Comparing children's and adults' interpretation of Italian indefinite quantifiers[1]

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Abstract
We investigate whether Italian native speakers and Italian children can order the quantifiers of their language on a magnitude scale. We look at three indefinite low-magnitude quantifiers (*alcuni, pochi, qualche, 'a few'*) and three indefinite high-magnitude quantifiers (*molti, parecchi, tanti, 'many'*). Dictionaries suggest that these quantifiers refer to different magnitudes, which would not only justify their co-existence in the language, but should also make scalar ordering possible. In two experiments, 96 adults and 16 five-year-old children took part in a magnitude comparison task. The results show a developmental difference in so-called "synonymous" quantifiers, which we explain by suggesting that children apply the Principle of Contrast to quantifiers.

Keywords: first language acquisition, interval scales, Italian quantifiers, linear scales

1 Introduction

In their influential paper on quantifiers in natural language, Barwise and Cooper (1981) wrote that:

> "While it is seldom made explicit, it is sometimes assumed that there is some system of axioms and rules of logic engraved on stone tablets – that an inference in natural language is valid only if it can be formalized by means of these axioms and rules. In actuality, the situation is quite the reverse. The native speaker's judgements as to whether a certain inference

is correct […] is the primary evidence for a semantic theory in just the way that grammaticality judgements are used as primary evidence for a syntactic theory" (pp. 201-202).

We collected such native-speaker judgements for six Italian quantifiers in an experimental setting, to see whether the magnitude order native speakers have for the quantifiers of their language differs from the order posited by traditional grammars and dictionaries. We present the results of two experiments that used a magnitude-comparison task with two populations, adults and children. Our research questions are: (a) Do Italian native speakers order the six quantifiers *alcuni*, *molti*, *parecchi*, *pochi*, *qualche*, *tanti* on a scale according to their magnitude? (b) Can Italian 5-year-old preschoolers order the same six quantifiers? (c) Are there differences between the adult and child ordering? After introducing the linguistic notion of scale (Section 2) and the Italian quantifiers (Section 3), we will formulate our hypotheses and predictions (Section 4). We will then present the two experiments (Section 5 and 6) and discuss their results (Section 7).

2   Scales

The use of linear scales to order quantifiers was extensively investigated in psychology during the 70's and 80's (Moxey and Sanford 1993:2). The degrees on a linear scale can be represented as points on a line, which precede or follow each other (Figure 1). Dehaene (1997) and Wiese (2003) explain how linear scales are commonly used for numbers and exact physical measurements (e.g. weight, length, etc.). On linear scales, no overlap is possible among the degrees. Moreover, we can make use of arithmetic predictor functions to establish an order among the degrees on the scale.

Figure 1: A linear scale

In formal semantics, Kennedy (2001) formalizes the scalar degrees required for the semantics of antonymic relations and comparative constructions as *intervals* on a scale, rather than points, (1a and 1b). Since quantifiers also form antonymic relations, (1c), this raises the question of the nature of the elements on a quantifier scale: are they points or rather intervals, similar to antonymic adjectives?

(1)   a.   Weight   <heavy, not heavy, not light, light>

      b.   Length   <long, not long, not short, short>

      c.   Quantity   <many, not many, not few, a few>

Interval degrees stretch to lengths corresponding to their semantic values, sometimes overlapping with neighbouring intervals. It follows that interval scales allow both degree overlap and voids between scalar degrees. The distance between interval degrees can also vary, but this flexibility comes at a price: interval scales have no predictor functions to order the degrees. Krifka (2006) explains how, whenever two or more intervals overlap, we normally opt for the more informative and less ambiguous of the options available. For example, if we have a choice between *not unhappy* and *happy*, we normally opt for the latter (Figure 2).
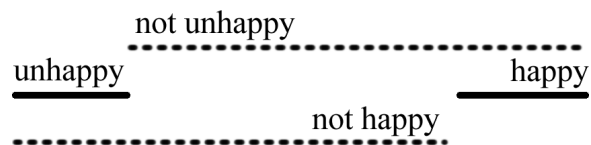

Figure 2: The interval scale for the adjective *happy* with solid lines representing the more informative degrees

Less informative adjectives are not placed at the extremes of the scale and often overlap with a more informative adjective. To test whether an adjective is at an extreme of the scale, we can therefore use the adverb *very*. Because *very* preferably combines with adjectives that denote an extreme of a scale, the combination *very happy* is felicitous, whereas the combination *very not unhappy* is not.

      The same test works for quantifiers: we can say *very few* and *very many*, but not **very several* (Kayne 2007). Similarly, in Italian *pochissimi* ('very few') and *tantissimi* ('very many') are possible, but not **parecchissimi* ('very several'). We implement these observations on the inflections of Italian quantifiers in our hypothesized scale (presented in §3) where *pochi* and *tanti* appear at the extremes of the scale, while *parecchi* appears as one of the intermediate degrees.

