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Spanish

Children's ability to improve their narratives:

A preliminary study of the relation to Executive Function abilities

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Abstract

Producing narratives where events are explained and the behaviors of the characters are considered through their psychological and epistemic states, requires not only linguistic and pragmatic competences, but also cognitive skills. Previous studies have shown that a short adult-child conversation about the causes of the story events leads children to tell narratives containing more inferential aspects, such as explanations and references to the characters' internal states. However not all children improve the content of their narratives after the conversational exchange.

Executive function skills, in particular cognitive flexibility and inhibition, were considered as possible determinants of this variation.

Participants were 21 French-speaking children aged 7-8 years, attending a Paris public school. Children were confronted with narrative and executive functions tasks. The narrative situation involved telling the experimenter a story based on five wordless pictures interpretable as a story of a misunderstanding between two characters (the *Stone story*), before and after a short conversation focused on the causes of the main events. Cognitive flexibility was assessed by a three-criteria classification task and a local/global figure-matching task; inhibition, by the Animal Stroop test.

Results confirm the positive effect of the short conversational intervention on the narrative content of children's second narrative. They also indicate that variation in children's ability to change is related to cognitive flexibility (measured by criterial changes in the classification task) and to inhibition (measured by response time in the Animal Stroop). These results need however confirmation in a study involving a larger sample and a wider age range.

Keywords: narratives, executive functions, intervention, French-speaking children

INTRODUCTION

Children's abilities to narrate 'good' stories have been found to be positively related to early literacy (e.g., Griffin, Hemphill, Camp & Wolf, 2004; Dobson, 2005; Makdissi & Boisclair, 2006), to reading comprehension and to writing skills in school-aged children (e.g., Dickinson & Tabors, 2002; Oakhill, Cain, & Bryant, 2003; Whitehurst & Lonigan, 1998; Reese, Suggate, Long & Schaughency, 2010). They have been also found to be related to school success (Snow, Burns, & Griffin, 1998), to language development (e.g., Cooper, Collins & Saxby, 1992; Mallan, 1991) and to predict mathematical skills (O'Neill, Pearce & Pick, 2004). Given these far-reaching implications, it is important to understand the conditions and the cognitive skills that allow this competence to be improved or best expressed. This chapter reports data on children's narratives produced before and after a short conversational intervention (SCI) and explores some of the cognitive underpinnings that might be related to children's ability to improve their narratives after the SCI.

Narrative development

Story telling is a discourse activity that requires cognitive, linguistic, discursive, and pragmatic skills. The development of children's narrative competence is a long process whose unfolding varies according to the content of what is to be narrated, the context in which they are produced and, within more controlled settings, on the types of elicitations and tasks required (e.g., Berman, 2004).

This development is seen to start early in rudimentary forms, with children producing their first references to past experiences by replying to their parents' questions or following on their initiatives (e.g., Miller & Sperry, 1988; Sachs,

1983; Veneziano & Sinclair, 1995). Then children produce simple narratives of temporally ordered events of personal experience or of short fictional stories (e.g., Nelson, 1999; Peterson & McCabe, 1991; McCabe & Rollins, 1994). By age 6, for narratives of personal experience, most children provide the *what*, *where* and *to whom* things happened, respecting the temporal sequence of events, and the rudiments of the *macrostructure*, with an initial setting, a complicating event and a resolution (McCabe & Rollins, 1994; Mandler, 1978; Peterson, 1990; Stein & Glenn, 1979). This is not however all there is to a narrative. Another important and central component of storytelling concerns talking about the causes of the events and the emotions, intentions and beliefs of the characters (relating to Labov's 'evaluative component' (Labov, 1972) and to Bruner's "landscape of consciousness" (1986: 14), by which the narrator also takes a stance towards the events). Indeed, although recounting a succession of events provides the skeleton of a story or past experience, it is the narration of the causal network, of the point of view of the characters and/or the narrator, that make the narrative interesting and worth telling to a listener (e.g., Hausendorf & Quasthoff, 1992).

