Closing-In behavior and motor distractibility in persons with brain injury

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ABSTRACT

Objective: This study investigates closing-in behaviour (CIB),a phenomenon observed in graphic copying tasks when responses encroach upon or overlap the model. The behaviour is most common amongst individuals with dementia and amongst preschool children. We explored the relationship between CIB and the *distractor effect* in reaching, whereby salient visual stimuli can influence the spatial trajectory of the reach. Method: a group of individuals with overlap CIB (n=9), without CIB (n=9) and healthy controls (n=6) underwent a task-irrelevant and a task-relevant distractors and the deviation of the movement trajectory towards the distractor location was measured in both tasks. Results: Individuals with graphic CIB showed more distractor-directed veering during reaching than did individuals without CIB or healthy controls, provided that the distractor was relevant for the reaching task. Conclusions: These results strengthen the relationship between CIB and the distractor effect and reinforce the hypothesis that CIB represents a disinhibited tendency to act towards the focus of attention.

KEYWORDS: EXECUTIVE FUNCTION, ATTENTION, MOVEMENT DISORDERS, PERCEPTION/SPATIAL PROCESSING, DEMENTIA.

INTRODUCTION

Closing-in behaviour (CIB), often observed in copying tasks is characterized by copying abnormally close to (Near-CIB), or directly on top of (Overlap-CIB) the model (Ambron & Della Sala, 2017). CIB is often observed clinically in graphic copying tasks, which are part of neuropsychological assessment (e.g., overlapped pentagons of the Mini-mental state examination or Rey Figure). However, its origins and implications in daily life are little understood, it is crucial to investigate this behaviour further. It has been posited that CIB may reflect a close coupling between attention and action within the motor system (McIntosh, Ambron, & Della Sala, 2008). In conditions such as copying tasks, where the focus of attention needs to be separated from the space of action, healthy adults can suppress the default coupling of attention and action. However, this suppression may fail if there is insufficient executive control or attention, resulting in actions that are magnetized to the attended stimuli (Ambron& Della Sala, 2017). This account of CIB, known as the *attraction hypothesis*, has found support in studies with children (Ambron, Della Sala, & McIntosh, 2009a; Ambron, Della Sala, & McIntosh, 2012) and people with dementia (Ambron, Mcintosh, Allaria, & Della Sala, 2009b; De Lucia, Grossi, Fasanaro, Carpi, & Trojano, 2013).

The general idea that attended visual stimuli may automatically prime a motor response has been labeled in the attention and action literature as *visual distractor effect* (Howard & Tipper, 1997). This effect describes the interference of a non-target stimulus on temporal (i.e., Reaction Time) and/or spatial characteristics (i.e., Movement

Trajectory) of goal-directed actions such as reaching. The presence of a salient non-target stimulus may cause a deviation of the movement trajectory towards (Welsh, Elliott, & Weeks, 1999) or away from (Howard & Tipper, 1997) the distractor location. A functional account that can accommodate both distractor-directed veering tendencies, is that the distractor prompts the preparation of a motor response towards it: this motor response is subsequently inhibited to execute the movement towards the target of the action. The level of distractor-response activation at the time of movement execution determines the bias of the movement trajectory towards or away from the distractor (Howard & Tipper, 1997).

The more attention is directed towards the distractor, the more likely the trajectory will be biased, and more strongly it must be inhibited (Welsh & Elliott, 2005). Task-relevant stimuli are more likely to elicit distractor effects, whether toward or away from the distractor, than task-irrelevant stimuli. In the former case, attention must be directed voluntarily to the distractor in order to perform the task correctly (e.g., the distractor may be a cue signaling which target to respond to). If the distractor is task-irrelevant, i.e. it does not need to be attended, it may nonetheless succeed in capturing attention exogenously.

In addition to the stimulus characteristics, the *distractor effect* is also shaped by participants' cognitive resources. Populations with poor cognitive resources, such as persons with brain injury (Ambron, Beschin, Cerrone and Della Sala, 2018 and children (Ambron et al., 2012) are more prone to distractor interference. Simone and Baylis (1997) showed that when patients with dementia are asked to perform a movement towards a target and to ignore a contiguous no-target stimulus, they show a large reaction time cost; they also tend to respond incorrectly towards the distractor location. The authors explained this pattern of behaviour and the distractor effect observed as reflecting a lack of inhibitory control.

