Exploring the development of Greek (non)temporal connectives with a Story Retelling Production Task

Maria Papakonstantinou

Aristotle University of Thessaloniki
mpapakon0@gmail.com

Abstract
The study aims to investigate the acquisition of the Greek connectives enô (=while/even though), ka守住s (=while/since) and afu (=after/since), which are ambiguous between a temporal and a non-temporal interpretation, and compare them with the unambiguous temporal ótan (=when). A short-story retell task (i.e. elicited production) was incorporated to answer our research aims. Four child groups aged 5:6, 7:8, 9:10 and 11:6 and a group of adult controls participated in the task. The results showed that the temporal interpretation of the ambiguous connectives is reproduced more than the non-temporal one. Unambiguous ótan is most frequently primed in the younger ages.

Keywords: ambiguous, (non)temporal, connectives, verbal aspect, prime

1. (Non)-temporal connectives: Theoretical and developmental considerations
Cross-linguistically some connectives are ambiguous between a temporal and a non-temporal interpretation. As regards the Greek ambiguous afu, enô and ka守住s, Tsimpli, Papadopoulou & Mylonaki (2010) proposed that the ambiguity has a syntax-semantics and discourse interface basis. Following Haegeman’s (2010) distinction between central vs. peripheral adverbial clauses the authors maintained that the bounded feature of the connective has the property to select the verbal aspect of the clause it introduces. In particular, the inherent boundedness of the connective, which specifies whether an event is +/- bounded, selects the verbal aspect which is compatible with the +/- value of its inherent lexical properties to license the temporal interpretation. When the formal features of the connective select the verbal aspect both the temporal and the non-temporal interpretations are available and disambiguation occurs at discourse. When the bounded feature is not compatible with verbal aspect, the temporal interpretation is blocked (Tsimpli et al. 2010).

Previous cross-linguistic research on the L1 acquisition of connectives revealed that the temporal connectives are acquired prior to the non-temporal ones (Keller-
Cohen 1987; Vion & Collas 2005; Κάννης 2010, Stamouli 2012 for Greek). Regarding order relations, sequence is acquired earlier than simultaneity (Clancy, Jacobsen. & Silva 1976; Keller-Cohen 1981; Faegans 1980), even though there are divergent results in the literature (c.f. Clark 1971), which are attributed to the different methodologies followed in the various studies (c.f. Silva 1991). Specifically, Clark (1971) incorporated clauses introduced with temporal connectives. Clancy et al. (1976), on the other hand, studied sentences which expressed simultaneous or sequential relations even if they did not involve overt conjunction marking. Also, Clark (1971) incorporated simultaneous when, while Clancy et al. (1976) counted only the sequential readings of when (also in Silva 1991).

Most previous studies used semantic criteria to evaluate the data. In particular, the semantic complexity of the connectives was used as a criterion to predict the order of development (c.f. Clark 1971; Bloom et al. 1980, Berman & Slobin 1994). According to these accounts the order of development is additive<temporal<causal<adversative (Bloom et al. 1980, c.f. Evers-Vermeul & Sanders 2009).

2. Aims of the present study

The main aims of the study are summarized as follows. First, we intend to observe which connective is more frequently produced in order to evaluate the influence of the ambiguity factor. Among the ambiguous connectives, results can reveal the role of connective-specific lexical properties in the order of acquisition of semantically equivalent connectives (c.f. Bowerman 1981).

Also, we examine whether sentence primes with a temporal interpretation as the contextually appropriate one, are primed more often than primes with a non-temporal meaning. These results can show us the age at which children become sensitive to connective-verbal aspect dependencies when they produce temporal and non-temporal propositions.

Also, we investigate the universally predicted priority of the sequential over the simultaneous interpretation and the precedence of the premise over the concessive meaning in production.

Finally, we investigate the reproduction of the temporal and non-temporal interpretation of the sentence primes in the utterances of the investigated groups. For
the cases in which the meaning of the sentence prime is maintained, we further examine the reproduction of the connective which introduces the specific clause.

