On the acquisition of discourse connectives: Between causality and mindreading[*]

Sandy Giannadaki & Alexis Kalokerinos
University of Crete
philp0806@philology.uoc.gr, kalokerinos@uoc.gr

Περίληψη

Η κατάκτηση των αιτιολογικών κειμενικών τελεστών συναρτάται με την ανάπτυξη των ικανοτήτων της μεταναπαράστασης και της νοανάγνωσης (mindreading). Στη βάση νατουραλιστικών και πειραματικών δεδομένων του λόγου παιδιών που κατακτούν την ελληνική γλώσσα ως μητρική στο πλαίσιο μιας τυπικής ανάπτυξης, διερευνώνται όψεις της κατάκτησης των τελεστών 'γιατί', 'επειδή' και 'αφού', και ιδιαίτερα του χρόνου και της τάξης εμφάνισής τους σε συνάρτηση με την κατάκτηση των 'πεδίων χρήσης' τους. Ειδικά για το 'αφού', διατυπώνεται και ελέγχεται η υπόθεση ότι οι πρώιμες εμφανίσεις του στοχεύουν το περιβάλλον της από κοινού προσοχής (joint attention), πριν εκδηλωθεί η ικανότητα απόδοσης νοητικών καταστάσεων.

Λέξεις-κλειδιά: αιτιολογικοί κειμενικοί τελεστές, νοανάγνωση, γλωσσική κατάκτηση

1   Introduction: Causality and mindreading

From a language-developmental point of view, mentation of causality and mindreading are entwined. Both are core constituents of meaning triggered by language behaviour. From an evolutionary point of view, mentation of causality relates to the prediction and explanation of change in the organism-environment system ("wider organismic system", Millikan 1993; Kalokerinos, to appear; Giannadaki, in preparation). Change may be produced depending on goals of self and others. Mentation of goals presupposes mentation of animacy, as observed in non-linguistic and pre-linguistic organisms. Goals enter the field of causes, and eventually form reasons to linguistic organisms, i.e. humans. Mindreading relates to the prediction and explanation of behaviour in humans as *agents*. Therefore, we expect language-acquiring children to be asked and ask *Why ...?* (Greek: *Γιατί/Jati ...?*), and answer and be answered *Because*… (Greek: *Γιατί/Jati* … - a homonym of the former) and [*In order*] *to* … (Greek: *Για να/Ja na* …).

In active language behaviour (production), high-level mindreading is attested after the third year of life (Nichols and Stich 2003, Goldman 2006, Apperly 2010). Nevertheless, low-level (implicit) mindreading is detected much earlier (Onishi and Baillargeon, 2005: 1;3.; Surian, Caldi and Sperbre 2007: 1;1). A necessary precondition of any kind of mindreading is *joint attention*, which "is found to correlate quite strongly with young children's initial acquisition of words" (Tomasello 2008: 159-160). High-level (explicit) mindreading is conceptually correlated with epistemicity, which needs

metarepresentative ability of mental states. Discourse connectives (DCs) constitute a privileged field in investigating the relationship between the acquisition of causality and the development of mindreading.

For ease of exposition in this paper, we will be utilizing Sweetser's (1990) tripartite scheme of 'domains of use', given in Table (1) with Kalokerinos' (2004) amendments:

	Sweetser 1990	Kalokerinos 2004
John came back because he loved her	CONTENT	Non-modal
John loved her, because he came back	EPISTEMIC	Modal-epistemic
What are you doing tonight because there is a good movie on?	SPEECH ACT	Modal-non-epistemic, Meta-modal

Table 1| Domains of use

According to studies in English, Dutch, French and Greek, content and speech-act causal connectives are acquired before epistemic ones (Kyratzis, Guo and Ervin-Tripp1990; Kati 1994; Zufferey 2010; Evers-Vermeul and Sanders 2011). Here we will be studying the acquisition of Greek *γιατί (jati)*, *επειδή* (*epiði*) and *αφού (afu)*. In adult speech, *jati* and *epiði* are encountered in all three domains. As indicated in Table 2, a *jati*-introduced segment is restricted to second position (P2); as observed by Kalokerinos (2004), *jati* is able to mobilize and target implicit information. On the other hand, *epiði* is positionally unrestricted, but has higher explicitness requirements (see examples (16-60) and discussion in Kalokerinos 2004: 39-47). Overall, *epiði* carries an instruction of explicitness on a representational Target Segment (TS) base; *jati* has access, beyond the explicit and representational, to both presentational and implicit representational aspects of TS (*ibid*, p. 47). From the standpoint of acquisition, we therefore expect to encounter *jati* earlier than *epiði*, as well as in the agrammatical position one (P1) in early occurrences.

