Research Article • DOI: 10.2478/v10134-010-0036-5 • Translational Neuroscience • 1(3) • 2010 • 244-254

VERSITA

Translational Neuroscience

EARLY COMMUNICATION DEVELOPMENT IN SOCIALLY DEPRIVED CHILDREN - SIMILAR TO AUTISM?

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Abstract

Social deprivation leads to various neuroanatomical, neuropsychological and behavioral disturbances in humans as well as in experimental animals. Shared characteristics of socially deprived subjects and subjects with autism have been documented. The aim of this study was to analyze early development of communication in institutionalized (INST) children (12-24 months) in comparison with age- and sex-matched group of typically developing (TD) children and a group of children with autism spectrum disorders (ASD). Our findings show that both socially deprived (INST) children and ASD children display delayed pattern of development in social, speech and symbolic domains. However, although INST children display significant developmental delay and share some features with ASD children, they have a qualitatively different developmental pattern of social communication in comparison to children with ASD. The results of this study indicate that growing up in an institution and lack of social and environmental stimuli influences development of skills that are fundamental for early speech and language development.

Keywords

Institutionalization • Social deprivation • Early development • CSBS-DP • Communication • Autism • Toddlers

Received 13 September 2010
accepted 19 September 2010

1. Introduction

Research on the effects of early social deprivation and institutionalization may provide insight into the mechanisms by which the social environment affects the entire human development. It is important to examine how much the absence or a reduced quantity of social stimuli during the early period influences the pattern of social communication development – does it change its quality or merely slow it down?

Institutionalized children may display some autism-like behavioral patterns [1,2] often described as "(post)institutional autism" [3]. What are the possible neurobiological mechanisms for such an adverse behavioral pattern? Do social deprivation and autism spectrum disorders (ASD) influence the central nervous system in the same manner? If so, do socially deprived toddlers show adverse social communication development early in life?

1.1 Social deprivation induces neuroanatomical and neurophysiological brain changes

Physiological and neuroanatomical changes in the brain, caused by separation from mother and by social deprivation, have been well described both in primates [4] and other mammals [5-12]. These studies identified the detrimental influences of early negative experiences on the limbic, paralimbic and neuroendocrine systems.

One of the few studies to directly show destructive consequences of social deprivation on a child's brain [13], analyzed the glucose metabolic pattern in the brains of Romanian orphans. Behavioral characteristics of these ten-year old children noticeably correlated with functional findings; that is, observed metabolic changes occurred in specific brain regions crucial to the regulation of impulsiveness and emotional responses. An extremely decreased glucose metabolic rate was noted in the orbital and infralimbic prefrontal cortex, in the amygdala, the hippocampus and the inferior temporal gyrus. Both the infralimbic and orbital frontal cortex are reciprocally connected to the amygdala and the hippocampus, and take part in the regulation of visceral responses to emotional stimuli, as well as in behavioral/cognitive flexibility [14]. Romanian orphans also showed structural changes in the fasciculus uncinatus [15] which links the amygdala to the medial orbital and temporal cortex.

Global changes in the absolute degree of metabolism and electric activity have also been described [16,17], as well as potential neurodevelopmental mechanisms underlying the association between institutionalization and psychiatric morbidity [18], and interactions of gene and environment in the setting of early social deprivation [19].

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1.2 Shared characteristics of socially deprived subjects and children with autism

Comparative analysis of experimentally deprived monkeys and children with autism [20] indicate that these two groups share certain behavioural characteristics: stereotyped motor activities, absence of typical communication behaviours, brief and rare eye contact, more interest in objects than in social partners etc. Similarities were also observed in the functional and structural brain characteristics of socially deprived animals, institutionally-reared children and children with autism. It is primarily limbic system changes that were identified in all three groups (Figure 1). Both in institutionalized children (INST) and children with autism (ASD), research has mostly focused on the hippocampus and amygdala, whose role in the development of socially appropriate behaviours and skills had already been proved on animal models. A hippocampal lesion in a monkey results in the development of stereotyped behaviours, with progressive loss of social behaviour and reduced eye contact [21], whereas a lesion in the amygdala leads to signs of social isolation such as a failure to initiate social interaction and inappropriate reaction to social signals [22]. These two structures are also frequently found to be altered in children with autism [23], and in institutionlized children [13].

In a sample of children placed in institutional care at an early age, Rutter *et al.* [1] identified autism-like symptoms in as many as 6.3 percent of children, while an additional 6 percent of children displayed some isolated behaviours observed in children with autism. This rate is much higher than in the general population. At school age, about 10-30% of children who experienced an institutional rearing showed quasi-autistic pattern [2,24]. Even if there is no increased autism ratio in institutionalized children, as suggested by some studies [25], this does not mean that early negative experiences do not alter brain function, because institutionalized children nevertheless do show deficiencies in the processing of social signals. Both children with autism [26,27] and children placed in institutional care at an early age [28] show deficiencies in face processing. In addition, both groups achieve below average scores on the theory of mind tasks [24], even when these scores are adjusted for the level of language development and non-verbal intelligence [29]. Results of these studies suggest that neural systems which are crucial for the processing of social information can be adversely affected by early experiences, although an early placement in foster care may quickly enhance the progress in socio-cognitive skills [30].

