

Abstract

During perception, our brain generates top-down predictions which aim to facilitate sensory processing. However, it can also result in misperception, or even create the illusion of something in the place of nothing. Dual task experiments have shown that expectation can misguide subjects to perceive a stimulus that has been removed in some trials.

Here we show that over 90% of subjects reported a subjective experience of the auxiliary task stimulus when it was actually absent. We also found a negative correlation between the amount of misperceptions reported and the Autism Spectrum Quotient score ($p < 0.01$) -- people who scored higher on the questionnaire were less likely to experience illusory objects.

Introduction

Expectations affect perception. It has been shown that in situations where the expectation of a stimulus is high and sensory information is deemed noisy or unattended, it is possible to perceive a stimulus that objectively is absent. Some individual differences in susceptibility to illusory perception have been reported, for instance, among autistic individuals.

We explored the frequency of the illusory perception of missing stimuli in a dual-task setup and report the findings of one in a series of experiments following a methodology similar to earlier studies^{1,2,3}. We developed the approach taken in the previous work in several respects: 1) including valid and invalid cues to study the effect of attention on misperception, 2) adding more critical trials, 3) measuring the autistic trait to find links between individual differences in perception and trait measures studied in a subclinical population.

Methods and Materials

14 participants (6 M, 10 F) took part in the experiment (age $M = 21.38$, $SD = 1.9$). Each trial started with a fixation cross, followed by an endogenous arrow cue pointing to the left or right side. The cue was valid for 80% of the trials and invalid for 20%. The target stimulus was a peripherally presented male or female face with a neutral expression, surrounded by the lines of a square-shaped figure. On 90% of the trials, the task was to discriminate the gender of the face (male or female). On 10% of the trials participants had to rate how clearly they perceived the square on a four-point Perceptual Awareness Scale (PAS). **On six critical trials no square was presented, although participants were asked to give a perceptual clarity rating.**

The main experiment consisted of four blocks of 80 trials. Participants were always trained on both the main task and the auxiliary task separately before the dual task condition.