      Given the fact that quantifiers denote quantities or degrees, and the generally accepted assumption that quantities and degrees can be represented as points or intervals on a scale, it must be possible to map quantifiers onto such a scale. Quantifiers denoting different magnitudes should then map onto different

points or intervals on the scale, whereas synonymous quantifiers should map onto the same point or interval on the scale.

3   Italian quantifiers

We classified six Italian quantifiers into two magnitude groups, according to the information available in a well-known contemporary descriptive grammar (Dardano and Trifone 1997) and several dictionaries (Devoto and Oli 1985; Felici and Riganti 1987; Palazzi and Folena 1992).

We distinguish a low-magnitude group (those that mean 'a few') and a high-magnitude group (those that mean 'many'). The low-magnitude group consists of: *poco* ('little', 'few'), *alcuno* ('some', 'a few') and *qualche* ('some', 'a few'); the high magnitude-group of: *molto* ('much', 'many'), *parecchio* ('several', 'much', 'many'), and *tanto* ('much', 'many'). In Italian dictionaries, the quantifiers across magnitude groups are sometimes cross-referenced as antonyms and the ones within the same magnitude group as synonyms.

The grammar defines *poco* as referring to a "small quantity". It is the antonymic counterpart of *molto*, which refers to "a large quantity". *Parecchio* is said to point to "a consistent quantity", smaller than *molto*, yet it is often used as a synonym for *molto*. *Tanto* is said to be equivalent to *molto*, but also to express the idea of "a large quantity" with more strength. Zamparelli (2008) defines *qualche* as pointing to a larger, yet still limited, quantity than *poco*.[2] The plural form *alcuni* is synonymous with *qualche*. According to Dardano and Trifone (1997) and Zamparelli (2008), *alcuni* has a cardinal reading.[3]

Combining the information from grammars and dictionaries, we may posit the linear scale in Figure 3, where the quantity denoted increases from left to right. Between *alcuni-qualche* and *parecchi* we draw the line separating the low- and high-magnitude groups.
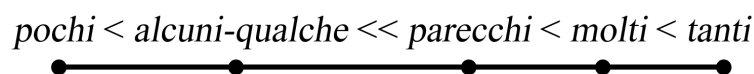
pochi < alcuni-qualche << parecchi < molti < tanti

Figure 3: The linear order of the six Italian quantifiers based on the information from grammars and dictionaries

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[2] In the two experiments to be discussed later, we use *qualche*, *alcuni* and the other four quantifiers only in their cardinal interpretation.

[3] *Qualche* can be singular or plural in meaning, but always triggers singular verb agreement. The singular forms of *alcuno* (masc., and *alcuna*, fem., 'any') are not relevant for us here, since they are used as negative polarity counterparts of *nessuno* and *nessuna* ('no').

4 Hypotheses and Predictions

Eve Clark (1987, p. 4) points out that all languages contain expressions whose meanings overlap and that "In many contexts these may be exchanged for each other, and that it is this degree of synonymy that is exploited in dictionaries and thesauri". However, she goes on to remark that these "overlaps are not equivalent to synonymy" and agrees with Bolinger (1977, p. ix) that "any word which a language permits to survive must make its semantic contribution". Following these claims, this would mean that the three low-magnitude quantifiers and the three high-magnitude quantifiers are only apparent synonyms. Since they refer to (sometimes slightly) different magnitudes, it should be possible to order them on a scale, perhaps the linear scale in Figure 3. This predicts that Italian native speakers have no difficulty in distinguishing low-magnitude quantifiers (*alcuni*, *pochi*, *qualche*) from high-magnitude quantifiers (*molti*, *parecchi*, *tanti*), and moreover, they will also be able to order the quantifiers within each group.

If participants do not order the quantifiers on a linear scale, however, it does not immediately follow that these quantifiers cannot be ordered on any scale. It may also be the case that the six quantifiers must be interpreted with respect to an *interval scale* instead. As such, quantifiers may establish antonymic relations only *across* magnitude groups, and those quantifiers whose intervals completely or partly overlap could be considered synonyms or near-synonyms, respectively.

We will further investigate whether there are differences in the ordering of quantifiers across the adult and child groups. The Principle of Contrast states that, in a language, differences in form always contrast in meaning (Clark 1987, p. 2) and it predicts that since words contrast in meaning there are no true synonyms (id., p. 3). This explains for example why a child who is presented with two terms from the same domain (e.g. *plate* and *bowl*, *plane* and *jet*, *animal* and *dog*), will not accept the terms to refer to the same entity (Clark 1987, p. 13). We hypothesize that children will not accept synonymous quantifiers, because the Principle of Contrast blocks synonyms and predicts children to expect one specific label to correspond to one specific meaning.