The contribution of the present study is that it tries to explain the order of development using syntax-semantics and syntax-discourse interface criteria (Tsimpli et al. 2010).

3. Research Predictions

With regard to the first research question on the order of acquisition of ambiguous vs. unambiguous connectives, we expect that ambiguity will delay acquisition, because of the extra cognitive load of ambiguous connectives and their heavier processing load compared to the unambiguous ones (c.f. Hawkins 1990). Accordingly, we expect more productions of ótan as it is unambiguous and very frequent connective in Greek (c.f. Τζάντζαν 1946).

Among the ambiguous connectives, we predict a delay in the production of kathós, since it contains more semantic load than the rest of the studied connectives, because of its extra manner feature encoded in its inherent semantics (Andriotis 1983, also in Tsimpli et al. 2010).

With regard to the universally predicted priority of the temporal interpretation (Bloom et al. 1980, Silva 1991 among others) we expect more productions of the sentence primes which target the temporal interpretation. Assuming a syntactic bootstrapping for L1 acquisition (Gleitman 1990), we also base our prediction on the central vs. peripheral distinction of adverbial clauses. Central adverbial clauses are more grammar oriented (Haegeman 2010).

Based on cross-linguistic findings (c.f. Bloom et al. 1980 among others) we predict an earlier and more frequent production of the sequential primed items over the simultaneous ones. For non-temporal connectives, we expect earlier production of the premise interpretation based on cross-linguistic findings (Bloom et al. 1980 among others).

As regards the degree of reproduction of the temporal /non-temporal meaning and the connective primed in the sentence primes, in both cases i.e. of meaning and connective reproduction we expect that the temporal interpretation will take a priority. In the reproduction of the exact connectives involved in the sentence primes, we expect substitution of the connectives with their semantic equivalents to be more
frequent with age (c.f. Slobin 1973). Overall, ótan is expected to be primed more frequently and earlier, whereas kaθòs is expected to be acquired late.

4. Method

4.1 Participants

The participants were all pupils, monolingual native speakers of Greek with typical development. The number of the participants was one hundred and fifty (150), divided into four age groups. The 5;6 group involved preschool children between 5 and 6 years (mean age: 5;6, SD: 0.25), the children in the 7;6 group were between 7 and 8 years (mean age: 7;5, SD: 0.24). The 9;6 group included children between 9 and 10 years (mean age: 9;6, SD: 0.24) and the children of 11;6 group were between 11 and 12 years (mean age: 11;5, SD 0.23). Thirty (30) adults, monolingual native speakers of Greek between 20 and 40 years (mean age: 23, SD: 4.7), served as controls. They all held a University degree.

4.2 Materials

The task contained four picture-stories. Three of the four stories comprised four picture sequences and the fourth story was a five picture-sequence. Picture stories were accompanied by story texts, which were read to the participants. Each story text was about 100-110 words. The story texts accompanying the picture-stories involved the connectives enó, afu, kaθòs and ótan, which were presented in each of the stories once, either in their temporal or in their non-temporal interpretation. The investigated connectives were involved in sentence primes which aimed to elicit production of the examined connectives and interpretations.

The verbal aspect of the sentence primes was compatible with the bounded feature of the connective which introduced them, for both interpretations targeted. In particular, enó and kaθòs which are specified as [-bounded] were with imperfective aspect and afu which is inherently [+bounded] was followed by perfective. With selected aspect both the temporal and the non-temporal interpretation of the connectives is licensed by the grammar. Disambiguation occurs at the discourse level. In the task we controlled the story context to regulate the test sentence interpretation. In (1a) and (1b) below we provide a couple of examples of sentence primes with kaθòs.
(1a) Καθώς μάζεψε τα καρότα, σκέφτηκε πως θα ήταν καλή ιδέα να ξεκουραστεί λίγο. [transl: While he was gathering IMPERF the carrots, he thought it would be a good idea to lie on the grass and have some rest.]

