fixation count per stimulus), we fitted linear mixed models with a fixed effect for preference, a fixed effect for task goal, and a random effect for participants. The models indicate that the effects of preference and task goal, as well as their

[1] Values in square brackets describe 95%-CIs.

interaction are distinguishable from random noise in this experiment (see Figure 2). Presented with pairs of stimuli, participants fixated the preferred stimulus compared to the not-preferred stimulus longer and more often if their task was to simply look at the stimuli or to choose the stimulus they like more. In contrast, participants fixated the not-preferred stimulus longer and more often if their task was to choose the stimulus they like less. The results for the two choice tasks (Block B and C) replicate the findings of van der Laan and colleagues (2015): total fixation durations are to be mainly determined by the task goal and only partly by the preference. Additionally, we detected similar patterns of gaze behavior for the free-viewing and the most-liking choice task.

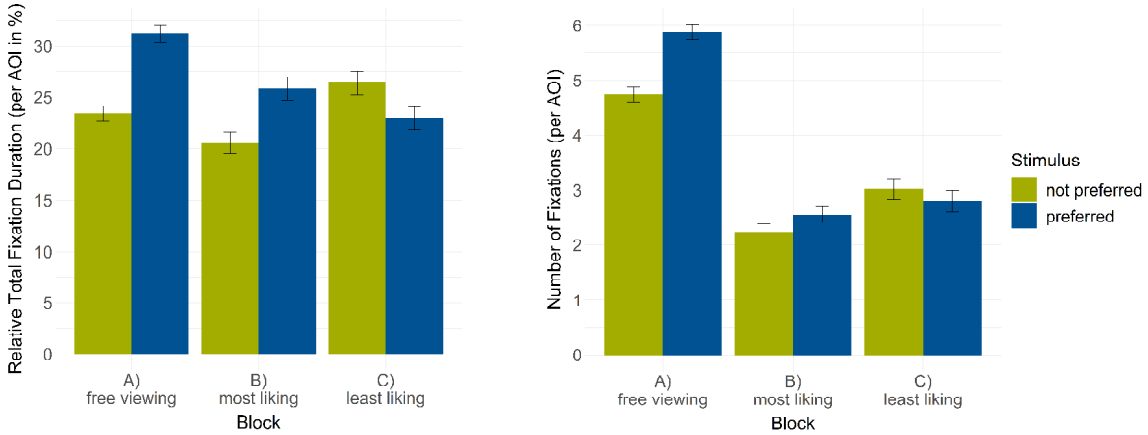

Figure 2. *Gaze behavior (i.e., relative total fixation duration and number of fixations per AOI) grouped by task goal (i.e., free viewing, most liking, and least liking) and stimulus preference (i.e., not preferred vs. preferred stimulus). The error bars represent 95% Cis.*

Discussion

Not only in the most-liking choice task but also in the free-viewing task, participants fixated the preferred stimulus longer and more often than the not-preferred stimulus. In contrast, when choosing the least-liked stimulus, participants fixated the not-preferred (i.e., target of choice) stimulus longer and more often. The similar patterns of gaze behavior in the free-viewing and the most-liking choice task suggest a tendency to, by default, focus on preferences. This preference focus can be suppressed by specific task goals. Furthermore, the preference strength affects gaze behavior: In all tasks, stronger preferences for one stimulus over the other were reflected in lower number of switches between the stimuli and in shorter reaction times. All effects were independent of stimulus type. Overall, for (eye tracking) experiments the tasks and task goals should be defined consciously and the strength of preferences needs to be considered. As the free-viewing and the preference-choice tasks resulted in similar gaze behavior patterns, a free-viewing task seems to be appropriate for determining preferences implicitly via gaze behavior.

References

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