The selective development of Agreement in Early Italian

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Four different agreement configurations in Italian (Determiner – Noun, Subject – Verb, Subject – Predicative Adjective, Clitic – Past Participle) can be naturally ranked from a minimum to a maximum of complexity in terms of the movement operations they necessarily involve, and of the derived representations at the interfaces. We put forth the hypothesis that this complexity ranking has predictive capacities with respect to the timing of full mastery of the different configurations in acquisition: a more complex configuration is expected to be fully mastered later than a less complex configuration. We check the consistency of the predicted sequence with the available data from corpus studies. Then, we test the prediction experimentally through the Forced Choice of Grammatical Form paradigm with children of age three, four and five acquiring Italian.

0. Introduction.

Agreement processes generally obey fundamental locality conditions. Nevertheless, different kinds of agreement involve somewhat different computational ingredients: some are necessarily satisfied in configurations derived via movement in multiple steps (e.g., past participle agreement with clitics in gender and number in many Romance languages), while others never involve movement (e.g., the agreement between a determiner and a head noun again in gender and number), and there are intermediate cases, involving less complex movement chains than clitic constructions. As a consequence of such computational differences, the surface configurations in which the agreeing elements appear can be quite diverse: maximally local in some cases, less local in others.

In the first part of this paper, we look at four different kinds of agreement configurations in Italian (Determiner - Noun, Subject – Verb, Subject – predicative Adjective, clitic – past participle) which can be naturally ranked from a minimum to a maximum of complexity in terms of the derivational operations which they require and of the derived representations at the interfaces. We then turn to language acquisition, and put forth the hypothesis that the ranking in terms of

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complexity has predictive capacities with respect to the timing at which the different agreement configurations are fully mastered in development. After verifying the consistency of such predictions with the data available from corpus studies, we turn to the experimental part of the paper, and we test the predictions of the hypothesis through the Forced Choice of Grammatical Form (FCGF) paradigm. The complexity ranking is shown to predict the order of full mastery of the four different agreement configurations in development.

1. Background: agreement configurations and locality.

Agreement is a morphosyntactic process by which two elements are (externally or internally) merged in a local configuration and share certain morphosyntactic features. A prototypical case is subject-verb agreement in person and number (in most Indoeuropean languages; other languages may involve other kinds of features). The process is governed by strict locality constraints: for instance, a verb typically agrees with its local subject, not with the subject (or other nominal elements) of an embedded clause. Moreover, locality is established in hierarchical terms, not linearly. So, in a sentence like

(1) The picture of the girls is on the table

The verb be does not agree with the linearly adjacent adnominal complement girls, but with the head of the subject noun phrase picture, more distant in linear terms, but closer in the hierarchical tree structure.

All agreement processes are submitted to general locality constraints. Nevertheless, the surface configurations holding between the agreeing elements can vary, within a narrow range. This gives us the possibility of drawing a typology of agreement configurations, based on the more or less strictly local nature of the relation holding at the interface. In this paper we'll look at the following four agreement configurations (all illustrated by Italian examples, as the experimental data will concern Italian):

(2) a. D-N agreement:

Le case
Thef,plur housesf,plur

b. Subj -V agreement:

Gianni parte
Gianni3P,sing leaves3P,sing'

c. Subj - Adj agreement:

Maria è stanca
Mariaf,sing is tiredf,sing

d. Clitic – Past-Part agreement:

Gianni le ha viste
Gianni themf,plur ha vistef,plur

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(2)a is a case of agreement in gender and number between the determiner and the noun in a nominal expression, an agreement that in fact spreads, in Romance, to adjectives and other nominal modifiers. (2)b illustrates agreement in person and number between the subject and the inflected verb; (2)c exemplifies agreement in gender and number between a subject and a predicative adjective, normally across a copular verb; (2)d is a case of agreement in gender and number between the clitic, attached to an auxiliary verb, and the past participle .

Arguably, in all these cases agreement is checked under strict locality conditions, essential conditions defined by (external and internal) merge and a local search (or "Agree") operation; nevertheless, the configurations holding at the interface between the agreeing elements differ significantly, due to independent properties of the constructions in (2). From now on, we will call the the "source" of agreement the nominal element whose features are copied and the "target" of agreement the head in the functional structure of the DP or of the clause which receives the featural specification of the source: in the system of Chomsky (1995), the distinction coincides with the one between the element bearing interpretable (and valued) features and the one bearing uninterpretable (and unvalued) features.

Agreement and movement are closely connected computational operations. For instance, in Kayne's (1989) classical analysis, core agreement configurations typically involve movement of the source to a local configuration with the target; and further applications of movement may subsequently separate the two elements, giving rise to non-local interface configurations. We would like to capitalize on this connection between agreement and movement to differentiate the agreement configurations given in 0(2): the number and properties of movement operations involved in the different configurations will determine a natural gradation of the complexity of the configuration, which we will use as a generator of predictions on the developmental course.

In presenting this idea, let us consider the four agreement configurations reported in (2), ranking them in terms of the movements operations necessarily involved.

The simplest case is (2a), D – N agreement, which does not involve movement at all: we may think of this kind of agreement as a morphological reflex of external merge putting these two elements together. Nothing moves here, in the normal case[1].

(3) D [NP … N …]

Absence of movement thus singles out (2a) from all the other cases, all requiring a movement operation.

Subj – V agreement (2b) involves, under current assumptions, movement of the subject from its thematic position in the *v*P to the Spec position of a functional head

[1] It is not entirely obvious, in this case, which element is the source and which is the target; nevertheless, this is not crucial for our typology, as nothing moves in any case and the two elements remain strictly local at the interfaces. On number and gender agreement within DP's see Cardinaletti & Giusti (2011).

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in the clausal structure bearing unvalued Phi features2 (the position AgrS of pre-minimalist analyses; following Rizzi 2006b, Rizzi & Shlonsky 2007 we use the label Subj to designate the head licensing the subject position in the high part of the functional structure of the sentence). The local Spec-head configuration between the source and the target of agreement is necessarily created by movement, and movement typically stops there: other principles conspire to preserve the local configuration at the interfaces. For instance, Criterial Freezing (Rizzi 2006b, Rizzi & Shlonsky 2007) has the effect of freezing the configuration and blocking further movement of the subject (see the references quoted on the strategy that languages may use to circumvent this ban).

(4) …. ___ Subj …. [vP DP ….]



A partially similar case is given by Subj – Adj agreement, illustrated in (2c). This configuration also involves movement of the nominal expression from its thematic position in the AP (under Stowell's 1983 Subjects across Categories hypothesis) to the Spec of a functional head bearing Phi features (perhaps a Pred(ication) head à la Bowers 2010); however, an important difference exists between the two cases. While for Subj-V agreement the local Spec-head configuration is a criterial one and no further movement is allowed, in the case of Subj-Adj agreement the Spec-head configuration holds in a non-criterial position. Hence the nominal expression does not (and in fact cannot) stop there: it further moves to the subject position of the copular verb, the normal subject position of clauses with criterial properties. The relevant point for our typology is that agreement of the predicative AP is typically checked "in passing" here: the subject moves from its thematic position to the adjectival agreement position, and then it moves further

(5) …. ___ Subj …. [___ Phi [AP DP ….]]