(1b) Κάθε μεσημέρι, διάβαζε στο σπίτι με τη μαμά του, καθώς χρειάζοταν τη βοήθεια της στο διάβασμα. [transl: Every day, he was used to doing his homework at home with his mum, since he needed IMP her help when studying.]

In both (1a) and (1b) καθώς is followed by imperfective. In sentence prime (1a) the temporal interpretation is the contextually appropriate one. In sentence (1b) the story context targets the premise interpretation.

4.3 Procedure
The task was administered in one session and lasted about 10-15 minutes. The children’s task was to retell each of the novel test stories after listening to the experimenter’s narration.

Before the testing, the experimenter explained the rules to the child and then asked whether the child needed any clarification. Each story was narrated once to the participants. At the end of the ‘retelling’ of each story by the participant, the experimenter moved on to the telling of the next story, making the comment ‘nice, let’s move on to another story’. No other comment was made on the performance of the participants. The experimenter used as neutral intonation as possible throughout the testing procedure.

5. Results
Both descriptive and inferential statistical analyses were applied on the data to allow within and between group comparisons. The SPSS 20.00 software was used to conduct statistical analyses. In particular, one and two way non-parametric chi-square tests were run.

5.1 Frequency of production
The total frequency of production of the connectives involved in the test items (i.e. sentence primes) (graph 1) reveals that otan is the most frequent connective in all
child groups’ production, as predicted. The adult control group, on the other hand, has an almost even production of all the studied connectives.

The within group statistical analysis revealed significant differences between the production of the unambiguous temporal οταν and each of the three ambiguous connectives. In the comparisons of αφυ vs. οταν and καθός vs. οταν all child groups produce οταν significantly more often (αφυ vs. οταν: 5;6: χ²=14.328, p=.000; 7;6: χ²=9.350, p=.002; 9;6: χ²=5.571, p=.018; 11;6: χ²=14.258, p=.000; καθός vs. οταν: 5;6: χ²=10.691, p=.001; 7;6: χ²=17.527, p=.000; 9;6 χ²= 5.094, p=.024; 11;6: χ²=11.311, p=.001). The comparison of ενό vs. οταν reveals a significantly enhanced production of οταν up to age 9;6 (5;6: χ²=13.620, p=.000; 7;6: χ²=12.952, p=.000; 9;6: χ²=7.872, p=.005). Non-significant differences were obtained for the rest of the testing groups.

The between-group per connective analysis obtained significant results only for ενό and οταν. Significant developmental differences are observed in the frequency of ενό between the 5;6-year-olds and adults (χ²=4.876, p=.027) and between the 7;6-year-olds and the adults (χ²=4.684, p=.030), which shows that there is development of ενό after the age of 7;6. On the other hand, οταν becomes less frequent in the older groups, at below chance levels from age 9;6. Significant differences in the frequency of οταν are observed only between the two youngest groups and the adults (5;6 vs. adults: χ²=8.139, p=.004, 7;6 vs. adults: χ²=6.976, p=.008).
5.2 Temporal vs non-temporal production

This section presents the results of the comparison of the temporal with the non-temporal production of each of the investigated connectives. The results are depicted in graph 2.

Graph 2. Accurate performance in the temporal vs. non-temporal production

As we observe, there is a trend towards an even production of the temporal and the non-temporal interpretation within all the examined connectives, as age advances. More specifically, the connective *afu* is used slightly more as temporal than as non-temporal by all child groups, while in the adults temporal *afu* is below chance (45%). *Eno* is more often used as temporal by the preschool children (67%). The remaining child groups and the adult controls use it more as concessive. Most productions of *kathós* are temporal at age 5:6 (83%). Temporal productions are reduced at below chance levels in the 7:6 (33%). At ages 9:6 and 11:6 temporal productions are at chance (61% & 57%, respectively).