Concerning fictional narratives based on wordless pictures as, for example, the storybook *Frog where are you*, elicited from children of different ages, speaking different languages (e.g., Berman and Slobin, 1994; Strömquist & Verhoeven, 2004), it was shown that pre-schoolers produce mainly descriptive narratives, following the temporal sequencing of events. Around 6-7 years of age children begin to provide causes and reasons for events, an ability that improves progressively until 9-10 years (e.g., Bamberg, 1994; Bamberg & Damrad-Frye, 1991; Berman & Slobin, 1994; Berman, 2004a). At this same age, and for stories children tell on their own (which is different from retelling what was heard just previously), children can also attribute mental states to the characters of the story

(Bokus, 2004; Richner & Nicolopoulou, 2001), but it is only around 8-9 years that most children mention internal states to explain the characters' behaviors (Bamberg & Damrad-Frye, 1991; Berman, 2004a, 2009; Berman & Slobin, 1994), and it is even later that they attribute to a character a false belief about an object or event (Aksu-Koç & Tekdemir, 2004; Bamberg & Damrad-Frye, 1991; Küntay & Nakamura, 2004; Veneziano & Hudelot, 2006).

Promoting children's narrative skills

Several studies have devised procedures aiming to improve children's narratives (see Pesco & Gagné, 2015, for a meta-analysis) and have shown that, on the whole, children can produce more elaborate narratives under certain conditions. For example, when prompted by specific questions, young children can produce narratives that mention more causal relations or more internal states of the characters (e.g., Eaton, Collis, & Lewis, 1999; Shiro, 2003). It should be noted, however, that in these cases, children's narratives were not monologically-produced, but were co-constructed and interrupted by the adults' questions.

Other studies found that children can also improve monologically-produced narratives through intervention procedures. In studies that implemented training sessions held over a relatively long period of time, and in which children were solicited to answer questions about the story events and their causes, or about the emotional states of the characters, post-training narratives contained more explanations than those produced before the training (Lever & Sénéchal, 2011; Peterson, Jesso & McCabe, 1999; Whitehurst et al., 1988). In these studies, however, development and intervention were mingled, and the pre- and post-test conditions were not exactly the same (for example, the stories differed).

In other studies, the intervention procedure was held in a single session (e.g., Silva, Strasser & Cain, 2014; Veneziano, 2010, 2016; Veneziano & Hudelot, 2006, 2009). Silva et al. (2014) showed that children who answered causality questions about the story before narrating it, mentioned more evaluative than children who had answered the same types of questions after they narrated the story. In this study, however, the two conditions were applied to two different groups of children, making it difficult to determine whether individual children could improve the narrative produced before the questions' session. Veneziano and Hudelot (2006, 2009) and Veneziano (2010, 2016) used a within-subject design in which the same child told the same story before and after a short conversational intervention where the experimenter asked the child questions about the causes of the story events. After the short conversation, children's narratives contained more explanations and more references to internal states (that had not been explicitly solicited during the conversation), including attributing a false belief to one of the characters, compared to the story narrated before the intervention. This effect was not obtained when the second story was narrated without participating in the conversation (Veneziano, 2016). This procedure was applied in this study.

Executive functions and improvements in narrative skills

To investigate the role of executive functions in children's ability to improve narrative content after the conversational intervention, we tested children on cognitive flexibility and inhibition. These executive function components were chosen as they seemed particularly relevant for children's ability to change their narrative after having already constructed one. Cognitive flexibility helps children changing mental sets (here, from the first to a second understanding of the story), while inhibition is essential to minimize the effect of a strong competing response (here, the narrative produced before

the conversation) in such a way as to minimally compete with the new understanding of the story that might have been grasped after the conversation.

Several studies have shown that cognitive flexibility and inhibition improve with age and that, particularly cognitive flexibility, continue to undergo further progress during school years (see Best & Miller, 2010 for a review).

This study explores whether executive functions such as cognitive flexibility and inhibition can explain at least in part, the individual variation in children's improvements in story telling observed after participation in the short conversation. This might indeed be the case as narrating a new story, where causality links are added or are considerably changed, involves being able to switch to a new version of the story, changing the viewpoint on it, and to inhibit the interpretation previously constructed. The relation might be a linear one, whereby the level of EF skills predict the magnitude of the progress in children's narrative performance after the short conversation. However, the relation might such that children who do change their narrative after the conversational intervention have higher score on the executive function measures. To throw light on these different possibilities, we performed both correlational analyses and tests of difference (T-test) and of independence (Chi-square test).

