

LINGUISTICA
COMPUTAZIONALE

VOLUME XXVI

HYPERMEDIA
FOR EDUCATION
AND RESEARCH

Editors:

Giovanna Turrini
Istituto di Linguistica Computazionale, CNR, Pisa, Italy

Francesca Bianchi
Università di Lecce, Italy



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THE IDENTIFICATION OF DEFINITION STRATEGIES IN CHILDREN OF DIFFERENT AGES

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Abstract – Traditionally, children’s definitions of a given noun have been considered as correct only if they fitted the classic Aristotelian model of definition: “X is a Y that Z” (see Snow, 1990). In a different perspective, the aim of this study was to identify the different types of definition children use, in order to define different domains of knowledge in the context of their developmental trend. Thus, the definitions provided by 10, 11- and 13-year-old children for concept nouns referring to different knowledge domains were collected and coded according to their different types. The results showed that, while children at 10 are already able to produce all the types of definition considered, the specific type of definition they produced critically depended on both the kind of the word to define and the specific knowledge domain it belonged to. In addition, there was a significant difference between groups of different ages.

Keywords – Cognitive development, definition production, conceptual knowledge organization, definition types.

1. INTRODUCTION

The research project from which the interactive educational tool *Addizionario*¹ (Turrini *et al.*, 2001) was developed offered our team the chance to study children’s skills in defining the meaning of words.

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In the applied psychology literature, since the first attempts to measure intelligence, e.g. the classic works by Galton and Binet, children's skills in producing apt definitions of nouns were considered as an indication of intelligence. Definitions were thought to be a matter of logical reasoning, as their function was assumed to be the unequivocal assessment of an entity among other entities by class inclusion. Following the Aristotelian view, according to which *definitio fit per genus proximum et differentiam specificam*, definitions presuppose an ordered world, the entities of which are linked by taxonomic relations in a hierarchical structure. Accordingly, intelligence was conceived of as the skill to recognize the class inclusion relations represented by taxonomic links. This view, however, has changed in the last fifty years with the acknowledgment of the fact that the human mind does not mirror a hypothetical structure of the world but rather shapes it through sensory experience. As a consequence, the multifaceted dimensions of the so-called practical intelligence have been highlighted and the dynamic and flexible character of conceptual knowledge has been fully recognized and analyzed.

Recent research on the acquisition of the defining competence has focused on the linguistic, metalinguistic and communicative aspects of definitions. With schooling, children develop the ability to reflect on their own linguistic productions and evaluate their aptness. Thus, they learn to produce 'formal' definitions based on either a specific type of class inclusion (e.g. *car* – it is a vehicle) or a general one (*car* – it is something that allows going to school fast). Studying a group of bilingual children who used English at school and French at home, Snow (1990) found that they were better able to provide definitions in English than in French. This result led her to conclude that good definitions are the outcome of a successful schooling process. Furthermore, she found that 49% of the definitions produced by 7-year-old children were of the formal kind; the percentage rose to 76% in 11-year-olds. She also found that while the structure of formal definitions became more complex with age, other types of definition did not change.

In this framework, it is not easy to establish what makes a definition 'good', as not only logical reasoning, but a variety of contextually determined abilities are required for producing good

definitions. The defining competence can be assumed to consist in the ability of the speaker/writer to clarify what a certain object, entity, or person is, or stands for, without repeating tautologically the *definiendum*. In order to fulfill this communicative function, i.e. to be easily understood by the receiver, a definition has to be clear and refer to shared knowledge. Therefore, definitions require referential, classificatory and linguistic skills on the part of the speaker/writer as they should allow the receiver to distinguish the defined object from the other objects in a setting and, particularly, from the other items belonging to the same class. Moreover, they require meta-cognitive and meta-communicative abilities that allow the speaker/writer to plan her/his production in order to adjust it to the assumed expectations of the receiver (Benelli *et al.*, 1989; Benelli and Moé, 2002) Thus, the ideal definition should be synthetic, very clear, and informative at the same time.