The chi-square tests we conducted, reveal significant differences between the temporal and non-temporal interpretation of the ambiguous connectives only for the youngest group of children whose production of temporal *kathós* is significantly more frequent than the production of premise *kathós* ($\chi^2=5.333$, $p=.021$). Between-group comparisons reveal significant differences between the temporal and the non-temporal production only for the connective *afu* in the comparison of the preschoolers’ group with a) the 7:6-year-olds ($\chi^2=4.717$, $p=.030$) and b) the 9:6-year-olds ($\chi^2=4.095$, $p=.043$) as well as between the adults and a) the 7:6-year-olds ($\chi^2=4.519$, $p=.034$) and b) the 9:6-year-olds ($\chi^2=3.892$, $p=.049$).
5.3 Maintenance of meaning

In this section the results provided show whether the temporal or non-temporal meaning targeted in the sentence primes is maintained in the participants’ productions\(^1\). The results revealed very high maintenance scores for both temporal relations examined, i.e. sequence and simultaneity across age groups. Graph 3 depicts measurements of the sequential connectives *afu* and *ótan* compared to the simultaneous *kabhós* and *enó*.

![Graph 3. Maintenance of the temporal meaning](image)

As we can observe in the graph, maintenance is very high both in the sequential and in the simultaneous productions. Within groups we observe that the meaning of the simultaneous primes is maintained slightly more than the meaning of the sequential ones up to age 9;6. Differences are absolutely neutralized in the control group’s performance.

With regards to temporality, the chi-square tests showed a significant maintenance of meaning of the sequential connectives within all the age groups tested (5;6: \(\chi^2=41.089, p=.000\); 7;6: \(\chi^2=52.920, p=.000\); 9;6: \(\chi^2=59.876, p=.000\); 11;6: \(\chi^2=69.444, p=.000\); adults: \(\chi^2=78.186, p=.000\)). In the simultaneous primes, the two youngest groups absolutely maintain meaning, and the remaining groups significantly maintain

---

\(^1\) In these measurements we counted all the productions which had the same temporal or non-temporal meaning with the sentence prime, irrespective of the connective used in it. The produced sentence may contain another connective than the one primed to express the same relation as the sentence prime.
the primed meaning (9;6: $\chi^2=31.837$, p=.000; 11;6: $\chi^2=30.421$, p=.000; adults: $\chi^2=45.082$, p=.000).

The results for the maintenance of meaning in premise and concessive sentence primes is presented in graph 4.

**Graph 4. Maintenance of the non-temporal meaning**

In the non-temporal primes, the premise interpretation is reproduced in very high rates by all groups. The concessive interpretation is reproduced more by the adults than by all child groups. In particular, children’s performance is at chance level at age 5;6 (50%); clearly above chance at age 7;6 (67%), while the 9;6, the 11;6 groups’ scores are around chance levels (44%, 56%, respectively).

The chi-square tests we applied on the data, showed that within group and interpretation only the premise meaning is significantly maintained from age 7;6 onwards (7;6: $\chi^2=9.846$, p=.002; 11;6: $\chi^2=22.533$, p=.000; adults: $\chi^2=42.320$, p=.000). The comparison between the premise with the concessive meaning reveals a significant preference to reproduce premise readings from age 9;6 onwards (9;6: $\chi^2=21.389$, p=.000; 11;6: $\chi^2=10.530$, p=.000; adults: $\chi^2=21.333$, p=.000). The between-group analysis revealed a significant maintenance of the premise meaning between the following groups: 7;6 vs 9;6 ($\chi^2=5.934$, p=.015), 7;6 vs adults ($\chi^2=4.745$, p=.029), 5;6 vs 9;6 ($\chi^2=6.578$, p=.010) and 5;6 vs adults ($\chi^2=4.007$, p=.045).
Next, results are presented for each connective. To start with the temporal interpretation (table 1) all the examined connectives have very high maintenance scores.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Afu</th>
<th>Enό</th>
<th>Kaθόσ</th>
<th>Otan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>match/non-match</td>
<td>Match%</td>
<td>match/non-match</td>
<td>Match%</td>
</tr>
<tr>
<td>5:6</td>
<td>12/1</td>
<td>92%</td>
<td>8/0</td>
<td>100%</td>
</tr>
<tr>
<td>7:6</td>
<td>14/5</td>
<td>74%</td>
<td>11/0</td>
<td>100%</td>
</tr>
<tr>
<td>9:6</td>
<td>12/6</td>
<td>67%</td>
<td>22/1</td>
<td>96%</td>
</tr>
<tr>
<td>11:6</td>
<td>19/3</td>
<td>86%</td>
<td>14/2</td>
<td>88%</td>
</tr>
<tr>
<td>Adults</td>
<td>15/2</td>
<td>88%</td>
<td>22/1</td>
<td>96%</td>
</tr>
</tbody>
</table>

