LIFE SPAN AND DISABILITY

Vol. XIII / n. 1 / January - June 2010

ISSN 2035-5963

Psychology
Social issues
Education
Rehabilitation
Habilitation

Journal promoted by the
Department of Psychology
Institute for Research on Mental Retardation
and Brain Ageing "Oasi Maria SS." - Troina

LIFE SPAN AND DISABILITY
Psychology, Social issues, Education, Rehabilitation, Habilitation

Promotes interdisciplinary research about psychological, social, educational, rehabilitative and neuro psychological aspects of the human life span. The aim is to give diffusion to the scientific studies of persons who have to cope with cognitive and emotional and interpersonal problems – for transient or persistent reasons – in the different periods of the life, when specific existential events (e.g., adolescence, lost of work, retirement, end of fertility, normal and pathological aging) could cause disease or actual disability. The neuropsychological and social aspects of Intellectual Disability, and the strategies to enhance the cognitive rehabilitation and the quality of life of these persons, were a main target in the published studies. The attention is focused, for the different phases of life and for the specific conditions of disease, on the skills suitable to promote the person's development, fully using all the existing or residual potentialities. The view to consider these aspects may be in turn educational, social, environmental, but taking into account the connections with the bio-psychological bases and/or with the data derived from empirical research. Both quantitative and qualitative methodological approaches are welcomed.

The contributions received are submitted to two members of the scientific committee, for a blind peer-review process.

Two issues per year will be edited, in English language, and published online on the website www.lifespan.it. Each issues will include research contributes, reporting original theoretical, methodological or empirical studies; diagnostic or intervention instruments (validation of techniques as tests or grids in the field of interest of the Journal); case-reports of clinical or rehabilitative relevance; reviews on specific themes.

LIFE SPAN AND DISABILITY

Journal promoted by the
Department of Psychology
Institute for Research on Mental Retardation and Brain Ageing "Oasi Maria SS." - Troina

CITTÀ APERTA

Città Aperta Edizioni s.r.l.
94018 Troina (En) - via Conte Ruggero, 73
Tel. 0935 653530 - Fax 0935 650234

Cover by Salvatore Felici

Published online: June 2011

Contents

Life Span and Disability / XIV, 1 (2011), 7-29

Action understanding and social learning in Autism: a developmental perspective

Giacomo Vivanti[1] *& Sally J. Rogers*[2]

Abstract

Social cognitive development in humans is grounded on a set of "hard-wired" skills that enable children to (1) pay attention to relevant aspects of the environment in order to make sense of other people's behaviour (2) incorporate the actions they observe into their own behavioural repertoire (i.e., social learning). This phenomenon, which allows individuals to take advantage of other people's knowledge and avoid the costs of trial-and-error learning, are likely to reflect the interplay of uniquely human social-cognitive biases (e.g., drive to orient attention toward other people) and higher-level cognitive processes (e.g., strategic selection of what to imitate). Difficulties in understanding and imitating others' actions, as well as difficulties in learning, are frequently documented in children with autism, a neurodevelopmental disorder characterized, by multiple deficits in the areas of social communication, and reciprocity and by behavioural rigidity. A set of recent experimental studies based on the eye-tracking technologies (Vivanti, McCormick, Young, Abucayan, Hatt, Nadig et al., 2011; Vivanti, Nadig, Ozonoff, & Rogers, 2008) provide us with new insight on the nature of imitative learning and its disruption in children with autism. In particular, mechanisms such as joint attention, gaze following and "reading" referential cues appear to be crucially involved in the ability to understand, predict and copy others' actions. We will discuss these find-

* *Received*: January 26, 2011; *Revised*: April 07, 2011; *Accepted*: April 10, 2011.

[1] School of Psychological Science, La Trobe University, Melbourne, Australia. E-mail: g.vivanti@latrobe.edu.au

[2] The M.I.N.D. Institute, University of California Davis Medical Center, Sacramento, California, U.S.A. E-mail: sally.rogers@ucdmc.ucdavis.edu

ings and their relevance for clinical practice, future research and theoretical debate on the neurocognitive mechanisms subserving social learning in children with and without autism.

Keywords: Autism, Imitation, Social Learning, Eye-Tracking, Mirror Neurons

1. Introduction

Most learning takes place in a social context (Vygotsky, 1978). This type of learning is particularly relevant in infancy and childhood and it's facilitated by specific cognitive and attentional biases that lead children to preferentially attend to social stimuli and to experience the participation in social exchanges as intrinsically rewarding (Legerstee, Anderson, & Schaffer, 1998).

Mechanisms involved in social reciprocity and social learning appear to be disrupted or inefficient in persons affected with Autism Spectrum Disorders (ASDs), a group of conditions characterized by multiple deficits in the areas of social communication and reciprocity and behavioural rigidity (Kanner, 1943; Volkmar, Lord, Bailey, Schultz, & Klin, 2004).

Most adults with Autism Spectrum Disorders are unable to live independently and need continuous assistance in their everyday life (Howlin, 2005). According to several scholars in the field, such disability, rather than being intrinsic to an Autism Spectrum condition, appears to be a consequence of being affected by such condition (Rogers & Dawson, 2010). In other words, the disability in autism might reflect the failure to learn skills that are crucial for cognitive development and adaptive functioning. In this view, specific differences in the way others' actions are attended, processed and learned might give rise to developmental sequelae resulting in cognitive and adaptive delays.