The apparent resemblance between distractor effects and CIB suggests that CIB might represent an extreme manifestation of the distractor effect, specifically of the tendency to veer towards attention-capturing stimuli (Ambron et al., 2012). This hypothesis has found some support in previous studies. A remarkable tendency of veering towards irrelevant distractors was reported in individuals with brain injury (Ambron et al., 2017), as well as in children (Ambron et al., 2012) with CIB. Using task-irrelevant and task-relevant distractors, the present study tests directly the hypothesis that CIB and the distractor effect are related phenomena in persons with brain injury. We predicted that patients with CIB would show a greater tendency to deviate towards the distractor than patients without CIB or healthy controls. As task-irrelevant and task-relevant distractor tap on different aspects of attentional capturing mechanisms, the study further tests whether a larger distractor effect in participants with brain injury and CIB is observed when attention is automatically captured by the distractor and/or when attention is endogenously directed towards the distractor location.

METHODS

Participants

The aim of the study is to test CIB as a form of distractor effect, not to investigate CIB in any particular form of dementia. Hence, participants were recruited according to presence or absence of CIB quite independently of the type of brain degeneration affecting them.

Eighteen patients were recruited from the Clinical Neuropsychology and Rehabilitation Unit of S. Antonio Abate Gallarate Hospital, Italy, which also granted the ethical approval. Participants were selected and sub-divided into two groups of 9 patients each based on the presence or absence of overlap CIB in at least one of the graphic copying tasks (see next section). Patients underwent CIB and the neuropsychological assessments first and in a subsequent session (2-7 days apart) they underwent the experimental tasks.

Six healthy controls (HC) were also tested among researchers' acquaintances to provide a baseline. As their cognitive health was based on self-report, we administered the MMSE to check for normal performance and for the absence of CIB (Table 1). The participation in this study was voluntary and no honorarium or other incentives were offered. One clinician (N.B.) conducted the patients' recruitment; one researcher (C.C.) gathered consent and carried out the testing, while another researcher (E.A.) analyzed the anonymised data.

******************** INSERT TABLE 1 ABOUT HERE********************

CIB assessment and neuropsychological battery

Participants were presented with a series of graphic copying tasks, used clinically to assess constructional abilities: overlapping pentagons of the MMSE, a square, two overlapping squares and a cube (Ambron et al., 2009a; Ambron et al., 2012; McIntosh et al., 2008). We favored a paper and pencil rather than a computer-based version of the graphic copying tasks to keep the assessment of CIB consistent with clinical practice and previous literature (Ambron et al., 2009a; Spinnler & Tognoni, 1987). We also deemed that there were no advantages in using a computer version of the task. All patients performed all the tasks, except two (1 CIB+ and 1 CIB-) who completed solely the MMSE. These tasks were chosen as part of the clinical neuropsychological assessment and as previously shown to elicit CIB (Ambron et al., 2009a; Ambron et al., 2012; McIntosh et al., 2008). For every task, we considered the relative distance between the model and the copy measured in mm to categorize the presence (i.e., the copy touches or overlaps the model) or absence (copies separated from the model by at least 10 mm) of overlap CIB (see Figure 1). Individuals' demographic and neuropsychological assessment are reported in Table 1.

******************** INSERT FIGURE 1 ABOUT HERE********************

Patients underwent the MMSE, the Frontal Assessment Battery (FAB), a visual search task, non-verbal short-term memory assessed by means of the Corsi Blocks and verbal short-term memory assessed by means of the Digit Span. The CIB+ and CIB-group did not differ in their performance in any of the tasks (see Table 1).