METHOD

Participants

Participants were 21 French-speaking children aged 7;1 to 8;1 years (Mean = 7;7; SD = 3 months) attending the second grade of a primary school in Paris. None of the children was reported to have language or cognitive problems.

Material

Narratives

To assess children's narrative skills before and after the short conversational intervention (SCI), we used the *Stone story*, adapted by Veneziano & Hudelot (2006) from a wordless pictured story that appeared in a collection designed for young children (Furnari, 1980). The *Stone story*, used already in previous research (e.g., Veneziano, 2010, 2016; Veneziano & Hudelot, 2006) consists of five pictures with no text (see Appendix 1) meant to represent a story of a misunderstanding between two characters. The first picture sets the stage showing two boys (referred to hereafter as P1 and P2) waving hello to each other from a distance (the 'greeting'). The second and third pictures represent the 'complicating event': the accidental stumbling of P1 on the stone, leading to P1 'pushing' P2 — the source of the misunderstanding by P2 of the behavior of P1 — followed by P2 'pushing back' P1. The fourth picture represents the 'resolution attempt' showing P1 crying and pointing towards the stone. The fifth picture represents 'the resolution' showing P2 helping P1 to get up.

Executive functions

To test *cognitive flexibility*, we used two tasks: a *classification* and a *local/global* task.

For *classification*, we used the material of the classification subtest of the Differential Scales of Intellectual Efficiency (EDEI-R, Perron-Borelli, 1996), consisting of 27 wooden pieces differing in shape (triangles, circles and squares), color (red, yellow and blue) and size (small, medium and big). Children were first asked to put into each of three containers the pieces that go well together. When they had finished, children were asked if there was *another way* to put together the pieces, so that they went well together, and this was repeated if a second classification was performed.

For the other task, we used an adaptation of the *local/global* task (Kimchi & Palmer, 1982; Poirel et al., 2011) consisting in six boards. Each board showed a geometric figure on top (a triangle, a square or a circle) and two other figures below

which presented similarities with the figure on top, either on the basis of the overall shape or of the smaller shapes making up the sides of the overall shape (see Appendix 2).

To test *inhibition*, we used the *Animal Stroop* (Wright, Waterman, Prescott & Murdoch-Eaton, 2003) meant to measure the ability to inhibit a solicited dominant answer. The Animal Stroop consists of three boards containing, each, the pictures of four animals (a cow, a pig, a duck and a sheep), presented several times but in different positions. Each board corresponds to three different conditions: congruent, control-face and incongruent. For all boards, children had to name the animals as fast and as accurately as they could. In the congruent condition, animals are drawn as they are in reality; in the control-face and incongruent conditions, the head and the body didn't match. children were asked to name the *body* of the animal, ignoring its head, which was replaced either by the caricature of a human face or by the face of one of the other animals on the board. Thus, in these two conditions, children need to inhibit one feature, considered dominant (the face, e.g. Johnson, 1993; Quinn & Eimas, 1996), to the benefit of the other feature of the animal (the body).

Procedure

Children were individually interviewed in a quiet room. All interviews were audio and video recorded.

Children were first confronted with the narrative task. The procedure applied here is very close to that used in previous studies (e.g., Veneziano and Hudelot, 2009; Veneziano, 2016). It is a within-subject design allowing to compare the narratives produced by the same child before and after a short conversation. At first, children looked at the five wordless pictures of the Stone story, presented sequentially, one at the time, in

the right order. Once the child was ready to tell the story, the pictures were removed¹ and the child narrated his/her story. After this monological, autonomously-produced, *first narrative*, the experimenter introduced the *short conversational intervention* (SCI) by asking children questions that focused the children's attention on the causes of the four main events of the story, and this while the pictures were again in front of the child. "How come that" or "Why": 1. P1 pushes P2² ('the first push'); 2. P2 pushes P1 ('the second push'); 3. P1 shows the stone ('pointing towards the stone'); and 4. P2 helps P1 to get up ('the reconciliation'). After this SCI, the children were asked to tell the story once again (the *second narrative*). As it was the case for the first narrative, also here the children told the story without having the pictures in front of them.

Then children were presented the Classification task. The experimenter placed the 27 wooden pieces and three containers on the table and asked the child to place into each container the pieces that go well together. Once they were finished, children were asked to justify their choice. All the pieces were then reshuffled, and children were asked to put together the pieces that go well together, but in a different way than what they had done before, again using the three containers. After the justification of their choice, the same procedure was repeated a third time.