DC	<TS, DC-SS>	<DC-SS, TS>
γιατί/ jati	OK	*
επειδή/ epiði	OK	OK
because	OK	OK

Table 2| Order of Segments
TS: Target Segment; SS: Source Segment (Kalokerinos 2004: 38; cf. Kitis 2006)

In the context of adult speech, *afu* has been described by one of us as dealing "with the question of belief anchored within the interactive setting", and (along with English *since* and French *puisque*) serving the management of the mutual cognitive environment by combining "a function of backgrounding, together with a function of free epistemic anchoring" (Kalokerinos 2004: 69, 57; cf. Kalokerinos 2001). If this were so, we would expect to attest *afu*-articulated utterances after the age of three, i.e. after the activation of metarepresentative abilities related to high-level mindreading. As a matter of fact, Zufferey (2010) dismisses early productions of *puisque*, a French cognate of *afu*, as effects of confusion with basic causal DC *parce que* (Zufferey 2010: 149-152). But if, as

elaborated below, *afu*-articulated utterances are reliably attested very early on, then we need to revise the aforementioned description of *afu*. From a developmental point of view, we now propose that first-appearing utterances of *afu*-articulated sentences target contents that the child perceives as belonging to a common attentional ground as formed by joint attention. In this early phase, the child may project her perception-grounded knowledge to common knowledge, in an egocentric move; the remnants of this are also attested later, even among adults, under the labels "quarantine failure" (Goldman 2006) or "curse of knowledge" (Birsch and Bloom 2007). We consequently propose three consecutive levels in *afu*-acquisition in native Greek children, as follows:

• L1: *afu* targets contents perceived as contents of joint attention, with emphasis on common attentional ground, also 'egocentrically' projecting personal perception or knowledge on common perception or knowledge.

• L2: *afu* targets contents of joint attention and more broadly of the mutual cognitive environment (first-order metarepresentation)

• L3: *afu* targets beliefs that as such belong to the mutual cognitive environment without their content being adopted by the speaker (second-order metarepresentation).

We surmise that development is cumulative, adding L3 to L2 to L1. Nevertheless, by L3 acquisition, L1 egocentrism recedes without being eliminated, as common adult experience reminds us.

2   The acquisition of Greek causal DCs: a naturalistic study and an experiment

2.1 Data, methodology and procedure

In order to test the hypotheses made in the first part we conducted a twofold study. First, we examined data from two corpora in the CHILDES database (MacWhinney 2000): the Stephany corpus (Stephany 1997), including longitudinal data from four children (Janna, Mairi, Maria, Spiros) aged 1;9 – 2;9; and the Doukas corpus (Doukas 2011), including data from two children (Eve, Maria) aged 1;7 – 2;11. All data have been transcribed in CHAT format.

Stephany Corpus		Doukas Corpus	
Child	**Age of recording**	**Child**	**Age of recording**
Janna	1;11 & 2;5 & 2;9	Eve	1;7 – 2;11
Mairi	1;9 & 2;3 & 2;9	Maria	2;0 – 2;8
Maria	2;9		
Spiros	1;9		

Table 3| Summary of CHILDES data

We gathered 214 DC-articulated utterances as follows:

wh-*jati*	causal *jati*	*ja na*	causal *afu*	*epiði*
113	63	19	19	0

Table 4| Number of DC-articulated utterances in CHILDES data

Also, no occurrences of temporal *afu* were found in our data.

