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RESEARCH REPORT

The development of episodic future thinking in middle childhood

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Abstract The ability to imagine future events (episodic future thinking—EFT) emerges in preschoolers and further improves during middle childhood and adolescence. In the present study, we focused on the possible cognitive factors that affect EFT and its development. We assessed the ability to mentally project forward in time of a large cohort of 135 6- to 11-year-old children through a task with minimal narrative demands (the *Picture Book Trip task* adapted from Atance and Meltzoff in Cogn Dev 20(3):341–361. doi:10.1016/j.cogdev.2005.05.001, 2005) in order to avoid potential linguistic effects on children's performance. The results showed that this task can be used to assess the development of EFT at least until the age of 8. Furthermore, EFT scores correlated with measures of phonological short-term and verbal working memory. These results support the possibility that cognitive factors such as working memory play a key role in EFT.

Keywords Cognitive development · Mental time travel · Episodic future thinking · Working memory

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Introduction

Human beings can travel through time, not physically, but mentally. At will, they might re-experience events from their own past and imagine potential future scenarios through the mental projection of the self back and forward in time. This complex ability has been termed *mental time travel* (MTT; Suddendorf and Corballis 1997, 2007; Tulving 2002) and is implemented in two systems anatomically and functionally related to each other: *episodic memory* (EM) allows one to relive past events (Tulving 1972, 2005) and *episodic future thinking* (EFT) allows one to imagine potential future scenarios (Atance and O'Neill 2001).

Some studies have investigated the potential interconnections between EM and EFT. Buckner and Carroll (2007) have focused on the prospection component of MTT, suggesting that self-projection could be the crucial common process of both EM and EFT: the shifting perception of oneself from the immediate environment to an alternative future one. According to this view, self-projection depends on memory systems because past experiences are the foundation on which alternative perspectives and imagined future scenarios are built. From a different point of view, the *Constructive Episodic Simulation* hypothesis by Schacter and Addis (2007; see also Schacter et al. 2012) posits that not only the projection of the self but also other skills might be necessary for MTT. Indeed, both the retrieval of past episodes and the generation of future scenarios require also

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an active process of scene construction that relies on the modulation of information about past events stored in EM into novel scenarios. In line with these hypotheses, there is some neuroimaging evidence suggesting that remembering the past and generating potential future scenarios recruit a common brain network in prefrontal, medial temporal and parietal areas (Addis et al. 2007; Hassabis et al. 2007; Okuda et al. 2003; Schacter et al. 2007).

All in all, it appears that EM and EFT share some important features. However, it is undisputable that there are also some critical differences between them. Indeed, if remembering past episodes requires the ability to reconstruct elements of an already experienced event, the simulation of potential future scenarios relies on a novel recombination of episodic information into an imaginary event. This process makes the generation of future events more difficult than the reconstruction of past events and supports the hypothesis that future event simulation may require additional cognitive and neural systems that are not involved in past episodic recall (Addis et al. 2007; Hill and Emery 2013; Okuda et al. 2003; Schacter et al. 2017; Szpunar et al. 2007; for a discussion see Schacter et al. 2012). For example, Okuda et al. (2003) reported greater activity in left parahippocampal areas during tasks assessing EFT than in tasks assessing EM and related such result to the fact that thinking about future events requires a significant reactivation of episodic experiences that need to be recombined in order to construct a meaningful future episode. Differences in neural activity between EM and EFT have also been reported by Addis et al. (2007) who found greater neural activity in bilateral prefrontal cortices (i.e., right frontopolar and left ventrolateral areas) when participants imagined future events than when they were remembering past events. This result further supports the idea that EFT at least in part requires different processes than EM. The prefrontal cortex is involved in a number of processes, including executive functions such as the ability to shift between tasks and mental states, monitor and update the ongoing flow of information, and inhibit undesired responses or behaviors (Miyake et al. 2000). This means that prefrontal areas are likely implicated in the control of behavior (D'Esposito and Postle 2015), one of the functions attributed to the so-called central executive component of the multiple-component model of working memory proposed by Baddeley and Hitch (1974; see also Baddeley 2012). In line with what has been proposed by Hill and Emery (2013), the recruitment of prefrontal regions in EFT tasks might, at least in part, depend on the involvement of working memory in generation of future episodes. Substantial evidence shows that working memory is associated with cognitive and language development (Riva et al. 2017; Marini et al. 2017a), and studies on college students (Hill and Emery 2013), as well as young and older adults (D'Argembeau et al. 2010; Zavagnin et al. 2016), support the possibility that at least one aspect of working memory, which is verbal working memory, might also play a major role in the construction of future events. In light of these considerations, in the present study we aimed at exploring the possible contribution of verbal working memory to EFT, focusing on the ontogenetic development of this ability.