Thus children are expected to posit different meanings for different quantifiers. If so, they should be able to order them on a scale. Whether the children's scale is the same as the one in Figure 3, the one that adults provide or a different one altogether, depends on their acquisition of the lexical semantics of each quantifier.

5   Experiment 1: Quantifier-comparison experiment with adults

The magnitudes of the six Italian quantifiers are tested by giving participants many pair-wise comparisons. Participants were given a magnitude-comparison task where, between two identical boxes, represented by pictures as shown below, they had to choose the box containing the larger quantity. The content of the boxes was described using quantifiers.

5.1   Method

The experiment was administered as a paper booklet. The test-items were constructed using six different pairs of quantifier contrasts: *pochi* vs. *qualche*, *pochi* vs. *alcuni*, *qualche* vs. *alcuni* for the low-magnitude quantifiers, and *molti* vs. *parecchi*, *tanti* vs. *molti*, *tanti* vs. *parecchi* for the high-magnitude quantifiers.

The high-magnitude test items were constructed with both genders (masculine and feminine) as well as with singular and plural nouns, with 6 contrasts per condition, making 18 high-quantifier pairs. Due to the morphologic constraints imposed by *alcuni* and *qualche* (cf. footnote 3), the low-magnitude test items occurred in both genders but only with plural nouns; there were 3 items per condition, making 9 low-quantifier pairs in total. The total number of test items per booklet was thus 27 quantifier pairs.

In addition each booklet contained 56 items with contrasts in the form of *low* vs. *high*, drawn from quantifier pairs belonging to opposite magnitude clusters, functioning as control items. We expected the participants to always choose the box denoted by the high-magnitude quantifier in these control items. Moreover, in each booklet we included 9 items showing quantifiers paired with themselves (e.g. *pochi*-vs.-*pochi*). We refer to these items as fillers. In contrast to the test items and control items, we did not on beforehand have any clear predictions about these filler items.

A minimal verbal and visual context was used (Figure 4). Each item showed two cardboard boxes numbered "1" and "2". Above the boxes a description of the box contents was provided, always in the same form: "Box 1 contains [*quantifier 1*] noun and box 2 contains [*quantifier 2*] noun". For each item, two questions were asked. Question 1 was: "Le due scatole contengono le stesse quantità?" ('Do the two boxes contain the same quantity?'). If participants chose "yes", they moved on to the next item in the questionnaire.

If they chose "no", there was a follow-up Question 2 which contained the real test question: "Quale scatola contiene la quantità maggiore?" ('Which box contains the larger quantity?'). A multiple choice answer was offered: (a) "Box 1", (b) "Box 2" or (c) "The two boxes contain different quantities, but I am not able to say for sure which one of the two boxes contains the larger quantity".

We used this two-question set-up because in Italian it is impossible to ask: "Which box, if any, contains the larger quantity?". Furthermore, asking only Question 2 might have biased the subjects, as they might have excluded the possibility that the two boxes might contain the same quantity.
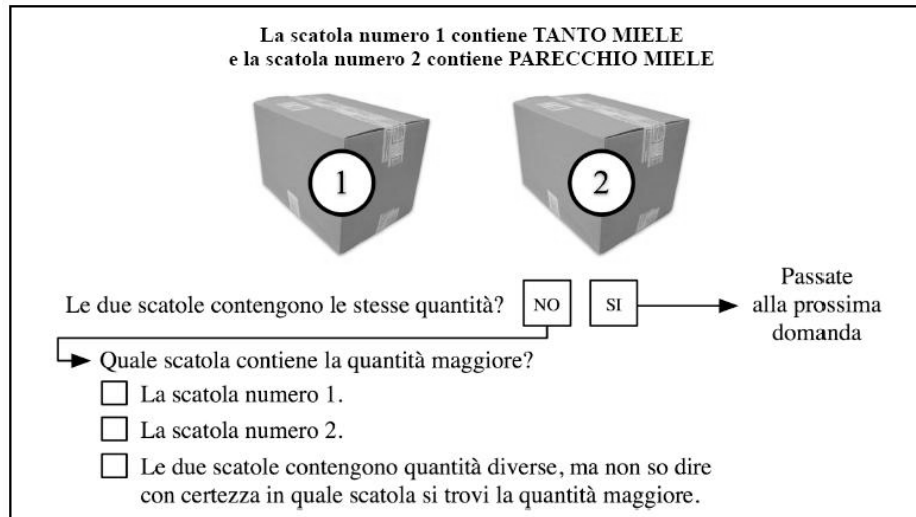

Figure 4: Example of an experimental item

The left-right position of the quantifiers was switched across two versions of the experiment. The quantified nouns included both mass and count nouns.[4]

5.2 Participants

The participants were 96 Italian adults (47 females, 49 males; mean age 43); 79 of these participants were from central Italy, 6 from the north, 9 from the south and 2 from the islands.

