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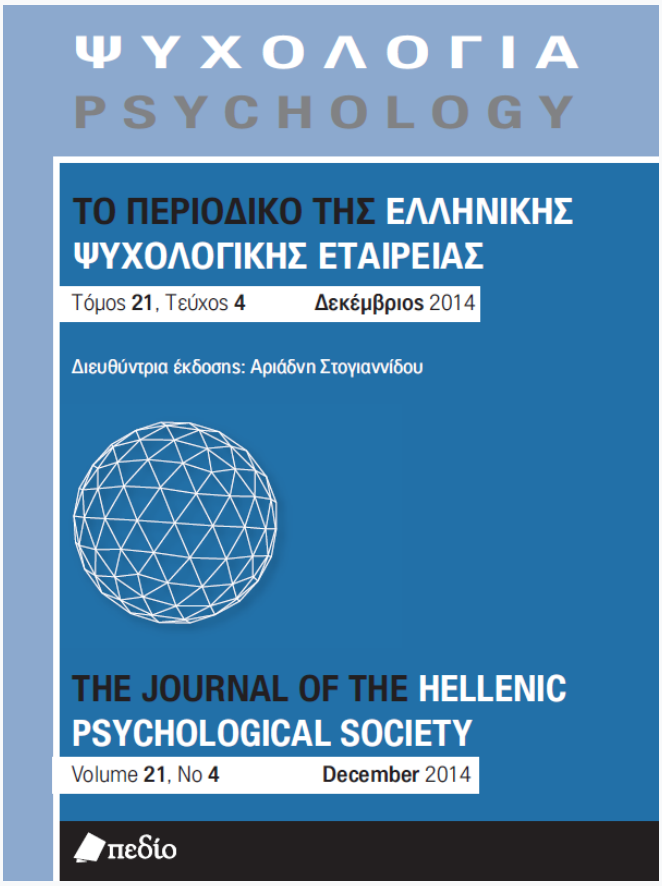

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Communication Development Report [CDR]: A parent report instrument for the early screening of communication and language development in Greek-speaking infants and toddlers

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ABSTRACT

This study aimed to explore the main psychometric properties of the CDR, a new parent report instrument for the early screening of communication and language development of Greek-speaking children. Based on a representative sample of 1391 children aged 7 to 30 months (M= 19.45, SD= 6.91), results are presented on the sensitivity, internal consistency, and convergent and divergent validity of its two major scales ('Preverbal behaviors' and 'Verbal behaviors') and their respective subscales (vocal and non-vocal preverbal communication, language comprehension, productive vocabulary, morphology and syntax). Results also illustrate the developmental patterns of the dimensions of communicative/linguistic development assessed, as well as the high and significant correlations among these dimensions of (pre)linguistic knowledge. Overall, results provide evidence on the functionality, validity and reliability of the CDR, and point to its use as a tool for the early screening of communication development in Greek-speaking children for clinical, educational and research purposes.

Keywords: Communication and language development, Parent report, early screening, Greek language, Infant, Toddlers.

1. Introduction

Early language development constitutes an important milestone and a useful indicator of children's overall development. Most children produce their first words at some point between the 12th and 18th month, while by the age of 24 months they use more than 50 words and begin to combine them in pairs to build their earliest simple sentences. By the age of 30 months, they normally have developed an extensive expressive vocabulary, as well as several of the basic grammatical structures of their language (e.g., Clark, 2009; Fenson et al., 2007). Nonetheless, it is al-

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so known that individual differentiations in this developmental course are very significant, and important temporal deviations in the emergence and development of those milestones are quite common in the early years (Bates, Bretherton, & Snyder, 1988; Bates, Dale, & Thal, 1995; Dale & Goodman, 2005; Fenson et al., 1994; Fenson et al., 2000; Hayiou-Thomas, Dale, & Plomin, 2012; Shore, 1995). Disentangling the complex underlying causes of early expressive language delay and predicting the developmental course of each individual late-developing child is an extremely challenging task, both for health professionals and for researchers of child language. However, it is also a critical one, since recent research is pointing to the significant benefits of early (prior to 3 years of age) intervention for those children that would not spontaneously overcome this delay and would be diagnosed with persistent language delay or other communicative or developmental disorders (e.g., Dawson et al., 2010; Girolametto, Pearce, & Weitzman, 1996, 1997; Landa & Kalb, 2012; Webb, Jones, Kelly, & Dawson, 2014; Whitehurst, Smith, Fischel, Arnold, & Lonigan, 1991). Various studies, thus, suggest the importance of a systematic early screening of children's communication and language skills for the earliest possible detection of any significant delay (e.g., Damico, Müller, & Ball, 2010).

Important efforts have been made in this direction internationally with the standardization of psychometric instruments based on parental reports, which can be used as routine screening tools for children younger than 3 years. They consist of extensive inventories of communicative and linguistic behaviors, among which caregivers are requested to recognize and mark those used by their children. Parent report inventories are reported to present several advantages in comparison to other clinical or laboratory procedures of assessment. They constitute cost and time effective tools, ideal for a brief initial screening of young children's communication skills in educational, pediatric or research contexts. They do not require children's participation in long sessions of direct observation, which are typically required for the analysis of a representative communication sample; neither do they involve their participation in structured tests, whose administration to children younger than 3 years can prove problematic due to young children's difficulty to respond to concrete instructions and procedures (Paul, 2001). Perhaps the most important advantage of parental reports is that the data collected are based on the representative knowledge that parents have of their children's communication and language (Dale & Goodman, 2005). This knowledge is grounded on the extensive experience and everyday observation of their children's spontaneous communicative behaviors in a great variety of contexts (Crais, 1995, 1996). Hence parent reports are believed to be more ecologically valid, even in comparison to naturalistic observations at home or in a laboratory (Bates, Bretherton, & Snyder, 1988). Additionally, for the same reason, parent reports permit the assessment of communicative behaviors which are very difficult –if not impossible– to observe in a clinical setting (e.g., private speech or vocalizations, everyday routines and interactions). Finally, their interpretation does not require specialized knowledge, so they can be used by non-experts in early speech and communication development (e.g., teachers, pediatricians) as a valid criterion for the referral of children to experts for further evaluation.

Naturally, parent reports are not devoid of disadvantages (Feldman et al. 2000; Fenson et al. 2000; Tomasello & Mervis, 1994). Particular emphasis is put on the risk of parental bias. A prerequisite for the use of these tools is, therefore, to demonstrate that parents, by answering their questions, can provide reliable data without overestimating or underestimating their children's skills. Relevant research has shown that parents, under certain conditions, can be reliable informants of their children's early communication and language skills (Bates, Benigni, Bretherton, Camaioni & Volterra, 1979; Bates, Bretherton & Snyder, 1988). In particular, it is suggested that two basic conditions must be met to enable the validity of parental reports (Dale, 1991, 1996; Fenson et al., 1993): (i) the assessment must be limited to current and emerging behaviors - rather than past, and (ii) par-

ents must be asked to identify –rather than freely recall– specific behaviors. Both conditions are thought to facilitate the memory of the respondents. For instance, as reported by Fenson et al. (1993), parents seem to be very reliable when requested to recognize the words that their child produces through a comprehensive or comparative word list, whilst at the same time it can be very difficult for them to freely recall the same words.