When the child finished or if s/he could not find a different way to put the pieces together, the experimenter presented the child the local/global task. In this task, children were first asked to indicate which of the two shapes, pictured below the top figure, best matched the figure above. Then the experimenter asked whether also the other figure could go well with the figure on top. For both pairings, children were asked to justify their response.

¹ The reason for that was to minimize children's attention on the details of the pictures and optimizing the chances to have children talk about non perceptible, inferential aspects of the story.

² Both P1 and P2 were named in the same way as the children had done in their first narrative.

Finally, children were presented with the three boards of the Animal Stroop test and, for each board, they were asked to name the animal (for the congruent board) or the body of the animal (for the control-face and the incongruent boards) as accurately and as fast as they could.

Data analysis

Narrative measures

All children's narratives were transcribed *verbatim* and analyzed by two persons, the first author and a trained assistant according to a detailed manual which included definitions and criteria illustrated by attested examples. The aspects of narratives coded here relate to the narratives' inferential aspects, that is, to those aspects that reflect the interpretations that require making inferences and filling the 'gaps' relative to what is represented in the pictures. Narratives were coded for the attribution of internal states and explanation of events. The analysis applied in this study is an adaptation of analyses performed previously (see, in particular, Veneziano, 2016). The cases of disagreement were discussed and usually resulted in agreed upon interpretations. Below some details about the measures on which results will be reported.

1. The attribution of internal states

All internal states children attributed to the characters were noted. These include *physical* (e.g., being in *pain*), *emotional* (e.g., being *angry*), *intentional* (e.g., *doing on purpose*), and *epistemic* states (including *belief*, *false belief* and the *rectification of the false belief*).

2. The False belief (FB) and the Rectification of the false belief (RFB)

The *false belief* and the *rectification of the false belief* are epistemic states but more complex than just mentioning that a character knows, beliefs or thinks something.

A FB was identified when the children mentioned the physical and/or nonintentional cause of the first push by P1 AND attributed to P2 the belief that P1 had pushed him on

purpose. For example, *'there is one who fell on a stone and pushed his pal; the other believed he had done it on purpose'*.

The RFB was identified when children had P1 explain to P2 that his initial push was not intentional, possibly adding the real reason for it (as, for example, *'he told him that he pushed him because of the stone'*).

Results on the total number of epistemic states and on the FB+RFB are included in the total number of internal states but, for their central importance in the story, will also be reported separately.

2. Explanation of events

All the explanations provided by the children were identified. Three explanations that are central to the understanding of the story as a story if a misunderstanding (the explanation of the first push, of the second push and of the reconciliation) are highlighted by including them in the inferential score, as detailed below.

3. The inferential score

In order to follow more clearly the central changes occurring between the first and the second narrative, an *inferential score* was attributed to each narrative. The *inferential score* (INF) takes into account *five inferential elements* at the same time: three central explanations (of the first push, of the push back and of the reconciliation), the attribution of the FB and of the RFB. The *inferential score* thus provides an *at a glance* representation of children's ability to express the essential inferential elements that make the story meaningful and worth narrating (e.g., Hausendorf & Quasthoff, 1992).

The INF score of a narrative could reach a maximum of 13 points: 7 points for the three central explanations (2 points for each expected explanation and 1 supplementary point if the first push was explained by both physical and non intentional causes; 1 point when other types of explanations were mentioned as, for example, for the pushing back, *'he*

pushes the other back for revenge’); 2 (or 1) points for the attribution of the FB to P2, according to whether the expression contained an epistemic verb or not; 2 (or 1) points for the RFB by P1, according to whether P1 was made to explicitly clarify the physical and/or non intentional reason of the first push, or whether the clarification remained unclear.

For the total number of internal states, of epistemic states, and for the FB+RFB separately, and of explanations, and for the inferential score, we calculated the difference obtained between the second, compared to the first, narrative after the SCI.

Executive Function measures

Cognitive flexibility – Children could score a maximum of 3 points in the Classification task (1 pt for each of the three possible completed classifications), and a maximum of 6 points in the local/global boards (1pt for each board where children could switch from one criterion to the other).