Experimental tasks

Two experimental tasks based on our previous study exploring CIB and the distractor effect in children (Ambron et al., 2012) were used in the current study: a *task-relevant* and a *task-irrelevant distractor* task (see Figure 2). Both tasks were presented to all the participants and required a simple reach toward a target location. We used computer-based rather than simple paper and pencil tasks because they allowed to control for the onset of the stimuli and to extract kinematic parameters, making the tasks akin to reaching paradigms used to measure the distractor effect in neurotypical individuals (Howard & Tipper, 1997; Welsh, Elliott, & Weeks, 1999). Participants executed the reaches using a pen-like stylus in contact with a touch-sensitive tablet (260×163 mm, Toshiba Portégé), with the screen tilted at 45 degrees and aligned with the participant's body midline.

In the *task-irrelevant distractor* task, there was one target car (green; 20x20 mm) on each trial, presented simultaneously with a (blue) distractor circle (20 mm diameter), which participants were told to ignore. In the *task-relevant distractor* task, there were two targets cars, one blue and one red (20x20 mm each), and the distractor was either a blue or red circle (20 mm diameter). Participants were instructed to reach for the car of the same color as the distractor-circle presented in that specific trial, and therefore the circle was actually a task-relevant discriminatory cue for the reach.

In each trial, the participant was required to rapidly connect a starting circle (a green dot of 10 mm diameter) on the near side of the screen with the target presented on the far right or far left (in the task-irrelevant) or in both sides (in the task-relevant) of the screen. The distractor was always presented at the same time as the target and placed at the right or left side of the target at 40 mm distance. Targets and distractor locations were arranged around a semi-circle, with the distance between starting point and the stimuli defining the radius of the circle (130 mm). Each trial began with the starting circle displayed, and participants placed the stylus inside the circle. When the stylus entered the starting point area, the color of the circle changed from dark to bright green, and targets and distractor were presented after 500ms. The trial ended 500ms after the stylus entered the correct target area.

******************** INSERT FIGURE 2 ABOUT HERE********************

For each task, participants completed two blocks of 20 trials[1], ten for each target location (left and right), with the distractor equally often on either side; trial order was shuffled

[1]In both irrelevant and relevant distractor task, three CIB+ individuals and three CIB- performed one block of trials because of tiredness and low motivation.

randomly. Four practice trials were given for each task. The order of the tasks was alternated between participants. This study was conducted in accordance with Helsinki Declaration principles and approved by S Antonio Abate Hospital ethics committee. All participants signed an informed consent prior starting the experiment.

Data processing and analyses

For each trial, the stylus coordinates were filtered with a dual pass through a second-order Butterworth filter (10 Hz high-frequency cut-off). Trials with incomplete or incorrect (the stylus entered the wrong target) movements were deleted (~10% of trials). A threshold of 10 mm/s was applied to the stylus speed to define the onset and offset of the movement, providing measures of Reaction Time (the time between the onset of the target and the onset of the movement in msec) and Movement Time (the time between the onset and offset of the movement in msec). To extract Deviation towards distractors, movement trajectories were normalized with respect to the straight-line path from the starting circle to the target. Mean perpendicular distance of the movement trajectory from this ideal path, across all samples, was calculated for each reach. Deviations toward the distractor (expressed in mm) were coded as positive and away from the distractor as negative.

Data were analyzed using linear mixed models using R (version 3.3.0) with LMER and languageR packages. This analysis takes into account between and within individuals' variability; it is less sensitive than other statistical techniques to missing data (Krueger & Tian, 2016) and inequality of the variance (Kliegl, Wei, Dambacher, Yan, & Zhou, 2011). In every model, participants were inserted as random intercept and the severity of the cognitive impairment as measured with MMSE (scores<18 severe; 18-24 moderate;>24 normal performance; see Tombaugh & McIntyre, 1992) was inserted as main effect in the models to control for its effects. To test for the contribution of the main factors of interest, groups (CIB+, CIB-, HC), target location (left, right) and distractor location (left, right) were sequentially inserted in the model in a stepwise manner. We compared different models using the log-likelihood ratio test implemented with ANOVA function in R. If the difference between two models, with or without one of the fixed factors, was significant, that factor was kept into the model. The final optimized model contained only those factors that contributed significantly to the model fit. For simplicity and as we did not have major predictions regarding the interactions between these factors, we considered only their unique contribution to the model fit. We checked for the normality distributions of the residuals and logarithmic transformation was applied when needed (Deviation, Movement time).