Some of the most widely used parental reports for the screening of young children's communicative development are: the M*acArthur-Bates Communicative Development Inventories* (MCDIs) (Fenson et al., 1993; Fenson, Marchman, Thal, Dale, Reznick, & Bates, 2007) for children aged 8 to 37 months, which have been adapted in more than 15 languages (Dale & Penfold, 2011), the *Communication and Symbolic Behavior Scales Developmental Profile* (CSBS DP) (Wetherby & Prizant, 2002) for children aged 6 months to 6 years, and the *Language Development Survey* for children aged 18 to 35 months (Rescorla, 1989), which forms part of the ASEBA (The Achenbach System of Empirically Based Assessment, - Achenbach, 2009) (for a more detailed presentation of these instruments, see: Karousou & Petrogiannis, 2014). To our knowledge, the latter is the only relevant tool that has been standardized in Greek population (18-35 months of age, *N*= 274) (Tsaousis, 2009).

All these instruments have been subjected to systematic explorations regarding their reliability and validity, which have produced sound results (Dale, 1991; Dale, Bates, Reznick, & Morisset, 1989; Feldman et al., 2005; O'Toole, & Fletcher, 2010; Rescorla, 2005b; Thal, Jackson-Maldonado, & Acosta, 2000; Wetherby, Allen, Cleary, Kyblin, & Goldstein, 2002; Wetherby, Goldstein, Cleary, Allen, & Kublin, 2003) and, thus, are systematically used internationally both in research and in clinical practice.

The preceding review of the relevant literature illustrates the necessity of the development and provision in the Greek context of a standardized and validated screening instrument targeting on the linguistic and communicative skills of very young children. Such an instrument would provide the necessary information to the experts for the earliest possible intervention in the case of potential delay or impairment.

Aim of the study

The general aim of this research was the development and standardization of a new parent report instrument which would (a) enable the screening of communication and language skills of very young children (7-30 months) growing up in a Greek-speaking environment, (b) be completed by parents independently of their educational background, (c) be highly reliable and valid, (d) cover various dimensions of communicative and language development, and (e) fully meet the particular characteristics of Greek language and culture.

In particular, the present paper aims to examine the functionality and the basic psychometric properties of the CDR by exploring the developmental sensitivity and the internal consistency, convergent and divergent validity of its scales and subscales.

2. Method

A cross-sectional design was used, with "children's age (expressed in months)" as a key criterion for forming 24 distinct age groups, with initial age the 7th month (level 1) and terminal age the 30th month (level 24). Overall, 61 communicative and linguistic behaviors were the principal variables of the study (grouped into two main scales and six subscales) that were assessed by means of the Communication Development Report (CDR), a structured parental report which was the main psychometric instrument of this empirical research.

Participants

The sample consisted of the caregivers of 1391 children covering the age range from 7 to 30 months (M= 19.45, SD= 6.91) (Table 1 presents the distribution of the sample by month and gender). With regard to their birth order, 45.2% of the

Table 1
Distribution of the sample by age (in months) and gender

Age (in months)	**Gender**		
	N (%) Boys	**N (%) Girls**	**N Total**
7	20 (43.2%)	21 (56.8%)	41
8	34 (60.3%)	26 (39.7%)	60
9	31 (54.4%)	26 (45.6%)	57
10	22 (43.1%)	29 (56.9%)	51
11	20 (50.0%)	20 (50.0%)	40
12	23 (48.9%)	24 (51.1%)	47
13	28 (62.2%)	17 (37.8%)	45
14	18 (43.9%)	23 (56.1%)	41
15	33 (56.9%)	25 (43.1%)	58
16	26 (56.5%)	20 (43.5%)	46
17	31 (50.8%)	30 (49.2%)	61
18	32 (50.0%)	32 (50.0%)	64
19	35 (57.4%)	26 (42.6%)	61
20	26 (40.6%)	38 (59.4%)	64
21	29 (53.7%)	25 (46.3%)	54
22	29 (52.7%)	26 (47.3%)	55
23	37 (50.0%)	37 (50.0%)	74
24	41 (56.9%)	31 (43.1%)	72
25	32 (52.5%)	29 (47.5%)	61
26	28 (47.5%)	31 (52.5%)	59
27	22 (36.7%)	38 (63.3%)	60
28	30 (41.1%)	43 (58.9%)	73
29	49 (57.0%)	37 (43.0%)	86
30	30 (48.4%)	32 (51.6%)	62
Total	**706 (50.8%)**	**685 (49.2%)**	**1391**

children were first-born, 33.8% second-born and 21% were third- or fourth-born. Furthermore, 43.9% of them were the only child in the family by the time their caregivers filled in the CDR. According to the information provided by their caregivers, all children were healthy, with no diagnosed sensory, physical or mental impairment. Children at risk for language delay (i.e., children with prenatal or perinatal complications, premature low birth-weight < 2.200 kg, or repeated otitis) were excluded from the sample. Finally, a basic requirement for taking part in the study was that Greek should be the main language spoken in the children's homes.

The majority of the questionnaires (86.6%) were answered by mothers, while the remaining were completed either by fathers (7.8%) or both parents (2%) or by grand-mothers (1.7%). With regard to maternal educational level, taken as an indicator of the family's socioeconomic status (Heilmann et al., 2005; Jackson-Maldonado et al., 2003; López Ornat et al., 2005) 35.7% of the mothers held a University degree, 29.7% received Technical Pro-

Table 2
Scales and subscales of the final standardized version of the CDR and basic developmental indexes included*.

SCALE I: Non-verbal behaviors	**Preverbal communication** (18)	**Non-vocal** preverbal communication (8)	Eye-gaze, different gestures, actions, play, routines
		Vocal preverbal communication (10)	Different types of vocalizations, vocal imitations, private vocal behaviors
	Language comprehension (4)	Non-verbal, behavioral responses to words and language expressions, which imply their understanding.	
SCALE II: Verbal behavior	**Productive Vocabulary** (23)	Vocabulary size and semantic categories of the words it contains.	
	Grammar (16)	**Morphology** (6)	Basic morphological variations of number, gender, person, tenses.
		Syntax (10)	Morphosyntactic complexity of the sentences

* Examples of the questions included in each subscale of the CDR can be found in Karousou & Petrogiannis (2014).

fessional/Vocational education, 29.3% completed secondary education (Lyceum), 5.1% completed the compulsory 9 years education and a remaining 1% had a lower educational background. Finally, out of the nationally-driven sample, 53% of the families were living in big cities (population >40.000), 14.9% in smaller cities (pop. 10.000 – 40.000), 17.6% in towns (pop. 2.000-10.000), and 14.6% in villages (pop. < 2.000).

Instrument

The Communication Development Report (CDR), a structured parental report questionnaire, was developed, validated and standardized for the screening of communication and early language skills of Greek-speaking children aged 7-30 months. Its development was based on recent research findings in the field of developmental psychology and psycholinguistics, as well as on a thorough review of other standardized psychometric tools used internationally for the early screening of young children's communicative and linguistic skills. It includes a variety of developmental indexes which are grouped into two main scales and six subscales, according to the dimension of communicative development they assess; namely: the "Non-verbal Behaviors" scale, which includes subscales on "Non-Vocal Preverbal Communication", "Vocal Preverbal Communication" and "Language Comprehension", and the "Verbal Behaviors" scale, which includes subscales on "Productive Vocabulary", "Morphology" and "Syntax" (Table 2).

