

Delays of attentional disengagement predict useful field of view decline in older adults

Zachary J.J. Roper,¹ Matthew Rizzo,^{2,3} and Shaun P. Vecera^{1,2}

¹Department of Psychology, ²Department of Neuroscience, ³Department of Engineering, University of Iowa

Introduction

Extant hypotheses concerning the role of attentional limitations in older adults propose a constriction of the attentional window. Attentional constriction reduces the area over which visual information can be extracted in a single glance thereby limiting the so-called *useful field of view* (UFOV) in those individuals. However, the attentional deficits commonly found in individuals experiencing cognitive decline reflect not only issues involving the scope of attention but also several other attentional processes – foremost of which is attentional disengagement. In contrast to the constriction hypothesis, we propose that the mechanism that produces attentional deficits – such as those experienced by adults with accelerated attentional decline – may reflect an impairment in disengaging attention from the currently selected visual stimulus. Twenty-nine observers completed the computer-based UFOV test consisting of four subtests. Observers were classified as UFOV impaired (n=15) or unimpaired (n=14) based on their performance on subtest 4. In order to assess the constriction hypothesis, observers completed a global local task. Stimuli in this task are composite – small letters are placed to form larger letters. If the constriction of attention solely determines UFOV decline, then UFOV impaired observers should deviate from controls and show no compatibility effect in the local condition.

