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Expressing Coreference in French: Cognitive Constraints and Development of Narrative Skills

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This study looks at how coreference is expressed under various oral production conditions and at various stages of development. Seven- to 11-year-old children and adults told "silent" comic strip stories involving two characters to a same-age peer. The stories varied as to: (1) the frame presentation mode, (2) the links between events across frames, and (3) thematic continuity. The results showed that, (1) in general, all speakers marked increasing referent givenness (the 7-year-olds and adults less so than the 11-year-olds), (2) arbitrarily placed picture sequences led to a greater number of markers of increasing referent givenness than ordered sequences (which made it easier to put the information into story format), and (3) speakers were more inclined to "tell the story" when the frames were shown all at once (on the same page) than when they were presented in booklet format (one frame per page). The manipulation of the production conditions turned out to be an effective way of revealing speaker competence. In step-by-step encoding where the pictures were discovered one at a time, 7-year-old children exhibited a greater tendency to describe each frame as an independent entity, 11-year-old children always marked increasing referent givenness, and adults maintained coreference in a more flexible manner by varying the markers used to express referent givenness. The viewing of all frames at once before encoding provided support for the expression of emerging narrative skills. This condition enabled the 7-year-olds to no longer describe the pictures independently, promoted the marking of increasing referent givenness between the ages of 7 and 9, and pointed out the age (9 years) when the speakers began to mark coreference as a function of how the story ended.

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The given/new opposition is a universal principle in the organization of discourse. Although its means of expression varies across languages (Ariel, 1988, 1990, 1991), cross-language comparisons have pointed out systematic links between the cognitive status (given/new) of referents and the corresponding linguistic forms in each referential system (Gundel, Herberg, & Zakarski, 1993). For example, using a pronoun (including demonstratives) always requires the referent to be activated in memory, and definite articles always require a single, identifiable referent. Forms that signal high referent accessibility (i.e., when the addressee's attention is focused on the corresponding item) are phonetically minimal (unstressed pronouns, clitics, zero anaphora) and offer little semantic information for identifying the referent. Whenever a referent has been introduced into a discourse and is mentioned again later, the speaker can choose among the range of expressions offered by the language to mark the current degree of accessibility. In doing so, he/she marks the existence of a referential identity relation (coreference) among the linguistic expressions he/she uses as the discourse unfolds.

Coreference can be achieved by anaphora or by other forms of back-referencing (Charolles, 1987; Corblin, 1983, 1995; Ziv, 1994). In linguistic terms, anaphoric references are defined as forms whose concept signified or significatum is not instantiated (it has no referential value, but is a variable in the mathematical or algorithmic sense of the term). To be instantiated, the concept signified must be related to a referent, also called the "antecedent" or the "controller," depending on the author (Adam, 1990; Berrendonner & Reichler-Béguelin, 1988; Charolles, 1987, 1990; Corblin, 1995; Reichler-Béguelin, 1987). From a cognitive standpoint, the semantic explicitness of the chosen anaphoric expression improves the accessibility of the antecedent for the addressee. Gernsbasher (1989, 1991) expressed this as a principle: the more explicit the anaphora, the more the antecedent stands out, and the easier it is for the addressee to efficiently and rapidly eliminate all other potential candidates. Thus, as Berrendonner and Reichler-Béguelin (1989) stressed, in an anaphoric relationship, two distinct types of identity relations can be established. When the antecedent is in the same sentence as the anaphor, the slots are coinstantiated within the sentence (example a below). When the antecedent is not in the same sentence, several patterns can occur. Either the antecedent is in another sentence (example b), or it is the outcome of an inference-making process (example c). In the latter case, the inference may be based on verbal cues, like **il**$_1$ (**he**$_1$) in example c, or on pragmatic cues, like **il**$_2$ (**he**$_2$).

(a) "Le dragon sait qu'**il** est le plus fort."
(The dragon knows **he**'s stronger.)
(b) "Le dragon est malade. **Il** ne mange plus."
(The dragon is sick. **He** has stopped eating.)

(c) "Atreyu ouvrit la porte. Un dragon attendait. **Il**$_1$ referma la porte et battit en retraite mais **il**$_2$ ne le vit pas."
(Atreyu opened the door. A dragon was waiting. **He**$_1$ closed the door and ran backwards but **he**$_2$ didn't see him.)

The expressions in a given referential system, as they are employed within a discourse, have many functions: the same forms contribute to marking the within-sentence status of information and to organizing information at the discourse level. When two or more coreferential expressions are employed consecutively in the same discourse, they trigger a series of back-referencing phenomena called "reference chains."

The goal of the present study was to determine how the within-discourse use of referential expressions in the course of development is affected by the cognitive constraints involved in the management of referential links. Our general hypothesis is that one of the major factors in coreference marking is the production context, understood to be a set of constraints of a conceptual nature (Clark & Carlson, 1981; Bronckart, 1985; Vion, 1995). Accordingly, contextual elements are hypothesized to introduce constraints in information management that can lead to various ways of coreferencing. This is assumed to be true whether the corresponding referential and narrative skills are in the process of being acquired or are already well in place.

Over the past 10 years, developmental research on discourse cohesion has shown that in cases where knowledge of the referents only becomes shared by the interlocutors as the discourse progresses, the referential system is mastered relatively late, and the performance of adult speakers changes with age. It is not until the age of 7 that children become capable of producing referential markers in connection with what has already been said (Hickmann, 1982, 1984, 1987a, 1987b, 1991, 1995; Hickmann, Kail, & Rolland, 1995; Karmiloff-Smith, 1981; Ricard & Snow, 1990; Sauvaire & Vion, 1989; Vion & Colas, 1999). At this age, referential expressions in children's productions begin to function like discourse cohesion devices. For adult speakers, ambiguous references reappear in greater quantities with age: either "new" referents are treated as "given" despite the fact that they have just been introduced, or the anaphoric devices employed during a narration do not point with certainty to one and only one antecedent. The reasons for this decline in communicative effectiveness in individuals who obviously have the necessary skills is just beginning to be investigated (Light, Capps, Singh, & Alberton Owens, 1994).

Observations based on pictorial materials have played an important role in the above studies (Bamberg, 1987; Berman & Slobin, 1994). Picture-based tasks are known to be more demanding for the speaker than ones where spontaneous or simply elicited productions are collected (Peterson, 1993). They require the speaker to intentionally mobilize his/her skills upon

request. Narration based on pictures necessitates two sorts of activities on the speaker's part (Trabasso, Stein, Rodkin, Munger, & Baugh, 1992; Trabasso & Nickels, 1992; Trabasso & Rodkin, 1994). The speaker must first understand the events represented in each picture and how they are connected to each other. This involves inferring the meaning of each picture and building a representation of the story as a whole. Secondly, the speaker's interpretation of the meaning must be encoded in narrative format. This requires establishing causal relations between the depicted events and defining the temporal relations between them, whether local (between two consecutive pictures) or global (between all pictures), which is guided to different extents by the way the story is depicted. Similarly, the expression of referential links can be promoted to varying degrees by whether the pictures are presented in ordinary comic-book format, where all of the pictures are presented on one page, or in booklet format with one picture per page. In the former case, the overall content of the story can be constructed (inferred from the knowledge of all events) and encoded. In the latter case, the content can only be inferred and encoded step by step: the speaker sees only one event at a time and therefore must "tell" the event at the same time as he/she connects it to the story content constructed so far.

The present study was conducted with native speakers of French (children and adults). The availability of the information to be related and the links between the events were manipulated. Each speaker was asked to "tell" comic strips to a same-age peer who did not know the stories. The explicit obligations (Hausendorf, 1993; Hausendorf & Quasthoff, 1992) were that there was a story (*eventability*) that could be told (*reportability*) and that to do so, a plot had to be related. The pictures contained no text. The speakers were instructed to report the comic strip content as accurately as possible by taking each picture into account while avoiding too many details. The addressees were instructed to act as attentive but passive listeners. Remaining silent, the listeners did not participate in the narration but were free to show signs of listening and/or paying attention. The analysis dealt with variations in how linguistic markers are used to express the degree of accessibility of the main character in the course of the narration.