*Table 1. Per connective maintenance of temporal meaning*

The statistics reveal significant maintenance of meaning in sentence primes which contain *afu* by all the groups, except the 9:6-year-olds (5:6: \( \chi^2=9.308, p=.002; 7:6: \chi^2=4.263, p=.039; 11:6: \chi^2=11.636, p=.001; 9:6: \chi^2=9.941, p=.002 \)). Sentence primes with *kaθόσ*, are significantly reproduced in their intended meaning by the 7:6-year-olds (\( \chi^2=12.800, p=.000 \)). For the rest of the groups maintenance is at ceiling. *Otan* is maintained by all the groups in the within group comparisons. In particular, significant maintenance of meaning is observed at ages 7:6 (\( \chi^2=52.071, p=.000 \)) and 9:6 (\( \chi^2=63.225, p=.000 \)). The youngest, the oldest children and the adult controls reproduce the primed meaning at ceiling.

The results of the maintenance of meaning of non-temporal primes are presented in table 2 below.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Afu</th>
<th>Enό</th>
<th>Kaθόσ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>match/non-match</td>
<td>Match%</td>
<td>match/non-match</td>
</tr>
<tr>
<td>5:6</td>
<td>5/2</td>
<td>72%</td>
<td>2/2</td>
</tr>
<tr>
<td>7:6</td>
<td>9/3</td>
<td>75%</td>
<td>8/4</td>
</tr>
<tr>
<td>9:6</td>
<td>13/0</td>
<td>100%</td>
<td>12/15</td>
</tr>
<tr>
<td>11:6</td>
<td>16/0</td>
<td>100%</td>
<td>14/11</td>
</tr>
<tr>
<td>Adults</td>
<td>20/1</td>
<td>95%</td>
<td>16/14</td>
</tr>
</tbody>
</table>

*Table 2. Per connective maintenance of non-temporal meaning*
As presented in the table, maintenance of the meaning is very high for *afu* and *kathos* across age groups, while *enό* has average maintenance, overall.

Non-temporal *afu* is significantly maintained only by the adult group ($\chi^2=17.190$, p=.000). The premise reading of *kathόs* is highly maintained by the 5;6 and the 9;6 year olds. The rest of the groups significantly maintain the meaning of premise *kathόs* (7;6: $\chi^2=7.143$, p=.008; 11;6: $\chi^2=7.143$, p=.008; adults: $\chi^2=25.138$, p=.000).

Between-group comparisons showed significant developmental differences for premise *afu* between a) the 5;6 vs. the 9;6-year-olds ($\chi^2=4.127$, p=.042), b) the 5;6 vs. the 11;6-year-olds ($\chi^2=5.007$, p=.025), c) the 7;6 vs. the 9;6-year-olds ($\chi^2=3.693$, p=.055) and d) the 7;6 vs. the 11;6 year olds ($\chi^2=4.480$, p=.034).

### 5.4 Maintenance of form

In this subsection we present the measurements of the productions in which the connective involved in the sentence primes is reproduced along with its intended temporal or non-temporal interpretation.

In graph 5 we present reproduction of connective in the temporal interpretation. Sequential connectives are compared with simultaneous ones. Sequential *afu* and *όtan* were counted together. Simultaneous *kathόs* and *enό* were scored together, as well.