Our fourth case Clitic – Past Participle Agreement (2d) also involves agreement "in passing". According to Kayne's (1989) seminal analysis (see also Belletti 2006), the clitic moves from object position, triggers agreement on the past participle endowed with number and gender features, and then proceeds to its final destination, the clitic position in the functional structure of the clause. Again, the position in which agreement is checked, the Spec-head configuration created with the participial head

[2] In the system of Chomsky (2000) Subj – V agreement involves two steps: first, the establishment of an Agree relation between the functional head endowed with Phi features in the inflectional space and the subject DP in its thematic position vP internally and, second, the successive movement of the DP to the Spec of the inflectional head. See Franck, Frauenfelder, Lassi & Rizzi (2006) for evidence supporting the view that agreement is checked twice, in the Agree configuration and then in the Spec-head configuration derived via movement of the subject. In this paper we will not address the status of agreement in configurations in which the subject remains in a lower position (such as so-called "free inversion" in Romance), hence in which the checking under Spec-head does not take place. See Guasti & Rizzi (2002) for discussion of this case.

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(an aspectual head in the system of Cinque 1999) is not a criterial configuration, hence the clitic proceeds to a higher position after checking agreement features:

(6) …. ___ Cl …. [___ Asp … [vP V DP ….]]

Clearly, the configuration bears some similarity with the case of adjectival agreement in that checking "in passing" is involved; but plausibly, the surface configuration between the trigger and the target is even less local in the case of cliticization. As the clitic chain always crosses a phase edge (the edge of the vP node in (6) in the system of Chomsky 2001), while the moved DP does not cross any such edge (if we assume, with Chomsky op. cit., that unaccusative and copular verbs define defective, not full vP phases).

In conclusion, the notion of movement provides us with three factors which could define a gradient of complexity between different agreement configurations.

The first is the general cost associated with a movement operation. Under this assumption, configurations involving no movement at all (D - N agreement) are more local and less complex than configurations derived by movement. However, once movement takes place, not all the configurations must be treated alike. This leads us to the second factor, related to the landing site of the moved constituent. The local spec-head configuration triggering agreement could be the final landfall of movement or not. In the first case, agreement will be obtained in a locally stable configuration at the interface (Subj -V agreement) while in the latter case, agreement will be achieved "in passing" (Cl – Past Participle agreement, Subj - A agreement).

The last factor concerns instead the "syntactic distance" between the position where agreement is checked and the final landing site of movement. We might assume that the intervention of a phase edge could add additional complexity, distinguishing Cl – Past Participle agreement from other configurations, as Subj - Adj agreement, which arguably do not cross a phase edge.

As we are interested in the global configurations holding at the interfaces, perhaps an even more perspicuous way of characterizing the gradient is through the representational notion of chain: we have a representation involving no non-trivial chains (D - N), a representation involving a non-trivial chain which ends at the agreeing head (Subj - V), a non-trivial chain which continues after reaching the agreeing head (Subj - A), and a non trivial chain which continues after reaching the agreeing head and crosses a phase edge (Cl – Past Participle) 3.

Each factor can be naturally thought of as increasing the complexity of the configuration: movement, as opposed to the absence of movement clearly does, as it represents an extra operation. Satisfaction in passing is more complex than satisfaction at the head of the chain, as it requires some form of reconstruction.

[3]Another possible factor singling out the clitic configuration is that it involves movement across an intervener: the clitic must move across the thematic position of the subject, while no other case considered in table (6) involves movement across an intervening nominal element. We will not try to tease apart here the two ways of singling out the fourth case.

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Crossing a phase edge involves keeping an element active in operative memory across phases.

By putting these observations in the form of a table, we obtain the following:

(7) Agreement configurations in relation to Movement

The computation of Agreement configurations:	Involves movement to the Spec of the target of agreement	Involves further movement from the agreement position	Involves further movement crossing a phase edge
D N Agr	-	-	-
Subj V Agr	+	-	-
Subj...A Agr	+	+	-
Cl ... Past Part Agr	+	+	+

In this paper we are interested in the consequences of this gradation of complexity for language development and a natural hypothesis is the following:

(8) A more local agreement configuration is fully mastered earlier than a less local agreement configuration.

This hypothesis, in conjunction with the gradient of locality in (7), generates a clear prediction on development: the four agreement configurations in (2) are fully mastered with the following temporal order in language development:

(9) I. D - N Agreement
II. Subj - V Agreement
III. Subj - Adj Agreement
IV. Cl - PastPart Agreement.

In order to test (9), we decided to adopt an experimental paradigm based on forced choices, close to explicit grammaticality judgment but able to avoid the limitations on tasks based on metalinguistic reasoning with young children (McDaniel et al. 1988).
In the next sections, we look at existing data on the development of agreement, which seems to be consistent with our hypothesis in (9). In section 4 we will present a new experimental study based on the Forced Choice of Grammatical Form.

2. Previous studies on morphological agreement in Italian

Early morphosyntactic development is a prominent topic in language acquisition and most of the agreement configurations previously mentioned have been analyzed in corpus-based and elicited production studies. On the basis of our hypothesis on a selective development of agreement, we will briefly review here the results of previous research on Early Italian.

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Let us start from subject-verb agreement. In considering this relation, we are interested in sentences with all the relevant functional projections in place: the pre-requisite for triggering agreement. Therefore, the first preliminary question amounts to asking when Italian children start producing inflected forms and what their proportion is on total. An answer to this question can be found in the results coming from corpora studies on Italian, as the ones reported in Pizzuto & Caselli (1992), Guasti (1993/1994) and more recently Caprin & Guasti (2009).

In a cross-sectional study based on the transcriptions of the spontaneous speech of 59 children, Caprin & Guasti (2009) found that children in the youngest age group (mean = 2;3 years) already produced 57% of inflected structures, mainly with present indicative and past tense. If imperatives are also included, the total of the inflected verbs reaches 90%.

These results are in line with previous ones coming from longitudinal studies (Guasti 1993/1994, Pizzuto & Caselli 1992), confirming that Subj-Verb agreement can be observed since the very first spontaneous productions. In general, the overall performance of Italian children with verbal inflection is remarkably good from early on, at least if compared to other populations of children, where non-finite forms are more frequent (Rasetti 2000; Poeppel & Wexler 1993; Phillips 1995) in early transcriptions.

Given that verbal forms are inflected since the earliest verbal productions, a second question, directly relevant to our discussion, is to determine to what extend children correctly process Subj-Verb agreement.

In their study, Caprin & Guasti (2009) reported (table 1) that at the present indicative children in the youngest age group already produce the correct Subj-Verb agreement morphemes in 94% of the cases (64/68). Longitudinal data from Guasti (1993/1994) also confirm that errors with verbal agreement morphology are extremely rare. Non-target verbal forms were produced only in a few cases and the highest error rate is the one of Martina, which didn't exceed the 6.2% in the period between 2;2 and 2;7. These results are analogous to the ones reported in Pizzuto & Caselli (1992), who analyzed the longitudinal transcriptions of three different children. Again, the highest error rate (Marco, 1;5 – 3;0) was only at 4.3%. The results are summarized in Table 2. The conclusion is that Italian children do not only use finite morphology from very early on, but also that they make relatively few mistakes.

