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DEVELOPMENT OF CONTENT RECALL IN DIFFERENT NARRATIVE TEXTS[1]

In the reported study, 60 subjects (50 children from 6- to 10-year-olds and 10 adults) were tested in an experimental situation of immediate written recall based on two orally presented stimuli (narrative texts), differentiated by the feature known vs unknown. Subjects were asked to listen to the story before writing it. The results show, first, that the effects of primacy and recency are less salient in the recall of the known narrative text than the unknown. We attribute this finding to the existence of different mnemonic registers. Secondly, from a developmental perspective, we show that the young subjects present a stronger influence of serial effects. Preoccupied by the coherence of the stories, the older subjects recall not only the beginning and the end, but also the middle of the stories.

Theoretical background

Mandler & Johnson (1977), Glenn (1978) and Stein & Glenn (1979) conducted several experimental studies of narrative recall on the basis of the story grammar model that they elaborated. These studies of recall of the different components of story grammar (frame/ initial event/ internal response/ attempt/ consequence/ reaction) yielded convergent findings. In length and number of episodes, the ability to recall a story improves with age but, importantly, the shape of the recall curve remains similar across age groups (6-year-olds and 9-year-olds compared with adults). That is, some narrative constituents are better recalled than others in all age groups. Specifically, the beginning and the end are better recalled than the middle. Interestingly, these results mirror the findings on word recall. A large body of literature, following Ebbinghaus' research (1885, cited in Lieury, 1975) has addressed the issue of word recall as function of word position in a list (Murdock, 1962;

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Lieury, 1975 ; Kekenbosh, 1994). The experimental design usually consists in presenting a list of words to each subject at a speed of one word per second. Subjects are then asked to recall freely (that is, in any order they wish) as many items as they can. The percentages of each word recalled is calculated according to its position on the list, how many times the first word in the list is recalled, how many times the second is recalled, and so on ... These results highlight the effect of serial position and, more precisely, the effects of primacy and recency in two very different situations: recall of narrative texts and recall of isolated words. In other words, there is a kind of "U-shape" to the curve of recall.

Several explanations have been proposed for this finding.

Associationist theory

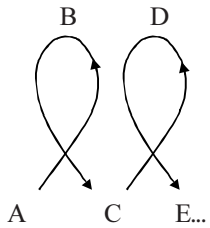
The first explanation is proposed by the associationist theory, which argues that during training, associative links between elements are created and stored in memory. Researchers in this field examined the conditions underlying these linkages and the memorization and omission of elements. They devised different experiments to test these effects, some of the most relevant of which are outlined below.

For example, Jost's rule states that each element in a word list plays the role of stimulus for the next element, which is the response to the preceding one, and the stimulus for the next one. This phenomenon is referred to as an "inter-item link" (Kekenbosch, 1994). These relationships lead to a chain, as follows.

> "When the material is presented as a list, the simplest associative structure allowing for its acquisition should be a chain. [...] the associationnists elaborated a technique on the basis of the corresponding associative structure, the serial learning consisting in learning an ABC type list ... in the right order, and most often by anticipation : the experimenter gives A and the subject is expected to give B as a response. Then, the experimenter provides the response B, and the subject is supposed to produce C... Apparently, A is used as a stimulus for the response B, which in turn is used as a stimulus for the response C, and so on" (Lieury, 1975: 41).

In line with these ideas, I propose that associations between the different elements of a list can be represented as "loops", as shown in Figure 1:

Figure 1. Graphic representation of the associationist theory



Lieury (1975) stresses that this hypothesis of "double function" (B plays the dual role of response for A and stimulus for C) does not explain the fact that in a recall task, the elements at the beginning and the end of the list are better recalled. As a result, the associationists have shown that a new link has an inhibiting effect both on the creation of

the next link and on the previously created links. This inhibition is due to proactive and retroactive interferences as discussed in the next section.