Inhibition – The Animal Stroop was coded for response accuracy and for response time for the incongruent condition (see under ‘material’ above). For response accuracy children could get a maximum of 24 points (1 pt for each animal labeled as expected) For response time, this consisted in the total time employed to label all the animals, and this for each of the boards.

RESULTS

Measures of narrative content

Table 1 shows the mean and the standard deviation for the different aspects of content measured in children’s narratives, before and after the SCI: the total number of internal states, with the total number of epistemic states and of FB + RFB also reported separately, the total number of explanations, and the inferential score.

Table 1 – Mean number and Standard deviation of different measures of narrative content, for the first and the second narratives

			FIRST NARRATIVE	SECOND NARRATIVE
Internal states	Total number	Mean SD	2.48	3.38
			2.42	2.31
	Total number Epistemic states	Mean SD	1	2
			1.38	1.95
	FB + RFB	Mean SD	0.43	0.90
			0.68	0.89
Explanations	Total number	Mean SD	2.19	2.85
			1.72	2.03
Inferential score		Mean SD	3.89	5.38
			3.91	4.57

T-tests for paired samples were applied to these different measures of narrative content, with the directional hypothesis that the measures should be all higher in the second than in the first narrative. Since the hypothesis is directional, the significance level was set at $\alpha = .05$, one-tailed. For the inferential score, an ordinal measure, we performed also the non-parametric test Mann-Whitney³.

All the measures in Table 1 increase in a statistically significant way them significantly increasing between the first and the second narrative. For the total number of internal states (mean gain of +.9), $t(20) = 1.87$, $p < .05^4$; for the total number of epistemic states (including FB and RFB) (mean gain of +.57), $t(20) = 2.74$, $p < .01$ and for FB + RFB (considered in themselves), $t(20) = 2.5$, $p = .01$. Similar results were obtained

³ For variables whose measures are in an ordinal scale, the Mann-Whitney non parametric test for difference was also applied. Results will be reported only if there was a difference in outcome between the parametric and the nonparametric tests.

⁴All the probabilities of this section are all one-tailed

for the total number of explanations (mean gain of +.67): $t(20) = 1.67$, $p = .05$, and for the inferential score (mean gain of +1.57), $t(20) = 1.97$, $p < .05$.

Thus, as in previous studies, also here we find an increase in the inferential content of the narratives after the SCI. This improvement is not limited to the increase in explanations, a result that could be accounted for by the explaining framework set by the SCI, but it concerns also an increase in the internal states attributed to the characters, including epistemic states and FB+RFB when these are considered on their own. As in the other studies, however, if there is an overall effect for the group, there is individual variation in children's ability to improve their narratives after the SCI.

Two subjects were removed because their first narrative contained already the expression of the misunderstanding between the characters (FB and RFB). Among the 19 subjects that were left, children split about even, with 9 children shifting from a no misunderstanding to a misunderstanding story and 10 children who did not change in this sense.

After describing the results on the executive function measures, we will provide analyses exploring whether this individual variation can be accounted for by the children's executive function skills, as they were measured in this study.

Measures of Executive function

Table 2 shows results obtained at the classification and at the flexibility local/global task. For the classification task, it presents the mean and SD of the complete classifications effectuated and for the local/global task, the mean number and SD of boards for which children could shift from one to the other similarity criterion.

Table 2 – Mean number and SD for the two cognitive flexibility tasks:

Classification and Local/global tasks

Classification (range 1 to 3)	Mean	2.24
	SD	0.58
Local/global boards (range 1 to 6)	Mean	4.38
	SD	2.44

In the Classification task, only 14% of the children could not produce at least a second different classification. The majority (58% of the children) could change the criterion only once and 28% could change it twice, completing correctly all the three possible classifications. The classification criteria they privileged were shape and color, while size was picked up least often.

For the local/global task, the majority of the children (67%) could match the figures on both local and global aspects in 5-6 boards; 14% could do that for a few boards only and 19% couldn't match the figures on more than one aspect, be it according to local or to global aspects.

Table 3 presents results obtained on the Animal Stroop task on each of the three boards (congruent, control-face and incongruent stimuli), for the number of expected denominations and the time employed to complete each board. The last line indicates the difference between the results obtained on the incongruent and those obtained on the control-face boards (response accuracy and time). Like the incongruent board, also the control-face board involves a conflict between the label by the body and that by the head, but the incongruent board requires an additional inhibition since the response to be inhibited also concerns an animal, which is not the case for the control-face board. For this reason, this difference is considered to reflect the additional inhibition required to deal with the semantic conflict created by the fact that the two parts belong to the same semantic domain (Wright et al, 2003).