RESULTS

Task-irrelevant distractor task.

DEVIATION. The factor Group, as well as target and distractor locations, did not contribute significantly to the account for Deviation data (LogLik= -619; $\chi 2$=5.4p= .25; R^2= .26). Indeed, if CIB- and HC showed a similar performance (t= 0.25, p= 0.80), CIB+ showed a larger tendency to veer towards the distractor than HC (t= -2.17, p= 0.04) and CIB- (t= -1.6, p= 0.12), but this last difference was not significant.

MOVEMENT TIME. The model including target only as factor of interest better predicted movement time data than the null model (LogLik= -231; $\chi 2$=49.5, p<0.001; R^2= .70), with movement time being longer when the target was on the left than side of the screen (t=-7.1, p<0.001).

REACTION TIME. The model including all factors (group, target and distractor) did not differ from the null model (LogLik= -859; $\chi 2$=5.3p= .25; R^2= .33), suggesting that none of the factors of interest contributed significantly to the model fit.

Task-relevant distractor task.

DEVIATION. The final model of Deviation comprised the main effect of the group (LogLik= -2812; $\chi 2$=10.05, p<0.001; R^2= .08). Specifically, CIB+ showed a larger deviation than both CIB- (t=-2.0, p=0.057) and HC (t=-3.1, p=0.005). Furthermore, the deviation towards the distractor was similar in CIB- than HC (t=-0.08, p=0.93).

MOVEMENT TIME. The target location was included in the final model (LogLik= -382.7; $\chi 2$=6.4, p=0.01; R^2= .61), with Movement Time being longer when the target was on the left than right side of the screen (t=-2.5, p=0.011).

REACTION TIME. The final model proving to differ from the null model (LogLik= -497; $\chi 2$=4.4, p=0.03; R^2= .47) included the main effect of distractor location. Reaction Time was longer when the distractor was on the right than left side of the screen (t=2.11, p=0.03).

******************** INSERT TABLE 2 ABOUT HERE********************

DISCUSSION

The present study tested the hypothesis that CIB and distractor effect are related phenomena in persons with brain injury. Following this account, individuals with CIB would show a larger tendency to deviate towards the distractor than individuals without CIB or HC. These predictions where met as movement trajectories of CIB+ individuals were more prone to veered towards the distractor location than the other groups, in particular when the distractor was task-relevant, consistent with the interpretation of CIB as a magnetic attraction of the movement trajectories towards the focus of attention (Ambron & Della Sala, 2017). Of course, in the standard copying tasks in which CIB is traditionally observed, the CIB sign is towards a task-relevant focus of attention, the model. The results from the task-relevant distractor condition thus imply that CIB and distractor effect in reaching are related phenomena, suggesting that CIB reflects the inability to inhibit a primitive coupling of attention and action. The enhanced tendency to deviate towards task-relevant distractors observed in CIB+ compared to the other groups emerged despite controlling for the severity of the cognitive decline. As previous work has shown that cognitive decline plays a crucial role in CIB (Ambron et al., 2009b; Ambron & Della Sala, 2017), the fact that an association between CIB and motor distractibility emerges despite controlling for severity reinforces our conclusions.

In task-irrelevant distractors, individuals with CIB veered towards the distractor more than controls and individuals without CIB but this last difference did not reach significance level, possibly due to low power This interpretation is plausible as previous observations have shown an association CIB and task-irrelevant distractor. Using similar tasks, a distractor-directed reach deviations in pre-school children was reported for both task-relevant and irrelevant distractors, and the difference between children with CIB and other groups was greatest in the task-irrelevant case (Ambron et al., 2012). 'Exogenous' CIB has also been reported in an individual with dementia, who could be induced to respond manually toward an irrelevant strip of reflective paper to one side of the target workspace (McIntosh et al., 2008). However, this tendency emerged only when the examiner crinkled the paper, attracting the individual's attention, suggesting that an exogenous stimulus may need to be highly salient (e.g., adding movement and sound as well as bright color) to elicit CIB. In addition, in a cohort of individuals with brain injury (Ambron et al., 2018), we noted that individuals with CIB showed a larger tendency to veer towards an irrelevant distractor than individuals without CIB or healthy controls. In this study individuals were asked to draw a straight line from the left to the right end side of an A4 paper, while an irrelevant distractor was presented on the top or bottom edge of the paper.