Second, we designed and conducted an original experiment[1] consisting of two tasks, a comprehension task[2] and a production task. The first involved narrating a short story divided into 10 (small) parts, followed by 3-4 questions on each, targeting the mastery of domains of use (content, speech-act, epistemic) of causal DCs and of the three mindreading levels we postulate for *afu*. There were two questions per domain of use for each DC (*jati, afu, epiði*) in total, plus a control question in each of the 10 parts. The design took into account the participants' linguistic and cognitive abilities, such as attention and working memory. The production part consisted of six role-playing games based on the story. Spontaneous speech was also recorded. We created a picture book and showed the relevant pictures while narrating the story orally. Here is a specimen of it:

Το μικρό ποντικάκι άρχισε να τρέχει [control sentence]. Το μεγάλο του είπε: «*Γιατί* τρέχεις;» [wh-*jati*]. Και εκείνο απάντησε: «Τρέχω, *γιατί* θα με πιάσει!» [content]. Τότε το μεγάλο ποντικάκι του είπε: «Πώς θα σε πιάσει; *Αφού* είναι γέρος! Δεν μπορεί να τρέξει!» [*afu*-L2]. Τότε όμως, ο γερο-Ποντικός σήκωσε ψηλά το μπαστούνι του κι όλα τα ποντικάκια άρχισαν να τρέχουν [control sentence].
The little mouse started running [control]. *The older mouse told him* "DC *are you running?*" [wh-jati]. *And he answered: "I'm running,* DC *he will catch me!"* [content]. *Then, the older mouse said to him: "How will he catch you?* DC *he is old! He can't run!* [afu-L2]. *But then, the old-Mouse raised his cane and all the mice started running* [control].

Children were tested individually at their kindergarten in a quiet classroom or, in four cases, at their homes. The tasks were administered over a 25-minutes session. We recorded and transcribed the conversations. A pilot test was first conducted using both child and adult participants to detect any defects in task design and methodology.

So far, participants are 32 monolingual children aged 3;5 – 6;8 acquiring Greek in a typical development; 10 adult monolingual native speakers of Greek served as controls.

To date, our corpus comprises a total of 823 causal DC-articulated utterances (not considering *wh-jati*) as follows:

jati	*ja na*	*epiði*	*afu*
464	87	19	77

Table 5| Number of DC-articulated utterances in experimental data

A DC in a domain of use was considered as acquired when two relevant occurrences were produced over a two-month period, following Zufferey (2010:132-133). Adults' echos and children's repetitions were excluded from the corpus.

---

[1] Number of approval by University of Crete Ethics & Ethics Research Committee: 150/17.07.2019
[2] In the spirit of Zufferey, Mak and Sanders (2015).

2.2 Results

2.2.1 The acquisition of DCs in their domains of use

We studied the data from CHILDES to detect time of acquisition of each DC. Data show that wh-*jati* appears before or simultaneously with causal *jati* in most cases; in the rest, children had already acquired both. Both DCs occur before or shortly after 2;0.

Child	Causal *jati*	Wh-*jati*
Eve	1;11.00	1;11.00
Maria (Doukas Corpus)	2;2.8	2;2.8
Janna	<2;5.12	<1;11.00
Mairi	<1;9.25	<1;9.17
Maria (Stephany Corpus)[3]	<2;3.11	<2;3.11

Table 6| Age of acquisition of *jati* per child

By way of illustration, in Mairi's data, wh-*jati* and causal *jati* are already there at 1;9. She probably acquired them earlier:

    (1)   *jati* to pi(res) 0to Daxti(liði)[4] ?   (Mairi, 1;9.17)
        'Why did you take the ring?'
    (2)   0na to (v)ɣalume (.) *jati* kol [*] ilo [*] kei.   (Mairi, 1;9.25)
        'Let's take it off DC sun is hot.'
        (Looking for a reason to take doll's hat off; probable interpretation)

Wh-*jati* outnumbers causal *jati* in the early occurrences, until 2;2 - 2;3; after 2;3, there is a notable increase in the causal *jati*-articulated utterances of most children:

Child	Age	Wh-*jati*	Causal *jati*	Causal *jati* answering *wh*-q
Eve	<2;3.23	6	5	3/5
	>2;3.23	5	19	10/19
Janna	1;11	3	0	-
	2;5.12 - 2;9.9	22	15	3/15
Mairi	<2;3.18	31	4	3/ 4
	>2;9.14	31	2	2/3

Table 7| Distribution of wh-*jati* and causal *jati*

As expected, we found scanty evidence of two-segment *jati*-articulated utterances ({TS, DC-SS}) under the age of two. However, at 1;9 Mairi already forms {TS, DC-SS} with directive TS (ex. (2) above). First occurrences of {TS, DC-SS} with declarative TS appear at around 2;3:

---

[3] A participant at 2;03.18 Mairi's files.
[4] Some basic CHILDES' symbols: xxx: The transcriber cannot hear or understand what the speaker is saying, 0word: Omitted word, [*]: Error marking, (.): Silent pause. Examples presented as in the CHLDES database.

(3) (T)a 0ta pao tso [*] tsagari *jati* ine Gaɣamena [*].   (Mairi, 2;3.17)
     'I will take them to the cobbler DC they are broken.'

In early occurrences *jati*-introduced segment (SS) can appear, agrammatically, in P1 (*jati*-SS, TS), as we expected:
   (4) *jati* klei xalase I ka(r)ekla   (Eve, 2;3.23)
        'He cries DC the chair broke.'
   (5) *jati* den xxx ligo xodri, de boro alo xxx   (Maria, c. Douka, 2;2.8)
        'DC not xxx a bit fat, I can't anymore xxx.'

We encountered robust grammatical <TS, *jati*-SS> from the age of 2;5 on. We surmise that its later stabilization in P2 is related to the concomitant appearance of *epiδi*, occupying P1:

   (6) *Γιατί* ε   *επειδή* θα σε πάμε αμέσως στην κλούβα,   σταμάτα
        jati (.) *epiδi* θa se pame amesos stin kluva   stamata
        να   κλέβεις.   (Mc, 3;5)
        na   klevis.
        'Because DC we will take you to the (police) van right away, stop stealing.'

   (7) *Γιατί*   *επειδή* φόραγε   φόρεμα.   (N, 4;1)
        jati (.) *epiδi* foraje   forema.
        'Because DC he was wearing a dress.'

Data from CHILDES provide us with the first speech-act uses of *jati* from Janna, at 2;9 in (8) and from Eve at 2;6 in (9). In our experimental data, which start from age 3;5, speech-act *jati*-articulated utterances reliably and regularly appear from the beginning, as in (10):

   (8) siɣa *jati* exo 0Dangomata 0apo kunupja.   (Janna, 2;9)
        'Be careful DC I have mosquito bites.'
   (9) oxi afta.
        jati ta δjavasa.   (Eve, 2;6)
        'Not these.
        DC I read them.'
  (10) Βοηθήστε με, *γιατί* δεν ξέρω τι να κάνω.   (M, 3;5)
        voiθiste   me *jati* δen ksero ti na kano.
        'Help me, DC I don't know what to do.'

As far as comprehension of causal *jati* per domain of use is concerned, our experimental data show early acquisition of both content and speech-act domains. Comprehension at age group <5;0 (N=15, mean age: 3;11) reaches 87.5% in the content domain and 81.25% in the speech-act domain, whereas at age group >5;0 (N=17, mean age: 5;10) reaches 100% in both domains. In our experiment, children had no difficulty grasping the meaning of utterances such as:

(11) Ο   γερο-Ποντικός   φορούσε   πάντα   τιράντες,   *γιατί*   το   παντελόνι
    o   jeropondikos   foruse   panda   tirandes   *jati*   to   pandeloni
    του   ήταν   μεγάλο.
    tu   itan   meɣalo.   (content)
    'The old-Mouse was always wearing suspenders DC his trousers were big.'

(12) Βοηθήστε   με,   ποντικίνες,   *γιατί*   έσπασαν   οι   τιράντες   μου.
    voiθiste   me   pondikines   *jati*   espasan   i   tirandes   mu.
     'Help me, mice (female), DC my suspenders are broken!'   (speech-act)

Moreover, in both content and speech-act domains children appear able to deal linguistically with mental structures of considerable *implicit* complexity, understanding and producing 'counterfactual' *jati*-articulated utterances from an early age, at which, as we will see, their mindreading abilities remain rather limited. This we take as evidence in favour of modular architectures of the mind.