Retroactive and proactive interferences

In learning, transfer effects[1] are unilateral (that is, learning of A (learning of B). The reason is that learning B, which follows A, cannot affect the learning of A, which is already completed when B is being learnt. On the other hand, learning of B can interact with the "memory" of learning of A just as learning of A can affect the "memory" of learning of B. Such interactions are measured by testing the recall of A and B. Two well-known tests account for the effects of these interactions (Tables 1 and 2)

Table 1: Task measuring the effects of retroactive interference

	Phase 1	Phase 2	Phase 3
Exp. Gr.	learning of A	learning of B	recall of A
Cont. Gr.	learning of A	–	recall of A

If the results show that the recall of A is poorer in the experimental group compared to the control group, there is retroactive interference. The term "retroactive" is used because the interference is due to the effect of a following task on recall of the preceding task. Retroactive interference is the first cause of forgetting (Lieury, 1975). This is the most frequent and commonest cause of omission: forgetting a name, a phone number or a movie is caused by the many acquisitions of other names, other phone numbers, other movies, that have occurred in the interim.

Table 2: Task measuring the effects of proactive interference

	Phase 1	Phase 2	Phase 3
Exp. Gr.	learning of A	learning of B	recall of B
Cont. Gr.	–	learning of B	recall of B

By contrast, if recall of B is poorer in the experimental group, interference is said to be "proactive", that is the converse.

In sum, forgetting may be the result both of following tasks (retroactive interference) and of previous tasks (proactive interference).

Now, this kind of "U-shaped curve" consistently displays a foreshortened right arm (Lieury, 1975), so that the interference phenomena are insufficient to explain this asymmetry. Looking for an explanation for this observed difference between the first and last

[1] „When two learning experiences follow each other, many interactions between them happen. At the acquisition level, the simplest case, the first apprenticeship can improve or decrease the efficiency of the second apprenticeship: these effects are called positive or negative transfer" (Lieury, 1975: 52).

elements of a word list, Murdock (1962) argues that the shape of the curve mirrors the mobilization of different mnemonic registers.

Mobilization of different mnemonic registers

The last words to be processed are still in short-term memory and thus, are more vulnerable compared with the first words, which are already stored in long-term memory.

Murdock (1962) reached this conclusion on the basis of the following experiment. As in the usual recall task, subjects were asked to recall words that were presented in a word list. In addition, and before the recall, the experimenter inserted a distracting activity: subjects were asked to count backwards for a short time. The results showed that recall of the first words on the list is not affected by the distracting activity, whereas recall of the last words is significantly reduced.

The study presented here applied a similar methodology to children's recall, not of words, but of narrative texts.

Method

Subjects

Sixty subjects participated in the study: 50 children ranging in age from 6 to 11, and an adult control group of ten subjects.

Procedure

These 60 subjects participated in two sessions, each following the same procedure: preparation, writing, and metalinguistic interview. During the preparation phase, the experimenter asked subjects to listen to an audio-recorded story. During the writing phase, the subjects were asked to recall the story they had just heard. The metalinguistic interviews consisted of asking subjects questions about the texts they had produced.

Materials

The stories used as stimuli were, during week 1, *Little Red Riding Hood* (the [+ known] story -referred to below as LRRH) and, during week 2, a story entitled *Dan, the Little Canadian Hunter* (the [- known] story, referred to as DAN). It was established in advance that subjects had no previous knowledge of the [- known] story, in contrast to LRRH. Comparability of the two texts was carefully checked to ensure that both display the same number of narrative components (orientation, complication and solution), the same number of narrative subcomponents (essential propositions), the same number of explicit markers of causal semantic relationship, the same number of total words and of content words (open class lexical items), and so on.

Hypotheses

Three hypotheses were tested for serial effects.