5.3 Results

In the responses to Question 1 – whether the boxes contained exactly the quantity – we found a significant difference between the percentages of "Yes" and "No" answers for the three types of items, even though "No" is the preferred answer for all types. This result indicates that no pair of quantifiers is perceived as expressing exactly the same quantity (Table 1).

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[4] Mass nouns were further balanced by physical properties (e.g. solid, liquid, and powder-like, as in *bread*, *milk*, *sugar*).

Table 1: "Do the two boxes contain the same quantity?": average results grouped by item type

Item type	Yes	No	Sig.
Test items	14%	86%	*p*<.001
Control items	0.28%	99.72%	*p*<.001
Filler items	32.83%	67.17%	*p*=.02

The average number of "Yes" answers to Question 1 increased significantly (Figure 5) across different item types: there was an average of 0.28% for the control high-low items, 13.68% for the low-low and high-high test items and 32.83% for the fillers (two same quantifiers). All contrasts among any two of these values were statistically significant (control vs. test: *p*<.001; control vs. filler: *p*<.001; test vs. filler: *p*=.01).
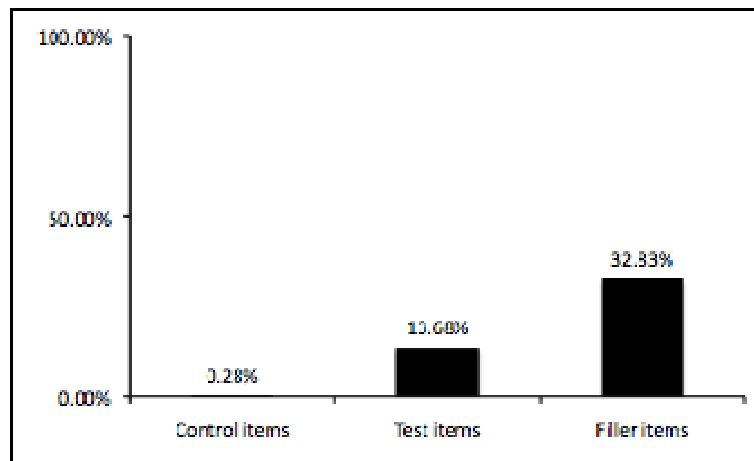
Figure 5: Average values of "Yes" answers to Question 1 in the adult experiment, grouped by item type

For the control items, which tested the difference between the low- and high-magnitude quantifiers, we expected the participants to say "No", in fact we excluded all four participants who made three or more mistakes with these items. Hence, data from these participants were not used in Figure 5, Table 1 and Table 2.

Participants behaved differently with the test items and filler items than with the control items: they consistently gave more "Yes" answers. Furthermore, they answered "Yes" with the filler items significantly more often than with the test items. For the filler items, if the participants would assign the same quantity to the same indefinite quantifier, they are expected to say "Yes".

However, they did so in only a third of the cases. This could in principle be an artefact of the large number of control items. However, there is an alternative explanation: two identical indefinite quantifiers may denote different quantities; for instance, in English it is plausible that two boxes, both containing "many apples", do not contain the same amount of apples. [5]

For all test items, the answers to Question 2 showed a significant preference for the (c) "Not sure" answer (Table 2). Across all control items, we found a significant preference for either answer (a): "Box 1", or answer (b): "Box 2" (also in Table 2).

Table 2: Results for Question 2: "Which box contains the larger quantity?"

Item type	Pair	Not sure	Box 1 or 2	Sig.
test	alcuni-vs.-pochi	75.6%	24.4%	*p*<.001
	alcuni-vs.-qualche	84.6%	15.4%	*p*<.001
	pochi-vs.-qualche	76.5%	23.5%	*p*<.001
	molti-vs.-parecchi	64.6%	35.4%	*p*<.001
	molti-vs.-tanti	83.8%	16.2%	*p*<.001
	parecchi-vs.-tanti	64.1%	35.9%	*p*<.001
control	alcuni-vs.-molti	5.6%	94.4%	*p*<.001
	alcuni-vs.-parecchi	7.6%	92.4%	*p*<.001
	alcuni-vs.-tanti	5.6%	94.4%	*p*<.001
	molti-vs.-pochi	2.7%	97.3%	*p*<.001
	molti-vs.-qualche	4.8%	95.2%	*p*<.001
	parecchi-vs.-pochi	2%	98%	*p*<.001
	parecchi-vs.-qualche	6%	94%	*p*<.001
	pochi-vs.-tanti	2.4%	97.6%	*p*<.001
	qualche-vs.-tanti	4.8%	95.2%	*p*<.001

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[5] This claim could be tested in a replication of the experiment including a new type of control items, e.g. "Box 1 contains zero apples and box 2 contains no apples" or "Box 1 contains two socks and box 2 contains a pair of socks".