![Graph 5. Form maintenance - temporal interpretation](image)

As we can observe in the graph, the sequential connectives are reproduced more than the simultaneous ones across groups, but still reproduction scores are around and below chance levels for sequence and much below chance for simultaneity.
The one-way non-parametric chi-square tests we conducted for the within-group analysis revealed that all groups, except the youngest, significantly substitute the primed connective for another, only in the simultaneous connectives examined (7;6: \( \chi^2 = 3.556, p = .059 \); 9;6: \( \chi^2 = 8.100, p = .004 \); 11;6: \( \chi^2 = 16.000, p = .000 \); adults: \( \chi^2 = 16.333, p = .000 \)).

The results for the reproduction of connectives which introduced the non-temporal sentence primes are depicted in graph 6 below.

Graph 6. Form maintenance – non-temporal interpretation

As we can observe in the graph, in the premise interpretation expressed with \( \kappa \delta \omicron \sigma s \) and \( \alpha \nu \), the primed connectives are maintained by the youngest group to a satisfactory extent (75%), but with age there are substitutions. The 11;6-year-olds and the controls maintained the primed connectives at around (56%) and above chance (60%) levels, respectively. In the concessive interpretation, there is absolute reproduction of \( \varepsilon \nu \delta \) by all age groups tested. The comparison of the premise with the concessive reading indicates that the connectives which express the premise meaning are more frequently substituted than the connectives that expresses the concessive meaning.

Statistics showed that in sentence primes which express the premise interpretation, the connective is maintained significantly more than it is substituted only for the youngest children tested (\( \chi^2 = 6.818, p = .009 \)). Significant differences between the premise and the concessive reading are observed from age 7;6 onwards, as the concessive \( \varepsilon \nu \delta \) is reproduced more (7;6: \( \chi^2 = 8.976, p = .003 \); 9;6: \( \chi^2 = 11.429, p = .001 \);
11;6: $\chi^2 = 15.750$, $p=.000$; adults: $\chi^2 = 18.824$, $p=.000$). No developmental differences were observed across ages.

Next, we present the results for the reproduction of each primed connective. In table 3 we present the results for the temporal interpretation.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Afu</th>
<th>Enό</th>
<th>Kaθός</th>
<th>Otan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Match/mismatch</td>
<td>Match %</td>
<td>Match/mismatch</td>
<td>Match %</td>
</tr>
<tr>
<td>5;6</td>
<td>3/9</td>
<td>25%</td>
<td>1/7</td>
<td>13%</td>
</tr>
<tr>
<td>7;6</td>
<td>6/8</td>
<td>43%</td>
<td>2/9</td>
<td>18%</td>
</tr>
<tr>
<td>9;6</td>
<td>4/8</td>
<td>33%</td>
<td>3/19</td>
<td>14%</td>
</tr>
<tr>
<td>11;6</td>
<td>6/13</td>
<td>32%</td>
<td>2/12</td>
<td>14%</td>
</tr>
<tr>
<td>Adults</td>
<td>4/11</td>
<td>27%</td>
<td>7/15</td>
<td>32%</td>
</tr>
</tbody>
</table>

Table 3. Per connective maintenance of temporal form

The youngest group mainly substitute the connective *afu* for another. The simultaneous *enό* is maintained less, *kaθός* is maintained half times of its production and *otan* is reproduced at above chance levels. The 7;6-year-olds equally maintain all the connectives at around chance levels, except for *enό* which is largely substituted. A very similar behaviour is observed in the production of the 9;6-year-olds, who maintain *afu* at below chance levels. *Enό* has even lower reproduction scores, while *kaθός* and *otan* are maintained at almost chance levels. The oldest children maintain *afu* at below chance levels. Note that *eno* and *kaθός* are highly substituted, while *otan* is maintained at chance levels. Finally, the control group has a similar behaviour with the 11;6-year-olds in all the connectives except for *eno*, in which maintenance scores are higher than in the 11;6 group, but still much below chance.

Developmentally, changes are observed only for the connectives *enό* and *kaθός*. *Enό* is maintained few times by all child groups and its maintenance is more frequent only in the adults. *Kaθός* is substituted more as age advances.