    'Counterfactual' content *jati* occurs in CHILDES data already at 2;9:

(13) *jati* Ta me komen [*] ta aftokinita.   (Janna, 2;9)
    DC cars will cut me (=hit me).
    (Giving a reason why she is taking the school bus and not going on foot).

In our experimental data, 'counterfactual' *jati* already occurs systematically and reliably at 3;5:

(14) Exp: Γιατί   το   μικρό   ποντικάκι   είπε   ότι   τρέχει;
            jati   to   mikro   pondikaki   ipe   oti   treçi?
        'Why did the little mouse say that he was running?'
    Ch: *Γιατί*   θα   το   πιάσει.   (K, 3;7)
            jati   θa   to   pçasi.
        'DC he will catch it.'

Epistemic *jati* is not encountered in the CHILDES data; in our data we encounter it from the outset (3;6), as expressing basic epistemicity. Children give adult-like answers to questions targeting the epistemic domain, similar to answers given by controls.

(15) Exp: Γιατί   οι   τσίχλες   έκαναν   δουλειά;
            jati   i   tsixles   ekanan   ðulia?
         'Why did the chewing gums work?'

(16) *Γιατί*   κολλάνε   οι   τσίχλες.   (M, 3;5, P, 3;10, E, 4;4)
    jati   kolane   i   tsixles.
    'DC chewing gums stick.'
(17) *Γιατί*   κόλλησαν   το   παντελόνι   του.   (Ef, 3;8, Mr, 3;8, D, 4;0)
    jati   kolisan   to   pandeloni   tu.
    'DC they stuck his pants [to his braces].'

(18) *Επειδή* κολλούσανε. (A, 5;8)
　　epiði kolusane.
　　'DC they stuck.'

Epistemicity increases from 71% at ages <5;0 to 82% at ages >5;0. We overall assume acquisition of basic (first-order) epistemicity before age 3;5.

　　As far as the order of acquisition of the three domains is concerned, if we consider utterances with directive TS to be speech-acts, then we do not have safe clues on the order of acquisition between content and speech-act domains, as realized in two-segment *jati*-articulated utterances. But taking into account mono-phrasal utterances (∅, *jati*-SS), we obtain some evidence that acquisition of the content domain precedes acquisition of the speech-act domain.[5] This is the case for Eve and Maria, whereas we attest co-occurrence for Mairi:

Child	CONTENT		SPEECH-ACT
	∅, *jati*-SS	{TS, *jati*-SS}	{TS, *jati*-SS}
Eve	1;10	2;3	2;6
Maria		2;3	2;5
Mairi	1;9	2;3	1;9

Table 8| Ages of acquisition of content and speech-act domain with *jati*

Based on the above data, we assume the following order of acquisition for causal *jati*:

{content [<] speech act} < epistemic

Content and speech-act *jati* are acquired before or shortly after completion of the second year of life (≈2;0); epistemic *jati* is acquired in the fourth year of life.

　　*epi*ði is not encountered in the CHILDES data (<2;11). In our experimental data (>3;4) *epi*ði occurs from the outset, both in content and speech-act domains (examples (19) and (20), below):

(19) *Επειδή* δεν περπατούσαν καλά τα πόδια του. (M, 3;5)
　　epiði ðen perpatusan kala ta poðja tu.
　　'DC his legs weren't walking well.'
(20) Ελάτε, ενισχύσεις, *επειδή* έχουμε έναν κλέφτη. (Mc, 3;5)
　　elate enisxisis *epiði* exume enan klefti.
　　'Come, reinforcements, DC we have a thief.'

Early data from five children testify that *afu* already occurs abundantly from 2;0 to 3;0.

(21) *Αφού* με αγαπάς, γιατί με μαλώνεις; (A, 2;1)
　　afu me aγapas jati me malonis?
　　'DC you love me, why are you yelling at me?'
(22) *afu* thes na to valis ato gia na kimithume. (Maria, c. Douka, 2;2)

---

[5] See also Kati 1994.