The psychometric properties of the CDR were established through a series of preliminary, pilot and exploratory studies. Initially, a *pre-pilot* version of the CDR was administered to a convenience sample (N=42) of parents of varying educational levels, aiming at detecting difficulties in understanding the questions that were included in the initial version of the instrument. As a result, the wording of some questions and instructions were modified (e.g., various examples have been introduced for greater clarity) for the subsequent version. A further sample was collected with the reformed *pre-pilot* version of the instrument (N= 148), whose anal-

Table 3
Concurrent validity and test-retest reliability results

Developmental dimension	CDR score* direct measures score correlations (Pearson's *r*)	Test-retest correlations (Pearson's *r*) within a two-month interval
Preverbal communication	.92**	.85**
Language understanding	.72**	.72**
Productive Vocabulary	.83**	.88**
Morphology	.92**	.72**
Syntax	.89**	.74**

** $p < .001$

ysis led to a substantial modification of the Language Comprehension and Productive Vocabulary subscales. Then, an extensive *pilot study* (N= 354) led to the exclusion of 9 items from the "preverbal behaviors" scale, which were proven to have no discriminative value or showed a very early ceiling effect (Karousou & Petrogiannis, 2014). Its results also led to the extension of the lower age limit of the CDR by one month, starting at 7 months of age. A *concurrent validity study* empirically established the reliability of caregivers as informants of their children's early language development through the CDR (Karousou & Nikolaidou, 2015). More specifically, direct measures of the spontaneous communication of 54 children video-recorded based on a semi-structured observation protocol were compared to the scores of the CDR filled in by their caregivers on the same day. An agreement between the two independent measures (parental vs. observational) was calculated for each communicative behavior. The correlations between the CDR scores vs. the direct measures scores was ranged quite highly for all dimensions of communicative/linguistic development (see, Table 2).

Finally, a *test-retest* study (Antoniadis & Karousou, 2013) was performed with 45 children initially aged 7-28 months with a two-month period interval. The analysis revealed high and very significant correlations for all the subscales of the CDR, establishing the measuring stability of the psychometric instrument, as well as a very good short term predictive validity (Table 2).

Structure of the instrument: The final version of the CDR consists of two main scales comprising a number of subscales each, which enable the assessment of specific dimensions of communicative/linguistic development, such as preverbal communication (vocal and non-vocal), language comprehension, productive vocabulary, morphology and syntax (see, Table 3). The instrument also includes a general information section concerning demographic characteristics of the family, the child's health, contact with other languages, schooling, etc.

All questions included in the CDR are closed-ended. Following the validity conditions proposed by Dale (1991, 1996) and Fenson et al. (1993), parents are invited to recognize the current or emerging communicative behaviors of their children. In order to facilitate the understanding, recognition and recall of these behaviors, instructions and/or questions are accompanied by specific examples or refer to specific communicative contexts in which the particular behaviors are likely to occur. Particular attention is also given to the wording of the instructions and questions so that they can be understood by parents independently of their educational background.

Scale I – Non-verbal behaviors. The first scale of the CDR assesses communicative behaviors which do not require the capacity for verbal communication (i.e., production of conventional lan-

guage). It includes questions about the various preverbal means used by young children to communicate, as well as questions regarding children's behavioral responses to words and expressions of their language, which indicate their comprehension.

(a) Preverbal communication: The items include questions on *non-vocal* ways of communication (e.g., establishing eye contact, gestures [proto-referential, proto-imperative, symbolic], communication through actions and rhythms, communication within interactive play, pretend and symbolic play), as well as questions on *vocal* communicative behaviors (various types of prespeech vocalizations, vocal imitation, private vocalizations). Caregivers are asked whether they have noticed their child communicating in any of these ways offering them a choice among the following answers: "Not yet" (0 points), "Rarely" (1 point) and "Often" (2 points).

(b) Language comprehension: Due to the methodological difficulty of assessing children's comprehension of particular words and expressions through parent reports (see, Feldman et al., 2005; Tomasello & Mervis, 1994), questions of this subscale aimed at presenting caregivers with everyday situations or communicative contexts in which their children respond behaviorally indicating their understanding of words and linguistic expressions. Parents are asked under which of the four proposed circumstances their child responds, and they are offered a choice among the following answers: "Not yet" (0 points), "Rarely" (1 point) and "Often" (2 points).

After the completion of the "Non-Verbal Behaviors" scale, caregivers are asked whether their children have ever spontaneously used any words (even if pronounced in a "wrong" way). Those who answer "not yet" are invited to omit the completion of the "Verbal Behaviors" scale.

Scale II – Verbal Behaviors. The second scale of the CDR assesses communicative behaviors which assume children's ability for verbal communication / conventional word production. More specifically, it includes an assessment of productive vocabulary, of basic morphological variations, as well as of the morphosyntactic complexity of the sentences produced by the children.

(a) Productive vocabulary: it constitutes an index of children's productive vocabulary size, whereas it informs on the semantic categories of the words it contains. This subscale includes word lists organized into 23 semantic categories (e.g., everyday expressions, people and their names, toys, food, clothes and accessories, home parts, furniture and objects, properties, questions, time, etc.). These categories cover a large amount of the concepts that form part of the everyday experience of Greek young children and, consequently, are very likely to be included in their vocabularies. For every category, caregivers are asked to estimate the number of words that their children produce (None [0 points], 1-5 [1 point], 5-10 [2 points], >10 [3 points]) by recognizing them through an extensive list of words.

(b) Morphology: it includes questions on the basic morphological variations that are likely to appear in the speech of Greek children of the age range covered by the CDR. More specifically, the items included concern the number, the gender and the case of nouns and adjectives, and also the verbal person and three basic simple tenses (present, past and future). Caregivers are offered many examples for each item and are asked whether their children use similar variations. The answers among which they have to choose are: "Not yet" (0 points), "Rarely" (1 point) and "Often" (2 points).

(c) Syntax: this subscale constitutes an index of the morphosyntactic complexity of the sentences produced by the children. More specifically, each of the 10 items it includes consists of an imaginary dialog with three (3) sentences of varying developmental complexity. Parents are asked to choose the sentence that sounds closer to what their child would say in a similar situation, that resembles the most in their child's "way of speaking". All the examples of the sentences used in this subscale, have been constructed based on real speech samples of children of this age range, which have been pooled from research data of the first author, as well as from the child language database of

Table 4
Mean scores and standard deviations of Scale I "Non-verbal Behaviors" and its subscales*.

Age group	Non-vocal preverbal communication (Max. score = 16)		Vocal preverbal communication (Max. score = 20)		Language comprehension (Max. score = 8)		SCALE I: Non-verbal Behaviors	
	M	SD	M	SD	M	SD	M	SD
07-08	42.88	21.34	32.38	18.49	38.74	24.91	37.35	16.78
09-10	55.38	20.01	41.11	19.12	42.71	24.18	46.59	16.36
11-12	72.77	19.16	52.64	20.30	68.97	27.42	62.93	17.08
13-14	83.07	22.36	63.72	25.02	79.65	27.12	73.65	21.19
15-16	87.80	15.61	70.10	22.47	85.70	18.22	79.37	16.52
17-18	91.15	10.95	77.72	21.94	89.80	17.63	84.80	15.03
19-20	93.55	10.93	84.68	15.03	94.56	10.96	89.70	10.32
21-22	94.55	8.68	88.03	14.22	95.64	11.71	91.78	9.85
23-24	93.54	9.89	90.68	16.93	97.17	7.45	92.90	11.01
25-26	95.31	9.56	91.67	12.44	97.08	8.84	93.98	8.91
27-28	94.22	9.66	91.50	12.11	96.24	9.61	93.35	9.00
29-30	95.65	7.31	93.28	12.50	96.88	11.47	94.79	8.28

***** The mean scores are expressed as a percentage over the maximum score of each scale/subscale.

Stephany in the "Child Language Exchange System" or CHILDES (MacWhinney, 2000; Stephany, 1997). Parental answers are scored from 0 to 3, according to the morphosyntactic complexity of the sentence they chose.