The statistical analysis revealed a significant difference in maintenance between the simultaneous connectives *enό* and *kaθός*. In particular, simultaneous *enό* is significantly substituted by all the child groups tested (5;6: $\chi^2=4.500$, $p=.034$; 7;6: $\chi^2=4.455$, $p=0.035$; 9;6: $\chi^2=11.636$, $p=.001$; 11;6: $\chi^2=7.143$, $p=.008$). Simultaneous *kaθός* is significantly substituted for another connective only in the oldest group of children ($\chi^2=8.909$, $p=.003$) and the adults ($\chi^2=15.385$, $p=.000$).
The within-group comparison between the two interpretations revealed significant differences in the maintenance of the connective only for *enò* with high maintenance scores in the concessive interpretation for all the groups tested (5;6: $\chi^2=5.833, p=.016$; 7;6: $\chi^2=12.436, p=.000$; 9;6: $\chi^2=23.491, p=.000$; 11;6: $\chi^2=21.000, p=.000$; adults: $\chi^2=18.024, p=.000$).

The between-group comparison per connective revealed a significant maintenance of *ótan* by the 5;6 compared to the 7;6-year-olds ($\chi^2=4.587, p=.032$). Simultaneous *kathòs* is maintained significantly less in the adult group than a) in the 5;6-year-olds ($\chi^2=6.181, p=.013$), b) in the 7;6 group ($\chi^2=3.636, p=.057$) and c) in the 9;6-year-olds ($\chi^2=6.142, p=.013$).

Finally, the between-connective comparison in the temporal interpretation, revealed significant differences in reproduction between *enò* and *kathòs* for the 9;6 group in favour of *kathòs* ($\chi^2=4.713, p=.030$). *Kathòs* is substituted significantly more than *ótan* by the oldest children tested and the adults (11;6: $\chi^2=7.710, p=.005$; adults: $\chi^2=9.850, p=.002$). *Afu* is substituted more than *ótan* by the youngest children (5;6: $\chi^2=5.809, p=.016$). Finally *ótan* is maintained significantly more than *enò* in all child groups, except the 7;6-year-olds (5;6: $\chi^2=7.298, p=.007$; 9;6: $\chi^2=8.781, p=.003$; 11;6: $\chi^2=6.686, p=.010$).

Next the results for the non-temporal interpretation are presented in table 4.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Afu</th>
<th></th>
<th></th>
<th>Enò</th>
<th></th>
<th></th>
<th>Kåthòs</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Match/non-match</td>
<td>Match%</td>
<td>Match/non-match</td>
<td>Match%</td>
<td>Match/non-match</td>
<td>Match%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5;6</td>
<td>2/3</td>
<td>25%</td>
<td>2/0</td>
<td>100%</td>
<td>1/1</td>
<td>50%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7;6</td>
<td>6/3</td>
<td>67%</td>
<td>8/0</td>
<td>100%</td>
<td>2/10</td>
<td>17%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9;6</td>
<td>6/7</td>
<td>46%</td>
<td>12/0</td>
<td>100%</td>
<td>6/9</td>
<td>40%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11;6</td>
<td>8/8</td>
<td>50%</td>
<td>14/0</td>
<td>100%</td>
<td>2/10</td>
<td>17%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adults</td>
<td>10/10</td>
<td>50%</td>
<td>16/0</td>
<td>100%</td>
<td>8/20</td>
<td>29%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 4. Per connective maintenance of non-temporal form*

The youngest children maintain *afu* at low levels, while *enò* is reproduced at ceiling. *Kåthòs* is substituted at chance levels. At 7;6 years, maintenance of *afu* is clearly above chance, *enò* is absolutely maintained and *kåthòs* is substituted for another connective to a large extent. Maintenance levels for *afu* and *kåthòs* drop for the 9;6-year-old group at around chance levels, while *enò* is maintained at ceiling. The oldest group of children changed *afu* for another connective half times, they
absolutely maintain enó and prefer to substitute kathós most of the times. Finally, the control group has identical maintenance scores with the 11;6-year-old children for afu and enó, while kathós is maintained at below chance levels.