'DC you want to put this so we can sleep.'

(23) *afu* ine mik(r)o to fu(s)tanaki.　　　　　　　(Mairi, c. Stephany, 2;3)
　　　'DC the dress is small.'

(24) *afu* tha pas.　　　　　　　　　　　　　　　(Eve, 2;11)
　　　'DC you will go.'

Based on all the above data, we assume the following order of acquisition for causal DCs:

<center>

{wh-*jati* [<] causal *jati*} < {*afu* / *ja na*[6]} < *epiði*

</center>

Wh-*jati* and causal *jati* are acquired before or shortly after completing the second year of life (≈ 2;0)[7], *afu*/ *ja na* during the third year of life (2;0 – 3;0), and *epiði* shortly before or shortly after completing the third year of life (≈ 3;0).

2.2.2　*Afu: Emergence of mindreading ability*

We have positive evidence for early acquisition of *afu*-L1/L2, but negative for early acquisition of *afu*-L3. In order to comprehend sentences as (27), children have to perform a higher-order metarepresentantion, so as to understand that character's words carry an ironic meaning. In our experiments, children aged under 5;0 have proven unable to do this.

Afu-L2: Positive evidence

(25) *Αφού*　σας　είπα,　έσπασαν　οι　τιράντες　μου!　　　　　(P, 3;10)
　　　afu　sas　ipa　espasan　i　tirandes　mu!
　　　'DC I told you, my suspenders are broken!'

(26) *Αφού*　είναι　γέρος!　　　　　　　　　　　　　(D, 4;0)
　　　afu　ine　jeros!
　　　'DC he is old!'

Afu-L3: Negative evidence

(27) Exp:　*Αφού*　εσύ　τα　ξέρεις　όλα,　ξέρεις　να　φτιάξεις　και
　　　　　　afu　esi　ta　kseris　ola　kseris　na　ftçaksis　ke
　　　　　τις　τιράντες　σου!
　　　　　tis　tirandes　su!　　　　　　　　　　　　　(narration)
　　　　　'DC you know everything, you know how to fix your suspenders!'

(28) Exp:　Τι　είπαν　οι　ποντικίνες　στον　γερο-Ποντικό;　Γιατί　του
　　　　　ti　ipan　i　pondikines　ston　jeropondiko?　jati　tu
　　　　　είπαν　να　τις　φτιάξει　μόνος　του　τις　τιράντες;
　　　　　ipan　na　tis　ftçaksi　monos　tu　tis　tirandes?

---

[6] For lack of space we do not expand on our *ja na* data.
[7] Kati (1994) also found causal *jati* at 2;1.

<center>428</center>

What did the mice (female) say to the old-Mouse? Why did they tell
him to fix his suspenders on his own?'

Ch: *Γιατί   τα   ξέρει   όλα.*   (E, 3;8.23)
jati   ta   kseri   ola.
'DC he knows everything.'

Exp: Είναι   αλήθεια;   Τα   ξέρει   όλα;
ine   aliθça?   ta   kseri   ola?
'Is it true? Does he know everything?'

Ch: Ναι.
ne.
'Yes.'

From age 5;0 onwards we have data on children's access to *afu*-L3, at the age they also
start producing mental verbs, such as *nomize* (he thought):

(29) Exp: Γιατί;   Πώς   ξέρουμε   ότι   οι   ποντικίνες   δεν   τον   βοήθησαν;
jati?   pos   kserume   oti   i   pondikines   ðen   ton   voiθisan?
'Why? How do we know that the mice (female) didn't help him?'

(30) *Γιατί   τα   ήξερε   όλα   και   είπε   να   τα   κάνει   μόνος   του.*   (G, 5;0)
jati   ta   iksere   ola   ke   ipe   na   ta   kani   monos   tu.
'DC he knew everything and he said he would do it on his own.'

(31) *Επειδή   θα   νόμιζε   πως   θα   τα   καταφέρει   μόνος   του.*   (S, 5;2)
epiði   θa   nomize   pos   θa   ta   kataferi   monos   tu.
'DC he thought that he would manage on his own.'