METHOD

Subjects

Two hundred fifty-five native French-speaking subjects (117 males and 138 females) participated in the study. There were 63 seven-year-old children (attending first grade, median age: 6;6), 64 nine-year-old children (attending

third grade, median age: 8;8), 64 eleven-year-old children (attending fifth grade, median age: 10;6) and 64 young adults (students at the University of Provence in Aix-in-Provence, France).

Materials

Each comic strip contained eight frames (8 × 8 cm). The first frame showed two characters. All subsequent frames showed only one of the two characters carrying out various activities. A minimal link between the frames was the continuous presence of one of the characters from the first frame.

Four different comic strip versions were constructed with the two characters (see Fig. 1) by taking all combinations of two variables, each with two categories. The first variable concerned the topic of the comic strip, which either remained the same or changed. In the *maintained topic* condition, the materials were designed in such a way that a topic ("thematic subject"; Karmiloff-Smith, 1981) would be induced after the first frame by the repeated presence of the same character in every frame, up to and including the last one. In the *changed topic* condition, the materials were designed in such a way that a thematic break was generated by the reintroduction in the last picture of the other character from the first frame (in other words, frame 1 had both characters, frames 2–7 showed only one of the two characters, and frame 8 showed only the other). The next variable was a secondary variable used to control the layout of the characters in the frames. To avoid any bias in referent marking brought about by the greater salience of one of the two characters due to its location in the picture, the layout (left, right) of the characters in the first frame was counterbalanced.

Another experimental variable was the type of link. The comic strips differed as to the salience of the links between consecutive frames (Fig. 1). In the *arbitrary* condition, the events in each comic strip, although presented as a sequence, could have occurred in any order. For example, in Figure 1a, the daily activities depicted are relatively independent of each other, and as such, are highly subject to inference making: the woman getting dressed (or undressed) could have been placed after the women putting on (or taking off) her makeup, or anywhere else in the sequence, for that matter. It was thus the speaker's task to infer a link between the pictures. In the *ordered* condition, the link between the frames was fixed, i.e., the order of the events could not be changed. For example, in Figure 1b, sweeping the floor, picking up the dust with the dustpan, and putting it in the bin are always carried out in the same order, and always come before washing the floor.

For each type of link, the materials consisted of 32 test comic strips (8 pairs of characters × 4 versions) and three filler comic strips containing

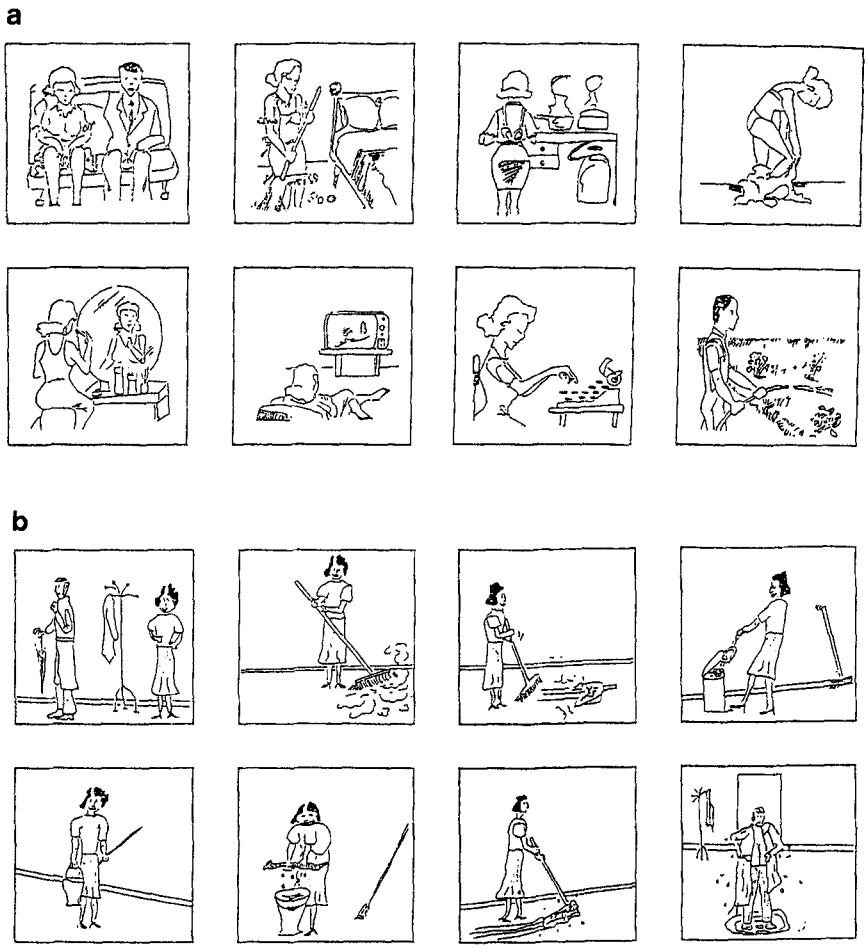


Fig. 1. Type of link.

only one character. The fillers were interspersed with the test comic strips, and also had eight frames (see list of materials in Appendix).

The last variable manipulated was the frame presentation mode. In the *simultaneous* presentation mode, the speaker saw all of the events in the story at once. The pictures were laid out on one page only. Subjects were asked to look at the comic strip and to prepare to tell the story immediately afterwards. In the *consecutive* presentation mode, the comic strip was presented in booklet format, with one picture per page. Subjects were instructed to turn the pages one by one and to say what was happening on

each page. As such, the events had to be verbalized on-line, as they were discovered.

Data Collection Design

Each subject was tested on one frame presentation mode and on one type of link. During testing, a given subject saw eight test comic strips (each presented in one of the four versions) and three filler comic strips (interspersed between two test comic strips). Given that, by construction, there were twice as many character pairs as versions, a subject saw a given version twice, with a different character set in each. Table I describes the version/character combinations used to construct the 32 test comic strips.

The data collection design required setting up four subgroups per age, for a total of 16 subgroups. For the subjects in a given subgroup, the comic strip presentation order was determined by random drawing.

Procedure

Testing was individual and lasted approximately 20 min. In the room where the experiment took place, there were three persons: the subject (the speaker), the experimenter, and the addressee of the narration (the listener). The addressee was a same-age peer from the speaker's grade in school. He/she only acted as the listener once during the experiment.

In simultaneous presentation, where the entire comic strip was presented on one page, the speaker was given the following instructions: "I am going to show you some comic strip stories. You'll see that there are no words in them, just pictures. Your task will be to tell the stories to your partner, who cannot see them. Be careful to talk about every picture, without forgetting any. Tell them in the following order (the experimenter pointed to the pictures in the normal reading order). You may study the pictures as long as you want before beginning." Then the first practice comic strip was presented to the

Table I. Combinations of Character Pairs and Versions (Vn)

	Character pair number							
	1	2	3	4	5	6	7	8
Versions	V1	V1	V4	V4	V3	V3	V2	V2
	V2	V2	V1	V1	V4	V4	V3	V3
	V3	V3	V2	V2	V1	V1	V4	V4
	V4	V4	V3	V3	V2	V2	V1	V1

subject, who studied it and kept it in sight until he/she had finished telling the story. Then it was taken away and the remaining comic strips were offered one by one.

In consecutive presentation, where the comic strips were in booklets, part of the above instructions were modified as follows: "I am going to present some stories in booklets (the experimenter showed a booklet). (. . .) You will be asked to say what's happening in each picture, without forgetting any. Be careful to talk about every picture, one after the other and not to go back over them." Then the first practice booklet was presented to the subject. Between each comic strip, the experimenter reminded the subject to work picture by picture, and not to backtrack.