Adequate definitions can be more or less informative, ranging from just some hints at the *definiendum* to fully articulated definitions depending on the specific situation. Accordingly, definitions can be cast in sentences of different length. Even if Snow (1991) stressed that ‘better’ means ‘more contextually adequate’, the researchers’ implicit assumption is that there is a standard and ‘better’ type of definition that children progressively learn. This assumption has often led to establish a hierarchy of types of definition, at the top of which is the best type, i.e. the classic Aristotelian form expressed by dictionary definitions: “X is a Y that Z” (e.g. Man is an animal which is two-footed and featherless) (Snow, 1991). As a result of this assumption, research has focused mainly on the linguistic expression of definitions rather than on their content. The linguistic expressions used by children in the defining activity have been considered as a necessary, even though not sufficient, feature in order to characterize good definitions. Moreover, the linguistic expressions in which definitions are cast have been also used for assessing and monitoring cognitive development, as they supply clear hypotheses about the development of children’s defining abilities (Belacchi and Benelli, 1999).

To our knowledge, only a few studies have investigated how the kind of the *definiendum* can bias the type of definition children

produce. Even in these cases, however, the nouns to define were conceived of as more or less difficult to understand and, consequently, to define from a priori perspective. McGhee-Bidlack (1991) found that abstract nouns were more difficult to define than concrete nouns for 10- and 14-year-olds. While concrete nouns elicited definitions based on both the class they belong to and the characteristics of the object, abstract nouns tended to elicit definitions based exclusively on the characteristics of the *definiendum*. Class-based definitions were elicited by abstract nouns only in 18-year-olds. These results led her to conclude that «ordinary dictionary definitions are mature adult definitions» (p. 425). Comparing the definitions of different hierarchical level nouns belonging to the artifact and the natural kinds produced by children aged 5, 7, and 10, Watson (1985) found that superordinate nouns, which support many inferences, were defined first. Furthermore, the definitions of natural kind nouns were based on their superordinate level nouns more frequently than artifact ones. Referring to Sperber and Wilson's (1986) «relevance theory», according to which an utterance is relevant if it elicits the highest number of inferences at the lowest cost, Watson (1985) argued that children progressively produce definitions «that are both inferentially rich and maximally informative to the hearer» (p. 222).

In the present study children's definitions were analyzed in a different perspective. Instead of focusing on children's linguistic expression conceived of as representing a defining skill that increases with age, this research focused on the conceptual content that underlies children's definitions. As recent research has shown, there is no thematic to taxonomic shift in children's conceptual development, because children are able to master also taxonomic knowledge very early (Waxman and Namy, 1997). There is therefore no reason for assuming the privileged status of formal definitions. In fact, as Nippold (1995) pointed out, besides the classical Aristotelian form, there are other types of definition that are more 'naturalistic', such as those involving negation and examples. Moreover, definitions can be formulated also by referring to attributes, function/purpose and cause/effects of the things and events to define. Thus, conceiving definitions as

linguistic entities that mirror children's conceptual knowledge of the different domains of experience allows the hypothesis that different definition strategies can suit concepts of different kinds, by yielding different types of conceptual information (Borghini and Caramelli, 2003). Focusing on the conceptual content of children's definitions rather than on their linguistic expression should help to highlight the developmental changes in the conceptual information from which definitions arise. Moreover, while researchers have usually only studied the definitions of nouns referring to both concrete (living and not-living) and abstract entities, in this study a wide range of nouns and verbs was analyzed, as conceptual knowledge encompasses objects, events and a variety of other knowledge domains as well. In this theoretical framework, the aim of the research was to identify the specific types of definition children produce depending on the different knowledge domains to define.