A simpler explanation of the difference between studies is that in the present findings the task-irrelevant distractor task was merely too simple and insufficient to grab participants' attention and induce a large bias towards the distractor. In a previous work (Ambron et al., 2018), titles of famous movies, which may be more appealing and attractive for older adults, were used. Also, while in our previous work (Ambron et al., 2018) the distractor was presented after the movement onset and appeared progressively as participants were drawing of the line, in the present study target and distractor were presented simultaneously. As task-irrelevant distractor is most likely to influence the response trajectory if it is highly salient and/or if it appears unexpectedly just before movement initiation (Welsh & Elliott, 2005), it is possible that the present irrelevant-distractor task might have not been sufficient to enhance a strong distractor effect. The task characteristics, in addition to the low power, may have prevented the differences between groups to reach the significance level. Alternatively, CIB might indicate a difficulty in inhibiting tasks relevant distractors. Graphic copying tasks require first the allocation of endogenous attention towards the model and then the disengagement and reallocation of attentional resources towards the copy space. The association between CIB and task-relevant distractors reinforces the hypothesis that CIB might be due to a difficulty in disengaging attention from the model and to perform an action at a different location from the focus of attention (McIntosh et al., 2008).

Although, the comparisons of the neuropsychological profile of CIB+ and CIB- did not reveal significant differences, trends towards significance level and medium effect sizes were observed for both visual search and Corsi block test suggesting that the lack of significant effects were possibly due to the low power. This pattern of results is in line with previous works which found CIB to be associated with an impairment in digit cancellation (Ambron et al., 2009b) or Corsi task (Serra, Fadda, Perri, Caltagirone, & Carlesimo, 2010), and support the notion that CIB is associated with attentional/executive deficits but visuospatial alterations also play an additional role (Ambron & Della Sala, 2018).

Temporal parameters of action performance were reported for completeness and as possible indicators of the distractor inference, but no specific predictions were formulated regarding CIB. The main factor under investigation was the movement trajectory, insofar as the association between CIB and the distractor effect was specifically predicted in the Deviation variable, which measures the degree to which the movement trajectories veer towards the distractor location. Indeed, differences between CIB+ and CIB-groups were observed only when looking at movement trajectory but not at the other movement parameters. In line with Simone & Baylis (1997), we found more pronounced distractor interference in patients than controls when looking at Reaction Time of task-relevant distractor, but we did not observe a further distinction between CIB+ and CIB-. Similar results were also obtained in testing the relationship between CIB and motor distractibility in children (Ambron et al., 2012) and suggest that CIB may influence movement trajectory specifically.

The present study provide additional support to the distractor effect literature, that postulates that a reaching response towards attended visual stimuli is primed automatically, but then inhibited to complete the reaching to the target location (Welsh, & Elliott, 2005). The level of inhibition of this response, which determines the final outcome of the movement trajectory, depends upon the characteristics of the distractor and the task structure. The present results support the observation that participants' cognitive resources are also a determining factor (Ambron et al., 2012) and persons with brain injury are more prone to motor distractibility than normal adults (Ambron et al., 2018).

The present results support the hypothesis that CIB may manifest in daily life when individuals perform complex motor actions, as for example walking or driving, increasing the risk of collisions with objects (Ambron et al., 2009b). Our results suggest that individuals with CIB are more prone to motor distractibility and if these effect can be observed in simple reaching tasks they would be likely to emerge also when performing more complex motor actions. Informing clinicians of the link between CIB and motor distractibility would be useful to prevent and reduce possible risks for individuals with brain injuries in daily life.