1.3 Effects of institutionalization on early communication and language and speech development

The development of children raised in institutionalized settings has been repeatedly studied , e.g. in the framework of The Bucharest Early Intervention Project [18,25,31-34]. However, very few studies focued on three important topics: a) the infant and toddler period (0-3 years); b) mother tongue acquisition; c) the development of sociocognitive abilities forming the basis for communication and language development. In fact, the majority of studies dealth with developmental outcomes from 4 years to adulthood or with an acquisition of the language spoken in the environment in which a child is placed (in most cases, this setting belongs to an area in which a different language is spoken). These studies have been mostly conducted in the United States of America, Canada and Great Britain, where children are adopted from the East European countries and China [35].

Furthermore, the studies could not satisfactorily deal with a number of methodological problems such as: distinguishing between children who, at the time of evaluation, lived in institutions and those who were evaluated after being placed in

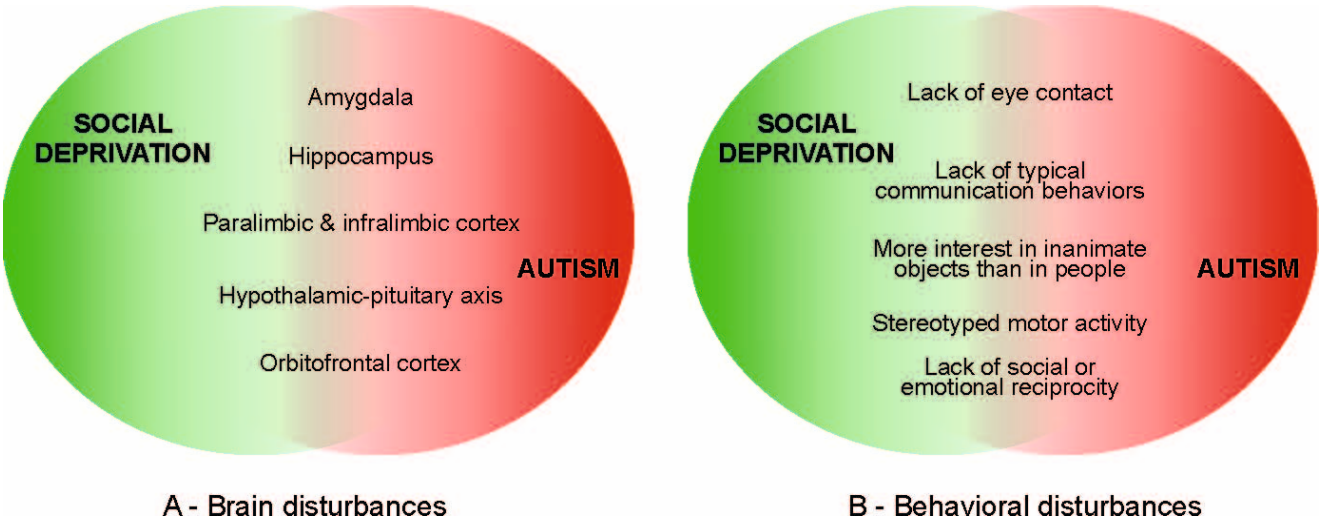

Figure 1. Overlapping patterns of brain and communication development disturbances in socially deprived subjects and subjects with autism. A. Brain areas which are altered in both socially deprived individuals and in children with autism (see text for references). B. Behavioral disturbances shared by socially deprived primates and children with autism (based on data from Winsow [20]).

foster homes, difficulties in sample balancing due to the age of children at the time of their placement in institutional care and their age at the time they went to a foster family, pronounced differences between the quality of care in children's homes across the world, incomplete anamnestic data etc.

Although a delay in speech and language development is one of the most frequent diagnoses found in institutionally-reared children [36], differences in patterns of social communicative behavior between institutionalized children and their peers may be observed even before they start to talk. Tizard and Tizard [37] demonstrated differences in communication between two-year olds raised in institutions and age-matched children raised in families. Children from a family setting exhibited a greater tendency to approach an unknown person when called and to sit in the unknown person's lap, and had less turbulent reactions when people they found to be important went away. Unfortunately, there are no studies on the development of joint attention and early communication characteristics in institutionalized children.

A number of factors are likely to influence the foundations of language and speech development: the absence of a primary caregiver, a reduced exposure to their mother-tongue and to the language of the environment in which they are being raised, rare communication episodes, limited social interaction, reduced physical mobility (lying in cribs, delayed start of independent walking) and narrow range of life experiences (children seldom leave institution). However, data show relatively favourable developmental outcomes [30] that can be observed within several months following adoption, especially if it is done at an early age, i.e. in the first year or early in the second year of life [25,35]. In their preschool and school years, children who were adopted during the first few years of their lives, generally, have average or borderline scores on language tests [13,15,30,35].