Table 3 – Mean number and SD of correct responses and total time to complete the Animal Stroop task for each type of board: congruent, control face and incongruent

Board Type	Mean SD	Number of Expected labels	Time from start to completion
Congruent	Mean	23	27.4
	SD	1.38	8.3
Control face	Mean	23.1	30
	SD	1.22	8.6
Incongruent	Mean	21.24	40.9
	SD	2.32	13.3
Incongruent minus control-face	Mean	-1.8	10.8
	SD	2.6	9.7

Consistent with earlier results, also here we found that children provide more expected responses to the congruent and control-face boards than to the incongruent board. The former boards also take, on average, less time to be completed, suggesting that the incongruent board, where the conflict between the head and the body activates the same semantic domain (animals), requires a higher level of inhibition than the control-face (where the conflicting responses concern two different semantic domains: human and animal) and the congruent condition, where there is no conflict at all.

Relation between changes in narrative content and executive function skills

In what follows we present different analyses to explore whether there is a relation between the ability improve the narrative content of the second story (produced after the SCI) and executive function skills, as they were measured here.

First, we performed linear correlations between the magnitude of the changes in each of the five measures of narrative content described above, and the scores obtained in each

of the executive function skills. Results of the Pearson (for the time of the Stroop and the total number of internal states, epistemic states and FB+RFB considered on their own, and explanations, which are all on an interval scale) or of the Spearman test of linear correlation (for all the other cases where at least one of the measures is on an ordinal scale) are presented in Table 4. Correlations were performed on the 19 subjects whose first narrative didn't contain the expression of the misunderstanding between the characters and its resolution

Table 4. Correlation coefficients between measures of EF and changes in narrative content between the first and second narrative.

EF measures Changes in:	Classifica- tion	Local/global boards	Stroop Incongruent : Number of expected responses	Stroop Incongruent : Response Time	Stroop Inc minus control: Response Time
Tot Internal states	ns	ns	ns	ns*	ns*
Tot Epistemic states	ns	ns	ns	ns*	ns*
FB + RFB	ns	ns	ns	ns*	ns*
Tot Explanations	ns	ns	ns	ns*	ns*
Inferential score	ns	ns	ns	ns	ns

* Pearson correlation test; when not specified, the nonparametric Spearman was applied

No statistically significant linear correlations were found between measures of executive function and changes in the five measures of narrative content.

The second analysis performed to explore the relation between changes in narrative performance and measures of cognitive flexibility and inhibition, was to consider whether the two groups of children, those who changed their stories towards a story of misunderstanding and those who did not, had different EF scores. To this effect we applied the t-test to the different measures of EF: number of different classifications completed, number of boards for which a change in criterion was obtained for the local-

global task, and number of expected responses and time of response for the Animal Stroop, for the incongruent board and for, for response time, the difference between the incongruent and the control-face boards. Also in these analyses we did not include the two children who already expressed the FB and the RFB in the first narrative. Given that the hypothesis is directional (the group of children who improved their second narrative have a higher score in EF measures), the one-tailed probability was applied and was set at $\alpha=.05$.

The two groups of children (N=9, for those who changed their narrative; and N=10 for those who did not change but could) were significantly different in cognitive flexibility (as measured by the number of classifications completed: $t(17) = 1.83$, $p < .05$, one tailed, but not by the local/global task) and in inhibition (as measured by the response time needed to complete the incongruent Animal Stroop: $t(17) = 1.77$, $p=.05$; but the difference between the groups did not reach statistical significance for the number of expected responses on the incongruent board: $t(17) = 0.89$, $p=.19$, nor for the time difference between the incongruent and the control-face boards: $t(17) = 0.92$, $p=.018$).

So, even though the sample is small and need further confirmation, these results point to the existence of some relationship between the ability to change one's previously constructed story and some EF skills relating to cognitive flexibility and to the ability to inhibit a previously activated schema. This point will be taken up in the discussion.

