How common are “express saccade makers”? Moving beyond Europe and simple East/West comparisons

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Introduction

“Express” saccades (ESs), are reflexive, visually-guided saccades, which have a low latency (approximately 100ms) and may form a separate early peak in the saccade latency distribution (Fischer & Weber, 1993). In normal, naïve participants, the proportion of ESs is increased by the use of a stimulus in which the fixation point is extinguished prior to the target appearing (the “gap” paradigm). It is also increased by prolonged training (Knox & Wolohan, 2015), and in certain patient groups (e.g. schizophrenia; Clementz, 1996). In the absence of training and pathology, the proportion of ESs is usually low, and in overlap conditions (fixation target remains illuminated when the saccade target appears) it is often close to zero. However there are some participants, “express saccade makers” (ESMs), who in overlap conditions exhibit a high proportion of express saccades (≥30%). ESMs had been suggested to be rare (~1% of the healthy population; Biscaldi et al, 1996). However, we have found that they occur much more frequently among Chinese participant groups, making up 20%-30% of participants (Amatya et al, 2011; Knox & Wolohan, 2014). What of other populations?

Methods

With local ethical approval, experiments were conducted in the Department of Psychology, Menoufia, Egypt. Seventy participants (30 female; median age: 19 yr; range: 18-23yr), all with normal or corrected-to-normal visual acuity, were recruited from the student body and tested in a single session. Eye movements were recorded using a Saccadometer (Advanced Clinical Instrumentation, Cambridge, UK), which projected a fixation and saccade targets (Figure 1) and recorded the resulting saccades using infrared reflective tapelike rate markers. This is the same instrument used in our earlier experiments and testing conditions were very similar to those used previously (eg viewing distance 1m, targets projected onto a white surface). Eye movement parameters and waveforms were stored for offline analysis and analysis. Participants were exposed to 4 runs of 200 trials, two of which were composed of gap trials (gap duration 200ms), and two of which were overlap runs. The order of runs was counterbalanced across participants. Median saccade latency was calculated for each participant, the distribution of latency plotted, and the percentage of latency (latency 80ms to 130ms; %EoS) out of all saccades in the latency range 50ms to 500ms calculated. Participants in whom %EoS was 30% or greater, were classified as ESMs.

Results

The same general pattern of results was observed as we have reported for previous cohorts. An analysis of latency distributions revealed a number which exhibited a clear early peak around 100ms (Figure 2B). Of a total of 70 participants, 10 (14%) met the criterion of a minimum of 30% ES in conditions. Replotting ESM and non-ESM (Norm) average distributions confirmed a clear difference in the proportion of ES, with non-overlapping 95% CIs (Figure 2C & D). We compared the new Egyptian dataset with those we have previously reported for groups of 70 Chinese and Caucasian (White British) participants (Knox & Wolohan, 2014). The Egyptian group was similar to the Chinese group in that we observed some participants with >50% ES in overlap conditions (Figure 3A). A distributions between the three groups revealed similarities and differences (Figure 4). The higher proportion of ESM in the Egyptian compared to the Caucasian group, was reflected in more prominent ES and faster peaks similar to those observed in the Chinese group. However, the later part of the distribution appeared to be more comparable between Egyptian and Caucasian distributions, and dissimilar to the Chinese group. We constructed difference plots (Figure 5) and calculated the mean unsigned bin-by-bin difference between the Egyptian and the two other groups (Figure 5, dashed lines). This was statistically significantly greater for the difference between the Chinese and Egyptian groups (0.65±0.06) than for the Caucasian and Egyptian groups (0.37±0.29; t=2.89, p=0.01).

Discussion

Given the lower proportion of ESMs in the Egyptian group (14%) compared to what we have found in multiple experiments on Chinese participant groups (29% Amatya et al, 2011; 22% Knox et al, 2012; 27% Knox & Wolohan, 2014) and the pattern of differences between overlap distributions (Figure 5), we ascertain that the Egyptian and Chinese participant groups behave differently. What remains unclear is whether the proportion of ESMs and overall performance of the Egyptian group is intermediate between the Caucasian and Chinese groups, or the Egyptian and Caucasian groups should be considered as being the same, and different to the Chinese group.

References


Acknowledgements

This work was funded by a grant to PCK from the Leverhulme Trust. We are also grateful for the support of the Department of Psychology, University of Menoufia and to the participants who took part in this study.

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