First, primacy and recency effects were predicted to be less salient in the recall of the [+ known] text for the following reasons: on the one hand, the saturation of the "loops" system (A is stimulus for B, which is both response for A and stimulus for C) will be more rapidly reached in the [- known] condition. Because subjects have no previous knowledge of the

story, they cannot anticipate the importance of this or that association, and thus pay equal attention to both. On the other hand, according to the theory of mobilization of different mnemonic registers, in the [+ known] story, all the parts of the familiar story are expected to be equally stored in long-term memory. Thus, all the parts are predicted to be equally recalled. In contrast, the story of DAN should display strong primacy and recency effects.

The second prediction is developmental: these effects should be more salient in the children's productions than in the adults'. The mature subjects should recall all the parts of the story equally so as to ensure textual coherence.

Thirdly, the differences between the [+ known] and the [- known] texts should decrease with age. In other words, recall schemas in the adult control group should be similar for both texts.

Coding

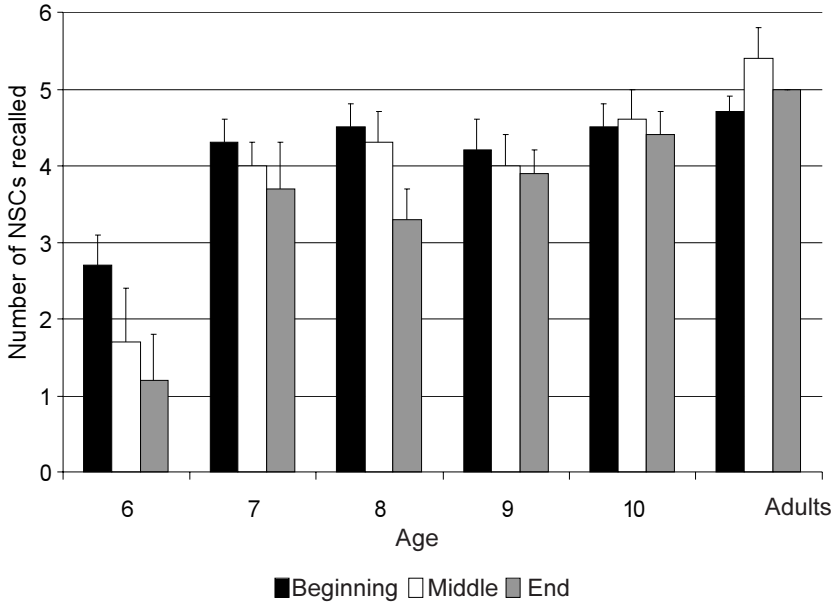
The 120 texts obtained were divided into narrative subcomponents (referred to as NSC) on the basis of independent judgements of 30 undergraduate students who were asked to extract the elements they judged essential for the story. Any story element listed by half or more of the students was defined as a NSC for purposes of this analysis. On the basis of these judgements, both texts were divided into 16 NSCs.

Table 3. NSCs in LRRH

I	LRRH should go to visit her grandmother
II	LRRH should go through the forest in order to see her grandmother
III	LRRH meets the wolf
IV	LRRH tells the wolf that she is going to her grandmother's
V	The wolf's trick about the paths
VI	The wolf arrives at the grandmother's
VII	The wolf imitates LRRH's voice
VIII	The wolf eats the grandmother
IX	The wolf, disguised as the grandmother, takes her place in the bed
X	LRRH arrives at her grandmother's house
XI	The wolf imitates the grandmother's voice
XII	LRRH does not recognize the wolf
XIII	The wolf eats LRRH
XIV	The hunter hears the wolf snoring
XV	The hunter frees LRRH and her grandmother
XVI	The wolf dies

Then, the 16 NSCs were divided into three categories according to their positions in the text: beginning, middle, or end. The beginning includes the first five NSC, the middle, the next six, and end, the last five. Thus, although this was not planned *a priori*, the middle part obtained one NSC more than the beginning and the end. Therefore, if the middle part should be less well-recalled, the results would be of a high validity, since they go against hypothesis 1.