An increasing number of investigations have explored the behavioral development of EFT in childhood (for a review see: Hudson, Mayhew and Prabhakar 2010; Prabhakar, Coughlin and Ghetti 2016). Most of the investigations have focused on early childhood, showing that the ability to predict future events emerges along with the ability to recall personal past events between the ages of 3 and 5 (e.g., Atance and Meltzoff 2005; Atance and O'Neill 2005; Suddendorf and Busby 2005). For example, Atance and O'Neill (2005) showed that 3-year-olds begin to refer to future states. However, Atance and Meltzoff (2005) reported that at this age the ability to generate future episodes is still not fully fledged, as the performance of such children is significantly lower than that of older children aged 4–5 years. Similar results have been reported by Busby and Suddendorf (2005) where 3-, 4- and 5-year-old children were asked to report something that they had done the day earlier and something that they would do the next day. Only 30% of 3-year-olds provided accurate answers reporting an event that had occurred the day before the experiment and could report an event that would occur the day after the experiment. Interestingly, there was no difference between the levels of performance for 4- and 5-year-old children, with both age groups providing accurate responses more than 50% of the time (see also Hayne et al. 2011).

The ability to envision future events is subject to further development in middle and late childhood (Abram et al. 2014; Coughlin et al. 2014; Gott and Lah 2014; Wang et al. 2014; Wang and Koh 2015). For example, Wang et al. (2014) examined whether children ranging from 7 to 10 years of age exhibited an actual fully grown competence in future and past constructions similar to that of adults. Children were interviewed about temporally near and distant past and future events (see Han et al. [1998] for details). Their descriptions of the past were similar to adults' memory descriptions. However, they had more difficulties in simulating future events than constructing past ones. Even more interestingly, Wang et al. (2014) observed that children relied more on general knowledge relative to episodic information in mental time travel than adults. Coughlin et al. (2014) examined future prospection and episodic memory in 5-, 7- and 9-year-old children and in adults. Participants were asked to provide narratives and introspective judgments about their experience of mentalizing past and future events. Analyses of the speech samples revealed that the ability to generate full-fledged episodes in both past and future event narratives (see Piolino et al. [2003, 2007] for details) improved during middle childhood. Interestingly, although both future prospection and episodic memory seem to progress during such a period, Coughlin et al. (2014) found that the construction of future events was more difficult than the construction of past ones. This finding adds further support to the idea that envisioning the future may require additional skills also from a developmental point of view. Similarly, Gott and Lah (2014) analyzed EFT in children ranging from 8 to 10 years of age and adolescents ranging from 14 to 16 years of age and found some differences between past and future events. Indeed, past events contained more episodic details than future ones, suggesting that the generation of future events was more difficult than recalling past events.

Overall, converging evidence suggests that EM contributes significantly but not exclusively to EFT and that other cognitive skills are involved in the simulation of future events. As previously mentioned, verbal working memory appears to be one of the most important skills in these processes. In light of these considerations, the present study aimed at investigating the developmental trajectory of EFT and its relationship with the development of verbal working memory in a wide group of 135 school-aged children ranging from 6 to 11 years old and with typical development. Following previous investigations (e.g., Hill and Emery 2013; Zavagnin et al. 2016), we hypothesized that verbal working memory would significantly affect EFT. However, contrary to previous studies (e.g., Coughlin et al. 2014; Wang et al. 2014) that have explored the ability to envision future scenarios in middle childhood, we assessed EFT using a behavioral rather than a strictly narrative task. We hypothesized that this choice would allow us to minimize the narrative requirements of the task and therefore control for potential narrative difficulties related to the young age of the children (e.g., Marini 2014). Furthermore, Gaesser et al. (2011) have explicitly suggested that language abilities might interfere with the assessment of MTT abilities in tasks that rely heavily on language (e.g., autobiographical interviews). For these reasons, in the current study the assessment of EFT was performed through an adaptation of the *Picture Book Trip task* by Atance and Meltzoff (2005). This is a task with minimal narrative demands that was originally developed for the assessment of EFT in preschoolers. Since in the original study by Atance and Meltzoff (2005), which focused on children aged 3 through 5, a ceiling effect was not observed, we hypothesized that such a task would also be useful to test EFT in older children. As a final goal, the current study aimed to determine the specific contribution that verbal working memory makes to EFT.