2. Materials and methods

2.1 Aim of research

The aim of this study is to analyze early social communication development in institutionalized toddlers. Two specific aims are: (1) to analyze whether (and if so, in which way) the characteristics of early social communication development in children raised in an appropriate family setting differ from those of children raised in institutions; and (2) to analyze possible differences in developmental patterns (achieved developmental levels in different developmental domains - social, speech and symbolic) in institutionalized children (INST group), typically developing children (TD group) and children with autism (ASD group).

2.2 Samples of subjects

Three groups of subjects were formed: (a) group of 24 typically developing toddlers (TD) aged 12-24 months; (b) group of 24 institutionalized toddlers (INST) aged 12-24 months; (c) group of 16 children with autism spectrum disorders (ASD) aged 12-44 months.

As part of the first goal, TD and INST children aged 12-24 months were selected in the sample by a paired samples procedure (pair is defined as one institutionalized and one same gender typically developing child with identical age in months). Therefore, INST group included 24 children living in the Home for Children and Young Adults Zagreb and an equal number of children living in a family setting (TD) in the same city (Zagreb). Due to a paired sample procedure, there were no gender-related differences, so each group (TD and INST) comprised 13 girls and 11 boys (Figure 2).

Children with established systemic diseases and/or syndromes were excluded from the sample. The institutionalized children had been in institutional care at least 6 months prior to the assessment. In the institution, care for the

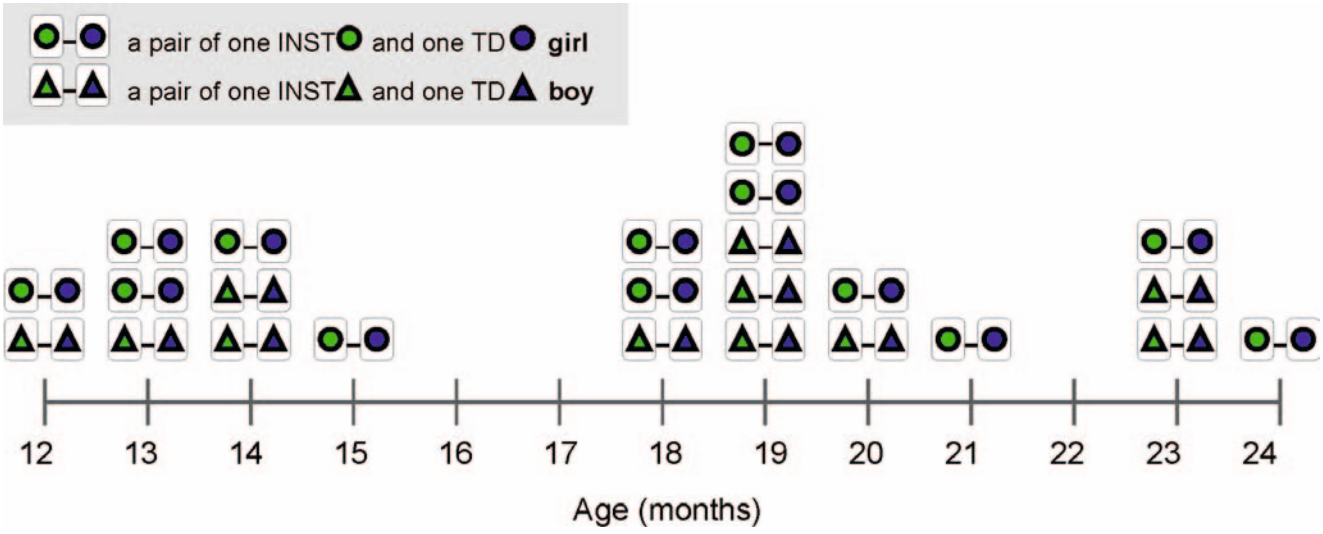

Figure 2. Paired institutionalized (INST) and typically developing toddlers (TD) in relation to age (in months) and gender.

children younger than two years (as toddlers in our sample) was done primarily by nurses. On average, there are three different nurses per day who feed and take care of children. All primary needs (feeding, bathing etc.) are satisfied daily, but toddlers often just lie in their cribs and there is a lack of close social interaction.