Tab.1. Agreement mismatches at present indicative. Cross-sectional data from Caprin & Guasti (2009).

Study	Group	MLUW and age	substitution on total
Caprin & Guasti 2009	G1	MLUW = 1 – 1.5 mean 2;3	4/68 (5.9%)
	G2	MLUW = 1.5 – 2 mean 2.36	12/242 (5%)
	G3	MLUW = 2 – 3.1 mean 2.51	13/838 (1.5%)

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Tab.2. Verbal inflection. Longitudinal data from Guasti 1993/94 and Pizzuto & Caselli (1992)

study	children	Age		correct finite forms	Total errors	substitutions excluding infinitives
Guasti 1993/1994	Martina	1;8 2;6	–	486	32/518 (6.2%)	8 (1.4%)
	Diana	1;10 2;6	–	619	10/629 (1.5%)	8 (1.2%)
	Guglielmo	2;2 2;7	–	208	10/218 (4.5%)	6 (2.7%)
Pizzuto & Caselli 1992	Claudia	1;3 2;9	–	935	23/958 (2.4%)	n.c.
	Francesco	1;4 3;9	–	827	17/844 (2.0%)	n.c.
	Marco	1;5 3;0	–	311	14/325 (4.3%)	n.c.

With this overall picture on Subj-Verb agreement in mind, the next step is to compare it to the other agreement configurations in 0. Given that Subj-Verb agreement is in an intermediate position, we expect to find, at the same developmental stage, a higher accuracy with D-N agreement. On the contrary, Clitic-PastPart agreement should be still problematic. Let us consider now these two structures in turn, disregarding for the moment Subj-Adj agreement in predicative constructions as we are not aware of any existing study directly addressing this issue.

For what concerns D-N agreement, a preliminary observation is that a more permissive distribution of null determiners is found in child than in adult grammar and that, at early stages, full-fledged determiners coexist with phonologically reduced forms (protosyntatic devices in Bottari, Cipriani & Chilosi 1994). Given that omissions and reduced forms are not informative on the development of D-N agreement, we need first to isolate full Ds. Their proportion on total has been investigated in several corpora studies (Ferrari & Matteini 2009, Caselli, Leonard, Volterra and Campagnoli 1993), with the most prudent estimation reported in Caprin & Guasti (2009) where the production of full determiner between the second and the third year is attested at 58.5% on total. Among these full unreduced forms, according to our hypothesis, we expect fewer agreement errors if compared with Subj-Verb agreement.

Caprin & Guasti (2009) report errors at about 3%, which is very much the same rate as the one given in Pizzuto & Caselli (1992) for Claudia, Francesco and Marco: their error rate being respectively of 4%, 3% and 3%. Notice that, in their count, Pizzuto & Caselli also included cases which could be classified as phonological and not as morphological errors. In fact, in Italian, the features +masculine +plural are

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associated with the two allomorphs “gli” and “i” and that their distribution is constrained by the properties of the following phonological segment. For this reason, the error rate in Pizzuto & Caselli (1992) may have been slightly pumped up by the fact that substitutions of “i” instead of “gli” (i occhiali, Claudio 1;9) have also been counted as mistakes.
On the basis of these studies, we can estimate that the proportion of D-N agreement mistakes, around the second year, is at most at 4%. This allows us to draw only one safe conclusion, namely that D-N agreement is not more difficult than Subj-V agreement. However this is a rather weak result, and although being compatible with our hypothesis, it doesn’t directly support it.

A first crucial problem should be evident at this point: in employing corpora analysis, many critical assumptions affect the count. This seriously weakens the possibility of obtaining a direct and accurate comparison between different structures. A second problem is that, in a normally developing population of children, the error rate is extremely sensitive to the selected time window. As an example, consider again Table 2 and the error rate relative to the transcriptions coming from the production of Francesco. Here we found the lowest proportion of errors, if compared with Claudia and Marco. In this case, it is likely that the error’s proportion has been underestimated as a direct consequence of an overextension of the selected time-window: Francesco is the only child being recorded until 3;9 years, much later than any other child. This problem could be only partially alleviated by employing additional controls based on developmental metrics, as dictionary size or MLU.
Elicited production can overcome some (but not all) of the drawbacks associated with the analysis of spontaneous production. This methodology has been repeatedly employed to study Clitic-PastPart agreement and the reason is that clitic constructions in the past tense are extremely infrequent in early transcriptions. As a consequence, the paucity of data makes any quantitative analysis unreliable. The rarity of this kind of sentences depends essentially on two factors. The first is that most structures involving participial forms (passives, for instance) are largely avoided in the first spontaneous productions. The second is that object omission is another distinguishing feature of early grammar. Consider the following three sentences, produced by one of the children taking part to an elicited production experiment reported in Moscati & Tedeschi (2009).

(10) a. (la mucca) l’ ha lavata
the cowf,sing cl has washed f,sing

b. ha lavato la mucca
has washedm,sing the cowf,sing

c. ha lavato
has washedm,sing

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Sentences (10)a and (10)b are two possible adult sentences, with obligatory past participle agreement in (10)a and the default –o [+masculine, +singular] form in (10)b. The third sentence (10)c is instead a typical sentence in Early Italian (see also Jakubowicz et al. 1996, Pérez-Leroux et al. 2008 for French, Wexler et.al. 2004 for Catalan and Spanish) and it is ungrammatical in the elicited context. Will this sentence be a reduced form of (10)a or (10)b? If we consider the null object in (10)c as a full DP, no agreement is required and the past participle is correctly inflected. On the contrary, if we instead consider (10)c as having a null clitic pronoun (McKee & Emiliani 1992, Tedeschi 2009), the silent counterpart of *l'* in (10)a, the study of the past participle morphology could be potentially relevant.
Given the debated status of sentences in (10)c, different studies keep the cases from (10)a to (10)c distinct. For this reason, the past participial agreement rate has been separately reported in relation to clitics, full DPs and null objects. This distinction is maintained in Table 3, where the results of the different studies are summarized.

Table 3. Past participle agreement in relation to direct objects.