Procedure

For the standardization study, participant families were recruited through contacts with nursery schools and pediatricians, as well as personal contacts of the researchers and the students of the Department of Education Sciences in the Early Years - Democritus University of Thrace from all the regions of the country. Once caregivers gave their informed consent to participate in the study, they were offered instructions as to how they should fill in the CDR. The general instructions stated explicitly that questionnaires should be filled in by the parents or caregivers of children aged 7 to 30 months (asking for a careful completion of the child's date of birth and the answering date), only if Greek language was spoken in the child's home. Caregivers were encouraged to read the specific instructions, explanations and examples offered for each group of questions very carefully and, in case of any particular doubt concerning an ability of the child, to discuss it with another person who also spends many hours with him/her or to directly observe the child. They were also encouraged to address any questions or doubts regarding how to answer the CDR to the person that provided it to them.

The return rate of the questionnaires was very satisfactory (approximately 90%). The average time for the CDR completion ranged from 10 minutes for younger preverbal children whose caregivers completed only the Preverbal Behaviors subscale, up to 20 minutes for older children whose caregivers completed both scales. Finally, a question concerning the caregivers' experience of completing the questionnaire yielded very satisfactory and encouraging comments, with no particular difficulties reported.

Table 5
Mean scores and standard deviations of Scale II "Verbal Behaviors" and its subscales *

Age group	Productive Vocabulary (Max. score = 69)		Morphology (Max. score = 12)		Syntax (Max. score = 30)		SCALE II: Verbal Behaviors (Max. score = 111)	
	M	SD	M	SD	M	SD	M	SD
07-08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09-10	0.60	2.74	0.00	0.00	0.31	3.21	0.46	1.93
11-12	2.18	6.30	0.29	1.99	0.92	5.79	1.64	5.40
13-14	7.40	15.98	2.23	11.53	2.95	12.21	5.64	13.72
15-16	14.76	20.36	5.53	16.49	6.09	14.68	11.42	16.97
17-18	28.45	27.48	12.93	26.06	13.36	20.06	22.70	23.46
19-20	35.32	24.99	12.50	23.80	18.90	21.92	28.41	22.24
21-22	49.01	28.39	27.75	35.34	24.59	27.71	40.11	26.92
23-24	57.48	25.76	38.81	35.28	37.72	24.91	50.12	24.46
25-26	70.79	19.68	52.29	33.09	52.00	22.61	63.71	19.78
27-28	74.39	23.88	63.10	31.20	58.50	25.21	68.56	22.94
29-30	80.35	20.33	72.13	29.54	68.90	23.93	76.36	19.98

* The mean scores are expressed as a percentage over the maximum score of each scale/subscale.

3. Results

The analyses targeted at examining the functionality of the CDR regarding: (a) the developmental *sensitivity* (discrimination of children's achievements per age group), (b) the *internal consistency* of the scales and subscales, and (c) the *convergent and divergent validity* of the scales' structure. In addition, results on the correlations between the scales and subscales are presented.

For a most effective treatment, organization and presentation of the data, results are presented by grouping the 24 monthly age levels to 12 bimonthly groups. Moreover, given that the various scales and subscales of the instrument include a different number of items and are scored differently, scores have been expressed as percentages over the maximum score (100%) of each scale or subscale in order to permit more direct comparisons among the children's achievements in the various dimensions of communicative development assessed. The basic descriptive statistics per age group for the scales and subscales of the CDR are presented in Tables 4 and 5.

(a) Developmental sensitivity

Based on the mean scores of the subscales per age group, as they appear in tables 4 and 5, clear developmental trends for the various dimensions of communication and language development are revealed. These trends are further supported by additional analyses of variance and post-hoc tests between age groups using the Bonferroni procedure. Overall, these findings suggest that the CDR can provide a valid assessment of young children's communication and language skills, since it appears to reflect their developmentally diversified level (sensitivity to change) in all its subscales. More specifically:

1. The main scales of the CDR: "Non-verbal" and "Verbal Behaviors"

The behaviors included in the CDR reflect significant developmental changes both in the "Non-verbal Behaviors" scale ($F_{(11,\ 1390)} = 236.18$, $p < .001$), as well as in the "Verbal Behaviors" scale

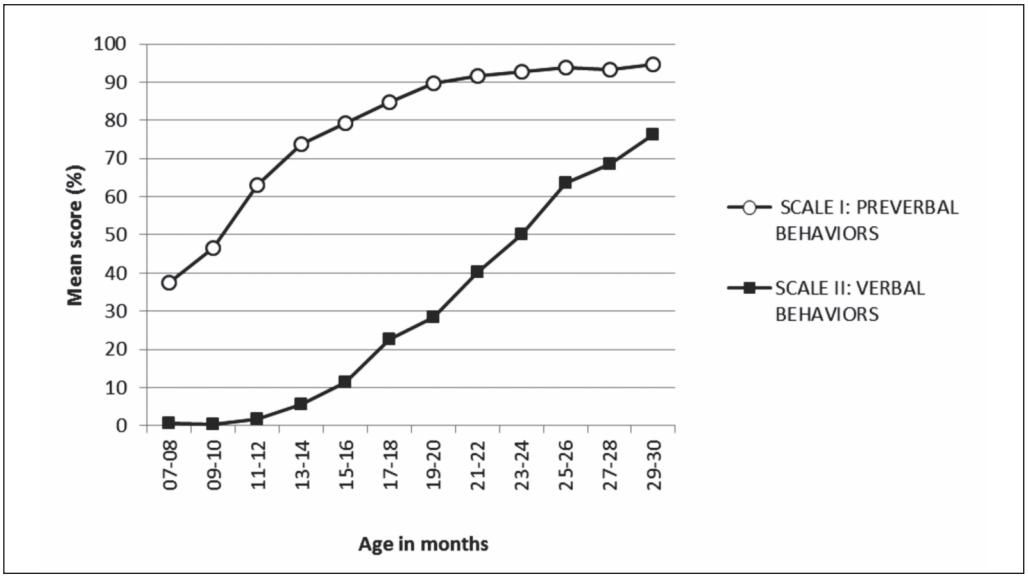

Figure 1
Mean score (expressed in % of the maximum score) for the two main scales of the CDR per age group