More specifically the following hypotheses were advanced:

- Definitions and knowledge organization: Concept nouns referring to concrete objects should be easier to define than concept nouns referring to abstract entities (McGhee-Bidlack, 1991) and to events. Nouns referring to different ontological kinds should elicit definitions based on different types of conceptual information. Thus, artifacts, natural kinds and parts should elicit definitions based on their perceptual features and their function/purpose (Barton and Komatsu, 1989). Nouns referring to abstract entities, i.e. of the nominal kind, should be defined by examples, by reference to their cause/effects and by taxonomic knowledge.
- Definitions and conceptual development: Even if also 10-year-olds were already familiar with the concept nouns selected for this study, however children's ability to master a greater variety of definition strategies can be supposed to increase with age. In fact, when their knowledge domains become more detailed and complex, children can develop more complex definition strategies. In this study, the minimal requirement for a statement to be considered as a definition was its clarity; tautologies, and associations, i.e. verbal productions having just a generic link to the concept noun (e.g. *heart - friendship*) were not considered as

'true' definitions. As tautologies and associations are due to lack of specific conceptual knowledge, they were supposed to be elicited more frequently by abstract and event concepts than by concepts referring to concrete entities, and their production was expected to decrease with age.

2. METHOD

2. 1. *Materials*

For the purpose of this study, 45 nouns were selected among the 800 most frequent nouns that had been produced by a group of children for another study. They included: 9 nouns referring to objects (6 artifacts, e.g. *box/computer*, 3 natural kind concepts, e.g. *cat*), 6 referring to parts of objects (e.g. *hearth/nose*) (see Tversky, 1989; Tversky and Hemenway, 1984 for the relevance of parts in children's conceptual development), 3 collective nouns whose exemplars were linked by a partonomic relation (e.g. *team*), 6 location nouns (e.g. *beach/shop*), 15 nominal kind concepts (3 temporal nouns, e.g. *Sunday*, 3 definition based nouns, e.g. *number*, 3 pure abstract nouns, e.g. *freedom*, 3 emotion nouns, e.g. *fear*, 3 social role terms, e.g. *farmer*), and 6 nouns referring to events (e.g. *travel*) (see Nelson, 1986 for the relevance of events in children's conceptual development). Thus, a great variety of different kinds of concept nouns (including locations, actions and events) was studied.

2. 2. *Participants*

Definitions were collected from a sample of 45 children living in Bologna (Italy). The children were subdivided into 3 groups with 15 members each according to age (10-, 11-, and 13-year-olds). These age levels were functional to the specific focus of the present research which intended to investigate age-related changes in children's defining strategies and not the acquisition of the defining competence.

2. 3. Procedure

The 45 concept nouns were written in random order on the pages of a booklet. Blank space was left between them for the children's productions. In the context of the *Addizionario* project, the children were presented with the booklet by their teachers at school and were asked whether they wished to voluntarily collaborate on the compilation of a dictionary for children written by children by writing one definition for each noun. All of them were very eager to collaborate on the project and they were allowed to work on the definition task in several sessions at their own pace.

3. DATA ANALYSIS AND RESULTS

The collected definitions were transcribed and coded by two experimenters, one of which was blind to the hypotheses. Cases of disagreement (5%) were solved after brief discussion.

3. 1. Coding norms

The coding procedure was aimed at distinguishing the different types of productions, i.e. the different types of definitions, and non-definitions, and establishing whether children referred to generic knowledge or to their own experience. The codes were the following:

- Definitions by attribution, when the child referred to the attributes of the *definiendum*, be they physical (shape, color, dimension etc.) or evaluative/qualitative, (e.g. *moon* – round and very far away).
- Definitions by example, when the child exemplified different types of the *definiendum* showing awareness of the aim of the message as directed to a receiver (e.g. *mushrooms* – there are poisonous and good mushrooms).

- Definitions by inclusion, when the child produced superordinate level concept nouns (e.g. *tongue* – it is a muscle).
- Definitions by function/purpose, when the child referred to either the function of an object or to the purpose of an event (e.g. *run* – to lose weight).
- Definitions by cause/effect, when the child referred to something that caused something else to happen and to the effects of the caused events (e.g. *wind* – when air makes grass move).
- Definitions by negation, when the child highlighted the lack of a feature in the *definiendum* (e.g. *freedom* – something you cannot touch).
- Definitions by generic reference, when the child referred to generic objects and people (e.g. *table* – a wooden thing where people usually have lunch).
- Definitions by self reference, when the children referred to themselves, their opinion and personal experience (e.g. *box* – I have one in which I keep my toys).