Study	N.of subjects, Age	Agreement with direct object		
		Clitic	null	DP
McKee & Emiliani (1992)	(N = 9, mean 2;4)	14/14 (100%)	8/8 (100%)	1/28 (3.6%)
Schaeffer (2000)	(N=5, mean 2;5)	8/8 (100%)	2/10 (20%)	0/8 (0%)
Moscati & Tedeschi (2009)	(N=10, mean 2;8)	1/4 (25%)	0/4 (0%)	2/20 (10%)
	(N=25, mean 3;6)	33/41 (80.5 %)	1/9 (11.1%)	1/94 (1.1%)
	(N=21, mean 4;4)	60/79 (75.9%)	1/5 (20%)	161/164 (1.8%)

Let us discuss first the case of post-verbal full DPs. In adult Italian, past participle agreement is excluded in sentences like (10)b. In this kind of sentences, children must know that the agreement rule is extremely selective and that it only applies to dislocated internal arguments. Empirical evidence from McKee and Emiliani (1992), Schaeffer (2000) and Moscati & Tedeschi (2009) show that Italian children are sensitive to the relevant distinctions and that they only marginally overgeneralize agreement to postverbal DP (see Antinucci & Miller 1976).
For null-objects, McKee and Emiliani (1992) report that past participle agreement is always realized. However neither Schaeffer (2000) nor Moscati & Tedeschi (2009) confirmed this conclusion, finding all together only 4 cases on 28 observations.
With pronominal clitics (10)a, the most interesting case for our purposes, Schaeffer and McKee & Emiliani found that whenever a clitic was produced, the correct agreement morphology was also selected by children as young as 2 y.o. However,

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results discord here and Moscati & Tedeschi reported a much lower agreement rate. A possible explanation for this inconsistency could be based on the relatively low number of total observations. Therefore, results become more reliable and stable when numbers grow with age. Null objects slowly disappear from child grammar and sentences with overt clitic pronouns become more productive. Whatever constraint blocks the overt realization of clitics in the early period, such limitation starts to disappear after the third year and, past this age, children tend not to omit objects anymore. Nevertheless, even at this later stage, Clitic-PastPart agreement is far from stable, as shown by the results from Moscati & Tedeschi (2009): Clitic-PastPart agreement is attested only at the 75.9% in the 4 y.o. group, when the number of relevant observations is of greater significance.

This result suggests that Clitic-PastPart agreement is more problematic than D-N and Subj-V agreement: while by the third year subject-verb and determiner-noun agreement errors have largely disappeared, PastParticipial agreeing forms are still far from being completely mastered.

This is in line with the predictions of the hierarchy in (9), even if the presence of null-pronouns in child speech shows another of the limits of production. In general, the possibility to omit sentential arguments is a serious problem for the study of both subject- and object-verb agreement. For example, the data on subject-verb agreement reported in Table 1 and 2 also include sentences with a null subject. Although the subject referent can be often inferred from the context, it is still impossible to establish with certainty whether the verb was incorrectly inflected4 or if a different referent was selected and then left unpronounced by the children. In this latter case, we would have a discourse-pragmatic violation, but not a morphosyntactic one.

In conclusion, although the results reported in this section are consistent with the idea that different kinds of agreement are fully mastered at different stages, different problems hamper a fully reliable verification of the hypothesis through corpus and elicited production studies. In order to check the prediction of the ranking given in (9) a more controlled task is needed. In the next section, we will then present an experiment based on a forced choice paradigm involving a direct comparison of the relevant grammatical and ungrammatical agreement forms.

4. Forced Choice of Grammatical Form

To investigate adult grammatical competence, the procedure traditionally employed is to resort to explicit grammaticality judgments. With adults, we could simply ask them to judge sentences (13) and (14) in turn, in order to reconstruct adult grammatical properties of agreement:

(13) (le ragazze) Gianni le ha viste
(the girls) John clf,plur has seenf,plur

[4] In the case of Subj-Verb agreement, a second problem is that unintelligible forms were also excluded. Now, these forms could likely be deviant forms indicating morphological mistakes and their proportion is not negligible. In the case of Francesco 142 out of 1406 verbs were excluded, around the 10% on total. In a picture where differences are made on a small scale, this amount of unanalyzed data may be potentially relevant.

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"(the girls) John has seen them"

(14) *(le ragazze) Gianni le ha visto
(the girls) John clf,plur has seenm,sing

However, grammaticality judgments require a grammatical/metalinguistic reasoning over utterances, a factor which might pose certain difficulties with young children (see McDaniel, McKee & Cairns 1998).
A way to circumvent this problem is to exploit children's ability in discrimination tasks and to combine grammaticality judgments with a forced choice paradigm. Pirvulescu & Belzil (2008) showed that children react consistently when asked to choose the right sentence between a syntactic minimal pair. Thus, instead of asking children to judge (13) and (14), we could ask them to choose between (13) and (14). If children choose (13) to the same extend as adults, we could assume that children master past participle agreement.
The Forced Choice of Grammatical Form Task (FCGFT) is then useful to overcome many of the problems connected with sentence production. In particular, we can balance the linguistic structures in order to collect enough data points to compare less frequent sentences with the more frequent ones. Moreover, by testing the same group of children, we will have a punctual temporal point of observation, unbiased by heterogeneous counting procedures and time windows. For this reason, we adopt it to investigate the four different agreement configurations, ranked in accordance to the hypothesis in (9). In what follows, we will briefly illustrate the contrasts which have been presented to children.
The first kind of violation concerns D-N agreement, the most local one. Remember that whenever a determiner is required, D-N agreement in gender and number is obligatory. Thus in the pair in (15), only (15)a is grammatical and it minimally differs from the ungrammatical (15)b for a number mismatch on the determiner *le*

(15) a. (la candela) la nonna la ha spenta
(the candle) thef,sing grandmotherf,sing clf,sing aux3p, sing put outf,sing
b. *(la candela) le nonna la ha spenta
(the candle) thef,plur grandmotherf,sing clf,sing aux3p,sing put outf,sing

The second structure is Subj-Verb agreement. We asked children to choose between (16)a and (16)b, with the latter presenting a number mismatch on the auxiliary:

(16) a. (la candela) la nonna la ha spenta
(the candle) thef,sing grandmotherf,sing clf,sing aux3p,sing put outf,sing
b. *(la candela) la nonna la hanno spenta
(the candle) thef,sing grandmotherf,sing clf,sing aux3p,plur put out,plur

The third kind of violation concerns past participle agreement. For a detailed description of the agreement pattern, we refer to Belletti (2006). For our purposes, it will suffice to say that past participle agreement is triggered when the direct

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object is moved from its base position, and it is obligatory with 3rd person direct object clitics as in (17)a. The alternative in (17)b shows again a number mismatch on the past participle.

(17) a. (la candela) la nonna la ha spenta
(the candle) thef,sing grandmotherf,sing clf,sing aux3p,sing put outf,sing
b. *(la candela) la nonna la ha spente
(the candle) thef,sing grandmotherf,sing clf,sing aux3p, sing put outf,plur

The last kind of agreement structure is Subj-Adj in predicative constructions as in (18):

(18) a. La fragola è rossa
the f,sing strawberryf,sing is red f,sing
"the strawberry is red"

b. *la fragola è rosse
the f,sing strawberryf,sing is red f,plur

This last contrast is especially interesting since, although some attention has been devoted to copular constructions (Franchi 2004, 2006), to the best of our knowledge no study has focused on the acquisition of adjectival agreement. Notice that the agreement paradigm of adjectives and participles is exactly the same: four morphemes used to express all the possible combination of gender and number:

Tab. 4. Adjectival and participial inflectional morphology in Italian.

features	inflection on adjectives	inflection on participles
m, sing	ross-o (red)	spent-o (put off)
m, plur	ross -i	spent-i
f, sing	ross -a	spent-a
f, plur	ross -e	spent-e

A developmental hypothesis based only on the size of the agreement paradigm (the larger the paradigm from which the correct form must be chosen, the harder the choice is for the child) would not distinguish between Subj-Adj agrement and Cl - PastPart agreement. Nor would linear order: in both constructions an extra element (an auxiliary) intervenes between the two terms of the relation. According to the ranking in (9), instead, our hypothesis makes the prediction that the discrimination task should be harder with the pair in (17) than with the one in (18).
The minimal pairs in (15) – (18) will be tested in three different populations of Italian children at different ages. In addition to the four agreement conditions, we also included a non-agreement condition, where the internal object is left in his base position and no past-participle agreement is allowed:

(19) a. la nonna ha spento la candela
thef,sing grandmotherf,sing aux3p,sing put outm.sing the candle f,sing

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b. *la nonna ha spenta la candela
thef,sing grandmotherf,sing aux3p,sing put outf,sing the candle f,sing

this last kind of sentences, lacking agreement, has been inserted in the test batteries to verify whether children unselectively extend the agreement rule also to post-verbal DPs (19)b as claimed in Antinucci & Miller (1976).