Graph 1. Mean number of NSCs recalled in terms of beginning, middle and end and standard deviation as function of age in LRRH



Graph 2. Mean number of NSCs recalled in terms of beginning, middle and end and standard deviation as function of age in DAN

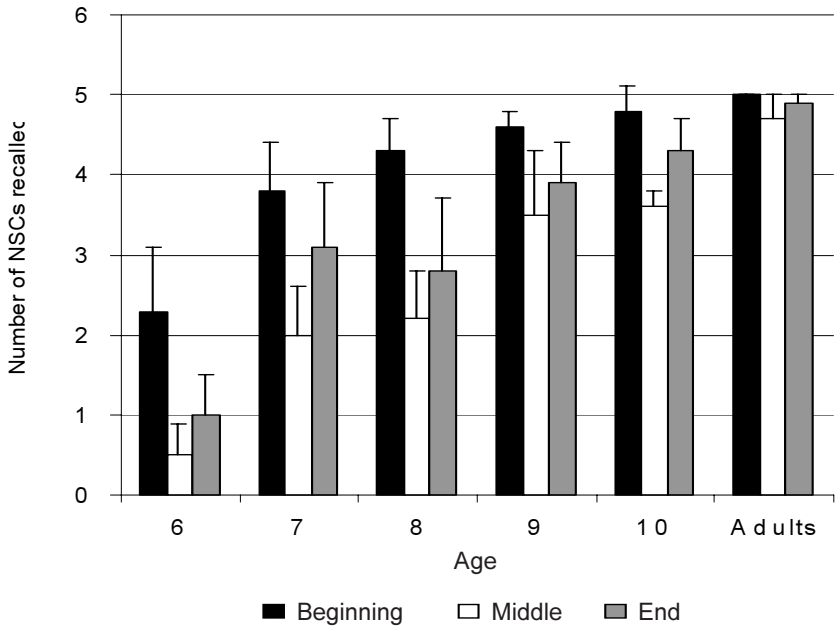


Table 4. NSCs in DAN

I	DAN's decision going to hunt
II	DAN meets a rabbit
III	DAN doesn't succeed in killing the rabbit
IV	A little indian appears
V	The little indian asks DAN for a fox's skin
VI	DAN meets a fox
VII	DAN doesn't know that the animal is a fox
VIII	DAN teaches the fox how to lay traps
IX	DAN comes back to check the first trap
X	The fox moves the biggest trap
XI	A porcupine falls into DAN's trap
XII	DAN releases the porcupine
XIII	The porcupine reveals to DAN the true identity of the fox
XIV	DAN falls into the trap which has been moved by the fox
XV	The fox releases DAN
XVI	The fox proposes to DAN to be a "living pillow"

Results

Distribution of recall of NSCs as corresponding to beginning, middle or end of the text yields very different profiles in terms of text familiarity [+/- known].

Table 5. Mean number of NSCs recalled in terms of beginning, middle and end, standard deviation and percentile as function of age

Text	Age		Beginning				Middle				End		
	(Years)	N	SD	Percentile		N	SD	Percentile		N	SD	Percentile	
				10éme	90eme			10éme	90éme			10éme	90éme
LRRH	6	2,7	0,9	1,5	4	1,7	1,4	0	3,5	1,2	1,2	0	3
	7	4,3	0,6	3,5	5	4	0,6	3	5	3,7	1,2	2	5
	8	4,5	0,7	3,5	5	4,3	0,9	3	5,5	3,3	0,8	2,5	4,5
	9	4,2	0,9	3	5	4	0,9	3	5,5	3,9	0,7	3	5
	10	4,5	0,7	3,5	5	4,6	0,9	3,5	6	4,9	0,6	3,5	5
	Adults	4,7	0,4	4	5	5,4	0,8	4	6	5	0	5	5
DAN	6	2,3	1,7	0	5	0,5	0,9	0	2	1	1	0	2,5
	7	3,8	1,3	2	5	2	1,2	1	4	3,1	1,7	0,5	5
	8	4,3	0,8	3	5	2,2	1,3	1	4	2,8	1,8	0	5
	9	4,6	0,5	4	5	3,5	1,6	1	5	3,9	1,1	2,5	5
	10	4,8	0,6	4	5	3,6	0,5	3	4	4,3	0,8	3	5
	Adults	5	0	5	5	4,7	0,6	4	5,5	4,9	0,3	4,5	5