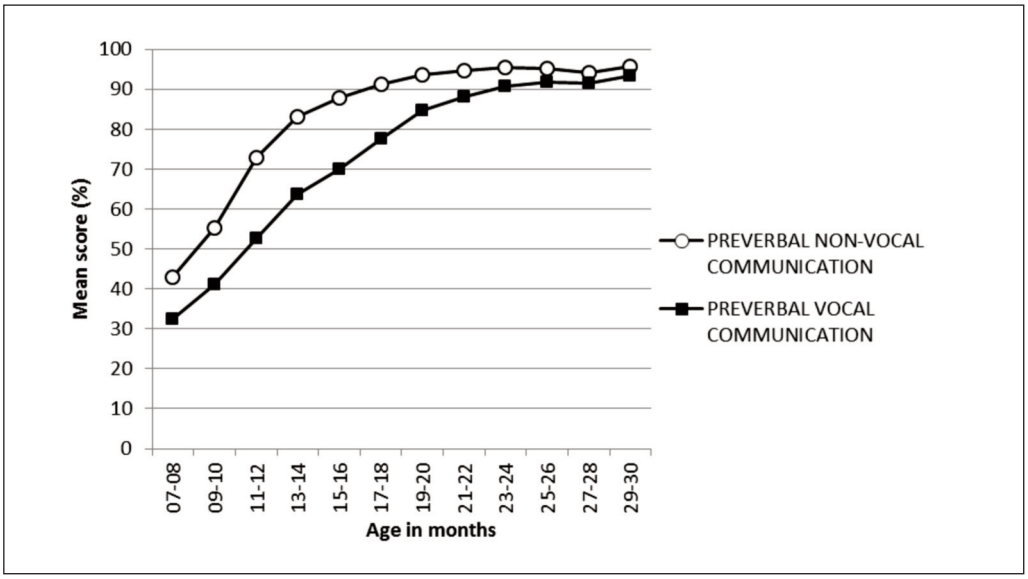

Figure 2
Mean score (expressed in % of the maximum score) for the two components (Non-vocal and Vocal) of the subscale 'Preverbal Communication' per age group

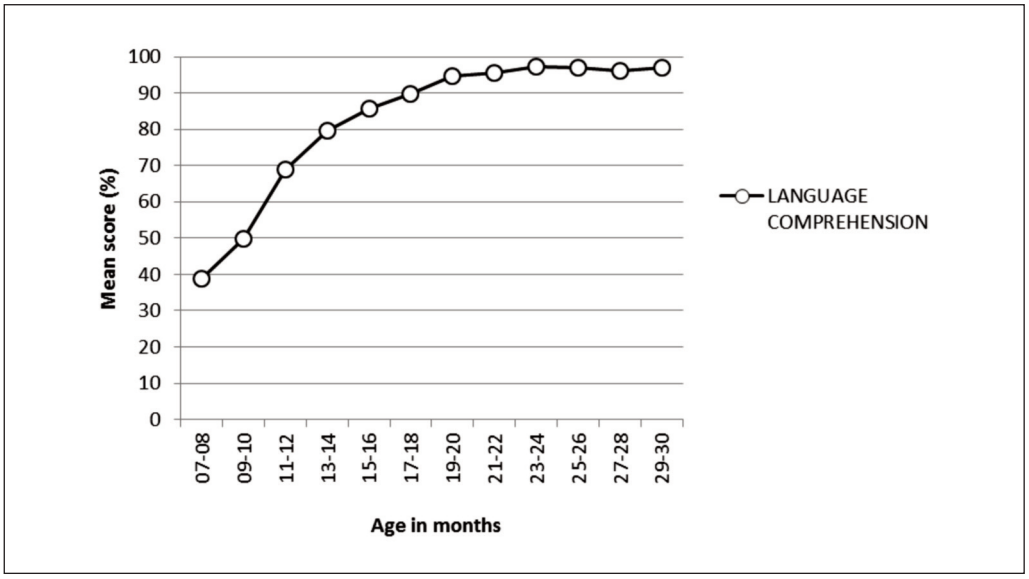

Figure 3.
Mean score (expressed in % of the maximum score) for the subscale of 'Language Comprehension' per age group

($F_{(11, 1390)}$ = 251.64, p < .001). More specifically, as reflected in Figure 1, the "Non-verbal Behaviors", as expected, emerge and develop earlier: already in the 07-08 age group their mean score begins with a 37% of the maximum score of the scale (max.= 44), while the most important progress takes place between 7 and 16 months of age when the most significant changes are reported in the post-hoc (Bonferroni) tests. Subsequently, the scores follow a slow ascending trend to reach, at 30 months, a 94.79% of the maximum score.

On the other hand, the mean score in "Verbal Behaviors" during the first months of the study (7-12 months) practically tends to zero. Then, children gradually start using increasingly more linguistic means to communicate. The most important progress is recorded from 17-18 months of age and until the end of the developmental period studied (30 months) when the mean score reaches a 76.36% of the maximum score (max.= 111).

2. The subscales of the CDR

2.1. Non-verbal behaviors: "Preverbal communication" and "Language Comprehension". The development of the two components of "Preverbal Communication" (Vocal and Non-vocal) is presented in Figure 2, and the development of the subscale "Language Comprehension" is presented in Figure 3.

All three dimensions of communicative behaviors that do not require the ability for word production appear already at 7-8 months with a mean score of 33-43% over their maximum score ("Non-Vocal communication", max = 16; "Vocal communication", max = 20; "Language comprehension", max = 8) and develop mostly during the early months of the study. Children's age has a very significant effect both on "Non-vocal" ($F_{(11, 1390)}$ = 168.36, p < .001) and "Vocal communication" ($F_{(11, 1390)}$ = 162.00, p < .001), as well as on "Language Comprehension" ($F_{(11, 1390)}$ = 166.70, p < .001).

Some interesting differences are noted between "Non-vocal" and "Vocal Communication" based on the post-hoc tests: whereas in "Non-vocal Communication" the most significant progress is recorded from the lowest age limit of the CDR until 13-14 months, the development of "Vocal Com-

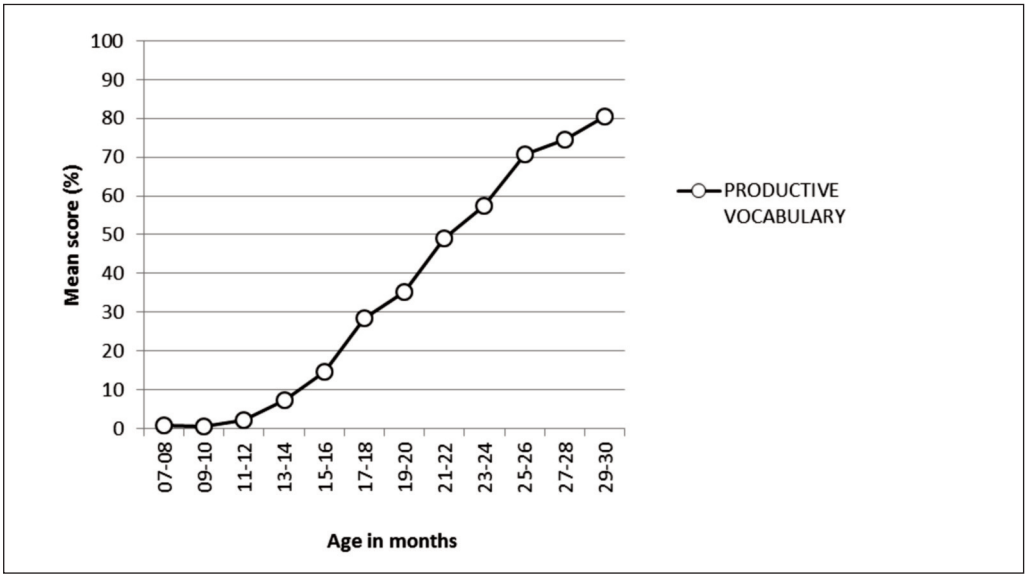

Figure 4
Mean score (expressed in % of the maximum score) for the subscale of "Productive Vocabulary" per age group