For the second specific aim, a smaller group (N=16) of children with autism spectrum disorders (ASD group) raised in a family setting and aged 12 to 44 months was formed (Table 2), in order to compare the developmental patterns of institutionalized children (INST) and children with ASD. Children with ASD were selected among children who were assessed in the Early Communication Unit at the Center for Rehabilitation (Faculty of Education and Rehabilitation Sciences, University of Zagreb) and their overall communication, language and mental age was estimated to be under 24 months (mean=18,25; SD=5,31; min=6; max=24). The *best estimate* diagnosis of the ASD [38,39] was based on the following measures: a) developmental history; b) Bayley Mental Scale of Infant Development [40]; c) The Pragmatics Profile of Everyday Communication Skills [41]; d) MacArthur-Bates Communicative Developmental Inventory (Words and Gestures) – Croatian version (Kovačević, Jelaska, Kuvač, Cepanec, unpublished) (see Table 1). Although children in the ASD sample were chronologically older than children in TD and INST group, this should not affect results significantly, since the aim of this research is not to compare absolute results in ASD, TD and INST children, but to evaluate differences in their developmental profiles, i.e. to assess differences in ratios of scores in social, speech and symbolic domain, within each group.

2.3 Measuring instrument

The CSBS-DP Infant/Toddler Checklist for children aged 6 to 24 months [42], was used (translated in Croatian by M.Cepanec). When completed, the

Table 1. Samples of subjects.

		Typicall developing children (TD)	Institutionalized children (INST)	Children with autism spectrum disorders (ASD)
Subjects	N (total)	24	24	16
	N. of boys	11 (45,8%)	11 (45,8%)	12 (75,0%)
	N. of girls	13 (54,2%)	13 (54,2%)	4 (25,0%)
Age	Minimum	12,00	12,00	12,00
	Maximum	24,00	24,00	44,00
	Mean	17,63	17,63	32,38
	Median	18,50	1,50	30,50
	SD	3,81	3,81	8,29

Table 2. Sample of children clinically classified as children with ASD (based on assessments done by trained psychologist and speech and language pathologist) in Early Communication Unit. There are 16 children in the sample, 12 boys and 4 girls, aged 12-44 months. Results on Bayley mental scale of infant development and MacArthur-Bates Communicative Developmental Inventory (MCDI) (Croatian version) are presented.

	Initials	Gender	Age (months)	Bayley scale (MDI)	Estimated mental age (months)	MCDI	
						Language comprehension (words)	Language expression (words)
1.	N.S.	female	12	70	9	0	0
2.	L.B.	male	24	<50	15	0	0
3.	I.B.	male	28	72	23	55	48
4.	F.P.	male	28	68	22	26	23
5.	L.P.	female	29	<50	14	6	0
6.	M. J.	male	30	<50	6	0	0
7.	S.J.	male	30	<50	16	2	0
8.	A.J.	male	30	<50	20	36	17
9.	M.D.	male	31	<50	20	20	13
10.	N.H.	female	35	68	24	-	118
11.	P.J.	male	36	<50	22	79	56
12.	P.S.	male	41	<50	20	27	21
13.	T.M.	female	42	57	24	33	7
14.	A.C.	male	44	<50	20	3	0
15.	L.C.	male	44	<50	15	2	0
16.	T.D.	male	44	<50	22	13	8

checklist provides information on possible delay/deviations in three developmental domains: social development, speech development, and symbolic development.

Original standardized scores [42] were used, since: (a) the checklist is primarily focused on non-verbal social communication; (b) results of the control group formed by typically developing Croatian children (TD) did not significantly differ from original norms; (c) the main aim of this study was not to determine absolute delay, but to see differences in developmental profiles in different domains (social, speech, symbolic) across subjects whose total raw scores are standardized by the same principle. Raw scores of ASD children who were older than 24 months were compared to the oldest normed group, as suggested by authors [42]. Although estimated mental age was determined for ASD children, we compared their raw scores to the oldest normed group (24 month old children), since: (a) results of both TD and INST children were standardized in the same manner – based on chronological and not mental age; (b) we were looking for differences on interrelations of results achieved on different composites, and were less interested to determine absolute delay; (c) many ASD children displayed disharmonic developmental profile.

Information about the early development characteristics relating to the children in institutional care were provided by their nurses, and for the children raised in a typical family setting (TD and ASD children) by their parents.

Statistical analysis was performed by the computer program SPSS 13.0 on the operating system Windows XP. The Wilcoxon test for paired samples, and Mann-Whitney U test were used.

3. Results

The results reveal that as a group, children from the Home for Children show significant differences from the home-reared children on all three composites: social (p=0,002), speech (p=0,000) and symbolic (p=0,000) (see Table 3). This data indicates that negative effects of early institutionalization can be observed very early, and that they are reflected on all of the observed developmental domains. However, when compared to ASD children, socially deprived children displayed significantly higher results on social composite (p=0,001), although these two groups of subjects did not differ on speech (p=0,613) and symbolic (p=0,503) composite. Due to higher chronological age of ASD children, it is not possible to make conclusions about absolute differences between INST and ASD children; however, results suggest that social development of ASD children is disproportionally slower than development in other developmental domains, which is not the case in socially deprived children.