Limitations of the study include the heterogeneity and small size of the sample. However, even considering these limitations, the outcome is rather clear. The main focus of our work was to establish whether the relationship between CIB and distractor effect could also be observed in persons with brain injury, quite independently of their specific disease, therefore we did not distinguish the groups based on the clinical diagnosis or other symptoms rather than CIB. Future work should investigate whether the association between CIB and distractor effect may vary across groups with different clinical diagnoses. If from one hand the sample size of our groups represents a limitation, on the other hand we selected patients Overlap CIB, which reflect a more extreme and less common form of

CIB (Ambron et al., 2009b). Future work should test if individuals with Near CIB are prone to the distractor interference as individuals with Overlap CIB.

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Table 1: Mean (and standard error of the mean) of demographic and of the neuropsychological tests of patients with and without CIB, and controls. The neuropsychological tasks were the Mini Mental State Examination, the Frontal Assessment Battery (FAB) (Appollonio et al., 2005), Digits cancellation (Spinnler & Tognoni, 1987), non-verbal short-term memory (i.e. Corsi Blocks; Novelli et al., 1986) and verbal short-term memory (i.e. Digit Span; Novelli et al., 1986) tasks. Closing-in+ and Closing-in- groups did not differ in their performance in any of the tasks (Table 1).

	Closing-in +	Closing-in -	Healthy Controls	Statistics
Diagnosis	5 AD 2 FTD 1 VaD 1 VE	5 AD 1 VaD 1 FTD 1 LBD 1 PSP		
Frequency of Closing-in	1 task for 3 individual 2 tasks for 3 individuals 3 tasks for 2 individuals 4 tasks for 1 individuals			
Sex	2 M, 7 F	6 M, 3 F	3 M, 3 F	
Age	70.6 (4.2)	73.4 (2.8)	69.5 (5.9)	$X^2(2)$=0.28, *p*=0.86, *E2*=0.01
Education (years)	10.4 (1.5)	8.4 (1.2)]	9.6 (2.1)	$X^2(2)$=0.75, *p*=0.68, *E2*=0.03
Mini Mental State Examination	16.3 (1.8)*	20.1 (1.8)*	28.6 (0.8)	$X^2(2)$=13.7, *p*=0.001, *E2*=0.59
Frontal Assessment Battery	8.6 (0.7) n=9	7.1 (1.1) n=8		*z* = -.53, *p*=0.59, *r*=0.013
Digit Cancellation	20.8 (2.6) n=8	27.7(2.5) n=9		*z=-1.78*, *p*=0.07, *r*=0.43
Corsi Blocks	2.2 (0.6) n=6	4.3 (1.2) n=6		*z*=-.1.85, *p*=0.06, *r*= 0.49
Digit Span	3.8 (0.5) n=6	4.4 (0.2) n=9		*z*=-1.04, *p*=0.29, *r*= 0.26

**p*<0.01 in comparison with controls;

AD: Alzheimer's Disease (AD); FTD: Fronto-Temporal Dementia (FTD); VaD: Vascular Dementia (VaD); LBD: Lewi body dementia; VE: vascular encephalopathy; PSP: Progressive Supranuclear Palsy.

TABLE 2: Mean performance (and standard error of the mean) for the effects of group (Closing-in+, Closing-in-, and controls), target (left and right) and distractor (left and right) for Deviation, Reaction Time and Movement Time in task-irrelevant and task-relevant distractor tasks. For DEVIATION, more positive scores reflect more distractor-directed veering