Text

These diagrams show that recall according to the three categories "beginning", "middle" and "end" has a significant effect on the number of reconstructed NSC in both texts [+ known] and [- known]. This is significant in LRRH ($F(2.162) = 6.598$; $p = .001$) as well as in DAN ($F(2.162) = 22.187$; $p < .0001$). But this does not mean the existence of serial effects in both texts. If one isolates the variable of text and neutralizes the variable of age, the following pattern emerges:

Figure 2. Mean number of NSCs recalled at beginning, middle and end in LRRH, all age groups merged

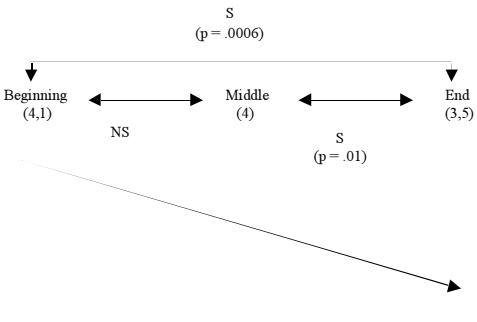
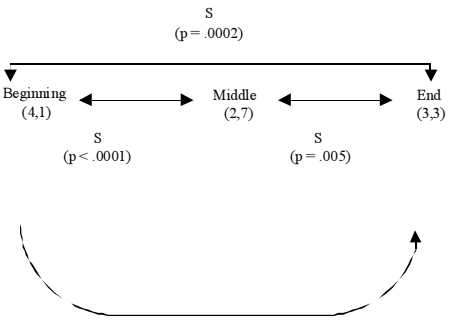


Figure 3. Mean number of NSCs recalled at beginning, middle and end in DAN, all age groups merged



The figures show that in the text [- known], the "shorter right-arm U-shape" described by Lieury (1975) and related to primacy and recency is very apparent and the values of p in Figures 2 and 3 show this effect to be highly significant.

From an associationist perspective, in the course of listening - and therefore of understanding - subjects who knew that they would have to recall the narration, detected and memorized the connections between its different elements.

However, as noted this "loop-shaped" system inevitably leads to a saturation phenomenon and, as a result, the creation of new connections after a while has an inhibiting effect on later connections (proactive interference). It was also noted that the interference hypothesis must be regarded as coupled with the process of mobilizing different mnemonic registers, which occurs during the tasks of immediate recall: if the beginning of the story has already been integrated into long-term memory, the end is still present in short-term memory.

It may seem surprising to think of the end of DAN as being still present in short-term memory when one considers the length of the text to be recalled. But during the experiment itself, I noticed that, unlike LRRH. children did not start the writing task immediately after listening to the tape-recording. This observation is corroborated by metacognitive comments in answer to the question "how did you manage to write the most important things?":

EDM (9 years-old)

ben euh j'ai pensé a l'histoire que tu nous avais donnée la et euh j'ai ++ je me suis souvenu je me suis d'abord souvenu et puis j'ai écrit ce que je retenais

[Well I first thought about the story you gave to us and I ++ I remembered I first remembered then I wrote down what I recalled]

It thus appears that subjects took advantage of this time interval in order to think about the content that they had to put into words and then, when they began to write, a few seconds after the end of the tape, the end of the story was clearly still held in short-term memory. Various experiments have in fact demonstrated that short-term memory is only a few seconds long, and cannot be thought of in terms of minutes (Lieury, 1975). In my opinion, in the situation of recalling DAN, both these factors combine to yield a recall in the shape "shorter right-arm U". These observations provide strong support for the conclusions of earlier linguistic and psycho-cognitive studies.