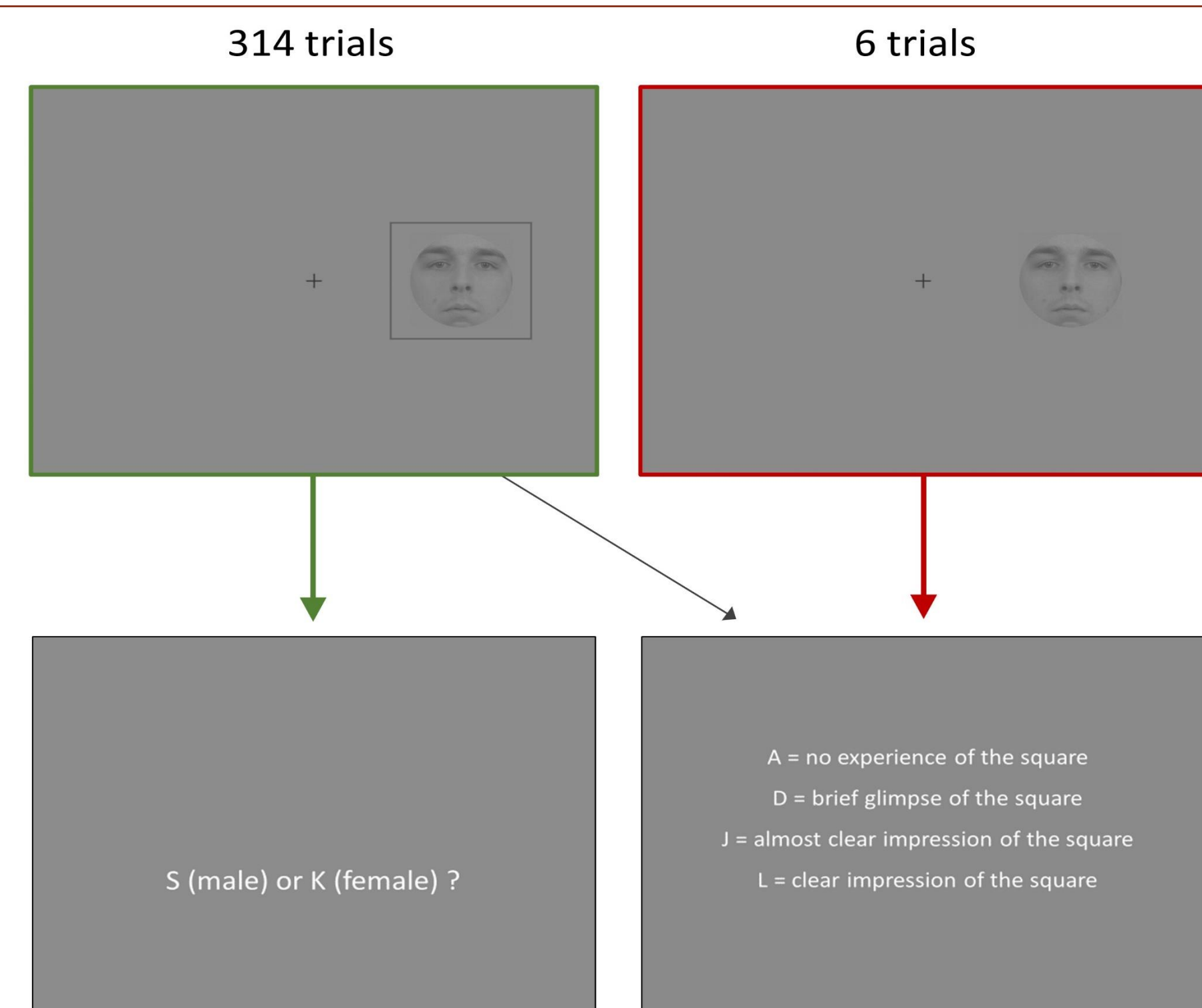


Figure 1. Experimental design showing the face stimulus of the main task and the square of the auxiliary task which was absent during critical trials; response screens for the main task and visibility tasks below.

Results

Our results show that divided attention in a dual task can effectively cause missing of the stimulus of the the auxiliary task to go unnoticed, as over 90% of subjects report experiencing a stimulus that objectively was not present at least once.

Although spatial cues were used and proved helpful for the main task of recognizing faces, as there was a significant difference in correct answers between the valid and invalid condition ($t(13) = -3.96$, $p = .002$), spatial attention did not affect the subjective visibility of the stimuli. Visibility ratings provided for the auxiliary task did not differ between the two cue conditions when the stimulus was present ($t(13) = -0.12$, $p = .905$) and during critical trials when it was absent ($t(13) = -0.69$, $p = .504$).

We found a significant negative correlation with the amount of misperceptions reported and the Autism Spectrum Quotient score ($r = -.68$, $p = .007$): people who scored higher on the questionnaire were less likely to experience illusory objects.