		Mean Trajectory (mm);	Deviation (mm)	Movement Time (msec)	Reaction Time (msec)
Task-Irrelevant Distractor					
Group	Closing-in +	0.3 (0.6)	1.00 (0.60)	1204.4 (42.57)	2003.3 (121.45)
	Closing-in -	-0.6 (0.1)	-0.04 (0.37)	991.2 (37.98)	2124.5 (83.06)
	Controls	0.5 (0.3)	-0.26 (0.16)	1272.5 (35.06)	2003.3 (95.55)
TARGET	LEFT	-0.3 (0.3)	0.24 (0.16)	1223.5 (42.57)	2045.0 (82.23)
	RIGHT	0.6 (0.3)	0.22 (0.60)	1073.6 (37.98)	2028.2 (81.72)
DISTRACTOR	LEFT	-0.1 (0.3)	0.11 (0.33)	1131.5 (31.57)	1989.2 (78.01)
	RIGHT	0.3 (0.3)	0.36 (0.36)	1162.9 (32.99)	2084.0 (85.76)
Factor(s) in the final model				**TARGET:** *F*=51.9, *p*<0.001, *semi-partial R2*= 0.9	
Task-Relevant Distractor					
Group	Closing-in +	1.6 (1.1)	5.65 (1.11)	1222.5 (53.45)	3596.9 (158.46)
	Closing-in -	-0.7 (0.1)	0.79 (0.58)	908.3 (34.47)	3237.6 (142.61)
	Controls	0.6 (0.5)	-0.08 (0.18)	1326.4 (40.22)	1994.9 (70.60)
TARGET	LEFT	-0.3 (0.6)	1.97 (0.18)	1161.9 (53.45)	3048.3 (117.95)
	RIGHT	1.3 (0.5)	1.93 (1.11)	1113.0 (34.47)	2838.6 (105.76)
DISTRACTOR	LEFT	-1.4 (0.5)	0.11 (0.33)	1150.2 (38.02)	2773.9 (99.86)
	RIGHT	2.4 (0.6)	0.36 (0.36)	1123.4 (33.10)	3109.7 (122.34)
Factor(s) in the final model			**GROUP:** *F*=5.1, *p*=0.005, *semi-partial R2*= 0.8	**TARGET:** *F*=6.4, *p*=0.01, *semi-partial R2*= 0.8	**DISTRACTOR:** *F*=4.4, *p*=0.03, *semi-partial R2*= 0.8

Figure Caption

Figure 1: Representation of Overlap CIB and graphic copying without CIB, but with poor accuracy of the copy.

Figure 2: Representation of Task-Relevant and Task-Irrelevant Distractor displays (top row) and timing of trial execution (bottom row).