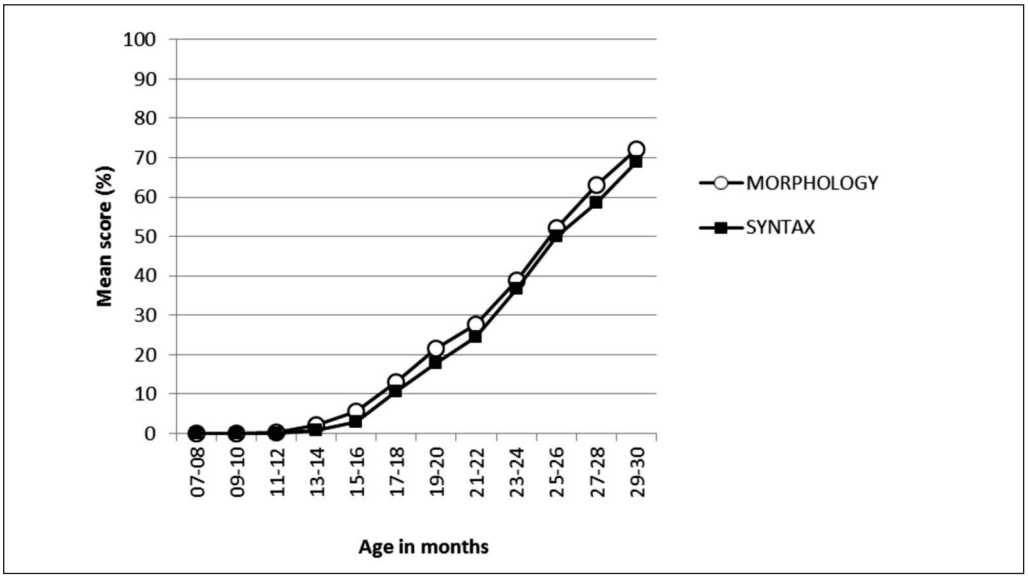

Figure 5
Mean score (expressed in % of the maximum score) for the grammatical subscales of 'Morphology' and 'Syntax' per age group

munication" appears to be slower since significant changes continue until 19-20 months of age. Furthermore, "Non-vocal Communication" reaches a mean score higher than 90% at 17-18 months. "Vocal Communication" reach the same mean score 6 months later (at 23-24 months).

With regard to the subscale of "Language Comprehension", its most significant progress is also recorded from the lowest age limit of the CDR until the 13-14 months age group. Then, its development follows a slower pace, reaching a mean score higher than 90% by the age of 19-20 months.

2.2. Verbal Behaviors: "Productive Vocabulary", "Morphology" and "Syntax". The development of "Productive Vocabulary" (max = 69) is illustrated in Figure 4, and the development of the two grammatical subscales "Morphology" (max = 12) and "Syntax" (max = 30) is depicted in Figure 5.

All three subscales making up the "Verbal Behaviors" scale, during the first 4 months of the study, appear with a mean score of zero, or close to zero. The effect of children's age is very significant in "Productive Vocabulary" ($F_{(11, 1390)} = 243.27$, $p < .001$), as well as in "Morphology" ($F_{(11, 1390)} = 131.21$, $p < .001$) and "Syntax" ($F_{(11, 1390)} = 187.13$, $p < .001$).

Some interesting differentiations in their developmental course are recorded. As expected, "Productive Vocabulary" emerges earlier and develops generally faster than the two grammatical dimensions ("Morphology" and "Syntax"). More specifically, the earliest indications for children's word production are documented at the 11-12 month interval with a mean score of 2.18%, while the most significant changes in "Productive Vocabulary" are recorded between 15 and 26 months of age. By the highest age limit of the CDR, "Productive Vocabulary" reaches a mean score of 80,35% over the maximum score for this subscale.

Morphological and syntactical skills, as reported by caregivers, are practically inexistent until the age of 13-14 months. A significant progress is recorded starting at 17-18 months and continuing until the higher age limit of the CDR (30 months) when they reach a mean score of 72% and 69% respectively. Overall, the developmental curves of the two grammatical subscales appear impressively similar. In fact, a paired-samples T-test revealed significant differences between the two patterns only until 15-16 months; after that age and until the last age group of the study, the developments of morphology and syntax are practically identical (p = n.s., for all age groups).

(b) Convergent and divergent validity of the CDR

The convergent validity of the items included in the CDR has been established by calculating the Pearson's *r* correlation coefficients between each item and the total score of the subscale it belongs to. Following the psychometric procedures widely used in this type of research (e.g. McHorney & Ware, 1994; McHorney, Ware, Rachel, & Sherbourne, 1994; Scientific Advisory Committee, 1995; Stewart, Hays, & Ware, 1992), sixty-one item-subscale intercorrelations have been explored in order to estimate the degree of convergence and discrimination of the items as for the dimension of communicative/linguistic behaviors represented by each subscale.

All CDR items presented very high correlations with their corresponding subscales (Table 6). The correlation coefficient of only one item has been found lower than .45. Overall, all the correlations were ranged in high levels and much higher than the value of .40 which is considered as the minimum sufficient value signaling the convergence of each item with the dimension it is thought to express, and thus, its convergent validity (McHorney & Ware, 1994; Ware, Snow, Kosinski, & Gandek, 1993).

With regard to the divergent validity of the items, all the correlation coefficients between each item and their corresponding subscale's total score were higher than all the correlations of the same item with any other subscale of the instrument (Table 6).

Additionally, the divergent validity of the CDR has been explored at a higher level by comparing the mean scores of the "Non-verbal Behaviors" & "Verbal Behaviors" scales through all age groups. In a paired-samples t-test the mean scores of the two main scales presented significant differences

Table 6
Convergent and divergent validity

Scales	Subscales	Item analyses		Scale analyses			
		Convergent validity		Divergent validity		Internal consistency	
		Correlations ranged[a]	Success (%)[b]	Success (%)[c]	Correlations ranged[d]	Cronbach α	
SCALE I: NON-VERBAL BEHAVIORS	**Preverbal communication**	0,47 – 0,81	100	100	0,25 – 0,71	0.93	**0.95**
	Language comprehension	0,47 – 0,67	100	100	0,41 – 0,75	0.82	
SCALE II: VERBAL BEHAVIORS	**Productive vocabulary**	0,60 – 0,92	100	100	0,45 – 0,89	0.98	**0.99**
	Morphology	0,74 – 0,90	100	100	0,74 – 0,83	0.96	
	Syntax	0,85 – 0,93	100	100	0,73 – 0,87	0.98	

[a] Correlation coefficients of the mean value of each item with the total score of the subscale it belongs to.
[b] Percentage of correlation coefficients item-subscale with a value >.40
[c] Percentage of items that show a higher correlation with the total score of the subscale they belong to, than with any other subscale of the instrument.
[d] Correlation coefficients between the items of the same subscale.

Table 7
Differences between the means of the main scales of the CDR per age group

Age group	*N*	**SCALE I:** Non-verbal behaviors	**SCALE II:** Verbal behaviors	*Df*	*T*	*p* <
		M	M			
7-8	101	37.35	0.00	100	27.11	.001
9-10	108	46.59	0.46	107	29.22	.001
11-12	87	62.93	1.63	86	33.13	.001
13-14	86	73.65	5.64	85	26.13	.001
15-16	104	79.37	11.41	103	34.13	.001
17-18	125	84.80	22.70	124	66.25	.001
19-20	124	89.70	28.41	123	31.87	.001
21-22	109	91.78	40.11	108	21.55	.001
23-24	146	92.90	50.12	145	21.64	.001
25-26	120	93.98	63.71	119	16.68	.001
27-28	133	93.35	68.56	132	12.93	.001
29-30	148	94.80	76.36	147	11.76	.001

Table 8
Intercorrelations between the main scales and the subscales of the CDR

	NON VERBAL BEHAVIORS	**VERBAL BEHAVIORS**	Non-vocal pre-verbal behaviors	Vocal preverbal behaviors	Language comprehension	Productive Vocabulary	Morphology
VERBAL BEHAVIORS	**0.60**						
Non-vocal preverbal behaviors	**0.91**	0.47					
Vocal preverbal behaviors	**0.95**	0.63	**0.76**				
Language comprehension	**0.88**	0.51	**0.80**	**0.75**			
Productive vocabulary	0.64	**0.99**	0.50	0.66	0.54		
Morphology	0.46	**0.89**	0.35	0.49	0.39	**0.85**	
Syntax	0.49	**0.94**	0.38	0.52	0.42	**0.87**	**0.88**

throughout the entire developmental span covered by the CDR (Table 7).