The instructions given to the addressees were the same in the two conditions. Addressees were to be attentive and listen carefully to the stories in order to understand them, but were not supposed to talk.

Hypotheses and Predictions

We were interested in the different ways in which the character in frames 2 to 7 was named.

Predictions About Development. To mark thematic continuity, an adult speaker can use various forms to indicate increasing referent accessibility as the narration progresses (starting from the character's name and ending with zero anaphora, with pronouns in between). The present study was conducted with children who were in the process of acquiring the ability to mark referents within a discourse. Over the age range considered, children should improve at using the referential system forms correctly in order to express accessibility. One manifestation of this would be a reduction in the formerly consistent use during narration of definite noun phrases or pronouns to mark thematic continuity and its replacement by a wider variety of markers that enable the gradual coding of increasing referent givenness as the story unfolds.

However, at all ages, variations in the marking of coreference should be dependent upon the cognitive constraints imposed on the speakers by the experimental device. Simultaneous presentation and necessarily ordered sequences are less demanding of the speaker's memory capacity and/or inferential skills than consecutive presentation and arbitrary sequences. Thus, they should facilitate the use of referential system forms that express coreference. The production variables manipulated here should point out the age level and the circumstances for the appearance of a given type of within-discourse coreferencing device.

Predictions About the Manipulated Variables. During narration, the availability of information about the characters and events is an important factor in determining the planning process. In this respect, our experiment allowed

us to compare three situations. In the first, the speaker verbally described one frame at a time (consecutive condition of the presentation mode variable). In this case, the step-by-step nature of the task—which limited the planning span—should intensify the increasing givenness of the character across frames. This was expected to favor coreference forms that gradually mark higher and higher degrees of referent accessibility. In the second and third situations, the speaker saw all frames at once and could therefore build an overall representation of the story before verbalization. In one case (second situation), the same character was acting throughout the remaining pictures (including frame 8) (simultaneous condition of the presentation mode variable and maintained condition of the topic variable). In this situation, knowledge of the fact that the same character would be present until the end of the story authorized the speaker to manifest two types of coreferential behavior. Either thematic continuity would (1) promote character referencing using forms that gradually marked its higher and higher degree of accessibility, or (2) it would, on the contrary, lead the speaker to focus on the plot and consequently break the regular progression in the marking. In the other case (third situation), when the speaker found the character in frame 8 to be the one that had not appeared since the first picture (simultaneous condition of the presentation mode variable and changed condition of the topic variable), he/she could take the final topic change into account in verbalizing the preceding frames. In this case, because the speaker knew the main character would disappear in the last picture, he/she was in a better position than in the previous situation to mark that character's gradually increasing givenness.

Depicted event linkage is another important factor in narration because it determines the inference making process. Accordingly, arbitrarily placed picture sequences should lead speakers to focus on coreference and thus to mark the gradual increase in referent givenness. Necessarily ordered sequences, on the other hand, should lead speakers to concentrate on the narration and may therefore cause them to break the steady progression in referent marking.

RESULTS

The 2040 recorded narrations (255 subjects × 8 stories) were transcribed and then broken down into paragraphs (one per frame) based on the conventions established by Hickmann, Liang, Hendricks, and Roland (1990). For the purposes of the present paper, only the results for the events depicted in frames 2–7 will be reported. Remember that these events only involved one character (the thematic subject of the six frames). We looked at how coreference to this character was achieved as a function of age, links between frames

(arbitrary vs. ordered), and comic strip presentation mode (simultaneous vs. consecutive).

Coding of Coreference Chains

For each production, coreference marking was diagrammed in the form of finite state diagrams. Each diagram consisted of six finite states (one state per frame). The following nine ways of referring to the character in frames 2–7 were noted (in increasing order of accessibility): a proper noun (PN) such as Sophie; a generic noun (GN) such as grandfather; a noun preceded by the French indefinite article (IA) "*un*" or *une*" (a/an), by the French definite article (DA) "*le*" or "*la*" (the), by the French demonstrative adjective (da) "*ce*" or "*cette*" (this/that), or by the French possessive adjective (pa) "*sa*" or "*son*" (his/her); left dislocation (LD), as in "*le N il*" (the N, he) or "*la N elle*" (the N, she); one of the third-person singular French personal pronouns (PP) "*il*", "*elle*", "*le*", "*la*", or "*lui*" (he/she/it/him/her); and zero anaphora (Z). For each production, the coreference chain was diagrammed starting at the initial state (frame 2) and ending on the final state (frame 7), so that any modifications in the linguistic choices made in the course of the production would become apparent.

On this basis, six major types of coreference chains were identified. Each type is described in detail below, using illustrations from the productions of the 9-year-olds telling comic strip stories from consecutively presented pictures with ordered links.

When, for a given frame, the referent was not named, the chain was labeled as interrupted. Interruption could occur for several reasons. One cause of interruption, hereafter called interruption by omission (IO), was that the content of one or more frames was not verbalized, as in example 1 below.

In another type of interruption, the production focused on some aspect of the frame content that did not necessarily involve the character. In this case, the verbalization produced for that frame did not refer to the character as an individual, but to a part of the character's body (the head, for example), or to an object that belonged to him/her (pipe, umbrella, etc.). This type of interruption will be called interruption by detail focusing (ID), as in example 2 below.

In still another type of interrupted chain, the statements made about a given frame did not refer at all to the main character, but rather to an event that, for the purposes of the narration, was used as a key element of the plot. This type of interruption will be called interruption by event focusing (IE) and is illustrated in example 3 below.

Whenever the referent was named in every frame, the chain was labeled as uninterrupted. From the standpoint of degree of marker accessibility, un-

Example 1. Interruption by omission

2 - la dame faisait souvent son ménage
(The lady often did the housekeeping.)

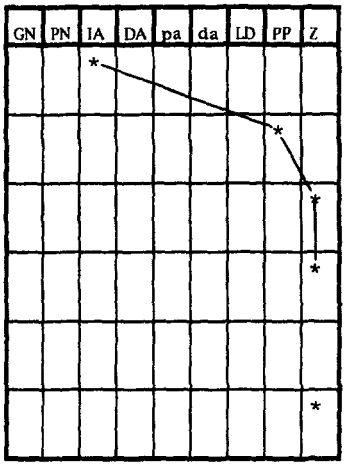
3 - elle prenait le balais et la pelle
(She got the broom and the dustpan.)

4 - puis le jetait à la poubelle tous les détritus
(Then threw it away in the wastebasket, all the dust.)

5 - ensuite prenait le seau
(Then got the pail.)

6 -

7 - et passait la serpillère
(And washed the floor.)



Example 2. Interruption by detail focusing

2 - i va dehors et comme il pleut il ouvre son parapluie il le met sur sa tête
(He goes outside and 'cause it's raining he opens up his umbrella. He puts it over his head.)

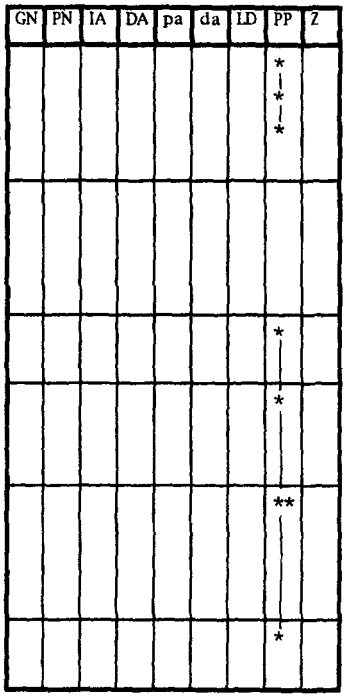
3 - après ya tellement de vent que le parapluie se retourne
(Then there's so much wind the umbrella turns inside out.)

4 - après ya ... ya une voiture qui l'éclabousse
(Then there's ... there's a car that splashes on him.)

5 - après i va devant la boulangerie mais elle est fermée
(Then he goes in front of the bakery but it's closed.)