Method & Materials
Children were first presented with a warm-up session consisting in a simple naming task. A sequence of objects was presented on a computer screen and children had to name each of them in turn. This preliminary warm-up task was adopted to familiarize children with the computer presentation and also to ascertain if they knew the names of the objects presented later in the test session.
At the end of the warm up, the test sentences were presented with the help of a sequence of two pictures. For example, in the first picture it was depicted an old lady approaching a burning candle and in the following one it was portrayed the same scene but with the candle put out. At the end of the second picture, children heard two sentences and they had to choose the 'right' sentence in each pair. There where 5 different conditions, one for each different agreement configuration plus the non-agreeing condition in SVO past tense sentences. Children heard six sentence pairs for Cl-PastPart agreement and four pairs for each of the other agreement conditions. Other six sentences for the non-agreeing condition were also added, for a total of twenty-four minimal pairs.

Table 5. Materials

Conditions	Examples	
	Grammatical	Ungrammatical
D – N	(la candela) la nonna la ha spenta	(la candela) le nonna la ha spenta
Subj-V	(la candela) la nonna la ha spenta	(la candela) la nonna la hanno spenta
Clitic - PastPart	(la candela) la nonna la ha spenta	(la candela) la nonna la ha spente
Subj – Adj	La candela è rossa	La candela è rosse
PastPart-DP	la nonna ha spento la candela	la nonna ha spenta la candela

All the target sentences were presented in minimal pairs, differing only in a single morpheme and the stimuli were counterbalanced with respect to the presentation order of the correct sentence. In order to make the task enjoyable by children, we carried out the sessions as games in which the child had to help a puppet to learn Italian.

Subjects
55 monolingual Italian-speaking children between 2;11 to 5;10 took part in the experiment. All the children were recruited from 3 kindergartens in the Siena area

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and they were assigned to three groups, in accordance with age. An additional group of 15 adults served as a control. Data about participants are given in table 6.

Tab.6. Participants

Age group	age	mean age	Tot
Group 1	2;11 – 3;9	3;4	30
Group 2	4;3 – 4;9	4;6	13
Group 3	5;2 – 5;10	5;4	12
Adults	>20	-	15

Results

Some children in the youngest age groups failed the preliminary naming task showing a poor lexicon or paying little attention to the images on the screen. For this reason, 7 children from Group 1, 3 children from Group 2 and 1 child from Group 3 were excluded. We report here the data of children that completed the task (i.e. looking at the screen until the end of the experimental session) and gave the correct answers to the initial naming task (Group1, N=23; Group2, N=10; Group3, N=11). Unintelligible responses were also excluded from the count.

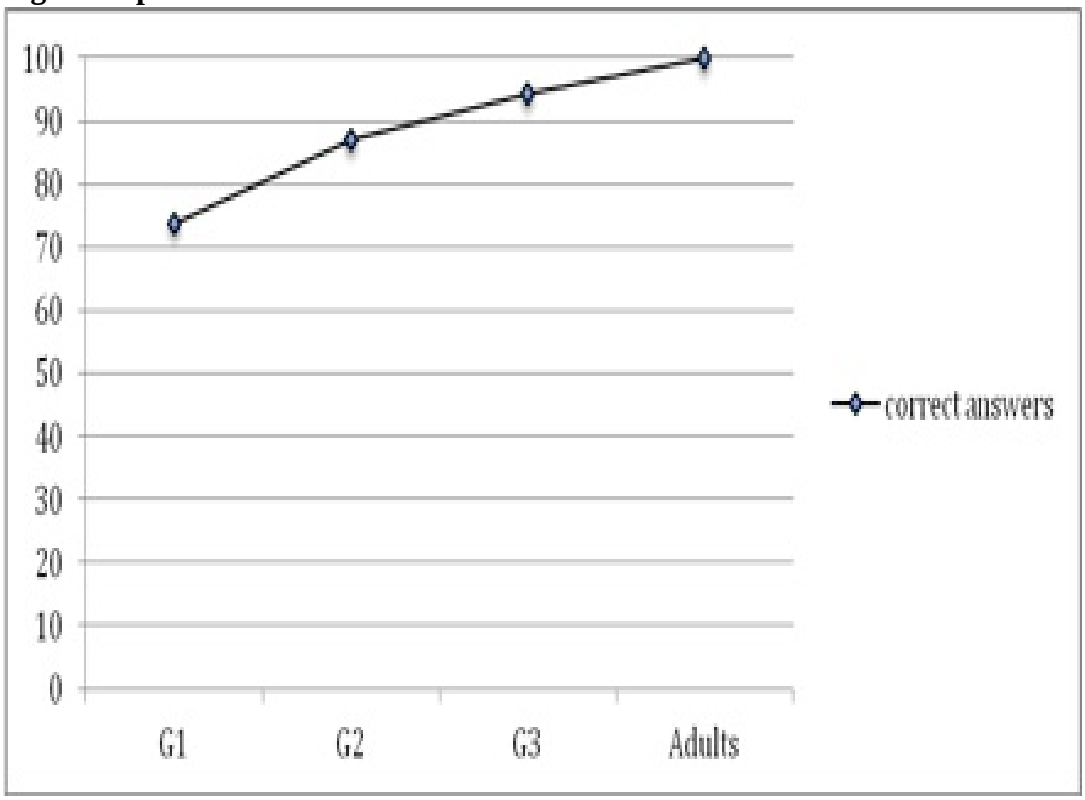
In Table 7 we report the number and the proportion of correct choices on total for each experimental conditions in the four groups. The overall rate of correct answers (figure 1) shows that children were able to detect the minimal difference between a pair of sentences already in Group 1. They chose the right alternative in 73.8% of the cases and the proportion of correct answers raised to 87% in Group 2 and to 94.3% in Group 3. No ungrammatical choice was instead made by the adults in the control group.