5.4 Discussion

The results on the control items show that adult native speakers of Italian have no problems ordering two quantifiers that belong to different magnitude groups. The results on the test items show that ordering two quantifiers that belong to the same magnitude group is not as easy for adults. All participants perceived the quantifiers as denoting different quantities, as the majority of answers to Question 1 were "No" answers. This seems to rule out the possibility that these quantifiers are interpreted as perfectly synonymous. However, the participants were not in agreement about the larger quantity of the two. This is unexpected with a linear scale, but can be explained with an interval scale. If the intervals denoted by the two quantifiers are not identical (thus ruling out perfect synonymy) but only partially overlap, it is impossible to determine an order between the two quantifiers.

In fact, even fully overlapping intervals may resist an ordering because of the indeterminacy of the exact quantities or degrees, which could explain the rather puzzling finding that also for identical quantifiers participants tend to answer that they refer to different quantities. If we nevertheless try to represent the results of this experiment as a linear scale, it would be the two-point scale in Figure 6, where the only distinction is between high-magnitude quantifiers and low-magnitude quantifiers. Accordingly, we must reject the scale in Figure 3 as representative of the magnitude order assigned by native speakers to the quantifiers.

alcuni-pochi-qualche << molti-parecchi-tanti

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Figure 6: Adult linear order of the six
Italian quantifiers

Interestingly, the amount of "Yes" answers to the question whether exactly the same quantity was in the boxes increased when the hypothesized linear distance between two quantifiers decreased (cf. Figure 3). This piece of data suggests that the same type of operation is used for the comparisons involved in test items, control items and filler items. Furthermore, we see in Table 2 that for some pairs (e.g. *alcuni*-vs.-*qualche*, *molti*-vs.-*tanti*) we have a percentage of "Not sure" answers around 80%, while other pairs (e.g. *molti*-vs.-*parecchi*, *parecchi*-vs.-*tanti*) are in the range of 60%, with the remaining two (*alcuni*-vs.-*pochi*, *pochi*-vs.-*qualche*) falling in between. We will come back to this observation in the general discussion.

6 Experiment 2: Quantifier-comparison by children

Experiment 2 investigated whether a population of 5-year-old preschoolers differed from the adults of Experiment 1. In Experiment 2, the magnitudes of the six quantifiers already seen in Experiment 1 were compared in a minimal verbal and visual context to find out whether children were able to establish a magnitude order among them.

6.1 Method

When testing 5-year-old children we are faced with two problems: children of this age cannot yet read, so we cannot use the same questionnaires as we used for the adults, and the task in Experiment 1 was too long to be suitable for children. We therefore shortened the task and adapted our method and materials, while keeping Experiment 2 as comparable as possible to Experiment 1 with adults.

Children watched a cartoon featuring a mouse. A pre-recorded voice explained that the mouse needed all boxes containing the larger quantity of different kinds of foods. We explained that the mouse was not sure which boxes contained the larger quantity and that he needed the child's help to accomplish his goal. The experiment consisted of a series of slides displayed on a laptop screen. Each slide showed two same-size closed boxes (Figure 7).
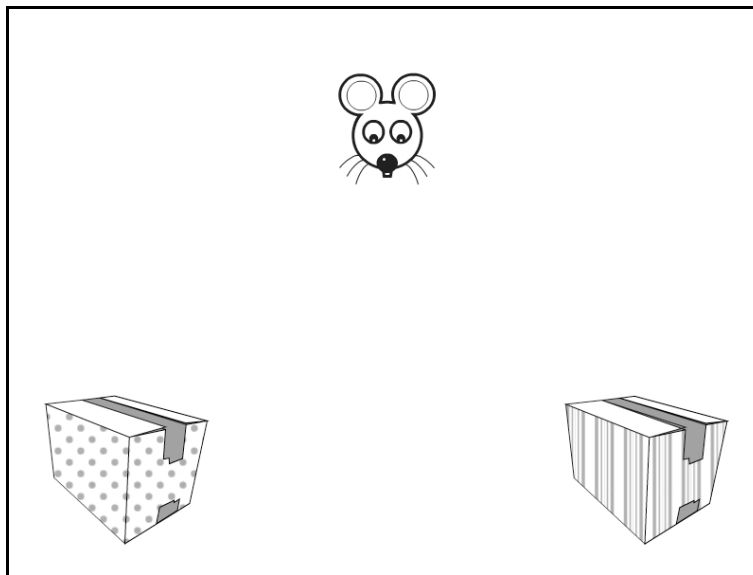

Figure 7: An item from Experiment 2

Each slide presented boxes with two different patterns (dots and stripes) of the same colour. Pattern colours changed across slides and we carefully balanced the combinations of quantifiers and patterns across two lists to avoid artefacts in

the data. Alternating the colours across the slides increased the novelty of the task for the children. For each slide, a pre-recorded voice told the child what was in each box (4).