Constriction Hypothesis

UFOV Test

Subtest 1

Central Vision and Processing Speed

1

Subtest 2

Divided Attention

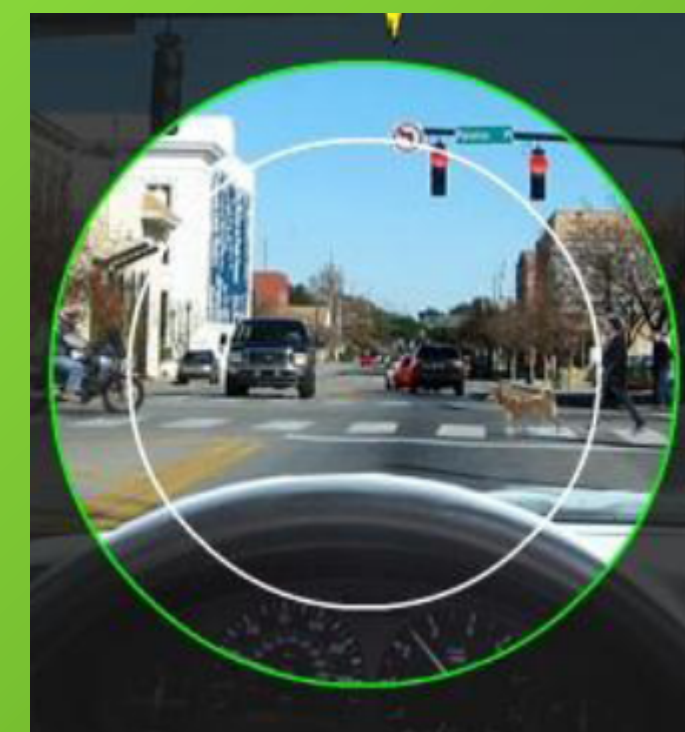
2

Subtest 3

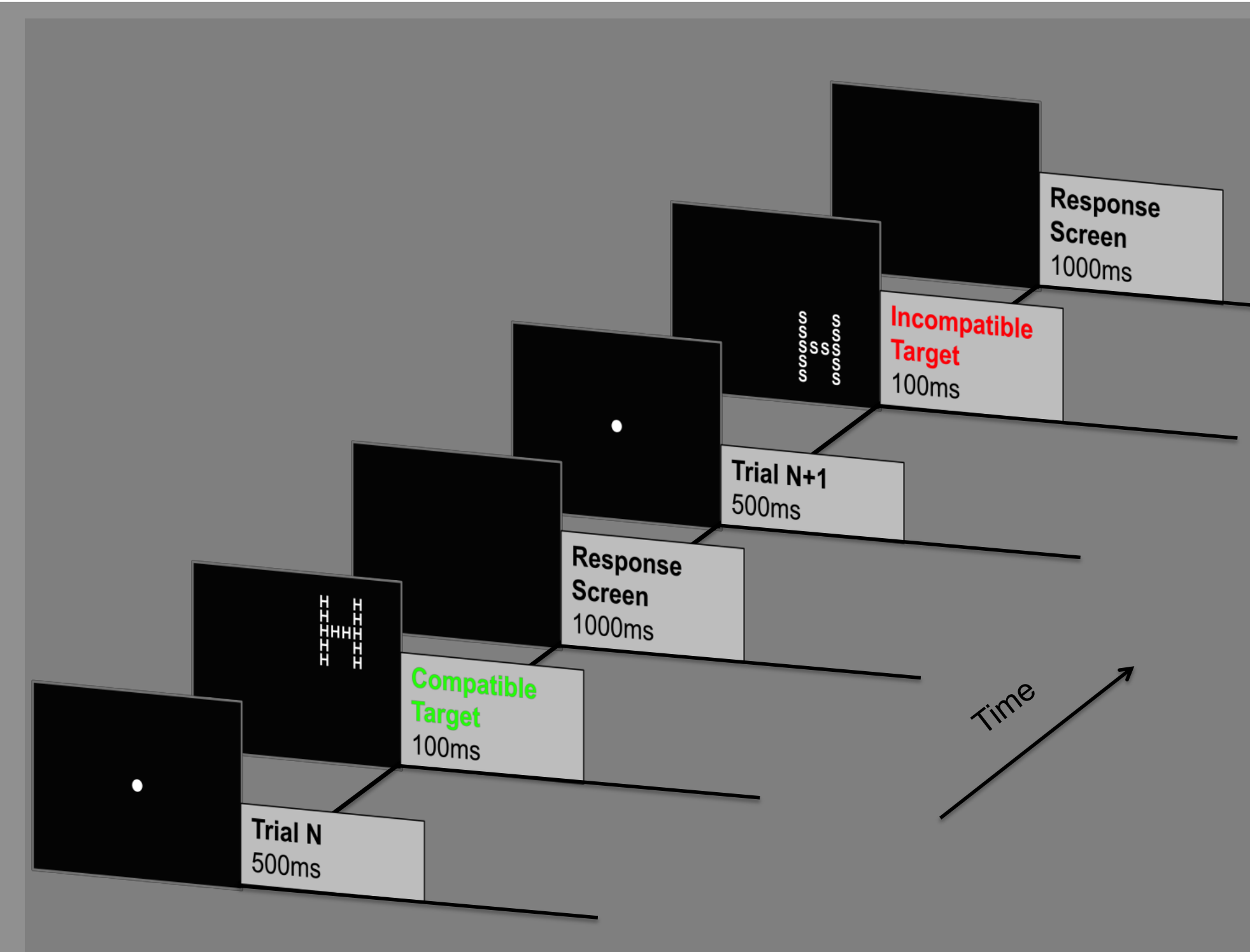
Selective Attention