Materials and methods

Participants

A cohort of 135 Italian-speaking children (61 males: 45.2%) aged between 6 and 11.06 years (mean 8.43; standard deviation 1.54) participated to the study. Their level of formal education ranged from 1st to 5th grade of primary school. All of them performed within normal range on a series of tasks aimed at assessing their levels of nonverbal intelligence (Raven's Progressive Matrices; Raven 1938) and their verbal short-term and working memory (Non-Word Repetition subtest of the Prove di Memoria e Apprendimento per l'Età Evolutiva [PROMEA, Vicari 2007]; the forward and backward digit span's subtests of the Wechsler Scales [Wechsler 1993]). Furthermore, they had average school performance. In a preliminary interview, their teachers confirmed that they had normal cognitive and learning development. According to school records and parents' reports, none of them had a known history of psychiatric or neurological disorders, learning disabilities, hearing or visual loss. All parents gave their informed consent to the participation of their children in the study and in the treatment of the data.

These children formed three age groups matched for nonverbal IQ level (as measured by administering the Raven's Progressive Matrices) [F (2, 132) = .009, p = .991] and gender [X^2 (2, N = 135) = 3.099, p = .212] (see Table 1). The first group was made of 43 children (15 males: 34.9%) aged between 6.0 and 7.10 years (mean 6.48; standard deviation .48) who attended the first and second year of primary school. Their nonverbal IQ ranged from 90 and 130 (mean 104.65; standard deviation 12.02). The second group was formed by 47 children (25 males: 53.2%) aged between 8.0 and 9.08 years (mean 8.58; standard deviation .49) who were attending the third and fourth year of primary school. Their IQ ranged from 90 to 130 (mean 104.47; standard deviation

Table 1 General data of the three age groups of participants

	Group 1 (n = 43)	Group 2 (n = 47)	Group 3 (n = 45)
Age	6.48 (.49) Range: 6.00–7.10	8.58 (.49) Range: 8.00–9.08	10.13 (.28) Range: 10–11.06
Education	1th–2nd grade	3rd–4th grade	5th grade
% of males	34.9%	53.2%	46.7%
IQ (Raven)	104.65 (12.02) Range: 90–130	104.47 (10.17) Range: 90–130	104.78 (11.68) Range: 90–130

Data are expressed as means, standard deviations and ranges where appropriate

10.17). The third group was formed by 45 children (21 males: 46.7%) aged between 10.00 and 11.06 years (mean 10.13; standard deviation .28) who were attending the fifth year of primary school. Their IQ ranged from 90 to 130 (mean 104.78; standard deviation 11.68).

Methods

Assessment of verbal working memory

All participants were administered tasks aimed at assessing their phonological short-term and working memory (digit span forward and backward subtests of the Wechsler Scales [1993] and the Non-Word Repetition Task of the PROMEA; Vicari 2007). Importantly, Gathercole et al. (2004) showed that these three measures loaded on a single factor in a two-factor model (namely verbal working memory) and, when included in a three factors model, loaded on two different factors: one (including digit span forward and Non-Word Repetition) possibly involved in the passive storage component of phonological working memory and the other (digit span backward) likely implicated in the active manipulation of the information running in the phonological loop. In the digit span forward task, the child is asked to repeat in the correct order sequences of digits spoken by the examiner. The digits range from 1 to 9 and vary in length. The number of lists correctly repeated by the child represents the digit span forward score. In the digit span backward task, the child is asked to repeat each sequence in the reverse order. Finally, in the Non-Word Repetition Task of the PROMEA the child is required to repeat a list of 40 *non-words* that the examiner must read aloud hiding her/his labial movements. Each correct answer is assigned 1 point for a maximum of 40 correct repetitions.