(4)   Nella scatola a pallini ci sono [*quantifier 1*] mele. Nella scatola a strisce ci sono [*quantifier 2*] mele.
        'In the box with dots there are [quantifier 1] apples. In the box with stripes there are [quantifier 2] apples.'

The experimenter asked the child the exact same question as Question 1 from Experiment 1: "Le due scatole contengono le stesse quantità?" ("Do the two boxes contain the same (two) quantities?"). If the child answered "yes", the experimenter advanced to the next experimental item. If the child answered "no", the experimenter asked a second question, which is similar to Question 2 in Experiment 1: "Quale scatola ne contiene di più?" ("Which box contains more?"). The child could either choose one of the two boxes (a) "dotted" or (b) "striped" or, if not sure about which box contained more, (c) say that he/she let the mouse choose (corresponding to (c) in Experiment 1).

In the practice session, we asked the child if he/she could tell which box was striped and which one was dotted, as we needed to know if he/she knew the two patterns. Four practice items followed, comparing numbers rather than quantifiers to avoid a learning effect. Two of these comparisons showed the boxes open so that their contents were visible (e.g. *two*-vs.-*ten* apples). Two more comparisons showed closed boxes instead. The practice session introduced the children to the task and checked for their understanding of the concept of "larger quantity".

The experiment spanned over two sessions, with a short break in between. The materials involved the same six quantifiers as Experiment 1. The experiment included 18 test items, 8 control items and 4 "attention catchers". There were 3 test items for each low-magnitude pair: *pochi*-vs.-*alcuni*, *pochi*-vs.-*qualche*, *alcuni*-vs.-*qualche*, and 3 for each high-magnitude-pair: *parecchi*-vs.-*tanti*, *parecchi*-vs.-*molti*, *molti*-vs.-*tanti*. To shorten the task, we only tested plural nouns. 6 of the control items were drawn from contrasts between pairs of quantifiers belonging to different magnitude-clusters: *tanti*-vs.-*qualche*, *tanti*-vs.-*pochi*, *qualche*-vs.-*parecchi*, *pochi*-vs.-*molti*, *parecchi*-vs.-*alcuni*, *alcuni*-vs.-*molti*; the remaining 2 control items were drawn from pairs of numbers: 4-vs.-10, 10-vs.-3. The 4 "attention catchers" introduced questions unrelated to the interpretation of quantifiers and appeared at regular intervals during the experiment.

6.2 Participants

The participants were 16 children, 7 boys and 9 girls, whose age ranged between 4;7 and 6;0 (mean age 5;3). All children were recruited in a kindergarten in Milan, had no linguistic impairments, and belonged to monolingual Italian families.

6.3 Results

For all control items, children gave a correct answer 96% of the time, almost always pointing at boxes containing the larger amount. The only exception was *qualche*-vs.-*parecchi* (see Table 5). For all test items, we found that children assign to "synonymous" quantifiers different magnitudes, always answering "no" to Question 1.

Table 3: Results for Question 1: "Are the two quantities exactly the same?"

Item-type	Pair	Yes	No	Sig.
test	pochi-vs.-qualche	0%	100%	*p<.001*
	pochi-vs.-alcuni	0%	100%	*p<.001*
	alcuni-vs.-qualche	2.1%	97.9%	*p<.001*
	parecchi-vs.-tanti	0%	100%	*p<.001*
	parecchi-vs.-molti	0%	100%	*p<.001*
	molti-vs.-tanti	2.1%	97.9%	*p<.001*
control	tanti-vs.-qualche	0%	100%	*p<.001*
	tanti-vs.-pochi	0%	100%	*p<.001*
	4-vs.-10	0%	100%	*p<.001*
	qualche-vs.-parecchi	0%	100%	*p<.001*
	pochi-vs.-molti	0%	100%	*p<.001*
	parecchi-vs.-alcuni	0%	100%	*p<.001*
	10-vs.-3	0%	100%	*p<.001*
	alcuni-vs.-molti	0%	100%	*p<.001*