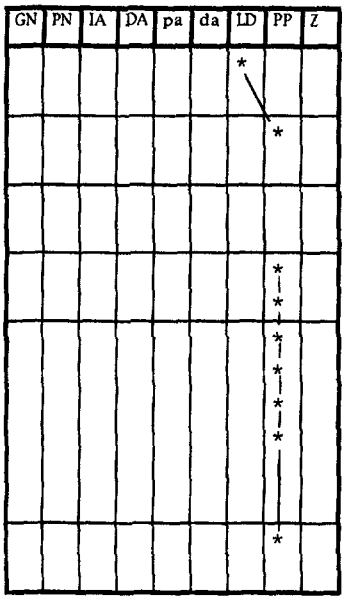
6 - i marche la tête en bas i voit pas qu'i ya un poteau
(He walks hanging his head. He doesn't see there's a post.)

7 - i se cogne la tête dessus
(He bumps his head on it.)



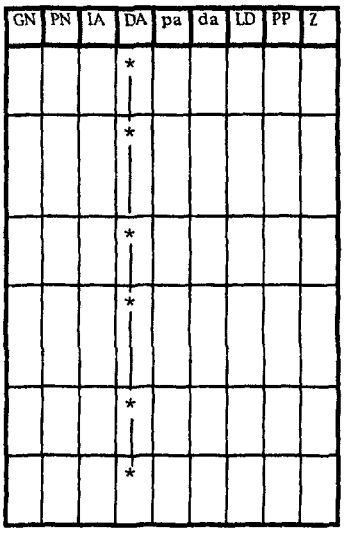
Example 3. Interruption by event focusing

2 - alors le petit i s'assit
(So the little boy, he sits down.)
3 - i met ... imet sa canne à pêche dans l'eau
(He puts ... he puts his fishing rod in the water.)
4 - après ya quelque chose qui a mordu
(Then there's something that bites.)
5 - il le relève i voit une chaussure
(He pulls it up. He sees a shoe.)
6 - après i se met à gen ... il a peur alors il a son filet ... après i se met à genoux et dans la chaussure y'avait un poisson
(Then he kneels d ... he's afraid so he has his net ...Then he kneels down and in the shoe there was a fish.)
7 - après avec son filet il l'attrappe
(Then with his net he catches it.)



Example 4. Constant chain

2 - la grenouille avait vu une mouche
(The frog had seen a fly.)
3 - la grenouille a sauté pour attrapper la mouche
(The frog jumped to catch the fly.)
4 - la grenouille a attrappé la mouche
(The frog caught the fly.)
5 - la grenouille saute ... la grenouille saute sur ... sur un rocher
(The frog jumps ... the frog jumps onto ... onto a rock.)
6 - la grenouille a sau ... a plongé sur la mer
(The frog jum ... dove into the sea.)
7 - la grenouille ... revient au bord
(The frog ... comes back ashore.)



interrupted chains could be constant, progressive, or irregular. A chain was called constant (C) whenever markers of the same degree of accessibility were used to refer to the character in every frame, as in example 4 below.

Uninterrupted chains were coded as progressive (P) whenever every marker referring to the character indicated an equivalent or higher degree of accessibility than the preceding marker, as in example 5.

A chain was labeled as irregular (I) when the markers used to refer to the character went back and forth between high and low accessibility. Irregular chains were of two types. In the first type, illustrated by example 6, the first statement made about a given frame contained a low accessibility marker that was followed by a rise in accessibility on the subsequent statements about that same frame. This was followed by a drop in accessibility on the next frame.

Another kind of irregularity occurred when the degree of accessibility fluctuated between two frames (example 7), with or without a within-frame change.

Overall Results

For each age, Table II gives the frequency of the six types of chains described above (a seventh category called "Other" was used to tally the few cases of chains with an omission already on frame 2). This table provides us with a general description of the age-linked tendencies.

Example 5. Progressive chain

2 - le petit garçon va sortir dehors
(The little boy is going to go outside.)

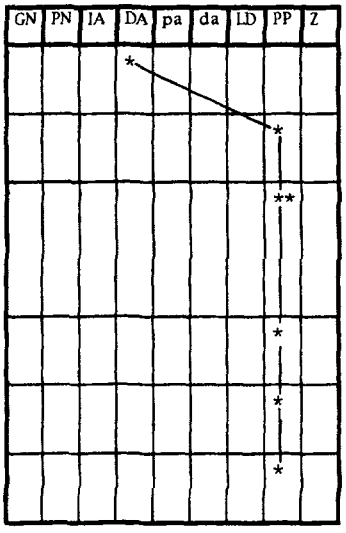
3 - il est dehors sur un chemin dans la forêt
(He's outside on a path in the forest.)

4 - puis il se promène, i voit des papillons et des champignons
(Then he walks along, he sees some butterflies and some mushrooms.)

5 - il cueille des champignons
(He picks some mushrooms.)

6 - il rentre chez lui le soir
(He goes home in the evening.)

7 - il met les champignons dans un vase
(He puts the mushrooms in a dish.)



Example 6. Irregular chain

2 - la fille elle partait dans un rocher pour regarder les vagues
(The girl, she was going into a cave to look at the waves.)

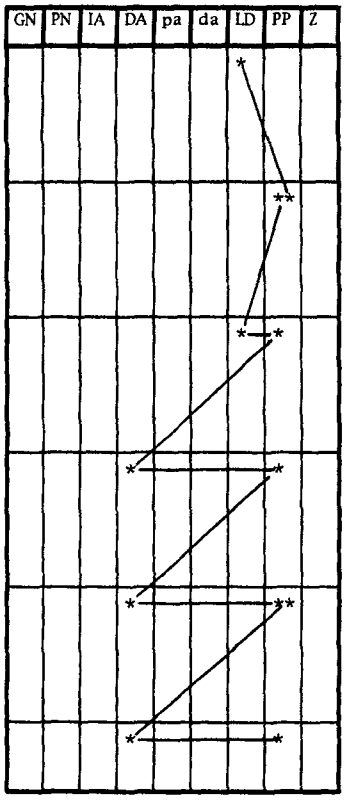
3 - elle a mis les pieds sur la mer et elle s'asseyait sur la côte
(She put her feet in the sea and she sat down at the edge of the water.)

4 - la fille elle ... elle se mettait sur la côte pour ... pour je crois qu'elle voulait nager
(The girl, she ... she was sitting on the water's edge to ... to I think she wanted to go swimming.)

5 - la nuit la fille a nagé, elle plon ... elle a plongé sur l'eau
(That night the girl went swimming, she dove ... she dove into the water.)

6 - la fille est en dessous de l'eau, elle avait un poisson et elle ... elle danse
(The girl is under the water, she had a fish and she ... she's dancing.)

7 - la fille s'essuie, elle repart à la côte
(The girl dries herself off, she goes back to the shore.)



As expected, the adult speakers were the ones to produce the greatest number of uninterrupted chains (82%). The children produced fewer such chains, and the distribution of interrupted and uninterrupted chains was relatively stable across age groups (an average of 72% of the chains were uninterrupted). Among the interrupted chains, interruption by event focusing (IE) outnumbered all other types, at all ages. However, the adults produced fewer than the children. Among the uninterrupted chains, progressive ones (P), which are suitable for coreferencing and for marking increasing referent givenness, were the most frequent at all ages (the 11-year-olds produced more than the speakers in the other age groups). Constant chains (C) came in second place for the 7-year-olds, while for the other groups, irregular chains (I) were the runners-up (highest frequency for adults).

Example 7: Irregular chain

2 - après i passe dans la route après ya une voiture
(Then he goes onto the road. Then there's a car.)
3 - après i passe
(Then he goes across.)
4 - après ya une voiture derrière l'hérisson
(Then there's a car behind the hedgehog.)
5 - après le hérisson se fait écraser par une voiture
(Then the hedgehog gets run over by a car.)
6 - et après il est dans le trou
(And then he's in the hole.)
7 - après i tire la langue en s'en allant
(Then he sticks out his tongue and goes away.)