Assessment of EFT: The Picture Book Trip task

In the *Picture Book Trip task* (Atance and Meltzoff 2005) each child was shown, one at a time, 4 colored pictures illustrating different destinations for a trip: a waterfall, a sandy desert with a long road, a mountain view and a rocky stream. They were asked to describe each picture's contents and then were explicitly asked to imagine themselves in the scenarios at a future time point. For each of the four target pictures (e.g., *waterfall*), the experimenter showed three different photographs, each representing a specific item that could be: (1) useful in the target scenario (i.e., *watercoat*); (2) completely useless in that scenario and not related to the scene (i.e., *money*), (3) semantically primed by the scenario (i.e., *rocks*). Children were asked which of these items they would need to bring with themselves. After choosing the selected item, they were invited to motivate their answers, explaining how the selected item would be useful in that scenario anticipating potential future needs. Children received 1 point for each item that had been correctly chosen (Identification Score, IS). One additional point was assigned whenever they could adequately motivate their choice, showing that they had been able to project themselves to meet a potential future need (Motivation Score, MS). It is noteworthy that, in the original version of the task, the Motivation Score was derived from a linguistic analysis of the motivation produced by the child for his/her choice. Namely, the child received 1 point only if (s)he included in the motivation (1) a future term (e.g., *going to*, *will*, *when*) and (2) words that explicitly referred to internal feelings. However, in Italian future states can be expressed also with present tense (e.g., "Domani vado a casa" "*Tomorrow, I go home"). For this reason, in our study, in order to avoid a potential linguistic bias, the motivation received 1 point if it correctly explained the choice regardless of the linguistic form used by the child. An EFT Composite Score (EFT_CS) was derived by summing up these two scores (max 8).

Results

Analysis of verbal working memory skills in the three groups

The group-related differences on the assessment of the children's cognitive skills were analyzed with a series of one-way ANOVAs with group as fixed factor and the three cognitive measures (i.e., scores at the digit span forward and backward subtests of the WISC and performance on the Non-Word Repetition task) as dependent variables. The level of statistical significance was set at $p < .017$ (.05/3 dependent variables) after Bonferroni correction for multiple comparisons. Effect sizes were calculated as partial eta squared. When a significant difference was found, post hoc Tukey's test was performed in order to explore more in detail the group-related differences. As shown in Table 2, the three groups differed on their performance at the Non-Word Repetition subtest of the PROMEA with a moderate effect size [F (2, 109) = 4.32, $p < .016$, $\eta_p^2 = .073$]. A significant group-related difference was also found at the digit span forward [F (2, 132) = 12.14, $p < .001$, $\eta_p^2 = .155$] and backward [F (2,132) = 29.22; $p < .001$, $\eta_p^2 = .307$] subtests of the WISC with large effect sizes. As for the Non-Word Repetition task, the post hoc analysis showed that the youngest group performed worse than the second group ($p < .041$), whereas the latter one did not differ from the oldest group ($p = .780$). In the digit span forward, the post hoc analysis revealed that the youngest group of children performed worse than the children of the second ($p < .003$) and third ($p < .001$) age groups who, in turn, had a similar performance ($p = .298$). As for the digit span backward, the post hoc analysis showed

Table 2 Cognitive profile of the three age groups of participants

	Group 1	Group 2	Group 3	Post hoc
Digit forward*	6.16 (1.38) Range: 2–9	7.15 (1.38) Range: 5–11	7.58 (1.37) Range: 4–10	1 < 2 = 3
Digit backward*	3.00 (1.00) Range: 0–5	4.17 (.96) Range: 2–6	4.84 (1.41) Range: 2–8	1 < 2 < 3
Non-Word repetition*	31.77 (4.27) Range: 19–38	33.32 (3.77) Range: 25–40	34.31 (3.06) Range: 28–40	1 < 2 = 3

Data are expressed as means (standard deviations) and ranges

*When group-related differences were significant after Bonferroni correction for multiple comparisons ($p < .017$)

Table 3 Performance of the three age groups on the test assessing episodic future thinking

	Group 1	Group 2	Group 3	Post hoc
Episodic future thinking Composite Score*	6.33 (1.91)	7.38 (1.07)	7.49 (1.41)	1 < 2 = 3
Identification Score*	3.37 (.87)	3.77 (.52)	3.78 (.70)	1 < 2 = 3
Motivation Score*	2.95 (1.13)	3.62 (.61)	3.71 (.73)	1 < 2 = 3

Data are expressed as means (standard deviations) and ranges

*When group-related differences were significant after Bonferroni correction for multiple comparisons ($p < .017$)

that the youngest group of children scored lower than the children of the second ($p < .001$) and third ($p < .001$) age groups who, in turn, performed differently ($p < .015$).