The cases of non-definitions encountered were the following:

- Association, when the child produced a free association (e.g. *hunger* – something to eat).
- Tautology, when the child repeated the *definiendum* or used a synonym (e.g. *friendship* – to have a friend).

3. 2. *Data analysis*

The productions for each code at the different age levels are shown in percent in Tables 1a-1c. The tables clearly show that the children were able to use all of the definition types at all the three age levels.

CONCEPT KINDS – 10-YEAR-OLDS						
DEFINITION STRATEGIES	SINGLE OBJECTS	PARTS	COLLECTIVE OBJECTS	LOCATION	NOMINAL KINDS	EVENT
Attribution	21	13	26	18	20	16
Exempl.	6.4	2.1	4	5	4.5	10
Inclusion	35	39	34	34	36	18
Funct/Purp.	8.9	18	5	4	9	3.4
Cause/Eff.	1.4	1.6	2	1	1.5	5.5
Negation	2.2	1.6	1	1	1.5	2.5
Generic Ref.	16	12	17	26	18	24
Self Ref.	6.7	8.5	7	8	7.5	5.9
Association	2.8	4.2	2	3	3	11
Tautology	0	0	3	0	0.8	4.2

Table 1a. Percentage of the different definition strategies used with the different concept kinds by 10-year-olds.

CONCEPT KINDS – 11-YEAR-OLDS						
DEFINITION STRATEGIES	SINGLE OBJECTS	PARTS	COLLECTIVE OBJECTS	LOCATION	NOMINAL KINDS	EVENT
Attribution	22	24	20	24	20	22
Exempl.	4.3	2.3	7	12	5.5	8
Inclusion	42	46	47	25	35	34
Funct/Purp.	14	3.5	3	4	2.6	12
Cause/Eff.	2	0.6	3	8	5.5	4
Negation	1.3	0	0	2	3.4	0.9
Generic Ref.	11	22	17	17	20	12
Self Ref.	0	0	0	1	0.3	0.3
Association	2	1.2	3	8	4.2	4.9
Tautology	0	1	1	1	2.9	1.2

Table 1b. Percentage of the different definition strategies used with the different concept kinds by 11-year-olds.

CONCEPT KINDS – 13-YEAR-OLDS						
DEFINITION STRATEGIES	SINGLE OBJECTS	PARTS	COLLECTIVE OBJECTS	LOCATION	NOMINAL KINDS	EVENT
Attribution	28	25	27	26	23	26
Exempl.	11	8	9	9	8	3.1
Inclusion	35	38	38	30	30	36
Funct./Purp.	10	2.7	4	6	2.4	19
Cause/Eff.	2.2	0.4	3	10	6.6	3.5
Negation	2.7	2.2	2	3	5.9	1.8
Generic Ref.	7.3	21	14	13	20	6.2
Self Ref.	1.1	0.9	0	0	0.9	0.9
Association	1.6	0.9	2	3	3.3	4
Tautology	0.5	0	0	0	0.5	0

Table 1c. Percentage of the different definition strategies used with the different concept kinds by 13-year-olds.

Even though the children were asked to produce only one definition for each concept noun, a definition could give rise to several elements falling under different codes. Therefore, the average number of elements present in a single definition can be taken as a measure of its complexity. Thus, the total productions at a certain age level divided by the number of the concept nouns to define was used to check whether the complexity of the produced definitions increased with age. As the ratio was 2.5 at both 10 and 11 years of age, and 3.2 at 13, it can be concluded that the complexity of children's definitions increased between age 11 and age 13.