Figure 3 shows, as expected, that most typically developing children have results within 1 standard deviation of the mean, while INST and ASD children mostly display results within 1-2 standard deviations below the mean on all composites. These results should be interpreted with caution, because ASD children probably have even greater deficits in early development than these results indicate. Nevertheless, ASD children achieved extremely low results in social

Table 3. Standardized scores (SS) on all three CSBS-DP composites for typically developing children (TD), institutionalized children (INST) and children with autism spectrum disorders (ASD). P indicates difference between the groups (Mann-Whitney U test). Standard scores are based on a mean of 10 and SD of 3 for the composites and a mean of 100 and SD of 15 for the total score.

		TD	INST	ASD	p TD-INST	p TD-ASD	p INST-ASD
Social composite (SS)	Mean	9,75	7,13	3,75	,002	,000	,001
	SD	2,82	4,01	1,44			
	Min	5	3	3			
	Max	17	17	7			
Speech composite (SS)	Mean	10,17	5,21	6,94	,000	,002	,613
	SD	3,10	2,17	4,61			
	Min	5	3	3			
	Max	17	9	17			
Symbolic composite (SS)	Mean	10,96	5,63	5,38	,000	,000	,503
	SD	3,42	2,22	2,60			
	Min	6	3	3			
	Max	17	9	11			
Total (SS)	Mean	99,00	76,71	72,38	,000	,000	,174
	SD	12,10	12,33	10,48			
	Min	82	65	65			
	Max	135	102	91			

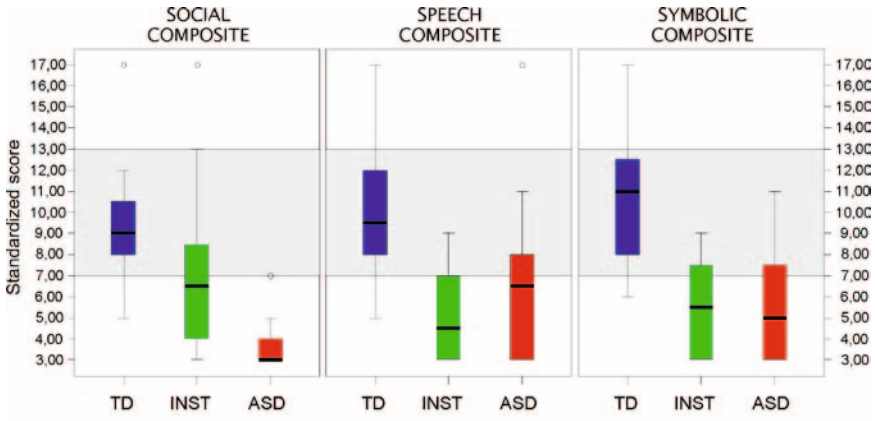

Figure 3. Boxplots showing standardized scores for all three groups (TD - typically developing children; INST – institutionalized children; ASD – children with autism spectrum disorders) of subjects on social, speech and symbolic composite. Standard scores are based on a mean of 10 and SD of 3.

composite - almost all had results that are more than 2 standard deviations below the mean, indicating a score below 2. percentile rank. This means that ASD children at three or four years of age, on average, have communication skills lower that 98% of 24-month old typically developing children. Wetherby *et al.* [38] analyzed CSBS-DP results of children with ASD (aged 13-27 months) and these children achieved average score of 4,00 on social domain, which is quite comparable to the average of 3,75 in our sample. These results also outline very slow progress in social skills in ASD children. Furthermore, in both studies ASD children displayed very homogenous results in social domain and narrow range of results. This pattern is not seen in INST children, who show great variability in social domain – some children show extremely low results (as ASD children), while some achieve average or above average results.

Figure 4 clearly shows that TD, INST and ASD groups do not show identical developmental patterns. An increase in the total score in institutionalized children is mainly driven by an increase in the social domain, while an opposite pattern is seen in ASD children, who show the biggest increase in the speech domain. These data are in accordance with well-known features of ASD children, since they often display atypical patterns of speech development and tend to vocalize and say words even if they do not understand them (nonfunctional speech and echolalia). The same pattern is seen on MCDI results (Table 2).

It is important to notice the big difference between INST and ASD groups on social composite scores, since our results suggest that these two groups obviously have completely different social developmental patterns – although INST children, on average, have similar total scores, they achieve two times higher scoring in the social domain than ASD children. Typically developing children show equal distribution of results within social, speech and symbolic domains, but institutionalized children and children with autism spectrum disorder tend to have somewhat different developmental patterns. While INST children show disproportionally higher results on the social composite scores, ASD children show disproportionally lower results on social composite scores and disproportionally higher results on the speech composite. Thus, both INST and ASD children show developmental delay in all domains, but their developmental profiles are different.