3

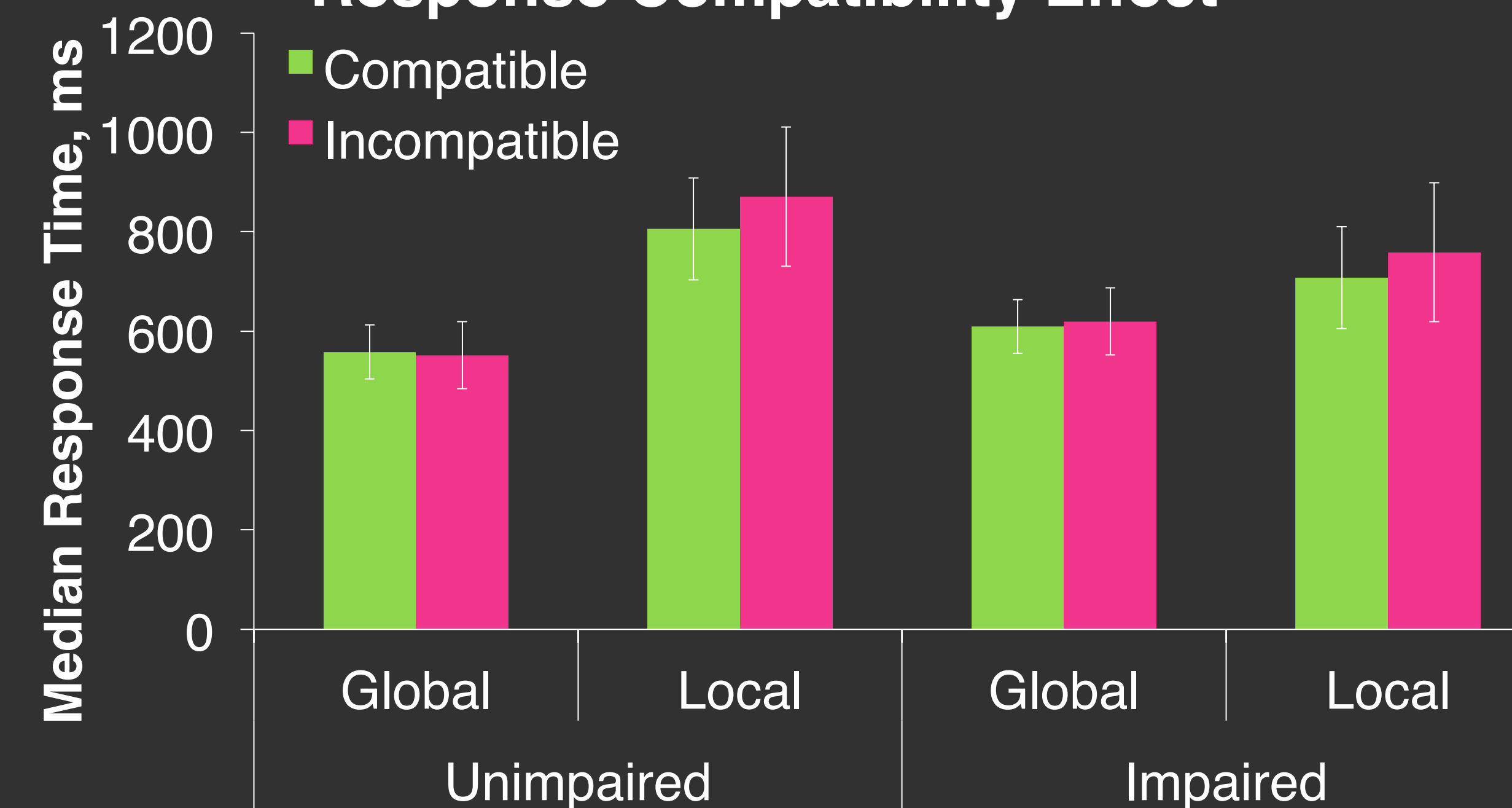
Disengagement?



Global Local Task



Response Compatibility Effect



Error bars represent 95% within subject confidence intervals (Loftus & Masson, 1994; Cousineau, 2005)