Table 7. Overall results of the FCGFT

Groups	Conditions					
	D-N	S-V	S-A	Cl-PastPart	PastPart – DP	Tot
G1	96,5% 72/85	79,8% 71/89	69,6% 64/92	56.9% 78/137	76,3% 74/97	73,8% 369/500
G2	100% 38/38	89,7% 35/39	87,2% 34/39	78,3% 47/60	85.2% 46/54	87% 200/230
G3	100% 44/44	93,2% 41/44	95,4% 42/44	89,4% 59/66	95.4% 53/66	94,3% 249/264
Adults	100% 60/60	100% 60/60	100% 60/60	100% 90/90	100% 90/90	100% 360/360

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Fig.1. Proportion of correct answers on total



Let us now examine the proportion of correct answers in the different experimental conditions, leaving for the moment aside PastPart-DP. Remember that agreement is obligatory for D-N, Subj-V, Subj-A and Cl-PastPart, while for the PastPart-DP condition past participle agreement is excluded and the default +singular, +masculine form has to be chosen. This is the only non-agreement condition and it will be considered separately later, when compared with Cl-PastPart agreement.

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Fig.2. Proportion of correct answers for each Agreement condition

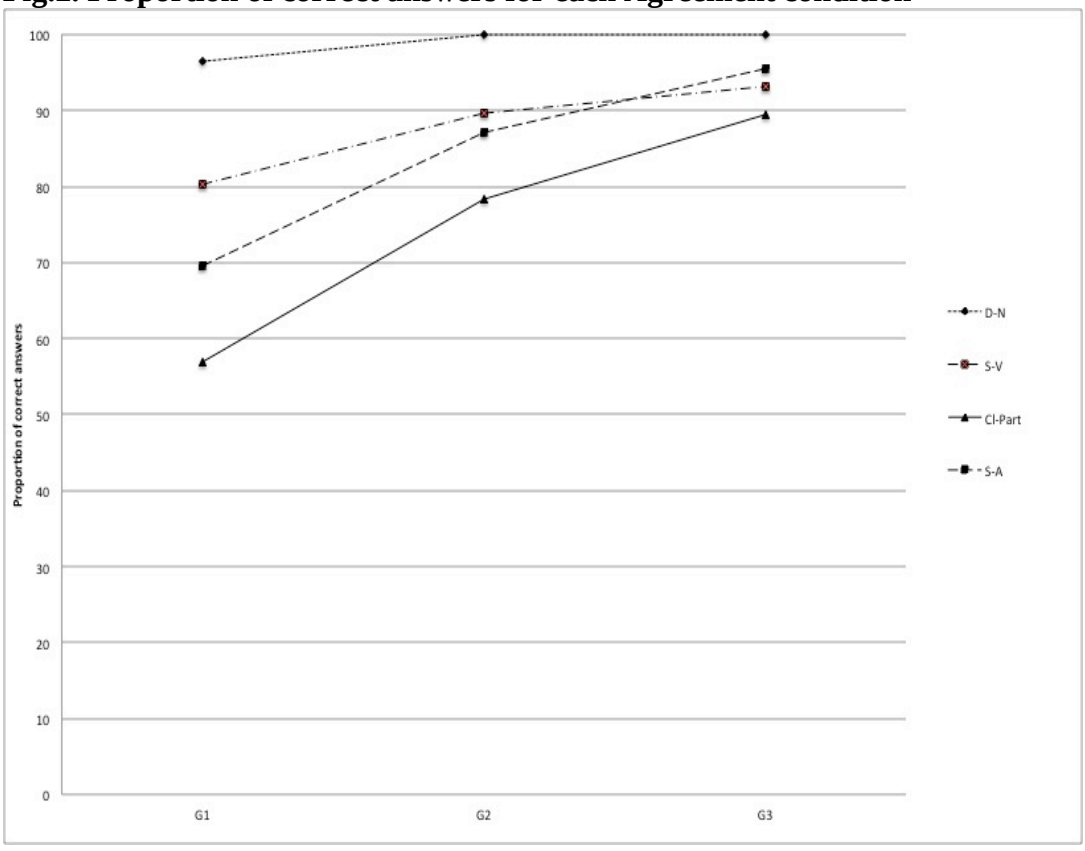


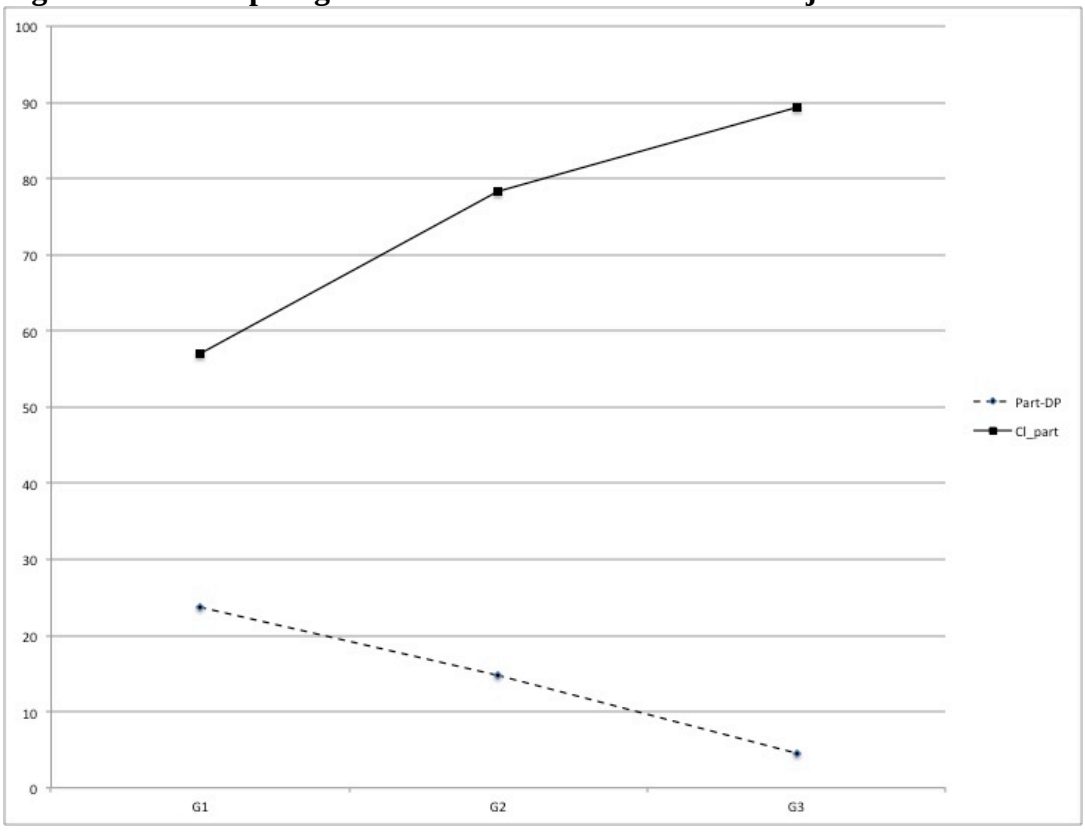
Figure 2 shows that the proportion of correct answers grows in relation to age, with the exception of D-N agreement, where an adult-like performance is found already in the youngest age group. This result is in line with the production studies from Guasti (1993/1994) and Pizzuto & Caselli (1992) and it confirms that, by the end of the second year, children master determiner-noun agreement without any difficulty. A clear developmental trend is instead observable in the other conditions, more pronounced for Cl-PastPart agreement. In this condition, children in Group 1 choose the right alternative only in the 56.9% of the cases. Notice that, even if children's performance rapidly increases with age, correct choices in the Cl-PastPart agreement conditions are still below 80% at four years. For what concerns instead Subject-V and Subj-Adj agreement, they also present a developmental curve, but less pronounced than in the case of Cl-PastPart agreement. If compared with the D-N and Cl-PastPart condition, these two kinds of agreement appear to be an intermediate case.