To analyze features of early social skills in socially deprived children, we made a qualitative analysis of the differences in early communication development between INST

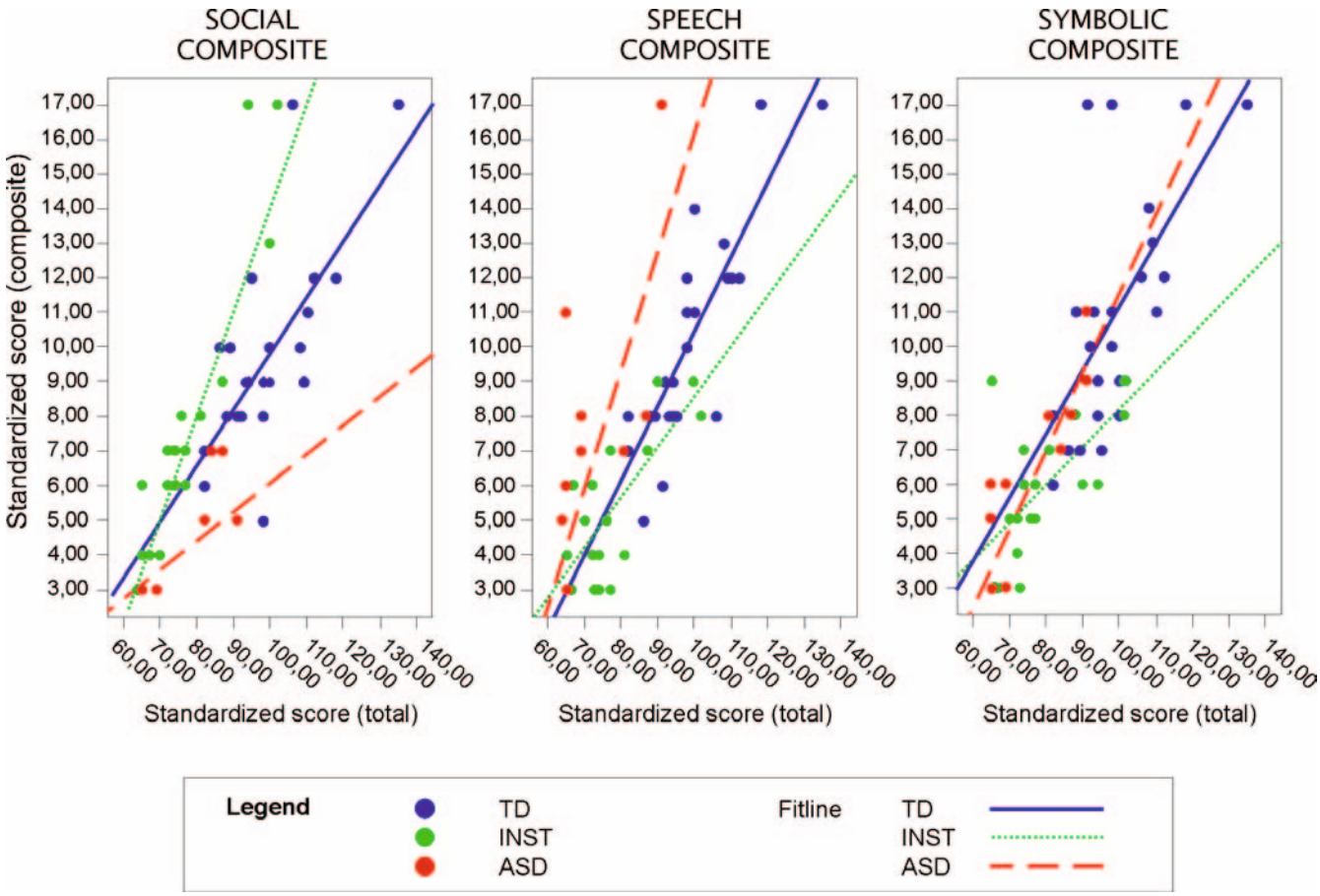

Figure 4. Scatter plot showing standardized results of all subjects (TD - typically developing children; INST – institutionalized children; ASD – children with autism spectrum disorders) on social, speech and symbolic composites in relation to total standardized scores.

and TD children, with special emphasis on social composite items. An analysis of the differences in results of the typically developing and socially deprived children on individual checklist items (see Table 4) revealed that children from institutional care displayed some features resembling those typically described in literature in children with autism spectrum disorder, but it also pointed out to other features/behaviours indicating the absence of the said disorder.

Aspects of early communication which showed delay in institutionalized children compared to TD group were the following: systematic responding to name when called, frequent asking for help, use of gestures, joint attention skills (use and understanding of a pointing gesture), language comprehension, complexity of vocalizations/babbling and language expression. Developmental disturbances regarding interest to play with different objects, a functional use of objects and symbolic play were also present.

More precisely, two thirds of children in institutional care did not speak in their second year of life, almost 60 percent of children understood less than four words/phrases, while more than a half had a functional use of merely one or two objects. At the same time, only one child in TD group did not speak a single meaningful word, and more than 92 percent understood more than four words/phrases and functionally used 3 and more objects. Of all the characteristics in INST group, most striking are: less systematic responding to name when called, a reduced use and understanding of the pointing gesture, less frequent asking for help and a reduced interest in different play objects, since these are some of the most often described behaviours in children with autism of the same age [38,43].