(c) Internal consistency reliability

In order to explore the reliability of the CDR, we have estimated the internal consistency of all its scales and subscales by calculating the coefficient Cronbach *α*. Results revealed that both the main scales, as well as all of their subscales have a very high internal consistency (see, Table 7). Concisely, the "Non-Verbal Behaviors" scale produced a Cronbach *α* of .94 and the "Verbal Behaviors" scale yielded an *α* of .99.

(d) Intercorrelations between the scales and subscales of the CDR

The intercorrelations between the main scales of the CDR ("Non-verbal Behaviors" and "Verbal Behaviors") and their subscales are presented in Table 8. The Pearson's correlation coefficient between the two main scales were in a moderate level (r = .60, p < .001). However, the correlations among the subscales belonging to the same main scale, as well as the correlations between each subscale and its corresponding main scale, were ranged in a high and very high level.

4. Discussion

The aim of this study was to explore the functionality and the main psychometric properties of the "Communication Development Report" (CDR), a new parental report instrument for the early screening of various dimensions of communication and language development (preverbal communication, language comprehension, productive vocabulary, morphology and morphosyntactic complexity) of children aged 7 to 30 months living in a Greek-speaking environment. The CDR has been developed so as to cover important needs of the clinical and educational practice in Greece; to be used as a valid and reliable criterion for the early referral of children presenting a slow communicative development to speech and language specialists for an appropriate evaluation; for the early detec-

tion of potential communication or/and language difficulties or delays, and thus, for the prevention of any adverse consequences these may have in children's general development (e.g., Girolametto et al., 1996, 1997; Guralnick, 1998; Snowling et al., 2001, 2006). Due to the clinical dimension that the use of the CDR entails, a primary requirement for its adequate use was to prove that it fulfills the psychometric properties that will guarantee the validity and the reliability of its measurements; in other words, that its use will lead to safe conclusions regarding the communicative/linguistic level of each child, as well as regarding how this level is related to the achievements of other children of the same age. The current paper presented evidence concerning some major psychometric properties of the CDR, based on its norming administration in a quite wide and representative sample of children aged 7 to 30 months (N = 1391).

Initially, we explored the "sensitivity" of the scales and subscales of the CDR to the expected developmental changes along all age groups. In all cases, clear developmental changes per age group were detected suggesting that the CDR can capture children's developmentally differentiated levels in all the dimensions of communicative and linguistic development explored by the CDR. The concrete developmental course of all these dimensions, as captured by the CDR, is consistent with the findings of recent psycholinguistic research on the emergence and development of these communication and language skills. More specifically, the data provided by caregivers suggest that children, several months before the emergence of their earliest words, have already developed a quite ample repertoire of preverbal communicative means (both vocal and non-vocal). Already at the age of 7-8 months, the mean score in the subscale of Preverbal Communication reaches a 37% of the maximum score for this subscale (42.9% for non-vocal preverbal communication, and 32.4% for vocal preverbal communication). It can be assumed, thus, that some of these communicative behaviors emerge earlier than the age of 7 months, as it is suggested by recent research on infant preverbal communication (for recent reviews, see, Karousou & López Ornat, 2013; McCune, 2008). From the 9th month onwards, all non-verbal communicative behaviors for which caregivers are asked (e.g., different kinds of gestures and vocalizations, imitations, interactive play, rhythmic movement, etc.) are gradually added to children's communicative repertoire. The most significant progress in preverbal communication is reported to occur between 7 and 14 months, for the non-vocal behaviors, and between 7 and 20 months for the vocal behaviors. The development of non-vocal preverbal communication, thus, appears to be somewhat earlier than the development of the communication with vocal means. These findings are consistent with recent observational research results which define the developmental course of the preverbal behaviors included in the CDR and characterize them as precursors and prerequisites for a normative language development (e.g., Chiat & Roy, 2008; Iverson & Goldin-Meadow, 2005; Karousou & López Ornat, 2013; McCathren, Warren, & Yoder, 1996; McCune, 2008; McCune & Vihman, 2001; Oller, Eilers, Neal, & Cobo-Lewis, 1998; Stoel-Gammon, 2011; Watt, Wetherby, & Shumway, 2006; Yoder & Waren, 2004).

Moreover, results indicated that children's ability to understand words and expressions of their maternal language also appears to be earlier than the emergence of their earliest words. More specifically, "Language comprehension" appears at the age of 7-8 months with a mean score of 38.7% over the maximum score for this scale. Consequently, and in consistence with recent experimental findings (e.g., Bergelson & Swingley, 2012), it can be assumed that the understanding of some basic words and expressions emerges earlier than the age of 7 months. The most significant progress in this subscale occurs by the age of 13-14 months. This finding is interesting as it is linked to the age of the emergence of "Productive vocabulary".

More specifically, the first indications for children's earliest words, as reported by parents through the respective subscale of the CDR, are detected at the age of 11-12 months with the most significant changes in expressive vocabulary taking place in the 15 to 26 months age period. Thus,

the precedence of language comprehension over language production, which is attested in all relevant psycholinguistic research (e.g., Bates, 1993; Fenson et al., 1994), is also confirmed by the CDR results.

As for the development and the relationship between the two grammatical dimensions, Morphology and Syntax, they are reported to emerge 2-4 months after the emergence of the earliest words, with Morphology being somewhat earlier than Syntax. This finding reinforces discussions regarding the earlier development of morphological variations in morphologically rich languages (Gagarina, 2014; Xanthos et al., 2011), such as Greek, as compared to languages with a mainly syntactic grammar, such as English, where the development of syntactical phenomena appears to be earlier (see, e.g. Kati, 1992). Both morphology and syntax follow a slow and practically linear development until the age of 30 months. The parallel and almost identical development of morphology and syntax is an interesting finding, given the very different psychometric characteristics of these two subscales (number of items, different nature/way of evaluation and scoring), which reinforces previous results on the close developmental relationship between these two dimensions of grammatical knowledge (e.g., Fenson et al., 2007; Jackson-Maldonado et al., 2003; López Ornat et al., 2005).

Overall, the developmental course of all the dimensions of children's communication and language development, as reported by children's parents through the CDR, is consistent with the findings of observational and experimental research - some of which were mentioned briefly- regarding the development of the communicative and linguistic behaviors included in the CDR. These findings, consequently, constitute a first indication of the CDR's construct validity.