Correspondence Analysis was performed to analyze the coded productions. In this statistics, the frequencies of the relations produced give rise to a broad data matrix that allows the identification of their weight and their graphical representation as points in a multidimensional space. On the graph, the geometrical proximity of the points shows the degree of their association and the similarity of their distribution (Hair *et al.*, 1992; Greenacre and Blasius, 1994). The aim of Correspondence Analysis is to represent the rows and the columns of a two-way contingency table (profiles)

as points in corresponding low-dimensional vector spaces. In order to project the observed points onto a low-dimensional subspace, it is necessary to define the Chi square metric as the distance in the space of the profiles. In fact, the distances between the points are not simply Euclidean distances but the weighted distances (Chi square) between the relative frequencies, (Hair *et al.*, 1992). Thus, the logic underlying Correspondence Analysis is quite similar to that of Factor Analysis: the first dimension explains a Total Inertia higher than that explained by the further dimensions. The maximum number of dimensions is the minimum between the number of columns minus 1 and the number of rows minus 1. Several Correspondence Analyses were performed:

1. With Age Levels and Definition Strategies as factors.
2. With Conceptual Domains (object, part, collective object, nominal kind, location, event concept nouns) and Definition Strategies as factors at each of the three age levels.
3. With Ontological Kinds of concept noun (artifacts, natural kinds, and nominal kinds) and Definition Strategies as factors at each of the three age levels.
4. With the different types of Nominal Kind concept noun (pure nominal kind, social role, emotion, time and abstract concept nouns) and Definition Strategies as factors at each of the three age levels.

In the following sections, the first Correspondence Analysis will be illustrated by its graph, while the results of the other Correspondence Analyses will be illustrated by tables summarizing the results at the three age levels. Only the factors which were clearly characterized in at least two age levels on either the first or the second dimension of the Correspondence Analyses will be discussed. The second dimension was not considered when it explained less than 15% of the total variance.

3. 2. 1. Age levels and Definition Strategies

On the first dimension, which explains 85.7% of the total variance, 10-year-olds' productions characterized by self reference and generic reference definitions (e.g. *hit* – I hit my knee; *need* – when one needs something, people should help) differed from the productions by 13-year-olds (Fig. 1). The oldest age group mainly produced definitions by cause/effect (e.g. *wind* – when air makes grass move), by example (e.g. *party* – when it is Carnival), and by negation (e.g. *holiday* – when one doesn't go to work). This analysis highlights the variety of strategies underlying 10- and 13-year-olds' definitions.

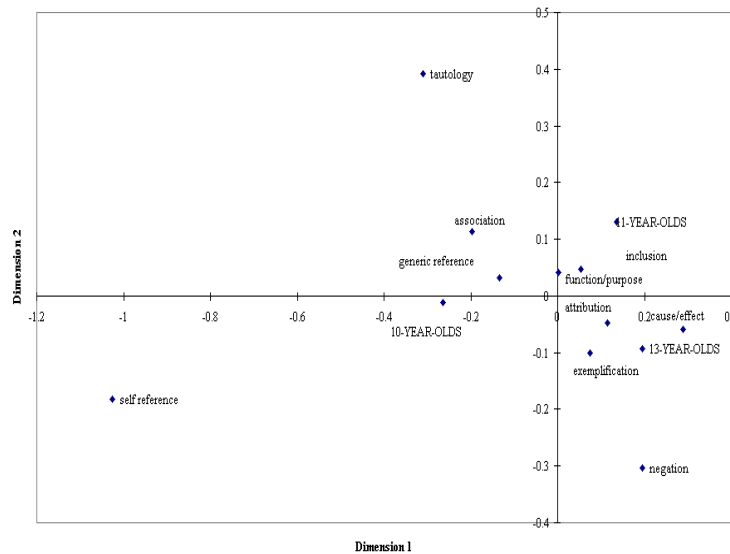


Figure 1. Definition Strategies Used at Each Age Level.
Dimension 1 = 85. 7%; Dimension 2 = 14.3%.

3. 2. 2. Conceptual Domains (Object, Part, Collective object, Nominal kind, Location, Event concept nouns) and Definition Strategies

The results of the three Correspondence Analyses that were performed, one for each age level, are summarized in Table 2.

Object concept nouns elicited definitions by inclusion (e.g. *box* – a container) and by function/purpose (e.g. *computer* – used to write) at all age levels.