(32) *Επειδή   νόμιζαν   ότι   τους   έλεγε   ψέματα.*   (M, 5;3)
epiði   nomizan   oti   tus   eleje   psemata.
'DC they thought that he was lying to them.'

These results were statistically analyzed in order to check whether age significantly
affects the success comprehension rate for *afu*-articulated utterances. A positive and
statistically significant correlation was found at ages >5;0 for *afu*-L3, when *afu*-L2 was
also marked with a positive value, with statistical significance at the 5% level (Levene
test), with Sig.=0.013 (Equal variances). The same result was achieved in the same group
for *afu*-L3 with the Pearson test (2-tail test) at 1% significance level (Sig.2-tailed=0.000).
    The diagram below illustrates the comprehension rate of *afu*-L2 and *afu*-L3
correlated with age. Children's age-groups[8] are given on the horizontal axis, with the
percentage of children that showed successful comprehension on the vertical axis. In
children aged >5;0, having mastered *afu*-L3 entails them having mastered *afu*-L2.
Emergence of L3 is positively correlated with full L2 acquisition.

---

[8] Group 3;0-4;0: N=8, mean age 3;7; Group 4;0-5;0: N=7, mean age 4;4; Group 5;0-6;0: N=9, mean age
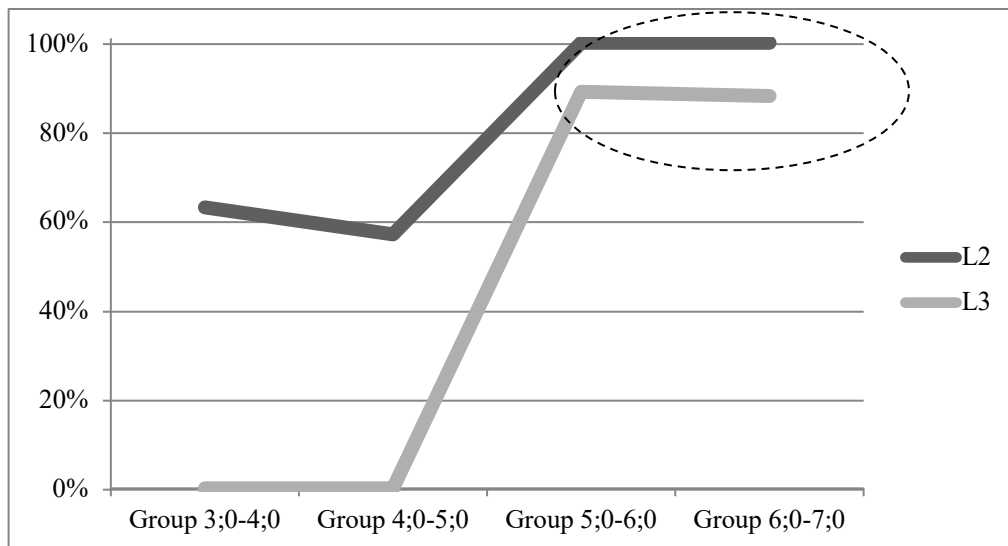5;5; Group 6;0-7;0: N=8, mean age 6;4.

Figure 1| *afu* **L2/L3 acquisition**

3   Conclusions

As far as both first appearance and mastery of the various uses of causal DC operators are concerned, acquisition depends among other things on: (a) the development of mental complexity, which we also track in the domain of mindreading; (b) the (linguistic) requirements for explicitness, which are positively correlated to (a).

Epistemicity and higher-order metarepresentative uses appear after: (a) basic content-handling, which relies on direct mind-world connection; and (b) basic (and automatic) handling of the perceptual/cognitive background, which relies on direct connection to the world perceived as communicative environment. Therefore, it was to be expected that we would encounter early acquisition of the speech-act domain in the way we did.

DCs with heavier demands for explicitness, such as *epiði*, occur later than DCs with lighter demands for explicitness, such as *jati*. However, complex non-mindreading cognitive functions implicitly operated in young children's minds are effectively communicated, as illustrated in the case of 'counterfactual' *jati*.