We turn now to the last experimental condition, namely past participle agreement with a post-verbal full DP. Remember, once more, that this configuration requires lack of agreement. Here mistakes are reversed and a non-adult response is the one in which the agreement rule is overgeneralized. By looking at Figure 3, the results indicate that children in Group 1 are already aware of the existence of a difference related to the type of the direct object. Young children choose past participle

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agreement with a full DP only in the 23.7 % of the cases, a remarkably low rate, when compared with clitic pronouns, where agreement reaches 56.9%5.

Fig.3. Past-Participle agreement in relation to the direct object



To analyse the results, we adopt a mixed effects logistic regression models (lmer package for R, Bates 2007) in order to account for by–subject and by-item variation6 in the response probability (Baayen 2008, Jaeger 2008). As fixed predictors we use Group (3,4,5) and Condition (D-N, Subj-V, Subj-Adj, Cl-PastPart, PartP-DP) and the model was fitted by setting the 3-year olds as the reference group for Age, and Cl-PastPart as the reference for Condition. In Table 8 the main effects of Age and Condition are reported.

[5] That children at 3 are fully aware of the distinction between clitic and non clitic objects is not surprising: corpus studies show that already several months earlier children never place object clitics in non-clitic positions (Hamann, Rizzi and Frauenfelder, 1996).

[6] The by-subject random slopes contribute to the model significantly, compared to an alternative model without them, as indicated by a log likelihood test of model comparison (χ^2=53.987, p<0.001)

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Table 8. Summary of the fixed effects.

		Estimate	Std. Error	z value	Pr(>|z|)	Sig.
(Intercept)		0.33657	0.28437	1.184	0.236586	
G1/Cl-PastP	vs	1.12121	0.54034	2.075	0.037988	*
G2/Cl-PastP						
G1/Cl-PastP	vs	2.30792	0.62621	3.686	0.000228	***
G3/Cl-PastP						
G1/Cl-PastP	vs	1.01169	0.32271	3.135	0.001719	**
G1/Part-DP						
G1/Cl-PastP	vs	0.67575	0.30999	2.180	0.029266	*
G1/Subj-Adj						
G1/Cl-PastP	vs	1.28833	0.34235	3.763	0.000168	***
G1/Subj-V						
G1/Cl-PastP	vs	3.38886	0.65030	5.211	1.88e-07	***
G1/D-N						

Mod1=lmer(accordo_corretto~gruppo*condizione+(1|soggetto)+(1|item), family=binomial)
Log-likelihood= -396.6; N=994. Intercept terms (reference levels): group=3, condition=cl-pastPart. Signif. codes: '***' p<0.001; '**' p<0.01; '*'p< 0.05

In the Clitic-PastPart condition, children in Group 1 had a probability of selecting the right answer not different from chance, behaving significantly worse than children in Group 2 (p<.05) and Group 3 (p<.001), showing a main effect of Age. A Condition effect also reaches significance and the probability of giving the right answer in G1 for the PastPart condition is lower than in the other 4 conditions (Part-DP, p<.01; Subj-Adj, p<.05; Subj-V, p<.001; D-N, p<.001).
Given that we are also interested in comparing children's behaviour for each agreement condition in the various age groups, we repeatedly fit the model7, varying the reference levels for Condition.

[7] We compare a simplified model without interaction (mod2) with the full model given in table 10 (Mod1) by using a likelihood ratio test. Given that the fit of the two models was not significantly different ($\chi^2 = 3.2652$; p>0.9) we adopt the simplified model in the rest of the paper.
Mod2=lmer(accordo_corretto~gruppo+condizione+(1|soggetto)+(1|item), family=binomial)

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Tab.9. Summary of fixed effects as function of the reference level for Condition.

Reference = G1/D-N	Estimate	Std. Error	z value	Pr(>|z|)	Sig.
(Intercept)	3.7254	0.6583	5.659	1.52e-08	***
G1/D-N vs G2/D-N	14.2888	1207.0136	0.012	0.990555	
G1/D-N vs G3/D-N	14.5972	1046.4617	0.014	0.988871	
G1/D-N vs G1/Cl-PastP	-3.3888	0.6503	-5.211	1.88e-07	***
G1/D-N vs G1/Subj-V	-2.1005	0.6808	-3.085	0.002033	**
G1/D-N vs G1/Part-DP	-2.3771	0.6731	-3.531	0.000413	***
G1/D-N vs G1/Subj-Adj	-2.7130	0.6670	-4.068	4.75e-05	***
Reference = G1/Subj-V					
(Intercept)	1.6249	0.3576	4.544	5.51e-06	***
G1/Subj-V vs G2/Subj-V	0.7690	0.7308	1.052	0.292626	
G1/Subj-V vs G3/Subj-V	1.5772	0.8253	1.911	0.056002	.
G1/Subj-V vs G1/D-N	2.1005	0.6808	3.085	0.002033	**
G1/Subj-V vs G1/Cl-PastP	-1.2883	0.3423	-3.763	0.000168	***
G1/Subj-V vs G1/Part-DP	-0.2766	0.3851	-0.718	0.472585	
G1/Subj-V vs G1/Subj-Adj	-0.6125	0.3752	-1.632	0.102600	
Reference = G1/Subj-Adj					
(Intercept)	1.01233	0.32664	3.099	0.00194	**
G1/Subj-Adj vs G2/Subj-Adj	1.14165	0.67822	1.683	0.09232	.
G1/Subj-Adj vs G3/Subj-Adj	2.66791	0.92430	2.886	0.00390	**
G1/Subj-Adj vs G1/Subj-V	0.61256	0.37525	1.632	0.10259	
G1/Subj-Adj vs G1/D-N	2.71306	0.66701	4.068	4.75e-05	***
G1/Subj-Adj vs G1/Cl-PastP	-0.67576	0.30999	-2.180	0.02926	*
G1/Subj-Adj vs G1/Part-DP	0.33593	0.35826	0.938	0.34841	
Reference = G1/Part-DP					
(Intercept)	1.34826	0.33875	3.980	6.89e-05	***
G1/Part-DP vs G2/Part-DP	0.59584	0.61612	0.967	0.333503	
G1/Part-DP vs G3/Part-DP	2.33195	0.81122	2.875	0.004045	**
G1/Part-DP vs G1/Subj-Adj	-0.33591	0.35826	-0.938	0.348448	
G1/Part-DP vs G1/Subj-V	0.27664	0.38514	0.718	0.472577	
G1/Part-DP vs G1/D-N	2.37716	0.67316	3.531	0.000413	***
G1/Part-DP vs G1/Cl-PastP	-1.01166	0.32271	-3.135	0.001719	**

Signif. codes: '***' p<0.001; '**' p<0.01; '*'p< 0.05

The intercept values show that in Group 1, the probability of giving the correct answer was higher than chance for all the D-N, Subj-V and Subj-Adj conditions (p<.01).