Part concept nouns (e.g. *number*), like Object concept nouns, elicited definitions of the function/purpose type at all the considered age levels (e.g. *nose* – used to breath). At 10 and 11, they also elicited definitions by association (e.g. *heart* – indicates metaphorically the goodness of a person).

As associations do not meet the minimal requirements to be considered as proper definitions, we must conclude that 10- and 11-year-olds are not yet fully able to define part of objects.

Collective object nouns did not elicit definitions of any specific type at any age level.

Nominal kind concept nouns elicited definitions by cause/effect or tautology (e.g. *Carnival* – party which consists in wearing masks; *season* – there are four seasons) in 10- and 11-year-olds. In 11- and 13-year-old children, they elicited definitions by generic reference (e.g. *joy* – when some people are happy for something).

Location concept nouns elicited definitions by inclusion (e.g. *park* – green area) in 11- and 13-year-olds.

Event concept nouns elicited association (e.g. *party* – when there is a party there is joy overall) and definitions by cause/effect (e.g. *party* – meeting of friends to enjoy themselves and dance) at all age levels.

Overall, these results showed a difference between concept nouns referring to concrete entities (Object, Part, Collective Object, and Location concept nouns) and those referring to abstract entities (Nominal Kind and Event concept nouns). The definitions of the former category were by inclusion and function/purpose, those of the latter by tautology, association, and cause/effect.

CONCEPT KINDS	DEFINITION STRATEGIES	CHARACTERIZED BY		
		10	11	13
Single Objects	Parts (1)	+		+
	Location (2)			+
	Event (1)			
	Inclusion (1; 2)	+	+	+
	Function/Purpose(1)	+	+	+
Parts	Single objects (1)	+		+
	Event (2)	+	+	
	Association (2)	+	+	
	Exemplification (2)		+	
	Inclusion (1; 2)	+		
	Function/Purpose (1; 2)	+	+	+
	Cause/Effect (1; 2)	+		
Collective Objects		/	/	/
Nominal kinds	Event (1)		+	
	Cause/Effect (1)	+	+	
	Generic reference (1)		+	+
	Tautology (1)	+	+	
Location	Single objects (2)			+
	Attribution (2)	+		
	Inclusion (2)		+	+
	Generic reference (2)		+	
Events	Parts (2)	+	+	
	Nominal kinds (1)		+	
	Association (2)	+	+	+
	Exemplification (2)		+	
	Function/Purpose (1; 2)		+	
	Cause/Effect (1; 2)	+	+	+
	Generic reference (1; 2)		+	
	Tautology (1)		+	

Table 2. Definition Strategies Used with the Different Concept Kinds.
Synthesis of the Correspondence Analyses.

Moreover, the fact that Event concept nouns elicited associations confirms Markowitz and Franz's (1988) findings that children who are already able to properly define nouns often produce naive definitions of verbs.

3. 2. 3. Ontological Kinds of concept nouns (Artifacts, Natural Kinds, and Nominal Kinds) and Definition Strategies

The results of the three Correspondence Analyses performed, one for each age level, are summarized in Table 3.

CONCEPT KINDS	DEFINITION STRATEGIES	CHARACTERIZED BY		
		10	11	13
Natural kinds	Attribution (2)	+	+	+
	Inclusion (2)	+		+
Artifacts	Function/Purpose (1)	+	+	+
Nominal kinds	Association (1)	+		
	Cause/Effect (1)		+	+
	Tautology (1)	+		

Table 3. Definition Strategies Used with Artifacts, Natural Kinds, and Nominal Kinds. Synthesis of the Correspondence Analyses.

Artifact concept nouns elicited definitions by function/purpose (e.g. *computer* – it can be used for working) at all the considered age levels.

Natural kind concept nouns elicited definitions by attribution (e.g. *planet* – it is small and yellow) at all the considered age levels, and also definitions by inclusion (e.g. *mushroom* – it belongs to the vegetal kingdom) at the ages of 10 and 13.