Developmentally, afu is reproduced more after age 5;6 years. Enó is absolutely maintained by all the participating groups. As already mentioned, the fact that there are not changes in the reproduction of concessive enó, leads us to assume that it is the most representative concessive connective in Greek. Káthos does not provide a clear picture of maintenance, but we observe that as age advances it is substituted more frequently.

The chi-square tests we conducted showed that when the premise interpretation is targeted kathós is significantly substituted by the 7;6 group (\(\chi^2=5.333, p=.021\)), the 11;6 year olds (\(\chi^2=5.333, p=.021\)) and the controls (\(\chi^2=5.143, p=.023\)).

The between connectives comparison of maintenance of the non-temporal readings of the connectives revealed that premise afu is maintained significantly more than kathós by the 7;6-year-old group (\(\chi^2=5.452, p=.020\)). Enó is maintained significantly more than kathós by all the groups tested, except the youngest children (7;6: \(\chi^2=13.333, p=.000\); 9;6: \(\chi^2=10.800, p=.001\); 11;6: \(\chi^2=18.958, p=.000\); adults: \(\chi^2=20.952, p=.000\)). Afu is substituted significantly more than enó by the 9;6-year-olds (\(\chi^2=8.974, p=.003\)), the 11;6-year-olds (\(\chi^2=9.545, p=.002\)) and the adults (\(\chi^2=11.077, p=.001\)).

The per connective between interpretations comparison of each participating group, revealed significant differences only for enó by all age groups tested. In particular, in the concessive interpretation there is absolute maintenance, while in the temporal meaning enó is highly substituted (5;6: \(\chi^2=5.833, p=016\); 7;6: \(\chi^2=12.436, p=.000\); 9;6: \(\chi^2=23.491, p=.000\); 11;6: \(\chi^2=21.000, p=.000\); adults: \(\chi^2=18.024, p=.000\)).

6. Conclusion

This section evaluates the results with reference to the research questions. As regards the role of ambiguity in the production of connectives it seems that unambiguous ótan is produced earlier because it contains less cognitive load, which facilitates its processing (Hawkins 1990) and acquisition.

Regarding the priority of temporality over non-temporality (c.f. Vion & Colas 2005 among others) there are more temporal productions, as expected. This should be
attributed to the centrality of the temporal adverbial clauses in derivation (c.f. Haegeman 2010; Tsimpli et al. 2010).

In the maintenance of the meaning included in the sentence primes, the results showed that the temporal meaning of the ambiguous connectives is maintained more than the non-temporal interpretation, as predicted (c.f. Κάντζου 2010 among others).

Within temporal relations sentence primes which have a sequential link are reproduced at similar levels with the simultaneous ones (c.f. Clancy et al. 1976). In the non-temporal sentence primes, the concessive interpretation is maintained by all the groups tested at ceiling levels. This implies that enό is a very representative concessive connective. These results show that the specific properties of the connectives, can account for cross-linguistic differences in the order of acquisition of temporal and non-temporal relations (c.f. Bloom et al. 1980)

As regards the maintenance of the connective primed in the sentence primes, we observed more substitutions of form than of meaning. Furthermore, the younger ages maintained the primed connective more than the older ages. We consider that children have not developed the full range of choices to express a single meaning yet (c.f. Slobin 1973).

Simultaneous enό exhibits high substitution scores, while as a concessive connective it is maintained by all groups at ceiling levels. Afu is maintained equally in both interpretations by the youngest children, but, as age advances, maintenance is higher in the premise interpretation. Finally, maintenance of kathόs in the two interpretations is similar, but reduced with age. Low production and maintenance of kathόs should be attributed to its extra manner feature adding processing load (Tsimpli et al. 2010).

References


Κάληδνπ, Β. 2010. Η σπονική οπγάνωζη ηογάνωζη ηην καηάκηηζη ηηρ Ελληνικήρ ωρ ππώηηρ και ωρ δεύηεπηρ γλώζζαρ. *Γηδαθηνξηθή Γηαηξηβή*, Δζληθό Καπνδηζηξηαθό Παλ/λην Αζελώλ.