Fig.1

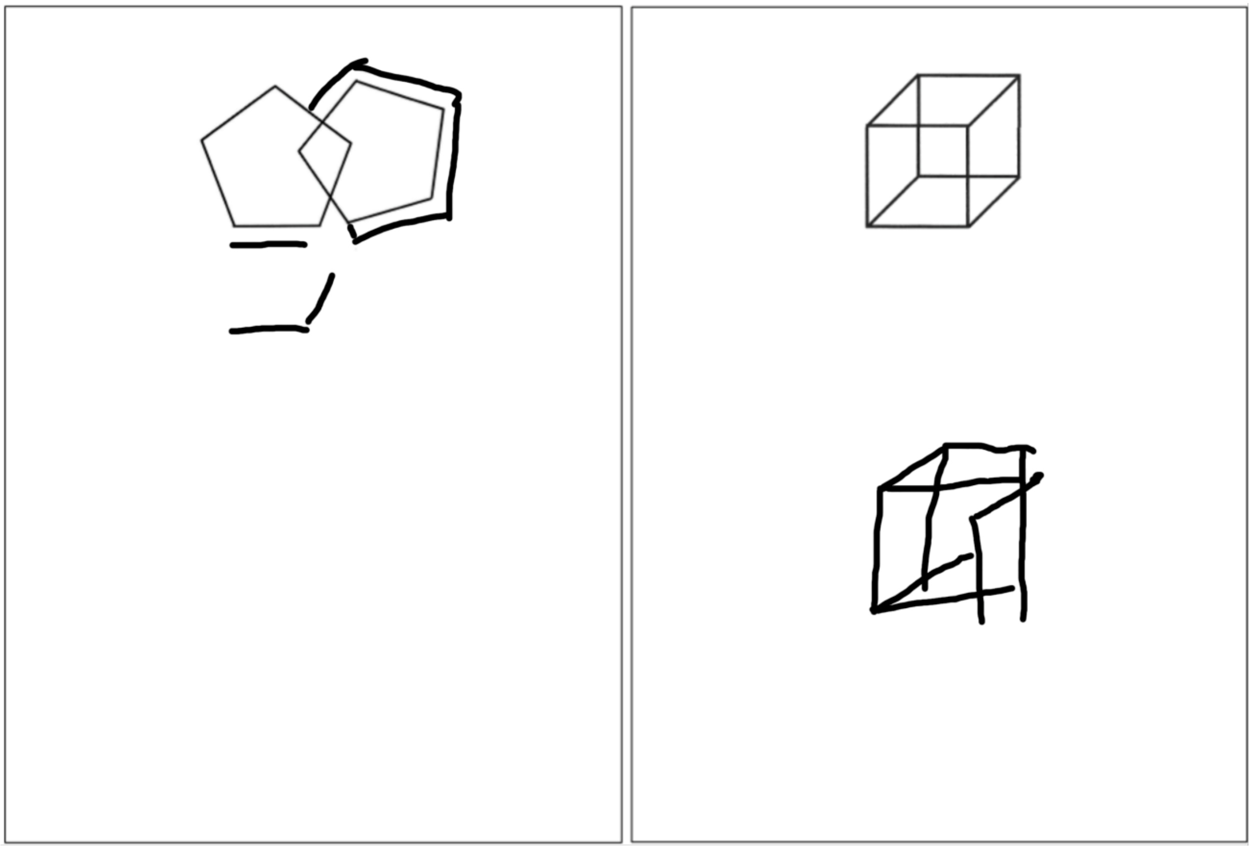
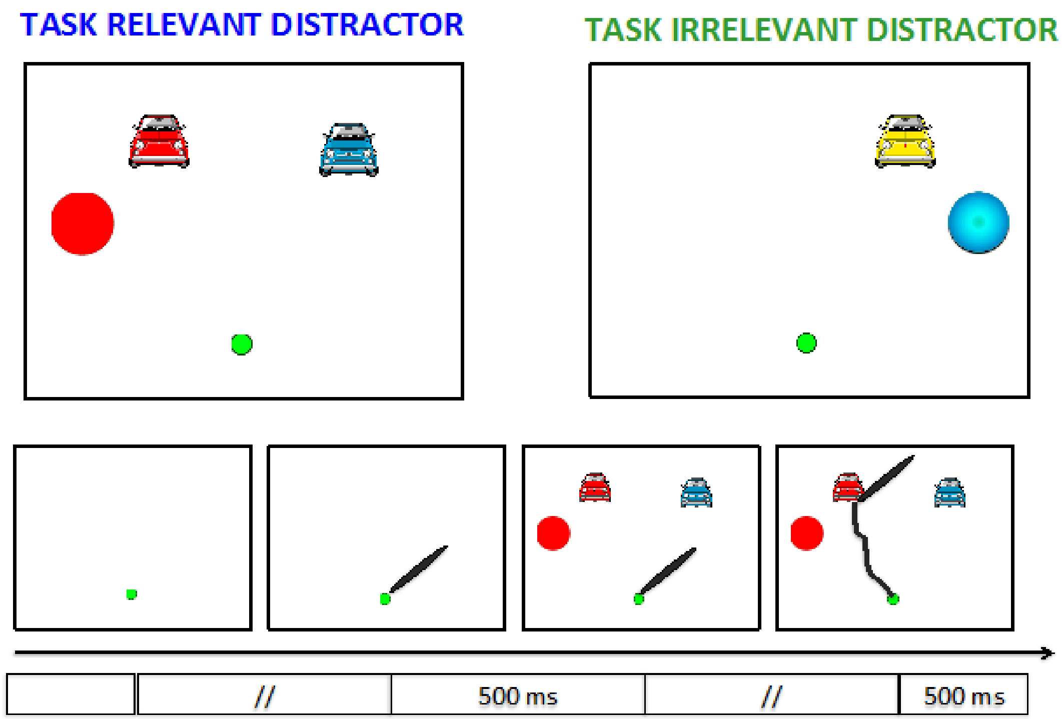


Fig.2



TASK RELEVANT DISTRACTOR
TASK IRRELEVANT DISTRACTOR
//
500 ms
//
500 ms