However, children in institutional care did not differ from TD children in several significant developmental features often described as deviant in children with ASD: a proper interest for social environment (typical interaction and emotional communication pattern), attracting attention to self, and, most importantly, presence of declarative communication functions. INST children focus their attention on adults during play comparably to their peers, they display a social smile and attract the adult's

Table 4. Analysis of differences on checklist items (raw scores) between typically developing (TD) and institutionalized (INST) children (Wilcoxon test for paired samples). * p<0,05; ** p<0,01.

		Min-max	TD		INST		p
			M	SD	M	SD	
Emotion and eye gaze	Shows happiness and agitation	0-2	1,95	0,21	1,96	0,20	1,00
	When playing with toys, looks to adults to see if he/she is watching	0-2	1,50	0,51	1,33	0,56	,317
	Smiles or laughs when looking at adults	0-2	1,71	0,46	1,67	0,48	,782
	Looks at a toy when adult looks at it and points to it	0-2	1,79	0,41	1,29	0,75	,007**
Communication	Let adult now when needs help	0-2	1,92	0,28	1,29	0,55	,000**
	Tries to get adult`s attention	0-2	1,54	0,59	1,50	0,59	,782
	Does things to make adult laugh	0-2	1,38	0,65	,88	0,74	,054
	Directs adult`s attention to an object (declarative purpose)	0-2	1,08	0,65	,96	0,69	,503
Gestures	Picks objects and gives them to adult	0-2	1,83	0,38	1,63	0,49	,132
	Shows objects (declarative purpose)	0-2	1,29	0,62	,69	0,60	,196
	Waves to greet people	0-2	1,88	0,34	1,25	0,79	,003**
	Points to objects	0-2	1,79	0,41	1,08	0,78	,001**
	Nods her/his head to indicate yes	0-2	1,33	0,82	1,13	0,90	,260
Sounds	Use sound or words to get attention or help	0-2	1,79	0,41	1,54	0,66	,058
	Strings sounds together	0-2	1,96	0,20	1,08	0,78	,000**
	Consonant sounds used	0-4	3,17	0,82	1,83	0,92	,000**
Words	Number of meningful words used	0-4	2,29	1,04	0,71	1,08	,000**
	Combination of words	0-2	0,71	0,91	0,46	0,72	,217
Understanding	Responds to his/her name when called	0-2	2,00	0,00	1,67	0,48	,005**
	Number of words/phrases understood	0-4	2,96	0,99	1,29	0,95	,000**
Object use	Shows interest in playing with variety of objects	0-2	1,83	0,38	1,50	0,59	,021*
	Approprite (functional) use of objects	0-4	3,33	1,01	1,71	0,91	,000**
	Number of blocks/rings child stacks	0-3	2,08	0,97	1,42	0,78	,013*
	Symbolic play	0-2	1,04	0,75	0,21	0,51	,000**

attention for non-instrumental purposes. More importantly, they, as a group, communicate for declarative purposes equally as often as their peers (ie. they lift objects towards the adult so that the adult can see them, they point at objects with a clear non-instrumental purpose), whereas these communication functions are exceptionally poor in children with autism [44]. For instance, our data showed that 62,5 percent of ASD children (mean age=32,38 months) and just 25 percent of INST children (mean age=17,63 months) do not communicate for declarative purpose. Moreover, in the ASD sample, 31,25 percent of children still do not understand the pointing gesture, which is an important socio-cognitive (joint attention) developmental skill that develops in typically developing children from 9 months onwards [45]. In the INST sample, although these children are chronologically much younger than ASD children, only 16,66 percent of children did not understand the pointing gesture.

Therefore, we may conclude that, in contrast to children with autism, children from institutional care displayed underdeveloped socio-cognitive skills, language comprehension and expression, and vocalization complexity, but retained the basis for healthy communication (a good social interaction, frequent initiation of communication, focusing on other people, declarative communication functions).

4. Discussion

Our findings indicate that growing up in an institution greatly influences a child's development. It may seem that living in today's current institutions (even in Eastern Europe) does not warrant a description of being„socially deprived". However, a lack of individualized care in the period of life when it is crucial greatly affects a child's development. The absence of a caring caregiver is a kind of trauma altering the development of the brain, lessening the ability to cope with stress and obstructing the formation of intimate and confiding social relationships. As already noted, „the need for intensive, reciprocal, individualized caregiving is not merely a cultural phenomenon but a reflection of biologic necessity" [46] (p. 573). A large number of personnel constantly rotating duties in the institutionalized setting of childrens homes create neither opportunity for the formation of intimate and affectionate relationships nor allow systematic, child-focused communication.