References

Apperly, Ian. 2010. *Mindreaders. The Cognitive Basis of "Theory of Mind"*. New York: Psychology Press.

Birch Susan.A.J., and Paul Bloom, 2007. "The Curse of Knowledge in Reasoning About False Beliefs." *Psychological Science, 18, 5*: 382-365.

Doukas, Thomas. 2011. *The Acquisition of the verbal domain in child Greek. Evidence from a new child Greek Corpus*. Unpublished Ph.D Thesis, University of Reading.

Evers-Vermeul, Jacqueline, and Ted Sanders. 2011. "Discovering domains–On the acquisition of causal connectives." *Journal of Pragmatics*, *43*(6), 1645-1662.

Giannadaki, Sandy. in preparation. *Meaning processing cognitive mechanisms. Mental systems cooperating with the language processor*. PhD diss. University of Crete.

Goldman, Alvin. I. 2006. *Simulating Minds. The Philosophy, Psychology, and Neuroscience of Mindreading*. Oxford: Oxford University Press.

Kalokerinos, Alexis. 2001. "Αφού [afu]." In P. Pavlou & A. Roussou (eds), *Proceedings of the 4th International Conference in Greek Linguistics* (Nicosia, Cyprus). Thessaloniki: University Studio Press.

Kalokerinos, Alexis. 2004. "The justifying connection, mostly in Greek." *Journal of Greek linguistics 5*(1): 27-80.

Kalokerinos, Alexis. to appear. "Biolinguistics encounters meaning. Aspects of naturalism." In Kalokerinos A. and Tsimpli I.M. (eds.), *Language and Evolution. Biolinguistic Perspectives*. Iraklio, Crete University Press [in Greek].

Kati, Dimitra. 1994. "Clauses of causal, temporal and conditional dependence in child's language." *Studies in Greek Linguistics* 15: 746-757 [in Greek].

Kitis, Eliza. 2006. "Causality and subjectivity: The causal connectives of Modern Greek." In Hanna Pishwa (ed.). *Language and memory: Aspects of knowledge representation*. 223-267, Berlin & NY: Mouton de Gruyter.

Kyrantzis, Amy, Guo, J., and Susan Ervin-Tripp. 1990. "Pragmatic conventions influencing children's use of causal constructions in natural discourse." In K. Hall, J. Koenig, M. Meacham, S. Reinman, and L. Sutton (eds), *Proceedings of the Sixteenth Annual Meeting of the Berkeley Linguistics Society*, 205-215.

MacWhinney, Brian. 2000. *The CHILDES Project: Tools for analyzing talk. Third Edition.* Mahwah, NJ: Lawrence Erlbaum Associates.

Millikan, Ruth. G. 1993. *White Queen Psychology and Other Essays for Alice*. Cambridge, Mass: MIT Press.

Nichols, Shaun, and Stich Stephen. P. 2003. *Mindreading*. Oxford: Oxford University Press.

Onishi, Kristine H. and Renée Baillargeon. 2005. "Do 15-month-old infants understand false beliefs?" *Science, 308*: 255-258.

Stephany, Ursula. 1997. "The acquisition of Greek." In Dan I. Slobin (ed.), *The Crosslinguistic Study of Language Acquisition, 4*, 183-333. Mahwah, NJ: Lawrence Erlbaum.

Surian, Luca. Caldi S. and Dan, Sperbre. 2007. "Attribution of beliefs by 13-month-old infants." *Psychological Science, 18 (7)*: 480-586

Sweetser, Eve. 1990. *From etymology to pragmatics: Metaphorical and cultural aspects of semantic structure*. Cambridge: Cambridge University Press.

Tomasello, Michael. 2008. *Origins of Human Communication*. Cambridge, Mass: MIT Press.

Zufferey, Sandrine. 2010. *Lexical Pragmatics and Theory of Mind: The Acquisition of Connectives*. Amsterdam: John Benjamins Publishing.

Zufferey, S., Mak, W. M., and Ted Sanders. 2015. "A cross-linguistic perspective on the acquisition of causal connectives and relations." *International review of pragmatics*, *7*(1): 22-39.