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## ► To cite this version:

Sabrina Bouhassoun, Christian Gerlach, Grégoire Borst, Nicolas Poirel. Framing the area for avoiding visual interference and optimizing visual search in adolescents and adults. FLUX, Sep 2022, Paris, France. . hal-04043209

**HAL Id: hal-04043209**

**<https://cnrs.hal.science/hal-04043209>**

Submitted on 23 Mar 2023

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# FRAMING THE AREA FOR AVOIDING VISUAL INTERFERENCE AND OPTIMIZING VISUAL SEARCH IN ADOLESCENTS AND ADULTS

Sabrina Bouhassoun<sup>a,b,✉</sup>, Christian Gerlach<sup>c</sup>, Grégoire Borst<sup>a,d</sup>, Nicolas Poirel<sup>a,b,d</sup>



Université  
Paris Cité



## BACKGROUND

### Visual distractions as a key factor during visual search

Because of our limited attentional capacity (Desimone & Duncan, 1995), searching for relevant information frequently induces attentional competition between relevant and distracting information.

Handling with visual distractors plays a key role during effective visual search and depends, at least in part, on the target and distractors attributes (e.g., Duncan & Humphreys, 1989).

Ignoring visual distractors is critical to ensure optimal working memory performance through lifespan (e.g., Zanto & Gazzaley, 2009).

The use of compound stimuli has proven helpful in teasing apart the effects of global and local properties of visual stimuli on both object recognition (Gerlach & Poirel, 2018) and visual search tasks (Kimchi et al., 2005).

Searching for details in our visual environment frequently requires cognitive resources (Poirel et al., 2014; see also Navon, 2003; Poirel et al., 2008).

During visual search task, participants require more time to identify a target at the local level as the number of distractors increases (e.g., Krakowski et al., 2015).

### AIMS OF THE STUDY

We investigated the developmental impact of a frame that delimits a portion of a screen during visual search, and how the frame can prevent the processing of irrelevant stimuli located outside of it during a demanding detail-local oriented attentional task

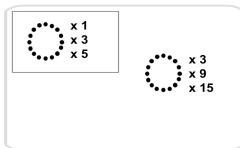
## METHODS

### Target :



Local-oriented trial

Inside-frame and outside-frame distractor conditions



### Sample

- Adolescents: n=41 (M = 12.4 years, SD = 0.6) with normal or corrected-to-normal visual acuity.

- Frame group : n=21 (M = 12.6 years, SD = 0.5)

- No-frame group : n=20 (M = 12.3 years, SD = 0.7)

- Adults:

- Frame group : n=46 (M = 22.5 years, SD = 5.0) with normal or corrected-to-normal visual acuity.

**Stimuli** All the stimuli were hierarchical Navon-like figures (Navon, 1977). Target stimuli contained a square at the target level (local or global level) and circles at the irrelevant level

**Frame group procedure** The frame appeared at one of five possible positions on the screen (upper right, upper left, lower right, lower left, or center)

- Target-present trials (50%) : The target was located inside a gray frame with one or more inside and outside distractors.

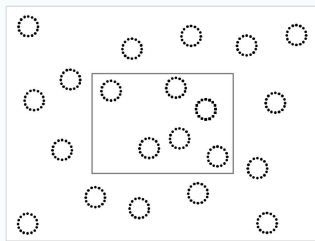
- Target-absent trials (50%) : Trials were matched with each target-present trial by replacing the target stimulus with a non-target.

**No-frame group procedure:** The exact same items were used, except that the frame was absent.

### ADOLESCENTS :

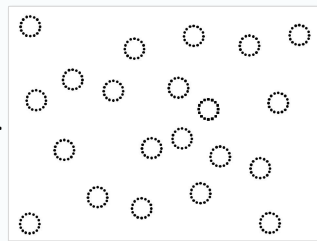
There was a **significant target level x group x number of outside-frame distractor interaction effect** ( $p < .001$ ,  $\eta_p^2 = .64$ ).

#### Frame group:



VS.

#### No-frame group:



The RTs **were not affected by the increasing of outside-frame distractors** during the local visual search task.

The RTs **were affected by the increasing number of distractors** during local target processing (all  $p < .001$ ).

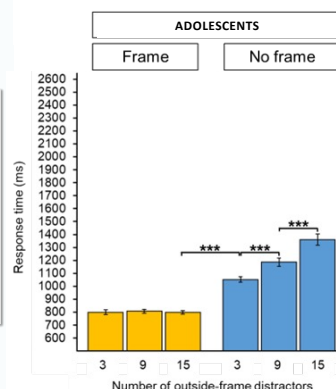
### ADULTS :

There was **no main effect of the number of outside-frame distractors** ( $p = .246$ ) and **no significant target level x number of outside-frame distractors interaction x trials interaction** ( $p = .351$ ), reflecting the lack of influence of the outside-frame distractors on RTs when searching for a target (present or absent-target) at both the global and local levels.

**Developmental trajectory of the effect of physical framing :**

Adults were faster during the local visual search task with the frame compared to adolescents ( $p < .001$ ,  $\eta_p^2 = .62$ ).

There was **non-significant interaction with age group** (adolescents ; adults) (all  $p > .10$ ).



## RESULTS

These results suggest that a frame presented on a visual display **can prevent attentional resources from being caught by irrelevant stimuli presented outside of the frame** (Bouhassoun et al., 2021).

The present results suggest that:

(1) Using a frame that delimits a topographical visual area is a concrete and efficient approach for **optimizing the allocation of attention during visual search in both middle-school adolescents and adults**.

(2) This effect of physical framing on visual search performance is found in both adults and adolescents, although adults are faster, which probably reflects a better executive control with age related to the maturation of the prefrontal cortex (e.g., Gogtay et al., 2004).

Our findings also provide evidence that **local details processing can be improved without modifying the structure of the stimulus** (Bouhassoun et al., 2021).

These findings afford a **better understanding of the deployment of attention during visual search and hold implications for daily real-world situations** such as academic/learning situations that require visual attention to be maintained over long periods of time.

## DISCUSSION

## TAKE HOME MESSAGE

When a frame delimits a restricted topographical visual area, it refrains the influence of an increasing number of outside-frame distractors for both adolescents and adults.

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<sup>a</sup> LaPsyDÉ, UMR CNRS 8240, Université Paris Cité, Paris, France

<sup>b</sup> GIP Cyceron, Caen, France

<sup>c</sup> Department of Psychology, University of Southern Denmark, Denmark

<sup>d</sup> Institut Universitaire de France (IUF), Paris, France