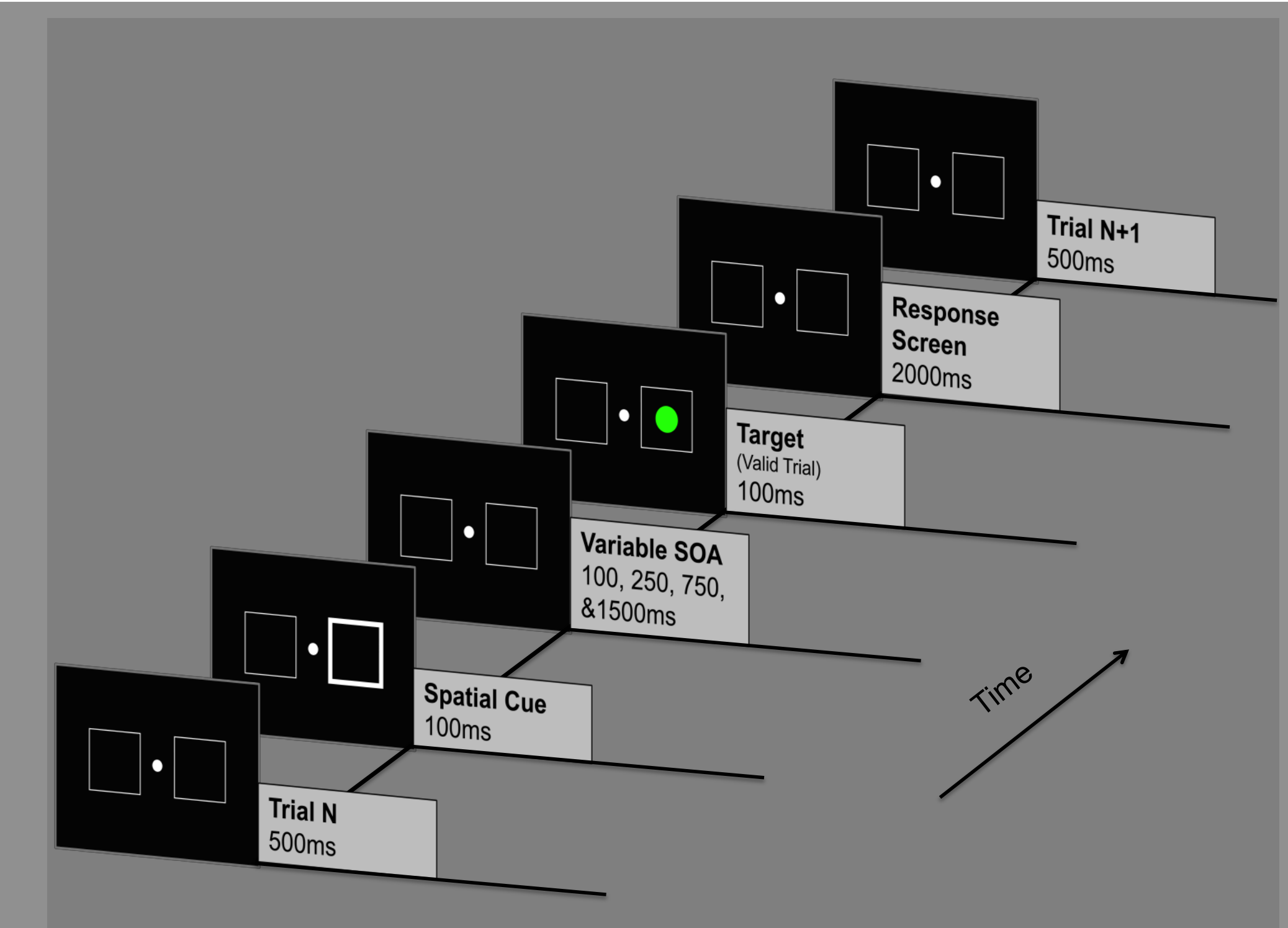
Results & Discussion

The graph above reflects no significant differences between performance in the impaired and unimpaired groups. A strict constriction account would have predicted the absence of a compatibility effect in the local condition for impaired individuals – when attending to the small letters, a shrinkage of the attentional window would have resulted in poor processing of the larger letter. Clearly the larger letter was processed in the local condition as impaired observers show a compatibility effect for that condition.