Nominal Kind concept nouns elicited tautologies (e.g. *parent* – person who becomes a parent) in 10-year-olds, while in 11- and 13-

year-olds they elicited association (e.g. *freedom* – it is important to preserve it) and definitions of the cause/effect type (e.g. *parent* – he has the duty to take care of his/her child).

These analyses clearly show that artifact concept nouns were defined referring to the purpose they are constructed for and to the goal they allow to attain. Natural kind concept nouns were defined by mentioning both the properties that characterize the entities they refer to and the class they belong to. It is worth noticing that natural kind concept nouns elicited definitions of the classic Aristotelian type (e.g. *planet* – it is a celestial body that is small and yellow). Nominal kind concept nouns, which 10-year-olds find difficult to define, elicited definitions by cause/effect in 11- and 13-year-old children.

3. 2. 4. Different types of Nominal Kind concepts (Pure Nominal kind, Social Role, Emotion, Time and Abstract concept nouns) and Definition Strategies

The results of the three Correspondence Analyses performed, one for each age level, are summarized in Table 4.

Pure nominal kinds elicited definitions by attribution (e.g. *number* – abstract and conventionally established) at all the considered age levels and also by inclusion (e.g. *number* – it is a symbol) in 11-year-olds. It is worth noticing that pure nominal kind concept nouns, which owe their existence to their definitions, elicited definitions of the classic Aristotelian type (e.g. *number* – it is a symbol that is abstract and conventionally established).

Social role concept nouns elicited definitions by generic reference at all the age levels considered.

Emotion concept nouns elicited definitions that were not based on any specific type of definition. Only 13-year-old children defined emotion concept nouns by generic reference (e.g. *fear* – somebody fears danger) and by example (e.g. *fear* – when a car moves at high speed). The lack of children's knowledge in this particular abstract domain has been already highlighted by Caramelli *et al.* (2004).

Temporal concept nouns elicited definitions by attribution and by inclusion in 10-year old-children, i.e. definitions of the classic Aristotelian type (e.g. *Sunday* – a day of the week that you wait for), while they did not elicit any specific type of definition in 11- and 13-year-old children.

Abstract concept nouns elicited definitions by association (e.g. *hunger* – in some countries people are hungry) and by negation (e.g. *hunger* – when you don't eat for a long time) at all the considered age levels. Clearly, they are difficult to define as they do not have a specific, concrete referent or a conventional definition like pure nominal kind concept nouns do.

Overall, these analyses show that nominal kind concept nouns are differently defined depending not only on the degree of their 'well-definiteness' (Keil, 1989), but also on the direct experience children have had of their contents. Pure nominal kind concept nouns, which do not have concrete referents, were easily defined by children when they had knowledge of the conventionally established contents of the nouns. Social role concept nouns, which refer to people by secondary categorization (Cruse, 1986), i.e. as referents they have people playing particular socially established roles the content of which is not yet mastered even by 13-year-old children, were poorly defined by generic reference. Emotion concept nouns, too, were difficult to define even for 13-year old children, who made generic references and produced examples of specific emotions. Time concept nouns referring to situations children experience directly every day were easily defined. Abstract concept nouns, which have neither concrete referents nor a well defined content, should be considered difficult to define, as children were able to specify what they are not, but not what they are.

CONCEPT KINDS	DEFINITION STRATEGIES	CHARACTERIZED BY		
		10	11	13
Pure nominal kinds	Temporal terms (2)			+
	Attribution (1; 2)	+	+	+
	Exemplification (2)	+		
	Inclusion (1)		+	
	Function/Purpose (2)		+	
	Cause/Effect (2)	+		
Abstract terms	Association (1)	+	+	+
	Function/Purpose (2)			+
	Negation (1)	+	+	+
	Tautology (1)	+		
Social roles	Generic reference (1; 2)	+	+	+
Temporal terms	Social roles (1; 2)	+		
	Nominal kinds (2)			+
	Attribution (1)	+		
	Inclusion (1)	+		
Emotion terms	Social roles (2)			+
	Exemplification (2)			+
	Generic reference (2)			+

Table 4. Definition Strategies Used with Different Nominal Kind Concepts. Synthesis of the Correspondence Analyses.