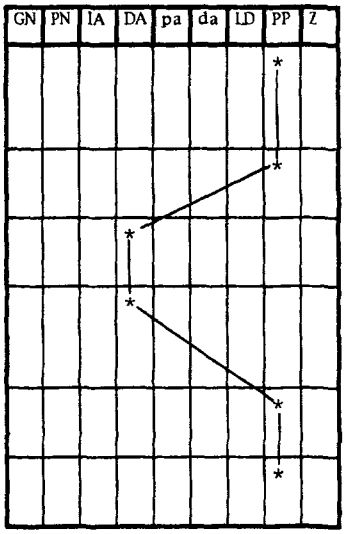


Table III gives the number of occurrences of the various types of chains for each production situation and type of link. This table gives us a general impression of the experimental device-dependent variations.

The production patterns differed considerably between the two types of links, as expected. While the uninterrupted chain rate always exceeded 93% for arbitrary sequences, the productions were approximately half uninterrupted and half interrupted for ordered sequences. The high rate of interrupted marking in this case was partly due to the increase in the number of

Table II. Frequency of Each Type of Chain by Age Group (in Percent)

Type of chain	Age 7 (N = 63)	Age 9 (N = 64)	Age 11 (N = 64)	Adult (N = 64)
IO	10	9	8	6
ID	2	3	3	3
IE	17	13	16	8
Interrupted	29	25	27	17
C	24	15	14	13
P	29	33	40	37
I	17	26	19	32
Uninterrupted	70	74	73	82
Other	1	1	0	1

Table III. Frequency of Each Type of Chain by Production Situation and Type of Link (in Percent)

	Production situation					
	Consecutive		Simultaneous-maintained		Simultaneous-changed	
Type of chain	Arbitrary	Ordered	Arbitrary	Ordered	Arbitrary	Ordered
IO	3	5	4	20	7	21
ID	0	6	0	0	0	7
IE	0	27	0	36	0	13
Interrupted	3	38	4	56	7	41
C	24	6	34	7	25	7
P	44	28	45	23	51	31
I	29	27	17	12	17	20
Uninterrupted	97	61	96	42	93	58
Other	0	1	0	2	0	1

omission chains (IO) and partly due to certain types of interruption that only occurred in this case, namely, the many event-focusing interruptions (IE) and the much rarer detail-focusing interruptions (ID). In addition, progressive chains (P), which outnumbered all others for the arbitrary sequences, no longer did so for the ordered ones. The effects of the presentation mode were not as conspicuous here. They showed up more clearly in the subsequent analyses.

The rest of the analysis was designed to test our predictions concerning the effects of the manipulated factors on four types of coreference chains, C, P, I, and IE.

Coreference Chains in Consecutive Presentation

For the condition where the subjects saw the pictures one by one, the frequency of uninterrupted chains (C, P, and I) was analyzed separately, using an ANOVA with the following design: 4 (Age: 7, 9, 11, adult) × 2 (Link: arbitrary, ordered). IE chains, which only occurred with ordered links, were analyzed separately, as a function of age only. Since each subject saw eight comic strips, the value of the dependent variable ranged between 0 and 8. An alpha level of .05 was set for all statistical tests.

A significant effect of age was obtained for all dependent variables (Table IV). Pairwise comparisons of performance across groups on each variable yielded the following results: (1) The 7-year-olds produced more constant chains than did all other age groups (making up 30% of their productions; mean comparisons: age 7/age 9: $F = 8.32$, $p = .0047$; age 7/age 11,

Table IV. Consecutive Presentation: For Each Age, Mean Number of Occurrences of Constant Chains, Progressive Chains, Irregular Chains, and Chains Interrupted by Event Focusing

Dependent variable	Age						
	Age 7	Age 9	Age 11	Adult	*df*	*F*	*p*
					3,119		
C	2.3	1.1	.8	.7		6.17	.0006
P	1.9	2.8	3.7	3.		4.6	.004
I	1.6	2.2	1.8	3.2		5.4	.002
					3,60		
IE	2.7	2.6	2.3	1.0		5.2	.0029

$F = 12.5$; $p = .007$; age 7/adult, $F = 15.3$, $p = .0002$). (2) Compared to all other age groups, the adults produced more irregular chains (39% of their productions; mean comparisons: adult/age 7: $F = 13.62$, $p = .0003$; adult/age 9, $F = 4.74$, $p = .03$; adult/age 11, $F = 10.2$, $p = .0018$) and fewer event-focusing interruptions (mean comparisons: adult/age 7: $F = 1.93$, $p = .001$; adult/age 9, $F = 11.05$, $p = .0015$; adult/age 11, $F = 7.21$, p .0093). (3) The frequency of progressive chains increased slightly between ages 7 and 11 (the performance difference between the 7-year-olds and the 11-year-olds was significant: 23% at age 7 vs. 46% at age 11; mean comparisons: age 7/age 11, $F = 13.63$, $p = .0003$).

A significant effect of the type of link was observed for constant chains [F (1, 119) = 22.6; $p = .0001$] and progressive chains [F(1, 119) = 13.5; $p = .0004$]. These two types of chains outnumbered the others for the arbitrary sequences. Remember that the remaining type of chain (i.e., interrupted chains caused by event focusing) only occurred for ordered sequences.

A detailed examination of the referential expressions used provides some additional information for interpreting these results. Constant chains at age 7, which represented 40% of the chains produced at that age, involved the repeated use of a definite article, as Example 4 illustrates. We also found chains characterized by the consistent use of an indefinite article. The latter production is inappropriate for coreferencing as well as for marking the cognitive status of the referent. In half of the productions, the speaker repeatedly said: "*C'est un N qui* . . ." ("It's an N that . . ."). This behavior was still observed occasionally at the age of 9, but disappeared completely after that. At age 7 and 9 alike, sequences of statements like "It's an N that . . ." were only found in arbitrary sequences. Thus, the consecutive frame presentation mode revealed that the 7-year-olds still had a strong tendency to settle for describing each picture separately. Moreover, arbitrary referential links across frames reinforced this

tendency. After the age of 7, constant chains declined in number and changed in nature: marking with a definite article was replaced by marking with a pronoun.

Progressive chains reached their maximum at the age of 11. This type of chain generally began with a left dislocation (see example 8) or, less often, with a definite article, as in example 5. The same distribution was found in the younger children. In contrast, the use of left dislocation practically disappeared in the adult productions. Left dislocation at the beginning of a coreference chain, so frequent in the children, is not just a reflection of their involvement in marking the status of the information, but also of their efforts to engage in the narrative process: they reintroduced one of the two characters in frame 1 as the thematic subject of what might follow.

Example 8

2. Le lapin i va voi . . . i va dans un . . . champ de carottes.
   (The rabbit, he's going to see . . . he's going into . . . a carrot patch.)
3. Et i prend une carotte.
   (And he takes a carrot.)
4. Il en prend une deuxième et il les mange toutes les deux.
   (He takes another one and he eats both of them.)
5. Il en prend une troisième et il la mange.
   (He takes another one and he eats it.)
6. Et après il a plus du tout faim.
   (And then he's not hungry anymore.)
7. Alors i va dormir près d'un arbre.
   (So he goes to sleep by a tree.)

The frequency of interruption by event focusing for the ordered sequences is another testimony to the fact that the children were absorbed in the narration process. They concentrated on the event in the plot, thereby neglecting to mention the character. Example 9 illustrates the difficulty they had simultaneously handling coreference and event narration. The adults managed this by using irregular chains (example 10).

Example 9

2. C'est un n'hérisson qui est. . . . qui est sur l'herbe et qui traverse la route.
   (It's a hedgehog that's . . . that's on the grass and that's crossing the road.)
3. Il traverse la route.
   (It's crossing the road.)