Interpretation of the results of the LRRH story is much trickier. Insofar as the subjects know the story before they listen to it during the preparatory stage, one might have expected that the beginning, middle and end of the narration would be as well recalled as the last, because they are all integrated in long-term memory. This would be consistent with the first hypothesis, which suggests that the two auditory media considered at the different stages of the narrative framework would be differentially recalled. In fact, this is not the case, since the end is significantly less well remembered than the beginning and the middle.

One could propose that serial effects combined with the feature of [+ known] highlight the difficulties associated with graphic-motor activity. However, recall that figures 2 and 3 were presented for all age groups together. Besides, even if the subjects already knew the story, they had to listen to it once again during the experiment, which explains the particularly developed beginnings of all the stories. This kind of graphic or notational behavior might be due to the fact that the beginning - already present in long-term memory since the story is already known - is reinforced in memory because of the primacy effect. As a result, subjects begin the task by rewriting the story in the minutest detail, whilst at the same time paying great attention to the actual activity of writing. This in turn suggests that the further the subjects go into the story, the more sustained is the attention required for the writing activity. This in turn means cognitive overload and saturation, which affect the writing process and cause children to perform their task somewhat carelessly.

To recapitulate, it would appear that when the linguistic material that needs to be reconstructed is of an unknown nature, processes of recall will conform to the serial effects theory, while the task of reconstructing a known story in writing from beginning to end demonstrates the difficulties due to the non-automation of graphic-motor activity.

Further, recall rates for the three phases of the story by the variable of [+/- known] shows that the beginnings and ends of both stories were recalled in a similar way (no significant differences were observed). On the other hand, the proportion of recall displays a clearly significant difference as concerns the central part of the story ($p < .0001$).

Age

Consider, next, differences of recall as a function of age. Results of these analysis are presented below for the two texts separately. These analyses test the second hypothesis, according to which serial effects should be more salient among younger than older subjects.

The LRRH story

Examination of recall of the LRRH story by age reveals two groups of behaviors: one group of 6-, 7-, 8- and 9-year-olds, and another of 10-year-olds and adults. The children in the first group in fact recall the beginning of the story better than the middle, and the

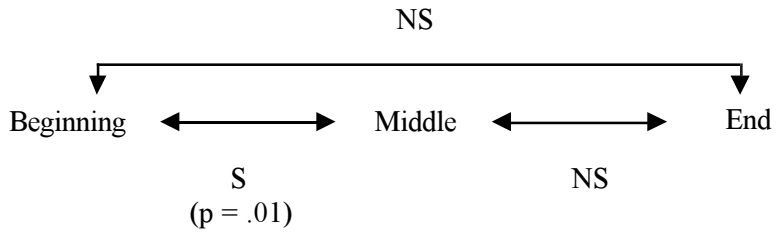
middle better than the end. This suggests that graphic-motor activity is not immune to association serial effects and the feature of [+ known], that is the 6, 7, 8 and 9 year-old children write a lot at the beginning of the story, but do not succeed in maintaining this level of writing activity to the end. In contrast, by age 10, when graphic-motor activity is totally automated, it is immune to this type of association.

The 10-year-old children and adults behave differently. The adults recalled the middle ($p = .0006$) and end ($p = .04$) of the story much better than the beginning. The 10 year-old subjects behave similarly (although the differences are not significant) because they are, too, more adept than the younger children at recalling the middle of the story as opposed to the beginning. These figures can be interpreted as follows: as long as the subjects are not too overwhelmed by the burden of the graphic-motor activity - if they manage to write as much at the beginning as at the end - they pay attention to the story-action (its middle episodes). The beginning of the LRRH story, like any narrative, sets the scene and presents the characters, describing the roles they will play during the story (NSC I to NSC V). From NSC VI on (when the wolf arrives at the grandmother's), the action moves faster, creating the core of the unfolding plot.