4. DISCUSSION

The results clearly support our hypotheses. The complexity of the definitions children produced increased with age and those by older children were characterized by multiple-strategy-based

definitions. Overall, as found in previous studies (Snow, 1990), the definitions by ten-year-olds were characterized by self and neutral reference, which shows that, at that age, children's knowledge is still self referred or generic. Eleven-year-olds were better able to define concepts by referring to class inclusion, although their definitions still drew on tautology, which is not a proper definition strategy. Thirteen-year-olds referred to causes and effects of the *definiendum* and, in many cases, their definitions were consistent with the formal Aristotelian model. The definitions of concrete object concept nouns showed a greater variety of definition strategies than those of abstract entities and events. Moreover, object concept nouns belonging to different ontological kinds elicited different types of definition. Natural kind concept nouns were defined by reference to their attributes and the superordinate level of the class they belong to, thus fulfilling the requirement of the Aristotelian definition scheme. Concept nouns referring to artifacts elicited definitions based on the functions they are constructed for. Nominal kind concept nouns, which are mastered later, as they are defined by tautology and association, were defined by 13-year-old children by referring to causes and consequences.

These findings nicely fit into Keil's (1989) interpretation of the development of children's defining skills and take his results a step further by showing that not only the *definiendum's* ontological kind is relevant in shaping children's definitions, but also the children's direct experience of the specific domain which the *definiendum* belongs to. In fact, even though children are already able to master all the definition strategies at the age of 10 (Markowitz and Franz, 1988; Mcghee-Bidlack, 1991), all the children in our study crucially employed those strategies depending on their own direct knowledge of the domains to define and on the classical ontological partitions as well (Keil, 1989). Overall, abstract concept nouns (Nominal Kind and Event concept nouns) were more difficult to define than concrete concept nouns (Object, Part, Collective Object, and Location concept nouns) at all the considered age levels, the definitions of the former being by tautology, association, and cause/effect, while those of the latter by inclusion and function/purpose. However, it is worth noticing that,

in both the concrete and the abstract domains, older children showed the Aristotelian definition model in defining natural and nominal kind concept nouns of the pure type. At the same time, they found it difficult to properly define specific domains of the concrete, and the abstract nouns (e.g. object parts and event, social role, respectively), and emotion concept nouns. Thus, it seems that there is more at play in determining children's definitions than the mere degree of 'well-definiteness' (Keil, 1989) of concepts and their ontological kinds. The results of this research allow us to argue for the role played by children's direct experience of the situations in which the referents of concept nouns occur in modeling their definition strategies. In fact, time concept nouns, which are unquestionably abstract but refer to specific situations children directly experience every day, were easily defined. Social role concept nouns, which instead refer to people's roles that are not directly experienced by children as actors, were difficult to define even at 13 years of age.

These results support a view of children's definition strategies that is coherent with perception and action-based models of conceptual knowledge (Jones and Smith, 1993; Smith and Heise, 1992; Smith and Samuelson, 1997; Mandler, 1992; 1997; Glenberg, 1997). According to this perspective, direct interaction with the world through perception and action gives rise to conceptual knowledge that encompasses a variety of domains that grows with age and, thus, domain knowledge becomes not only wider, but also more and more integrated into abstract conceptual knowledge. This explains why children define concrete nouns earlier than abstract ones and certain knowledge domains earlier than others. It also explains why older children's definitions are cast in multiple definition strategies. In this integrated view of conceptual knowledge, rather than shifting from a form of knowledge to another (e.g. from characteristic to defining features, from perception to conception, from thematic to taxonomic), children develop a contextually shaped and flexible (Barsalou, 1991; Ross and Murphy, 1999) conceptual knowledge organization. Accordingly, children improve their ability to use multiple defining strategies with age, and the choice of the strategy to use depends on both the children's direct knowledge of the

domains to define and the diverse dimensions of their direct knowledge of the *definiendum*.

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