4. Il traverse la route et ya une voiture qui arrive.
   (It's crossing the road and there's a car coming.)
5. La voiture elle s'ac. . . . la voiture elle tape dans l'hérisson.
   (The car, it bumps . . . the car, it hits the hedgehog.)
6. L'hérisson i tombe et . . . non i roule.
   (The hedgehog, it falls and . . . *no* it rolls over.)
7. Et i revient sur l'herbe.
   (And it comes back onto the grass.)

Example 10

2. Le hérisson se trouve à coté de la route. Une voiture passe.
   (The hedgehog is there by the side of the road. A car goes by.)
3. Le hérisson traverse la route difficilement.
   (The hedgehog has a hard time crossing the road.)
4. Et commence à s'hérisser quand arrive une voiture.
   (And starts bristling its fur when a car arrives.)
5. La voiture passe et tamponne le hérisson.
   (The car goes by and hits the hedgehog.)
6. Le hérisson roule sur le coté de la route.
   (The hedgehog rolls over onto the edge of the road.)
7. Il arrive à coté d'un arbre o?? il y a des fruits.
   (It lands near a tree where there's fruit.)

Note that from the standpoint of the referential expressions used, both of these types of chains almost always began with a definite article.

Coreference Chains in Simultaneous Presentation

In cases where the subjects saw the entire story before verbalizing, we can study not only the production patterns as a function of age and type of link, but also the effects of thematic continuity or discontinuity introduced on the last frame. In order to test our predictions for the different factors manipulated, uninterrupted chains (C, P, I) were analyzed separately using an ANOVA with the design 4 (Age: 7, 9, 11, adult) × 2 (Link: arbitrary, ordered) × 2 (Topic: maintained, changed), and with repeated measurements on the topic factor. The frequency of the interrupted chain IE was analyzed by age and topic. In each case, the value of the dependent variable ranged from 0 to 4. Table V lists the significant effects at a p level less than or equal to .05.

Note first of all that in simultaneous presentation, the age effect differed from that observed in consecutive presentation (preceding section). As such, the frequency of constant chains in simultaneous presentation was solely dependent upon the type of link and the topic. Overall (as in the preceding section), these chains were more numerous when the links were arbitrary (arbitrary 1.1 vs. ordered 0.3) and when the topic was maintained

Table V. Simultaneous Presentation: List of Significant Effects

		Dependent variable					
		C		P		I	
	df	*F*	*p*	*F*	*p*	*F*	*p*
Age	3,120					4.44	.005
Linkage	1,120	73.83	.0001	33.57	.0001		
Topic	1,120	5.43	.02	10.41	.002		
Age × topic	3,120			3.9	.01		
Topic × linkage	1,120	6.23	.01			5.39	.02
Age × topic × linkage	3,120			3.04	.03		
		IE					
		F	*p*				
Age	3,60	3.46	.02				
Topic	1,60	47.17	.0001				

(maintained 0.8 vs. changed 0.6). The significant interaction effect between these two factors (Fig. 2) indicates that this type of chain mainly occurred for arbitrary sequences and all the more so when the character in frames 2–7 was still present at the end of the comic strip (maintained topic). Thus, contrary to our predictions, arbitrary links and the presence of the same character until the end of the story favored the continuous reuse of the same referential expression to mark coreference.

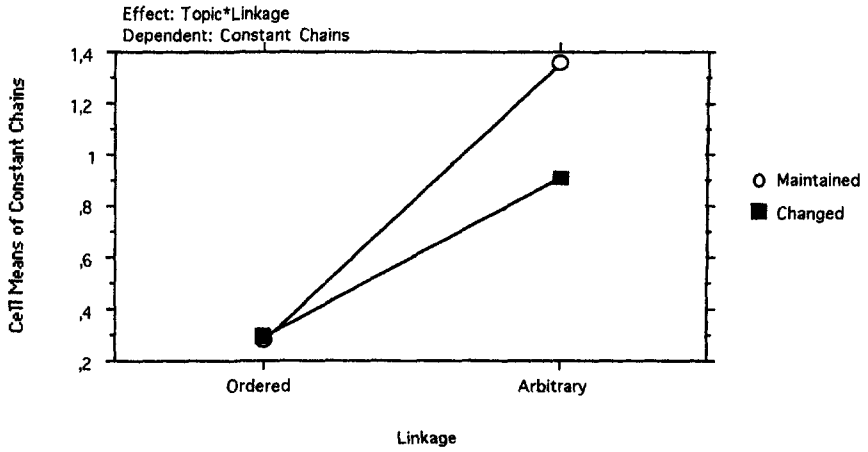


Fig. 2. Simultaneous presentation. Constant chains: topic × link interaction.

Looking at the referential expressions used in these chains, we can see that an indefinite article was never used repeatedly (this approach was characteristic of the 7-year-olds in consecutive presentation), and the repeated use of a definite article was virtually nonexistent at all ages. The chains that were constant were so because of the use of a pronoun (a marker of high referent accessibility). Seeing all of the events before telling the story, and being able to use the comic strip as a support for the verbalization, thus allowed all speakers to achieve the appropriate kind of marking, from both standpoints (cognitive status of the referent and coreference). This observation allows us to stress the importance of experimentally controlling the frame presentation mode before attempting to assess the referential competence of speakers. Note, however, that the simultaneous mode as it was set up in this experiment does not allow us to state with certainty that the 7-year-olds actually did do within-discourse referent marking: the constant presence of the frames during verbalization in effect allowed for the deictic use of pronouns.

The production of progressive chains, like constant chains, was found to depend on (1) the type of link, since there were more progressive chains with arbitrarily placed sequences, as in consecutive presentation (arbitrary 1.9 vs. ordered 1.1); (2) the topic, since there were more progressive chains when the topic changed (maintained 1.3 vs. changed 1.6); and (3) the interaction of these two factors with age (Fig. 3a and 3b).

When the topic was maintained, the progressive chain rate was relatively stable across age groups (being more frequent only with arbitrary sequences). When the topic changed and the pictures were arbitrarily placed, the increasing occurrence of progressive chains was observed for the 9-year-old group alone, while this happened for all three groups of children when the picture sequences were ordered. Adult performance was essentially the same in both topic conditions. The simultaneous presentation mode revealed a specific sensitivity in the 9-year-olds to topic changes. The appearance of another character at the end of the sequence of frames, which until that point had been connected to each other solely by the repeated presence of the same character, led the 9-year-olds to organize their production in accordance with the ending: more than the other speakers, they marked the increasing givenness of the character in frames 2–7 in view of the final change.

Looking at the referential expressions used, we can see, as in consecutive presentation, that the adults hardly ever produced chains beginning with a left dislocation. On the other hand, the children (more than in consecutive presentation) used left dislocation in chain-initial position. This device clearly prevailed over definite articles. The children's involvement in the narrative process thus seems to have been well supported by simultaneous viewing.

The occurrence of irregular chains, as in consecutive presentation, turned out to be linked to age (age 7: 0.6, age 9: 0.4, age 11: 0.6, adult: 1.0).