Children's "Yes" answer pattern differs from the adults' one. For children, the average amount of "Yes" answers was for the control items 0% and for the test-items 0.7% (the difference is *n.s.*). Our data shows a significant developmental difference in the way children and adults evaluate the various quantifiers (Figure 8).
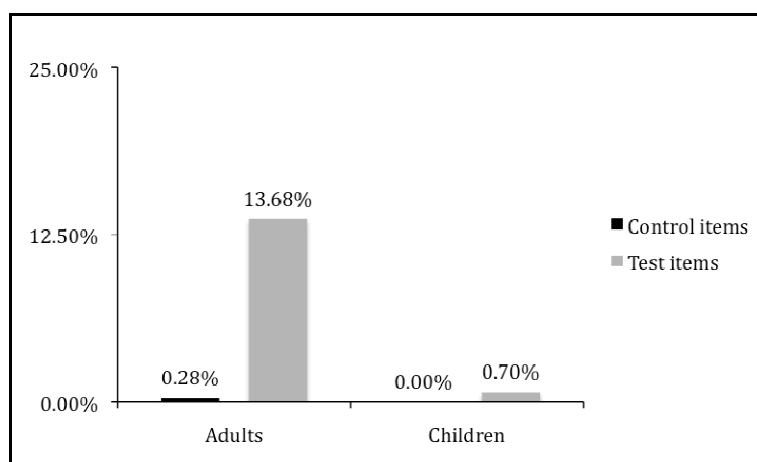
Figure 8: Developmental difference in "Yes" answers to Question 1 for test and control items

Regarding the children's results, we believe the high percentage of "No" answers to Question 1 is not an artefact due to the control items. The task included 18 test items and only 6 linguistic control items: if we were to witness any artefact at all, it should have been the test items influencing the control items and not the other way around.

Moreover, the children almost never let the mouse choose a box (only 10 times out of a total of 416 experimental items). Instead, they demonstrated very precise knowledge of which quantifier pointed to the largest quantity (Table 4). The comparisons involving same-magnitude quantifier pairs show that *alcuni* refers to larger quantities than *pochi* ($p=.007$) and *qualche* ($p=.006$), and that *parecchi* refers to a smaller quantity than *molti* ($p=.01$). The comparison of *tanti* outranking *parecchi* was nearly significant ($p=.09$). The comparisons *pochi*-vs.-*qualche* and *molti*-vs.-*tanti* were both not significant.

Table 4: Results on test items for Question 2: "Which box contains the larger quantity?"

Quantifier 1	Quantifier 2	Sig.
alcuni (78.7%)	pochi (21.3%)	*p=.007*
alcuni (81%)	qualche (19%)	*p=.005*
pochi (41.3%)	qualche (58.7%)	*n.s.*
molti (76.6%)	parecchi (23.4%)	*p=.01*
molti (43.8%)	tanti (56.3%)	*n.s.*
parecchi (31.3%)	tanti (68.8%)	*p=.09*

Table 5 shows that children performed adult-like on the control items, with the exception of *qualche*-vs.-*parecchi*. The outcome of the other comparisons achieved statistical significance (chi-square *p*=.005).

Table 5: Results on control items for Question 2: "Which box contains the larger quantity?"

Pairs	Low Q.	High Q.	Sig.
alcuni-vs.-molti	0%	100%	*p*=.005
alcuni-vs.-parecchi	0%	100%	*p*=.005
3-vs.-10	0%	100%	*p*=.005
pochi-vs.-molti	0%	100%	*p*=.005
4-vs.-10	0%	100%	*p*=.005
qualche-vs.-parecchi	31.2%	68.8%	*n.s.*
pochi-vs.-tanti	0%	100%	*p*=.005
qualche-vs.-tanti	0%	100%	*p*=.005

Eight out of the sixteen children showed coherent individual patterns and established a certain scalar order for at least four out of the six same-magnitude comparisons. If we look at these individual patterns between-subjects though, only the comparisons of *pochi*-vs.-*alcuni* and *parecchi-vs.-molti* showed similar answers, with *alcuni* and *molti* pointing at the larger quantities. Unfortunately, when looking at individual patterns, we do not have enough data points per condition for a reliable statistical analysis.

6.4 Discussion

Children performed adult-like for all comparisons between quantifiers of different magnitude, showing that they can clearly distinguish low- from high-magnitude quantifiers. Children differed from the adults in the comparisons between two same-magnitude quantifiers.

For the two pairs *pochi*-vs.-*qualche* and *molti*-vs.-*tanti*, children's results apparently align with those of adults. However, while adults opt for the "Not sure" answer, individual children were always certain which quantifier was denoting the larger quantity but gave different answers, so that as a group they performed at chance level.

For all other test items, children were able to point to the quantifier representing the larger quantity. We can order their results on a four-point scale (Figure 9).

pochi-qualche < alcuni << parecchi < molti-tanti

Figure 9: Child linear order of the six
Italian quantifiers

Since the ranges of *molti* and *tanti* overlap, and *qualche* overlaps with *pochi* but not with *alcuni*, also for children we must reject the scale in Figure 3, even though the scale derived from the children's results comes closer to it than the scale derived from the adult's results.