Finally, we performed chi-square tests of independence (corrected for continuity) to check whether the distribution of children who changed or did not change their narrative was different as a function of each of the EF scores. We built 2x2 contingency tables with change in narratives as one variable, and EF measures showing change on the other (at least one classification change; a number higher than the mean for boards in the

local/global task, for number of expected responses and time to complete the board for the incongruent Animal Stroop, and, for the latter, the difference in the time employed to complete the incongruent and the control-face boards).

The one result that was clearly statistically significant is the relation between changes in narrative content and inhibitory control, measured by the difference between the time employed to complete the control-face and the incongruent boards (above or below the mean): $\chi^2 (1, N=19) = 6.26, p=.011$. The other results were not statistically significant. For the local/global boards and for the number of expected labels for the Stroop, the distribution between the two groups of children is similar. However, for the number of completed classifications and for the time employed to complete the incongruent board of the animal Stroop⁵, there is a clear tendency for children who changed their story to perform better in these two tasks. In both of these cases, had we doubled the number of cases in the same distributional profile, both relations would have been statistically significant.

Thus, in both of the last two analyses, some measures of cognitive flexibility and of inhibition appear to be good candidates for explaining at least part of the variance observed in children's ability to change their initial story.

DISCUSSION

This first study on the possible determinants of the variation in children's ability to change their previously constructed story, after the short conversational intervention focused on the causes of the events, has first confirmed results of previous, larger scale, studies on the positive effects of the SCI on children's narratives. Indeed, even with a relatively small sample, we find an improvement in the inferential content of the

⁵ For classification: $\chi^2 (1, N=19) = 1.34, p=.24$; for response time in the incongruent board: $\chi^2 (1, N=19) = 2.63, p=.10$

narratives children tell after the SCI. As a group, children produce stories that contain more explanations, more overall internal state attributions, and more epistemic states, and talk more about the misunderstanding and its resolution through the expression of the false belief of P2 and of the rectification of the false belief by P1. Moreover, the second narratives' inferential score – which is a composite measure of the expression of the central explanations, of the misunderstanding and of its resolution, increases significantly as well.

As in other studies, also here we found however that not all children improved the inferential content of their second narrative. Indeed, excluding from the sample the two children who expressed the misunderstanding and its resolution already in their first narrative, only about half of the remaining children who could improve their narrative, did so.

In this study we explored whether some Executive Function skills relating to cognitive flexibility and to the ability to inhibit a previously activated schema, could be related to this observed variation. No linear correlation between the degree of the changes in narrative content and the size of the EF scores, were found. We did find however significant differences between the group of children who changed their first narrative and the group who did not, with respect to cognitive flexibility, measured by the number of different classifications completed, and to inhibition skills, measured by the difference between the time employed to complete the control-face and the incongruent. For cognitive flexibility, no differences were found between the groups on the ability to find an alternative match between the shapes on the local/global task, and, for inhibition, on the number of expected responses for the incongruent board of the Animal Stroop. The third analysis, which tested whether the children in the two groups distributed differently with respect to each of the different EF measures, found a significant relation between changes in narrative content and inhibitory control, measured by the 'inhibition cost'

(Wright et al., 2003, namely, the difference between the time employed to complete the incongruent and the control-face board. Also here, we found a tendency, for children who changed the narrative interpretation, to perform better on cognitive flexibility (classification task) and on inhibition (the time employed to complete the incongruent board), but given also the smallness of the sample, these relations did not reach the set significance level ($\alpha=.05$).

Thus, in both of the last two analyses, some measures of cognitive flexibility and of inhibition appear to be good candidates for explaining at least part of the variance observed in children's ability to change their initially-provided story.

It is interesting to note here that for all the four measures of EF considered, EF skills appear necessary, though not sufficient, to produce the change in the second narrative. Among the children who had low scores in EF measures, only a minority produced a central change in their second narrative: This is 0% for children who produced no different classification, 22% of those who took a time longer than the mean to complete the incongruent board, 33% for children who gave a number of expected responses lower than the mean in the incongruent board of the Animal Stroop, and 40% of the children who, on the local/global task, matched the shapes on both criteria on a number of boards lower than the mean.