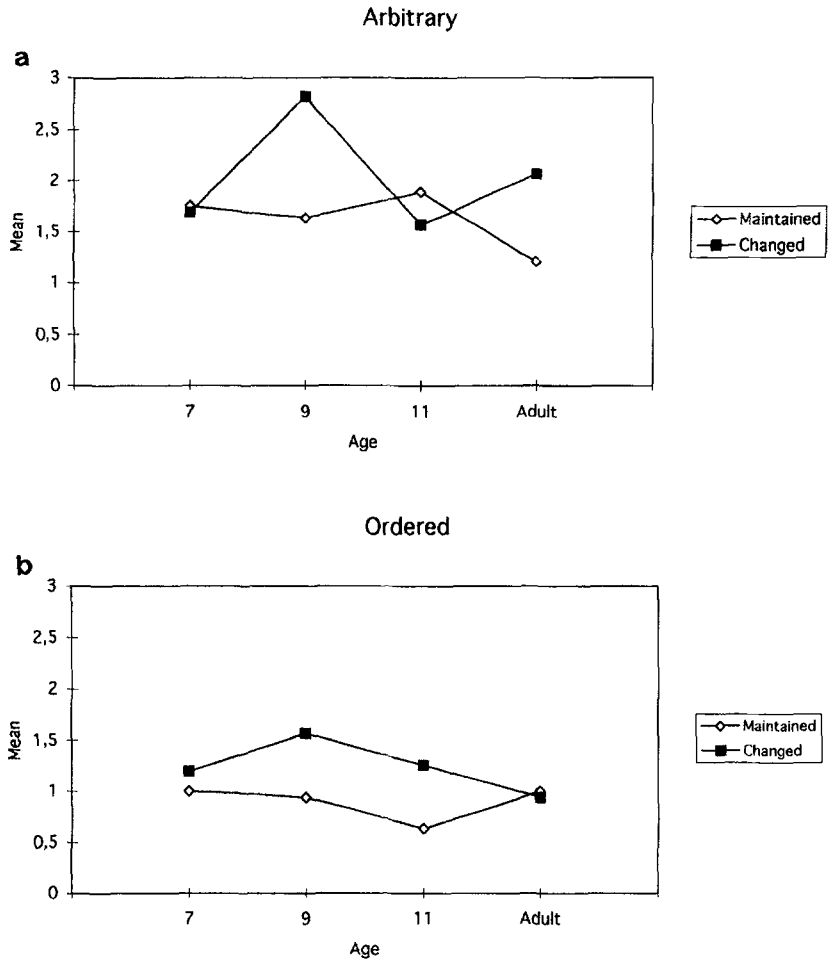


Fig. 3. *Simultaneous presentation. Progressive chains: age × topic × link interaction.* (a) arbitrary links; (b) ordered links.

Pairwise comparisons of the performance observed at each age showed that the adults were the ones to produce the greatest number of irregular chains (mean comparisons: adult/age 7: $F = 6.79$, $p = .01$; adult/age 9: $F = 12.08$, $p = .0007$; adult/age 11: $F = 5.92$, $p = .0165$). This finding was supported by a difference in the referential expressions used to begin chains. While the children began their marking in a variety of ways (definite articles, pronouns, or left dislocation), the adults nearly always started with a definite article. The occurrence of irregular chains was also subject to an interaction between the topic and type of link factors (Fig. 4).

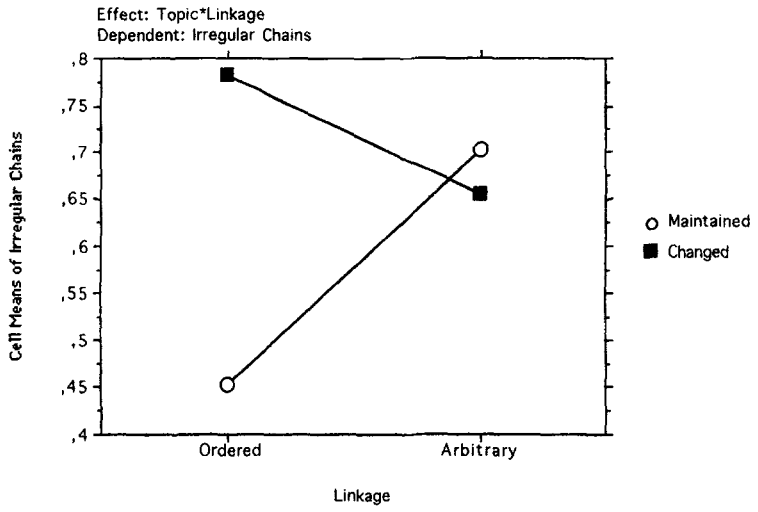


Fig. 4. Simultaneous presentation. Irregular chains: topic × link interaction.

Arbitrarily placed picture sequences led to equivalent performance in both topic conditions. Ordered sequences caused a drop in the number of irregular chains when the topic was maintained and a contrasting rise when the topic changed. Irregularities in referent accessibility marking were thus promoted by ordered links between frames and by the need to conduct the narration in accordance with the topic change.

The production of interrupted chains caused by event focusing was age-linked (age 7: 1.2, age 9: 0.8, age 11: 1.3, adult: 0.7). Pairwise comparisons of the performance obtained at each age pointed out a different situation from that observed in consecutive presentation. Here, the 11-year-olds stood apart from the 9-year-olds and adults in that a significantly greater number of them were interrupted-chain producers. This leads us to believe that children at this age are at a turning point in their ability to handle coreference and narrative event organization at the same time. The introduction of a complication in the story caused them to neglect to mention the main character, but for this type of chain, the productions of the 7-year-olds were quantitatively and qualitatively equivalent to those of the 11-year-olds. In the 7- and 11-year-old finite state diagrams, we found (1) the same number of interrupted chains due to event focusing, (2) referential expressions that began in the same way at both ages (primarily with definite articles), and (3) an overall pattern in the chains that was essentially progressive. Thus, the performance of the youngest children here did not stem from their tendency (noted in section 3) to simply describe the frames, and in doing so, to high-

light the most salient elements in their verbalizations. The explanation proposed for the 11-year-olds applies to the 7-year-olds as well.

We also noted a topic effect: event-focusing interruptions were more frequent when the topic was maintained (maintained 1.5 vs. changed 0.5). Knowing that the theme was maintained thus led the speakers, as predicted, to focus on the plot in order to tell the story, while also leading them to produce interrupted reference marking.

Effect of Span of Information Available for Planning Narration (Presentation Mode)

The analyses that follow enabled us to summarize the findings discussed so far and to verify statistically the effect of the presentation mode. This effect was not very apparent in the overall results, but did show up in the separate analysis of the presentation modes (preceding two sections).

The frequency of C, P, and I chains was analyzed using an ANOVA with the following design: 4 (Age: 7, 9, 11, adult) × 2 (Link: arbitrary, ordered) × 2 (Presentation mode: consecutive, simultaneous). IE chain production was analyzed by age and presentation mode. The value of the dependent variable ranged from 0 to 8. Table VI lists the significant effects at a p level less than or equal to .05.

For all data pooled, there was a significant effect of age on all dependent variables, but, while for C and P chains the effect differed across presentation modes (age by presentation mode interaction), it did not differ for chains I and IE.

For C and P chains, in addition to the finding mentioned in the Overall Results section above (that these two types of chains were more frequent

Table VI. Comparison of Presentation Modes: List of Significant Effects

		Dependent variable					
		C		P		I	
	df	*F*	*p*	*F*	*p*	*F*	*p*
Age	3,239	5,23	.0016	2,97	.03	8,73	.0001
Linkage	1,239	75,53	.0001	42,54	.0001		
Presentation	1,239					19,66	.0001
Age × presentation	3,239	3,6	.01	3,88	.0098		
		IE					
		F	*p*				
Age	3,120	6.496	.0004				

with arbitrary picture sequences), an age-linked presentation mode effect was observed. The number of constant chains in simultaneous presentation varied little from one age to the next, while consecutive frame presentation increased the frequency of these chains for the 7-year-olds and decreased it for the other age groups. The analyses in the preceding two sections told us that, contrary to what happened in consecutive presentation, constant chains in simultaneous presentation led to productions containing only pronouns. The simultaneous presentation mode thus favored the use of coreference markers of high referent accessibilility (formally appropriate for coreferring and for marking givenness/newness). In contrast, the consecutive presentation mode led to independent descriptions of each frame, especially for the youngest children.

Progressive chains are indicative of the speakers' involvement in marking the main character as given. The adults who used this type of chain exhibited little sensitivity to the presentation mode (consecutive 3.0 vs. simultaneous 2.8). The children, on the other hand, were more highly affected by this variable. The 11-year-olds' overall performance was similar to that of the adults, except that the consecutive presentation mode caused them to produce more progressive chains than did the simultaneous mode (consecutive 3.7 vs. simultaneous 2.7). At the ages of 7 and 9, the opposite behavior was observed. Improvement in coreference marking by means of progressive chains was observed between these two ages, but both age groups produced more progressive chains when the whole story could be seen at once (age 7: consecutive 1.9 vs. simultaneous 2.8; age 9: consecutive 2.8 vs. simultaneous 3.5). Thus, the simultaneous presentation mode led the youngest children not only to achieve appropriate marking of coreference, but also to engage in a narrative process.