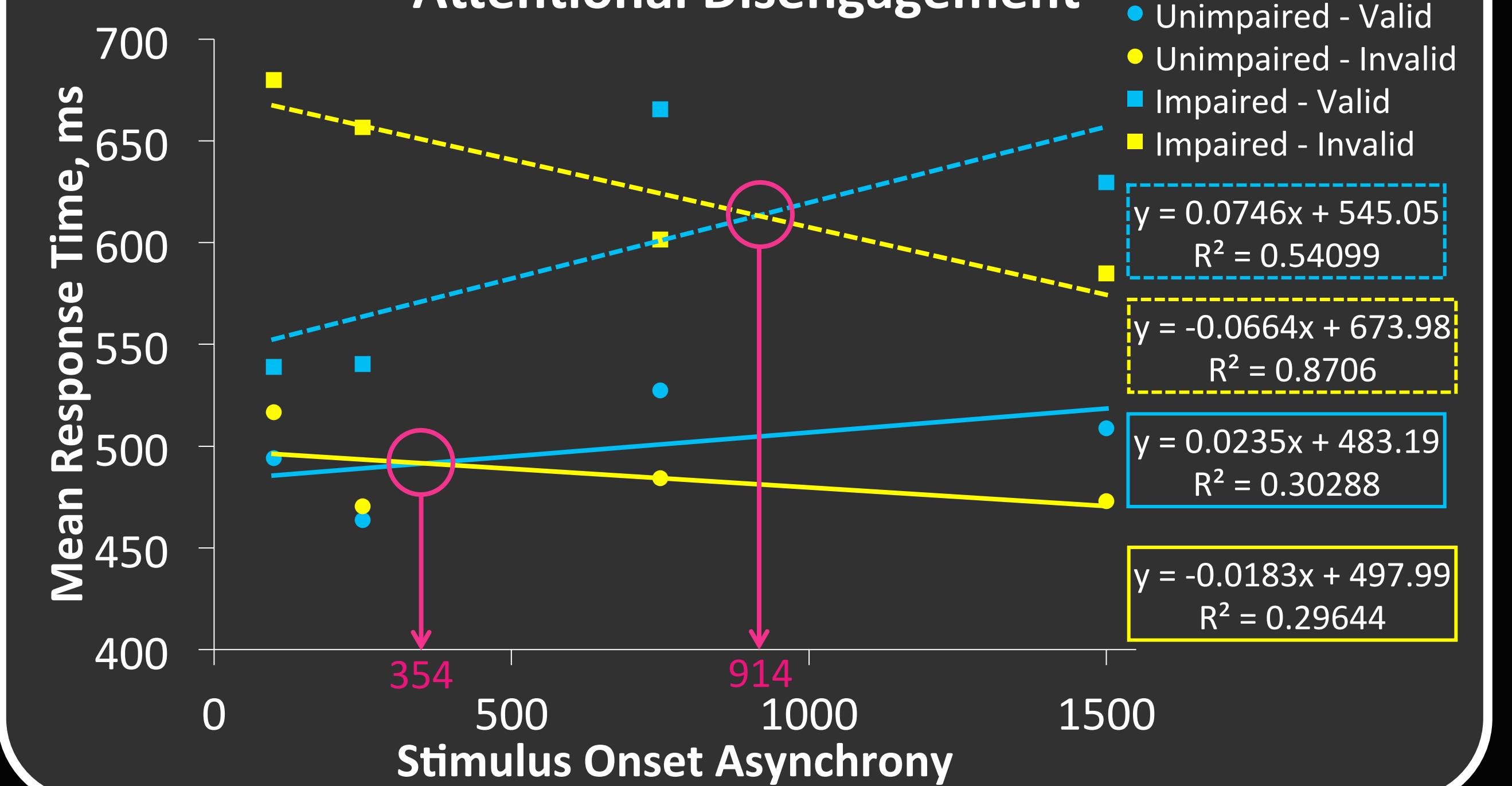
It is worth noting that impaired individuals do show an attenuated compatibility effect in the local condition compared to controls. We take this to imply that attentional constriction cannot completely account for the decline in performance characteristic of the UFOV deficit. Alternatively, we argue that the ability of UFOV impaired individuals to disengage attention for a stimulus is impaired in addition to a possible constriction.

The second task tests the disengage hypothesis. Observers performed a basic cuing task (50% valid) that included four different Stimulus Onset Asynchronies (SOA). At shorter SOAs, healthy subjects show facilitation for valid trials, whereas at longer SOAs, they exhibit inhibition of return (IOR) and are faster on invalid trials. The point at which facilitation crosses over to IOR is a good indicator of attentional dwell time and it can be inferred that any deviation from the normal crossover reflects delays in attentional disengagement.

SOA Cuing Task



Attentional Disengagement



Results & General Discussion

The results of the second task reveal a delayed crossover point for UFOV impaired observers. This implies that those subjects have increased attentional dwell times as would be characteristic of problems with attentional disengagement.

The results of these two tasks demonstrate that UFOV impairment may not be entirely driven by constriction of the attentional window. It now seems likely that in addition to constriction, impaired individuals may experience sticky attention. These results are important as the ramifications of UFOV impairment pose a public safety hazard. Those individuals who are UFOV impaired are twice more likely to be involved in traffic accidents. Evidence has shown that UFOV impaired individuals take longer to cross and have trouble initiating crossings at intersections. Efforts to train away UFOV impairments can only be successful if the current data demonstrating attentional disengagement dysfunction are fully considered alongside attentional constriction.