One may ask why, for cognitive flexibility, classification is better related to the ability to change narrative content than the local/global task? This might be the case because the classification task presents more similarities with the abilities required to change the narrative after the SCI. Indeed, performing a new classification and telling a different story after the SCI, both require that children break up what was just constructed. Instead, in the local/global task, children do not have to choose between alternative solutions, but have to see the two solutions and consider both as possible, without replacing or deconstructing the solution they had previously come up with.

For inhibition, it is interesting to note that only the time required to complete the task shows a relation to the ability to change the story. Response time seems indeed to reflect a more direct measure of the ability to rapidly inhibit an inappropriate response, while producing the expected response may reflect more the ability to focus on one part of the picture (the body of the animal) to the neglect of the other (the head), but this procedure could give rise to the correct responses after some back and forth process from one aspect to the other, ending up, through the repetition of the task, in a certain automatism of the task, whereby the child learns to pay attention only at the body of the animal, minimizing the role of the response based on the head.

Results of this study are quite encouraging suggesting that the variance observed in children's ability to reinterpret their narrative in terms of a mental problems between the characters after the SCI, has clear relations with measures of cognitive flexibility and inhibition. This study should however be considered only a first step into the understanding of the variance in the effectiveness of intervention procedures in children's ability to improve their narratives. For a clearer understanding of this relation, future research needs to expand the sample to include a larger number of participants and a wider age range. Moreover, also the executive function measures will need to be expanded to include additional tests of cognitive flexibility, such as Simple Simon (Jones, Rothbart, & Posner, 2003) and the Dimensional Change Card Sort t (DCCS) tests (Zelazo, 2006).

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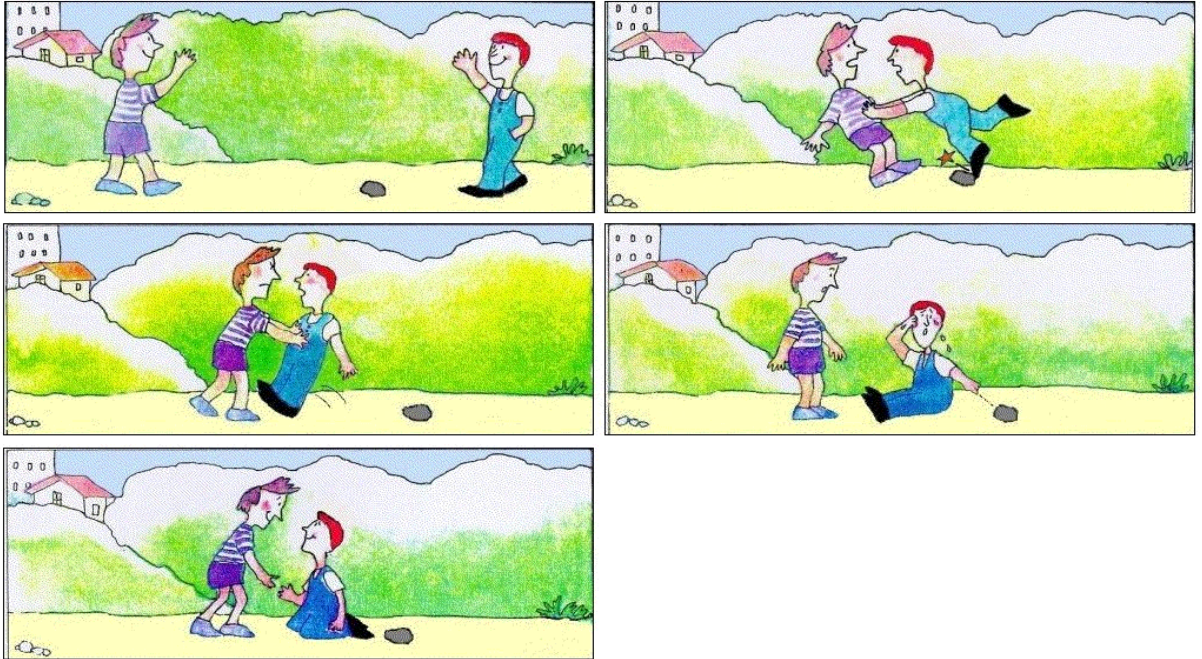
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APPENDIX 1

The Stone Story

(Furnari, 1980; adapted by Veneziano & Hudelot, 2006)



APPENDIX 2

One of the boards from the *Local/global* task
(Kimchi & Palmer, 1982; Poirel et al., 2011)