We must also point out that in all the developmental dimensions studied, but mostly in the subscales belonging to the "Verbal Behaviors" scale, at the age groups where the corresponding behaviors emerge and present their most important progress, the standard deviations to the mean score are quite large. As suggested by earlier studies (e.g., Feldman et al., 2005; Fenson et al., 2000; Jahn-Samilo, Goodman, Bates, & Sweet, 2000), the important size of these standard deviations does not seem to be due to psychometric limitations of the parental report instruments. Conversely, it seems to reflect the actual important individual differences that characterize language development during these early transitive stages (Bates et al., 1988; Dale & Goodman, 2005; Fenson et al., 1994, 2000). This interpretation is further reinforced by the results of the concurrent validity study of this concrete psychometric instrument (Karousou & Nikolaidou, 2015). By comparing the results of the CDR with those of a direct observational evaluation of the same children's communicative and language skills, confirmed the CDR's ability to provide valid data regarding children's communicative development.

In an additional series of analyses, we explored the functionality of the CDR as for the convergent and divergent validity of its main scales and individual subscales, while we also examined their level of internal consistency. Overall, analyses showed very satisfactory findings, reinforcing the psychometric properties of the CDR. More specifically, all questions (developmental indices) included in the CDR showed very high correlations with the total score of the subscale they belong to. Additionally, all the correlation coefficients between each item and the total score of its respective subscale were in all cases higher than the same item's correlation coefficients to the total score of any other subscale. The involvement and importance of each particular question in assessing the specific developmental dimension which it represents was, thus, confirmed. Moreover, it was found that the mean scores of the two main scales (Non-verbal and Verbal behaviors) show very significant differences throughout the developmental span of the study, establishing the discriminant validity of the CDR at a higher level of analysis.

The reliability analyses also indicated that both main scales of the CDR and all their individual subscales present an exceptionally high internal consistency (Cronbach's α is .95 for the "Non-verbal behaviors" scale and .99 for the "Verbal behaviors"

scale). Finally, additional information concerning the functionality of the CDR resulted from the intercorrelations between the main scales and the individual subscales of the instrument. In summary, the relationship between the two main scales (Non-verbal and Verbal behaviors), though very significant, was rather moderate. This finding was totally expected given that these two scales were designed from the outset to include behaviors that emerge and grow in different developmental phases (before and after the emergence of conventional language, respectively). The most interesting finding, however, concerns the particularly high correlations (a) of each subscale with the main scale it belongs to, and (b) between the subscales belonging to the same main scale. These very high correlations reinforce the consistency of the scales and subscales of the CDR. Moreover, they constitute a strong indication of the construct validity of the instrument as they indicate that the subscales are measuring aspects of children's communicative/linguistic development which seem to be representative of each developmental dimension. They are also consistent with relevant research findings (e.g., correlations of the order of r = .90 between expressive vocabulary and grammar, but also between morphological and syntactic development, as reported in many versions of the MacArthur-Bates CDIs – e.g., Fenson et al., 2007; Jackson-Maldonado et al ., 2003; L pez Ornat et al., 2005).

5. Conclusions

All the results of the current analyses provide strong evidence for the functionality of this new psychometric tool, for its capacity to measure developmental changes at many dimensions of communicative development from a very young age, and for providing accurate information on the developmental level of each child in each of these dimensions.

A longitudinal study, which is planned to be concluded in the near future, will provide additional information on a different aspect of the validity of the CDR and more specifically its mid and long-term predictive validity (i.e., its ability to predict children's later language development based on an initial screening of their communication and language skills with the CDR). Particularly interesting would be the longitudinal follow-up of children whose initial screening situates them in the lowest percentiles for their age group.

However, the empirical evidence presented herewith constitutes strong evidence for the validity and reliability of this new psychometric instrument, suggesting that it can be used for an accurate early screening of the communication and language development of Greek-speaking children for the age range of 7-30 months. In that sense, we believe that the CDR can meet important needs of the clinical, educational and research practice in Greece.

As mentioned earlier, the CDR can be used by non-experts in child communication development (e.g., pediatricians or preschool educators) for an accurate evidence-based identification of possible communication and/or language delays or disorders, serving as a reliable criterion for deciding on the need of referring children to specialists (i.e., speech therapists) for further evaluation. In that sense, the CDR will contribute to an earlier diagnosis and treatment of possible language disorders and, thus, to the prevention of the adverse effects they can have on children's overall development. Moreover, given the high ecological validity posed by parental reports, as well as the multiple dimensions of communication and language development that the CDR explores, it could also be an important instrument in the hands of the relevant specialists. In conjunction with other laboratory or clinical evaluation methods, it could provide valuable information and be used as a useful criterion for the diagnosis, the identification of the specific difficulties and "strengths" of every child, the tailoring of specific intervention programs, and the regular monitoring of their results.

The CDR can also be a valuable tool for research on child development since it can be used as a criterion for controlling the characteristics of research samples based on their communication/lan-

guage level. Finally, by permitting an easy and economical data collection from large populations, the CDR can foster research in early communication and Greek language development (typical and atypical), as well as research in the multiple relationships between communication development and the various factors that may affect it (e.g., cognitive, emotional, social, demographic, cultural, etc.).

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Τεστ Επικοινωνιακής Ανάπτυξης [ΤΕΑ]: ΄Ενα ψυχομετρικό εργαλείο για την πρώιμη εκτίμηση της επικοινωνιακής και γλωσσικής ανάπτυξης ελληνόφωνων παιδιών βρεφικής και νηπιακής ηλικίας

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ΚΩΝΣΤΑΝΤΙΝΟΣ ΠΕΤΡΟΓΙΑΝΝΗΣ[2]

ΠΕΡΙΛΗΨΗ

Στόχος της παρούσας εργασίας είναι η διερεύνηση των βασικών ψυχομετρικών χαρακτηριστικών του ΤΕΑ, ενός νέου ερωτηματολογίου γονέων για την πρώιμη εκτίμηση της επικοινωνιακής και γλωσσικής ανάπτυξης ελληνόφωνων παιδιών. Παρουσιάζονται αποτελέσματα, βάσει ενός αντιπροσωπευτικού δείγματος 1391 παιδιών ηλικίας 7 έως 30 μηνών (Μ.Ο.= 19.45, Τ.Α.= 6.91), σχετικά με την ευαισθησία του εργαλείου στις αναπτυξιακές αλλαγές, την εσωτερική αξιοπιστία, και την συγκλίνουσα και αποκλίνουσα εγκυρότητα των δύο βασικών κλιμάκων του ΤΕΑ («Προλεκτικές συμπεριφορές» και «Λεκτικές συμπεριφορές») και των αντίστοιχων υποκλιμάκων τους (φωνητική και μη φωνητική προλεκτική επικοινωνία, γλωσσική κατανόηση, εκφραστικό λεξιλόγιο, μορφολογία και σύνταξη). Τα αποτελέσματα επίσης αναδεικνύουν την αναπτυξιακή πορεία των διαφόρων διαστάσεων επικοινωνιακής/γλωσσικής ανάπτυξης που αξιολογούνται, καθώς και τις σημαντικές μεταξύ τους διασυσχετίσεις. Τα ευρήματα στο σύνολό τους προσφέρουν σημαντικές ενδείξεις για την λειτουργικότητα, την εγκυρότητα και την αξιοπιστία του νέου αυτού ψυχομετρικού εργαλείου ως μέσου για την πρώιμη εκτίμηση του επικοινωνιακού/γλωσσικού επιπέδου μικρών παιδιών, για κλινικούς, εκπαιδευτικούς ή ερευνητικούς σκοπούς.

Λέξεις-κλειδιά: Επικοινωνιακή και γλωσσική ανάπτυξη, Ερωτηματολόγιο γονέων, Πρώιμη εκτίμηση, Ελληνική γλώσσα, Βρεφική και νηπιακή ηλικία.

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