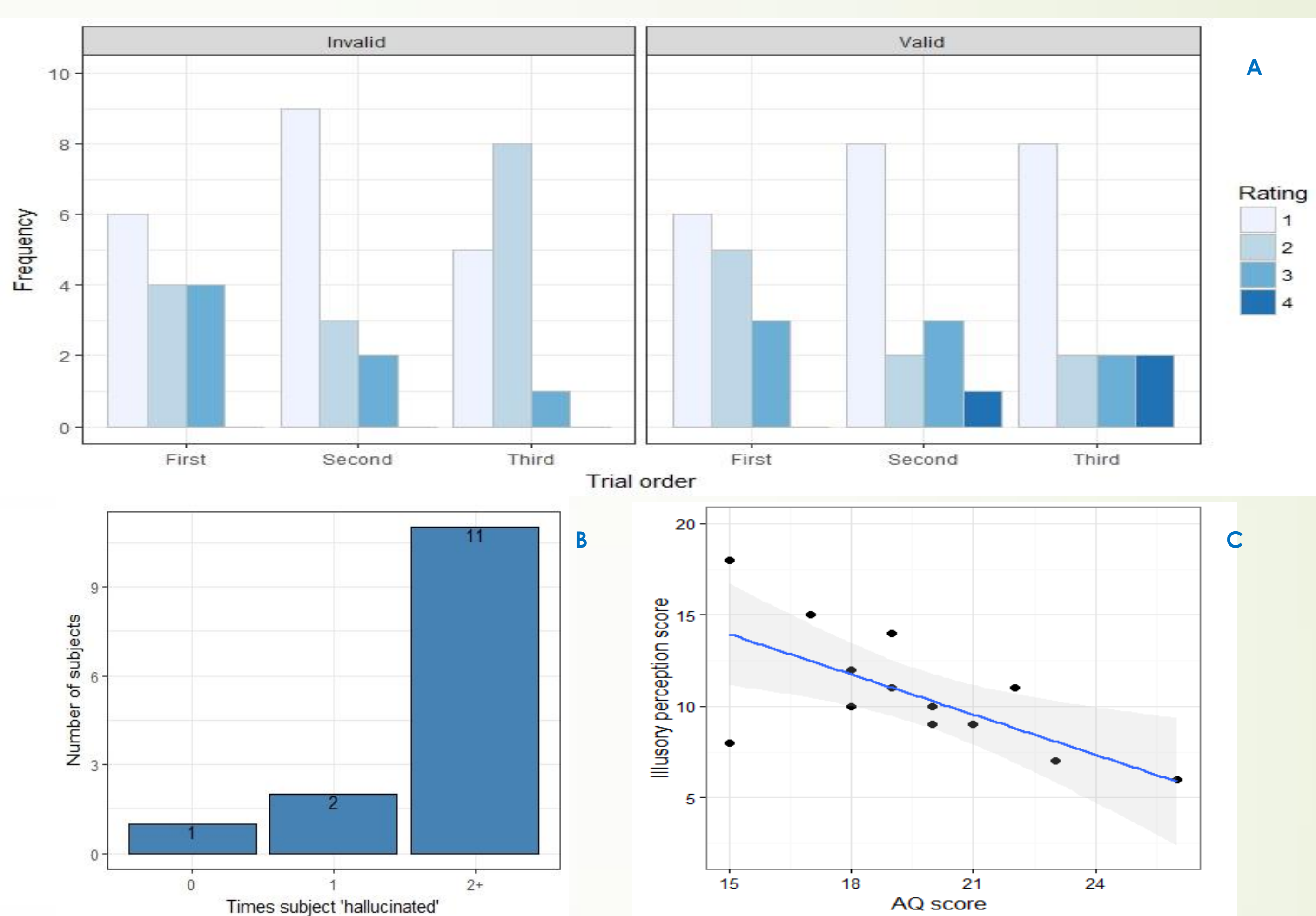


Figure 2. A - Absolute frequency bar plots showing visibility ratings provided for each of the critical trials in the valid and invalid cue condition. B - Number of participants who reported some experience of stimulus (rating 2 or higher) during critical trials when no stimulus was presented in each experiment. C - Scatterplot with regression line and 95% confidence interval for the Autism Quotient score and illusory perception score.

Discussion

We observed a significant negative correlation between the score on the autism questionnaire and the amount of illusory perception. The correlation suggests that people with higher scores on the autism questionnaire perceive the world in its sensory detail more correctly. This finding is in line with the conjecture that autism is related to an enhanced weighting of sensory information over priors^{4,5,6}. We also show that illusory perception is very common and effectively induced in such dual-task setups. Lastly, we found no effect of spatial attention on the amount of illusory perception, however, we note that it is possible that there were not enough critical trials for a significant effect to emerge. We foresee the need for a larger study in the future that could provide more conclusive results.

Conclusions

Overall, our results demonstrate that (i) misperception of an absent stimulus in a dual task is more common than previously thought; (ii) individual differences in top-down effects on perception persist, and can be linked to autistic traits.

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