For irregular uninterrupted chains and event-focused interrupted chains, pairwise comparisons across age groups confirmed that as a whole, the adults produced the greatest number of irregular chains (approximately twice as many as the children: adults 2.6 vs. children 1.4) and the smallest number of interrupted chains due to event focusing (approximately half as many as the children: adults 1.2 vs. children 2.4). The latter occurred only when the sequences were ordered and did not vary significantly across presentation modes, whereas irregular chain frequency was mode-dependent: irregular chains were nearly twice as common when the speakers saw the frames one at a time (consecutive 2.2 vs. simultaneous 1.3). As a whole, interruption by event focusing appears to have been a typical behavior of the children. Regardless of the frame presentation mode, whenever the comic strips made the referential links plain, the children failed to establish uninterrupted coreference marking. In contrast, irregular chains like the one in example 10 appear to be a reflection of a successful effort to maintain consistent coref-

erences, especially in the most difficult cases, i.e., when the span of information available for verbalization was very small.

DISCUSSION

This study looked at how child and adult speakers mark coreference when narrating a series of events shown in a sequence of pictures. Our goal was to find supporting arguments for the hypothesis that the manifestation of referential and narrative competence (whether in the process of being acquired or already well in place) is dependent upon the cognitive constraints inherent in the research paradigm used in the present case, a picture-based narration. Our assumption was that identifying those constraints and controlling them experimentally should improve our understanding of how speaker competence is acquired and put to use. Our analysis focused on the way in which speakers referred to the character depicted in frames 2–7 of 8-frame "silent" comic strips (for an analysis of the verbalizations obtained for frames 1 and 8, see Vion & Colas, 1998, 1999).

At all ages considered in this study, the speakers produced mainly uninterrupted coreference chains. The character was usually mentioned (70% of the time or more in all cases) in the description of every event depicted between frames 2 and 7. The referential expression used to refer to the character generally indicated a higher (or equivalent) degree of accessibility than the preceding expression (progressive chains, averaging 38% of the productions). In addition to progressive-chain coreferring, uninterrupted referential marking was achieved in one of two ways: either the character was designated using markers of equal referent accessibility (constant chains, averaging 17% of the productions) or the character was designated by markers that fluctuated in the course of the production between a low and a high degree of accessibility (irregular chains, averaging 23% of the productions). Interrupted coreference marking was also found at all ages (averaging 23% of the productions), less often by failure to mention the event in a picture than by failure to mention the character in the utterances about a picture (interruption by event focusing).

Definite articles and left dislocations were the major ways of beginning a coreference chain (representing 22% and 25%, respectively, of all chain-initial markers). Both of these forms are appropriate for naming and highlighting the character that, of the two characters depicted in the first frame, was to become the thematic subject of the frames that followed (exclusive of the last frame in some cases). We also found that children were the only ones to use left dislocation. These observations as a whole confirm the idea that the speakers studied here, each in his or her own way, did indeed engage in a process of within-discourse marking of coreference.

The frequency of occurrence of each type of chain varied with age: progressive chains were highly prevalent at age 11, constant chains were more so for the 7-year-olds, irregular chains were especially frequent for the adults, and event-focused interrupted chains were mostly found for the children.

Beyond the major tendencies listed above, the coreference chain patterns found in the productions were dependent upon the constraints imposed on the verbalization. Looking at the productions as a function of the variables manipulated provides some supporting arguments in favor of our general hypothesis. The type of link between frames turned out to be what stood out as having the most effect on referential expression use. At all ages, there were more constant chains and progressive chains when the links were arbitrary. Speakers confronted with an arbitrarily placed sequence of events in which the same character was always "on stage" set out to narrate the actions being accomplished. Focusing on the need to establish relationships for each event, they spoke of the character either by indicating his/her increasing degree of givenness, or by maintaining a constant degree of accessibility. In a complementary fashion, chains interrupted by event focusing were only found in ordered sequences. Here, where the character's actions were clearly ordered, the speakers no longer had to focus solely on establishing relationships. They could now try to build a story (i.e., describe a series of events about the same character that form a whole, with a beginning, a middle, and an end). For the purposes of the narration, these speakers thus focused on elements that were relevant to the plot. By concentrating on these elements, they broke the monotony of merely relating a series of actions by giving the events an overall direction, but in doing so, they no longer mentioned the actual character. The links between events were coherent enough and the aspects selected were sufficiently well related to the topic to make it possible not to mention the character without detracting from the coherence of the narration. Thus, the type of link was indeed a cause of variations in the manifestation of the speakers' skills, whether being acquired or already in place.

The frame presentation mode provided the key to determining what skills are specific to each age. It allowed us to show how the ability to mark the cognitive status of referents and thematic continuity is acquired between the ages of 7 and 11. The step-by-step frame encoding required in the consecutive condition enabled us to show that 7-year-olds still display a strong tendency to describe each picture independently. It also pointed out that 11-year-olds are particularly careful to mark increasing referent givenness and that adults maintain coreference by means of markers that fluctuate between high and low referent accessibility. Speaker awareness of the content of all frames before encoding, and the opportunity to view the entire story throughout verbalization, promoted the expression of the children's developing skills. This presentation mode, in which the relationships between the frames could be perceived

directly, was all it took to allow the 7-year-olds to stop describing the frames independently. Because it also suggested that there might be an overall direction to the pictures in the sequence, the simultaneous presentation mode facilitated the marking of increasing referent givenness between the ages of 7 and 9. Finally, it pointed out the age (9 years, as Berman & Slobin, 1994, also showed) at which speakers begin to mark co-reference, no longer according to a pattern they simply perceive in the picture sequence, but because they are able to coordinate the sequence into a whole (coreference behavior is geared to the ending of the story, which in this case could be anticipated).

The results obtained here prompt us to regard the picture-based narration task as a good rather than stringent situation for revealing the emerging skills of children. The way pictures are displayed can make it possible or impossible to directly perceive the relationships between events, and as such, inference making about the nonperceivable relationships may or may not be needed. The display may provide relationships that are already organized in a logical order, or it may require determining the links and coordinating them to form a coherent flow. These display-specific constraints do not have the same impact at different stages of cognitive development. Provided we control the cognitive processing it triggers, picture-based narration allows us to: (1) assess the stability or lability of the linguistic means used at each age, (2) better understand the relationships between the development of the processes as they are applied to the extralinguistic environment and the acquisition of rules that govern the conventional within-text functioning of the markers in the referencing system, and (3) in doing so, gain insight into the extent to which certain everyday contexts are more conducive than others to the manifestation of newly acquired competence.

APPENDIX: EXPERIMENTAL MATERIALS

Arbitrary links

Test comic strips: contents of first frame

1. A man and a woman sitting on a sofa
2. An adolescent and a little boy
3. A man and an adolescent at the beach
4. A woman and a little girl at the table
5. A turtle and a crocodile at the water's edge
6. A monkey and a lion in the brush
7. A hen and chicks in the courtyard
8. A cat and a donkey in the fields

Topic of filler comic strips (one character only)
a. A cat is playing by the sea
b. A grandmother is shopping
c. A man is getting up in the morning

Ordered links

Test comic strips: contents of first frame
1. A child and an old man in the living room
2. A man and a woman at home
3. A boy and a girl at the beach
4. A boy and a man fishing
5. A dog and a cat sleeping on a rug
6. An earthworm and a snail in a kitchen
7. A hedgehog and a rabbit at the roadside
8. A fish and a frog near a pond

Topic of filler comic strips (one character only)
a. A dog is playing in a yard
b. A boy is exploring a cave
c. A mouse is looking for food

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