Analysis of EFT in middle childhood

The group-related differences on measures assessing the children's skills in EFT were analyzed with a series of one-way ANOVAs with group as fixed factor and the three measures (i.e., EFT Composite Score, Identification Score and Motivation Score) as dependent variables. The level of statistical significance was set at $p < .017$ (.05/3 dependent variables) after Bonferroni correction for multiple comparisons (see Table 3). Effect sizes were calculated as partial eta squared. When a significant difference was found, post hoc Tukey's test was performed in order to explore more in detail the group-related differences.

A statistically significant difference was found in the EFT Composite Score ([F (2, 134) = 8.16, $p < .001$, $\eta_p^2 = .110$). Namely, the post hoc analyses showed that the youngest group scored significantly lower than children of the second ($p < .003$) and third ($p < .001$) groups who did not differ from each other ($p = .938$). The ANOVA showed group-related differences on the Identification Score ([F (2, 134) = 4.67, $p < .011$, $\eta_p^2 = .066$). In this case, the post hoc analyses showed that younger children scored lower than children in the second ($p < .025$) and third ($p < .022$) groups who did not differ from each other ($p = .996$). A significant difference was also observed for the Motivation Score ([F (2, 134) = 10.47, $p < .001$, $\eta_p^2 = .137$). Again, the Tukey's post hoc analysis showed that youngest children scored lower than children in the second ($p < .001$) and third ($p < .001$) groups who did not differ from each other ($p = .855$).

Relation between verbal working memory and episodic future thinking

The relationship between measures of phonological short-term memory (as measured with digit span forward and Non-Word Repetition), verbal working memory (as measured with digit span backward) and the EFT Composite Score in the participants was first investigated using Pearson product–moment correlation coefficient. As shown in Table 4, a significant positive correlation was found between the EFT Composite Score and both digit span forward ($r = .180$; $p < .037$) and backward subtests of the WISC ($r = .219$; $p < .011$) and with the Non-Word Repetition task ($r = .253$; $p < .007$). This relation was further explored by performing a multiple regression analysis that included the EFT Composite Score as dependent variable and the measures that correlated with this variable (i.e., digit span forward, digit span backward and Non-Word Repetition) as predictors. This analysis showed that the three predictors explained 9.6% of the variance ($R^2 = .096$, F (3, 111) = 3.81, $p < .012$).

Table 4 Correlation matrix presenting the results from Pearson product–moment correlations across all participants

	Digit span backward	Non-Word repetition	EFT Composite Score
Digit span forward	**$r = .394$; $p < .001$**	**$r = .275$; $p < .002$**	**$r = .180$; $p < .037$**
Digit span backward	–	$r = .123$; $p < .217$	**$r = .219$; $p < .011$**
Non-Word repetition	–	–	**$r = .253$; $p < .007$**

EFT Composite Score: episodic future thinking Composite Score

Significant correlations are reported in bold

Among these, only the performance at the Non-Word Repetition task significantly predicted the EFT Composite Score ($\beta = .20$; $p < .037$).

Discussion

The main purpose of the present study was to investigate the ability to envision potential future events in school-aged children with typical development and to determine the role played by verbal working memory on EFT. Children were administered one behavioral task with minimal narrative demands aimed at evaluating their proficiency in projecting themselves forward in time. As we hypothesized, the results showed that such a task can be used at least up to the age of 8 years and that the participants' EFT skills correlated with measures of verbal working memory. Furthermore, performance on a Non-Word Repetition task predicted children's performance at the task assessing EFT (EFT Composite Score).

As a first point, we would like to focus on the development of EFT skills in middle childhood. In the *Picture Book Trip task*, 6- and 7-year-olds correctly chose fewer items than older children (Identification Score) and often failed to motivate their choice with respect to children from 8 years onward (Motivation Score). Consequently, their EFT Composite Score was lower than that achieved by older children. Participants aged 8–11 years scored similarly on all of these measures with many reaching ceiling level. Hence, basic skills for EFT emerge by 7–8 years of age with further development into adolescence. Interestingly, a recent investigation showed the usefulness of the *Picture Book Trip task* for the assessment of EFT skills in a large cohort of children with autism spectrum disorder (ASD) who still performed significantly lower than control participants at the age of 11 years (Marini et al. 2017b). Since individuals with ASD have been reported to exhibit impairments in narrative processing (e.g., Barnes and Baron-Cohen 2012; King et al. 2014; Jolliffe and Baron-Cohen 2000), the use of tasks that minimize narrative requirements in the assessment of EFT, such as the one developed by Atance and Meltzoff (2005), is highly advisable. More generally, the results from our investigation are partially in line with similar findings by Abram et al. (2014) who showed that between the ages of six and eight children may still experience difficulties in episodic autobiographical memories (i.e., remembering events experienced in the past) and imagining potential future events. Obviously, this result cannot be interpreted as evidence of the fact that such functions do not continue their development later on. By administering an adapted version of the Child Autobiographical Interview (Willoughby et al. 2012) to a group of 14 children aged between 8 and 10.11 years and 15 adolescents aged between 14 and 16.11 years, Gott and Lah (2014) have shown that adolescents produce more details than children while remembering past events and imagining future ones. Furthermore, Abram et al. (2014) described a general progression in autobiographical skills at least until the age of 21 years. Overall, then, the results from the current investigation and those from the studies by Abram et al. (2014) and Gott and Lah (2014) support the possibility that the basic skills necessary to imagine future events are still not fully fledged until the age of 8, but also that they will be further developing throughout adolescence.