Rutter *et al.* [1,24] described behavioural characteristics of some institutionalized children as 'quasi-autistic' because they resembled, but were not identical to behaviours shown by children with autism. The quasi-autistic pattern manifests itself as a relatively good use of the means of communication and the existence of a significant level of social interest [1]. Our results strongly support these notions, since our analysis demonstrated that social interests were preserved in INST children, but were profoundly disrupted in children with autism. This suggests a favorable prognosis in INST children, thanks to the „preservation"of prosocial interests and skills. That may explain why the developmental patterns of socially deprived children may be significantly enhanced through early intervention and placement in a stimulating setting [30,35] and why some institutionalized children with quasi-autistic pattern loose their autistic-like features later in life [24].

However, our findings also demonstrated that, although their developmental profiles are different, INST and ASD children do show some shared features (delayed first words, delayed language comprehension, delayed joint attention skills etc.). However, although both INST and ASD children differ from TD children in all domains (social, speech, symbolic), the social development of INST children is significantly less affected than their symbolic and language development. On the other hand, ASD children show profound deviation in social development and less deviant speech and symbolic abilities.

When analyzing total scores in our sample, 69 percent of ASD children and 71 percent of INST children scored below the 10th percentile. This is in agreement with existing data on ASD children [39] in their second year of life. However, when analyzing just social composite scores, INST children display twice higher score even when compared to, on average, 16 months older ASD children with the same total score. This further demonstrates that unfavourable environmental conditions have a much more profound impact on cognitive and socio-cognitive development, and as a result, on the acquisition of language; while the basic interest for people and the basis of early interaction and communication are less disrupted.

Differences between groups on speech composite are also quite illuminating. In children with ASD, a delay in babbling and a decreased frequency of vocalization are one of the first developmental disruptions reported in the first year of life [47]. Our data confirm this notion, but also indicate that vocalizations/ babbling of INST children is also less complex and less varied, as already suggested by others [48,49]. Although showing developmental delay in speech domain, ASD children in our sample showed disproportionally higher results on the speech domain than INST children with the same social communication skills. It seems that ASD children start to talk "earlier" than TD and INST children in a way that they start to talk before developing necessary social skills for its use – that is way their speech is often not directed to anyone nor used for communicative (functional, social) purposes.

Joint attention skills were also noted to be significantly disturbed in both INST and ASD children [50]. In our sample, INST children significantly differ from their peers with regard to comprehension (p=0,007) and the use (p=0,001) of the pointing gesture. The unexpected finding was the less frequent responding to name in INST children, compared to TD children. However, it should be noted that all INST children responded to their name (which was not the case in the ASD children), but the frequency (sometimes vs. often) was slightly lower in INST than in TD children (Table 4). It is also important to notice that less frequent systematic responding to the name when called has been documented in children with (general) developmental delay [38], although it is generally considered as a specific sign of autism spectrum disorder.

Many other developmental disturbances have been described in both INST and ASD children, such as the presence of stereotypes [34], or intolerance to loud noises [13]. While these features could not be assessed with the

CSBS-DP checklist, further research is needed to analyze differences/similarities between socially deprived and ASD children in these behaviors/information processing domains.

In conclusion, although institutionalized children display significant developmental delay and may initially resemble children with autism, they have a qualitatively different developmental pattern of social communication in comparison to children with ASD. For example, they do not show an atypical communication pattern (prevalence of instrumental over declarative social acts in early period) so characteristic for ASD children. When compared to their peers, INST children ask for help less frequently (instrumental/imperative function) than TD children, but do not differ in declarative communication functions, which is again in sharp contrast with ASD children.

While environmental factors are obviously important in shaping early unfavorable development of INST children, as well as in enhancing their developmental "catch-up" under favorable conditions, one should not ignore the other partner in this "nature-nurture" interaction – the developing brain itself. The brain may be regarded as pliable dough shaped through the powerful interaction and mutual dependence between genetic and environmental (especially social) factors. It seems that in clinically different groups of children, the involvement of identical brain areas does not necessarily lead to identical behavioral outcomes. It remains to be investigated to what extent a higher level of social deprivation in INST children may contribute to a higher degree of limbic system and „social brain" dysfunction, and to the increase of the amount of "autism-like" behavioural disturbances. As Nelson *et al.* [51] stated, the efficacy of foster care in preventing some disorders but not others is intriguing. This may have to do with the issue of sensitive periods or perhaps genetics. Many new studies on pathophysiology of ASD (e.g. oxytocin receptor deficiency – [52]) continue to point toward brain elements which are affected in socially deprived children. It remains to be seen to what extent differences in brain mechanisms and brain pathology differ among these two groups of children, and why developmental delay/deviation in socially deprived children is "manageable" in a greater amount than deficits in ASD children.

Acknowledgments

This work was supported by the Croatian Ministry of Science, Education and Sports, grant No. 013- 1081870-2627. We wish to thank all the staff of Home for Children Zagreb.

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