With the exception of the D-N condition, we found a significant differences between Group 1 and Group 3 (.004 < p <.06) for all the other experimental conditions, a finding which confirms the developmental trend shown in figure 2.

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Moreover, the probability of giving the correct responses in the D-N condition is significantly higher than in the other Subj-Adj ($p<.001$), Subj-V ($p<.01$), PastPart-Cl and DP-PastPart ($p<.01$) conditions in every age group. This supports the view that the D-N and the PastPart-Cl conditions are differentiated from the two intermediate Subj-V and Subj-Adj conditions, being the two extremes of the scale.
One last observation concerns the non-agreement condition, where children performance increases with age and the trend reaches significance when G1 is compared with G3. This gradual improvement seems to suggest that, initially, children occasionally overextend the agreement rule to non-moved DP, selecting the sentence with Past-Participle agreement more often than their older peers at age five.

Discussion of the results
The data reported in Table 7 show that morphological agreement develops with age, with a different speed in relation to different configurations. The only agreement configuration that presents no increase in relation to age is the D-N condition: three years old children already have a virtually perfect knowledge of determiner agreement. This result also shows that young children do not have problems with the experimental task per se. On the other extreme, we found that Cl-PastPart agreement is still problematic at age 4. It is only one year later that the children's performance gets closer to the adult one.
Subj-A and Subj-V show a level of complexity that it is somewhere in the middle between D-N agreement and Cl-PastParticiple. In these two conditions, children' performance in Group 1 it is still inaccurate (with a higher level of accuracy for Subj-V agreement), but it rapidly increases over time (see fig. 2). This shows that while the difficulty associated with Subj-Adj and Subj-V agreement disappears between age 3 and age 4, a residual problem persist with Cl-Past Part Agreement.
These results are consistent with our hypothesis, which predicts a gradual improvement in the different structures in accordance with the order in (13). It should be noticed though that tendency to a higher accuracy with Subj - V than with Subj – A emerging from table 7 fails to reach statistical significance. We thus leave open for further work the question of whether the two cases should be separated or collapsed in the complexity metric. The point firmly established here is that they are clearly distinct from both D –N and Cl- Past Part agreement, the two extreme points in the ranking8.
A residual question regard the errors made by 3 years old children in the non-agreeing condition. Antinucci & Miller (1976) claimed that there is a stage in early Italian in which children overgeneralize agreement to post-verbal DPs. It is well-known that such an agreement option is attested in certain southern Italian dialects

[8] Should further work establish that the tendency to a greater difficulty with Subj – A than with Subj – V agreement is not substantiated, our movement-based metric of complexity should be simplified to generate a tripartite distinction involving three steps:

1. No movement (D-N agreement);
2. Phase-internal movement (Subj – V and Subj – A agreement);
3. Movement crossing a phase edge (Cl- Past Participle agreement).

We leave the issue open here.

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(Loporcaro 1998), and may hold in certain varieties of French (Pirvulescu & Belzil 2008). Such an agreement pattern clearly is a UG option; we may then be observing here a case of "parametric discontinuity" (Rizzi 2006), the persistent exploration by the child of a UG option that is not target-consistent.

Conclusions

Agreement phenomena respect fundamental locality principles. Kayne (1989) introduced the important idea that the local Spec-Head configuration between the trigger and the target of agreement is essential for proper checking, an assumption adopted by early minimalist analyses (Chomsky 1993, 1995). Chomsky (2000) shifted much of the burden for agreement checking to the Agree operation, establishing a probe-goal relation between a functional head and a nominal expression, followed by movement of the nominal expression to the Spec of the functional head; subsequently, evidence was provided that the Spec-head configuration is not just a by-product of movement post-Agree, but actively participates in the checking of agreement features (Guasti & Rizzi 2002, Franck et al. 2006). Within this tradition, we continue to assume that the Spec-head configuration is a critical component of agreement checking. Three of the four agreement processes that we have considered in this study -- Subj – V, Subj – A, Cl – Past Part -- share a checking component in a Spec-head configuration. If this component is common, other properties of the three agreement configurations differentiate them in a way that is amenable to a natural complexity scale based on the required applications of movement, or internal merge.

In Subj – V agreement, the nominal expression moves to the Spec of the functional head in the functional structure of the clause endowed with Phi features and stops there, due to the criterial properties of the position, in the sense of Rizzi (2006), Rizzi & Shlonsky (2007).

In Subj – A agreement, the nominal expression moves to the Spec of the functional head expressing adjectival agreement, and then continues to move to its final destination, the subject position of the clause, due to different factors (the necessity of satisfying the criterial properties of the latter position, Case Theory, etc.). Agreement is thus checked "in passing" in the Spec-head configuration. The derivation of the global structure of A agreement is thus more complex than the previous one in that it involves a movement step both before and after checking; in representational terms. it is more complex because the trigger and target of agreement always end up in a less local (not structurally adjacent) configuration in the surface representation, which plausibly involves added costs in the processing of the structure.

Finally, clitic – past participle agreement involves an even more complex derivation and representation: again, agreement is checked "in passing", as the clitic moves from the thematic position to the Spec of the relevant agreement head, from which it proceeds to the clitic position (Kayne 1989, Belletti 2006). Moreover, the movement chain always spans over two distinct phases, in the sense of Chomsky 2001, as it comes from within the vP and moves through the phase edge to a landing site in the next higher phase, thus plausibly engaging extra computational resources

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in terms of operative memory requirements (the extra complexity of this case can also be seen in terms of intervention, as suggested in FN 3).
As for the first agreement process considered here, D – N agreement, it clearly does not involve a Spec-Head configuration, but rather a head-head configuration; moreover, it appears to be highly local, as it involves all the heads occurring in the stretch between D and N, e.g., Q and A in examples like Lef,plur molte f,plur belle f,plur idee f,plur "the many beautiful ideas". The strong locality of the phenomenon is highlighted by an effect observed in Zamparelli (2000): an adjective which is invariable for number and gender, such as blu (blue) cannot appear prenominally, thus interrupting the continuous stretch of agreeing heads: lef,plur rossef,plur bandieref,plur della libertà ('the red flags of liberty') vs * lef,plur blu-bandieref,plur della libertà ('the blue flags of liberty'). It thus appears that the agreement in question is a direct reflex of external merge: as a new element is externally merged to N (or to a higher projection of the nominal system), it agrees in number and gender with it. We will not work out the details of the analysis of this DP-internal agreement (see Cardinaletti & Giusti 2011 for relevant discussion); anyway, what is clear is that this kind of agreement is not dependent on movement: thus, in our hierarchy of complexity based on movement, it represents the lower end, the case not involving movement at all. On this basis we arrived at the hierarchy expressed in (9) and repeated here:

(20) I. D - N Agreement
II. Subj - V Agreement
III. Subj - A Agreement[9]
IV. Cl - Past Part Agreement.

In this paper we have put forth the hypothesis that this complexity hierarchy has a predictive capacity on the temporal order of full mastery in language development, under the natural assumption that, all other things being equal, more complex configurations are fully mastered later than simpler ones. We have systematically tested this prediction through a task of forced choice of grammatical form, and shown it to be correct in language learners acquiring Italian.

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[9] But see fn.8.

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