Interestingly, the EFT scores of all three groups in the present study correlated with measures of verbal working memory. This leads to a second issue. The children's performance on tasks assessing EFT skills mirrored that observable on measures of phonological short-term and verbal working memory. Children in the first group (i.e., 6–7 years old) obtained lower scores than older participants at both digit span forward and Non-Word Repetition tasks that reflect the functionality of the phonological loop component of working memory. Importantly, however, on the digit span backward task (which reflects the functionality of the processing component of working memory) 6- and 7-year-olds scored worse than 8- and 9-year-olds who, in turn, scored worse than 10- and 11-year-olds. These findings are consistent with those reported in the literature about the development of working memory in childhood and adolescence (e.g., Siegel 1994). Indeed, in a comprehensive study assessing working memory skills in 4- to 15-year-old participants, Gathercole et al. (2004) showed that three of the main systems of working memory (i.e., the phonological loop, the central executive and the visuospatial sketchpad) shared a linear increase from 4 years through adolescence and did not show any significant alteration in their reciprocal interrelationships from 6 years onward. This suggests that working memory is in place by the age of 6 but continues to develop throughout middle childhood. As mentioned earlier in this discussion, in our study the increase in both phonological short-term and verbal working memory performance correlated with measures assessing episodic future thinking. This association represents an unexplored issue in middle childhood, as, to the best of our knowledge, the few studies assessing the role of working memory in EFT have usually focused on older participants (e.g., college students [Hill and Emery 2013], or young and older adults [Zavagnin et al. 2016]). This result confirms that the ability to generate future episodes relies at least in part on the development of phonological short-term and verbal working memory: EFT is based on the ability to extract episodic memories from long-term declarative memory, but the systems of phonological working memory may play a significant role in keeping these memories active before a coherent potential new episode can be generated. At the same time, however, we would like to stress that the measures of working memory employed in this study accounted only for 9.6% of the total variance observed in the EFT Composite Score. This leaves open the possibility that the prefrontal activations observed in neuroimaging studies (e.g., Addis et al. 2007) for the construction of potential future episodes might also reflect other skills. In other words, EFT may rely not only on verbal working memory but also on other components of working memory (i.e., visuospatial working memory and the episodic buffer) as well as on additional cognitive functions. Recent evidence suggests that executive functions such as the ability to inhibit irrelevant responses may also play a role in EFT. For example, D'Argembeau et al. (2010) suggested that in young adults executive processes might support the strategic aspects needed to recombine autobiographical details into future scenarios. However, this is still a largely unexplored issue in children that needs to be analyzed in future studies (see, for example, Hanson et al. 2014).

In conclusion, the present study suggests that EFT is the product of a complex interplay of several factors not limited to verbal working memory that continues to improve in middle childhood. Within this developmental trajectory, the age of 8 seems to be an important milestone, as children can adequately pass a task for the assessment of EFT such as the one used here. Further research is required to deepen our understanding of the complex nature of EFT mechanisms, their cognitive substrates and respective developmental trajectories.

Author Contributions For the specific concerns of the Italian Academy, we specify that: FF planned the study, adapted the original tests, supervised the recruitment of the participants and wrote the paper; AC, SN and IA contributed to the adaptation of the original tests, recruited the participants, administered the tasks and wrote the paper; RM recruited the participants, administered the tasks and contributed to the interpretation of the data; SV and GV supervised the recruitment of the participants and the administration of the tasks and contributed to the interpretation of the data; AM supervised the recruitment of the participants and the administration of the tasks, ran the statistics and wrote the paper.

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