The DAN story

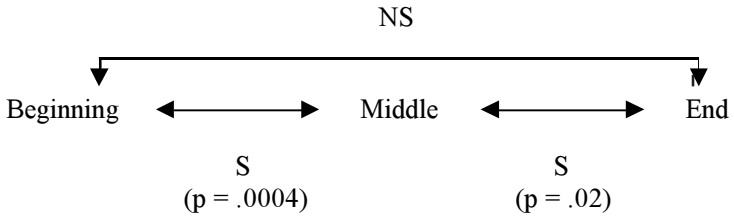
In contrast to LRRH, an analysis of DAN does in fact allow us to pinpoint clear developmental stages. All the subjects, from the 6-year-old children through to the adults, display a U-shaped curve as discussed in section 1. Figure 2 above shows that all age groups display a shorter left-arm U. Again, however, significance tests allow us to split the population into three groups: 6-, 7-, 8- and 9-year-olds vs 10-year-olds vs adults. For the youngest subjects, the beginning is significantly better reconstructed than the middle ($p = .004$ for the 6-year-olds, $p = .009$ for the 7-year-olds, $p = .002$ for the 8-year-olds and $p = .04$ for the 9-year-olds). However, in none of these age groups is the middle or the end recalled significantly better or worse, as shown in Figure 4:

Figure 4: Statistical comparison between beginning, middle and end in DAN at stage 1 (6/7/8/9 year-olds)



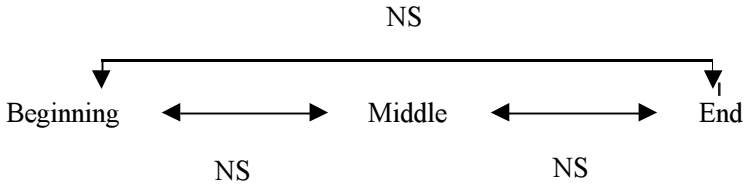
Among the 10-year-olds, the beginning is significantly better recalled than the middle ($p = .0004$), but data for this age group indicate that the end is also significantly better reconstructed than the middle ($p = .02$):

Figure 5: Statistical comparison between beginning, middle and end in DAN at stage 2 (10 year-olds)



There do not appear to be any significant differences in the ways in which the three passages of the story are reconstructed by adults (even if they do show primacy and recency effects):

Figure 6: Statistical comparison between beginning, middle and end in DAN at stage 3 (Adults)



These findings indicate that children start adopting "adult-like behavior" from the age of 10 in this respect. The scores for this age group correspond to a transitional stage between the youngest children and the adults. The 10-year-olds' improvement in their recall of the final NSC shows that this precedes an improvement in recall of the middle NSC.

In spite of lack of serial effects by age in recall of the [+ known] LRRH, my developmental hypothesis is confirmed by these effects in the case of DAN. In the case of LRRH, it was pointed out that the combination of the [+ known] feature with the serial effects demonstrates the non-automation of the graphic-motor activity in the 6, 7, 8 and 9 year-old subjects, and an increase in attention to action for the 10-year-olds and adults. In contrast, in DAN, serial effects are apparent for the whole range of subjects. Further, differences in recall of the various parts of the story (beginning vs middle vs end) confirm the hypothesis according to which primacy and recency effects are more salient in younger children, while the older subjects manage to reconstruct all the essential NSC in accordance with the course of events, without the intervention of any serial effects.

Text and age

The figures in Graphs 1 and 2, as well as earlier observations, enable us to validate the third hypothesis. The adults are in fact the only group that show no significant differences in the recall of the various parts. It would thus be worth while to add more age groups between the 10-year-olds and the adults to show at precisely what age this development occurs.

Conclusions

The results presented in this article show that recall of a known narrative text does not involve the same cognitive activities as recall of an unknown text. In a familiar story, subjects must manage the "flow" of their writing in order to avoid too great attention to detail at the beginning and too little at the end, while in the latter, they need to focus on activation of the content of the story itself.

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