The fact that a significant number of the children's answers (31.2%) did not rank *parecchi* above *qualche* may seem surprising, given the 81% of *alcuni* ranking above *qualche*, and the 100% of *parecchi* ranking above *alcuni*. One possible interpretation of these conflicting results could come from the finding of Borges and Sawyers (1974), who conducted a psychometric study on English quantifiers. In their experiment, they used the quantifiers *few*, *several*, *some*, *lots*, *many*, and *most,* and found two distinct usages for *several* (which is the English closest equivalent of *parecchi*). The participants assigned to *several* a meaning split across two different scalar positions: there turned out to be a low-*several* (6) and a high-*several* (7).

(6)   *few < low-several < some*

(7)   *some < high-several < lots, many < most*

Considering that *some* translates as both *qualche* and *alcuni*, and that *lots-many* translates as *molti-tanti*, the child data relative to *parecchi* seem to mimic the split-interpretation of *several* discovered by Borges and Sawyers. It is also possible that the ranking of *parecchi* by some of the children represents a temporary phase in development, before the quantifier shifts into a scalar position higher than *qualche*.

7   General discussion

We hypothesized that Italian native speakers can order the six quantifiers *alcuni*, *molti*, *parecchi*, *pochi*, *qualche*, *tanti* on the linear scale based on traditional grammars and dictionaries in Figure 3, repeated here:

pochi < alcuni-qualche << parecchi < molti < tanti

Figure 10 (= 3): The linear order of the six Italian quantifiers based on the information from grammars and dictionaries

However, adults were only able to distinguish high- from low-magnitude quantifiers, resulting in a two-point scale (Figure 6). The children established a partial four-point ordering instead (Figure 9). For the adult group, therefore, we must reject the hypothesis. Our results indicate that adults do not order the six quantifiers on a linear scale. Children, on the other hand, appear to do so, at least partially.

It is conceivable that the adults order the quantifiers on an interval scale, on which all three quantifiers within the same magnitude group massively overlap. Our experiment was not designed to establish the extent of quantifier overlap, however. Although the percentages for the "Not sure" answers in Table 2 seem to suggest a large semantic overlap for specific pairs of quantifiers (e.g. *alcuni*-vs.-*qualche*, *molti*-vs.-*tanti*), we do not believe this is a reliable measure. The experiments presented here only allow for a firm conclusion about the absence of a linear scale. The existence of an interval scale and the extent of overlap among interval degrees on such a scale was investigated in Montalto (2009:64-74).

The children's ordering of quantifiers may be explained by the Principle of Contrast (cf. §4). Applying this principle to the quantifiers from the same magnitude group, children will expect each quantifier to correspond to a specific quantity that is different from the quantities denoted by other quantifiers, thus blocking semantic overlap. The adults in our first experiment, on the other hand, easily accept certain quantifiers as synonymous, and furthermore fail to establish a clear order between quantifiers that they perceive as denoting different magnitudes. This suggests that the Principle of Contrast no longer holds in the adult grammar.

Why should children differ from adults? We think the explanation can be sought in the interaction between language and the cognitive domain of numbers. Considering the relative lack of familiarity of five-year-old children with numbers and arithmetic operations to evaluate the precise numerosity of sets, they might have developed an ordered scalar system of quantifiers based on their linguistic input and the Principle of Contrast, which decays when solid arithmetic abilities are acquired.

Of course, given the nature of the task with two closed boxes and indefinite quantifiers, participants may have thought it to be unlikely for two boxes to contain exactly the same quantity, and for this reason say "No" to Question 1 ("Do the two boxes contain the same quantity?"), irrespective of the semantics of the two quantifiers. However, the adults seemed to treat test items, control items and filler items differently.

Setting up a further series of experiments, including new control items for adults (e.g. zero-vs.-*no*; two-vs.-*a pair*) as well as same-quantifier items (e.g. *pochi*-vs.-*pochi*) in the children's experiment, might be a fruitful way to further investigate these specific aspects of quantifier meaning.

8   Conclusion

In order to find support for a linear scale as posited by Italian grammars and dictionaries, we experimentally investigated whether adult Italian native speakers can order six quantifiers on such a scale. We also looked into the question whether Italian 5-year-old preschoolers were able to order the same six quantifiers, and whether any developmental difference could be found between the two groups. Our hypothesis of a linear scale did not hold for the adults. The children revealed a partial ordering. Whereas both adults and children are able to express a magnitude choice between antonymous quantifiers, only children expressed firm magnitude judgments for (near-)synonymous quantifiers, leading them to the establishment of a partial ordering. We suggest that the Principle of Contrast offers a plausible explanation for this difference between children and adults.

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