From infancy, children with autism show a diminished attention to social stimuli compared to peers (possibly because they don't experience the same level of social reward that is associated with participating in social exchanges in typical development; Dawson, 2008); they also show difficulties in understanding and imitating the actions they observe (Vivanti, McCormick, Young, Abucayan, Hatt, Nadig, Ozonoff, & Rogers, 2011). How is this affecting the learning processes that contribute to shape the developing brain during early developmental stages? We will focus our discussion on the nature of such phenomena in a developmental perspective.

2. Imitation and social learning in autism

Social learning is a type of learning that occurs as a function of observing and replicating novel behavior executed by others (Bandura, 1962). The most commonly observed social learning process in humans is imitation (Tennie, Call, & Tomasello, 2009; Whiten, McGuigan, Marshall-Pescini, & Hopper, 2009).

The centrality of imitation as a general learning mechanism in early childhood (Uzgiris, 1981; Meltzoff, 1985; Tomasello, 1999) is supported by

evidence that, in typically developing young children, a variety of key developmental accomplishments demonstrate strong relationships with imitation skills, including general cognitive abilities (Strid, Tjus, Smith, Meltzoff, & Heimann, 2006), language development (Bates, Thal, Whitesell, Fenson, & Oakes, 1989; Masur & Eichorst, 2002), sharing of affect (Uzgiris, 1999), cooperation (Colombi, Liebal, Tomasello, Young, Warneken, & Rogers, 2009), and social responsiveness (Heimann, 1998; 2002), although the nature of these relationships is not fully understood.

Because of the relationship between imitation and several other developmental domains, it is plausible that an early imitation deficit in autism may contribute to impairments in cognition, social communication, and adaptive skills (DeMyer, Hintgen, & Jackson, 1981; Rogers & Pennington, 1991; Hepburn & Stone, 2006). Imitative difficulties in children with autism were first identified and studied almost 40 years ago by DeMyer and colleagues (DeMyer, Alpern, Barton, DeMyer, Churchill, & Hingtgen, 1972). Subsequently the imitation deficit in autism has been confirmed by many methodologically rigorous studies using comparison groups of developmentally matched children with typical development, as well as matched groups involving children or adults with other developmental disorders, and several systematic reviews, including a meta-analysis (e.g., Sigman & Ungerer, 1984; Rogers & Pennington, 1991; Smith & Bryson, 1994; Charman, Swettenham, Baron-Cohen, Cox, Baird, & Drew, 1997; Stone Ousley, & Littleford, 1997; Rogers, 1999; Rogers, Stackhouse, Hepburn, & Wehner, 2003; Williams, Whiten, & Singh, 2004; Vivanti, Nadig, Ozonoff, & Rogers, 2008).

Interestingly, not all aspects of imitation seem to be equally impaired in ASD. While both frequency of imitation and precision of imitation appear to be affected, people with autism show relatively better performance in imitating goal-directed actions on objects than gestural and facial movements (Vivanti *et al.*, 2008; Colombi, Vivanti & Rogers, 2011).

3. Neuropsychology of imitative learning

Crucial insights on the neuro-cognitive processes involved in imitative learning have been provided by Rothi, Ochipa and Heilman (1991) and Tessari, Canessa, Ukmar and Rumiati (2007). Both their models include three main phases:

Encoding phase. This step involves the formation of a representation of the action based on the imitator's visual attention to relevant properties of the demonstrator's action.

Cross-modal or transformation/matching phase: in this process, the imitator's previous knowledge of the meaning and motor aspects of the action

is recruited, allowing for an efficient transfer from a perceptual code to a semantic and motor code. When the observed action is novel and cannot be mapped onto the imitator's motor vocabulary, the action, rather than being processed as a unit, is decomposed in a series of chunks that are each maintained "online" in working memory. In this case, imitation relies on a direct mapping from the perceptual to the motor features of the action, without a "semantic" mediation.

Execution phase: during this phase, the action is executed and the perceptual analysis of the performed action is compared to the representation of the action to provide online feedback and corrections on the motor plan.

The process begins with an observation of an action. The occipital cortex maps the observed action, and projects to the superior temporal sulcus (STS) region. The STS is a high-level visual-processing area that is selectively activated by the perception of biological movements (Decety & Grezes, 1999; Allison, Puce, & McCarthy, 2000; Pelphrey, Adolphs, & Morris, 2004). Recent findings suggest that the STS is specialized in interpreting dynamic social signs, such as gaze and head directions, and in processing social information conveyed by biological motion. Moreover, this region provides a somatotopic representation of the observed actions (Pelphrey, Morris, & McCarthy, 2005). Therefore, one role of STS is to distinguish social/biological motion, to translate perceived information into body knowledge, and possibly to detect intentionality in the perceived movement (Castelli, Happé, Frith, & Frith, 2000; Castelli, Frith, Happé, & Frith, 2002; Pelphrey, Singerman, Allison, & McCarthy, 2003; Schultz, Chawarska, & Volkmar, 2006). The STS then projects to the inferior parietal lobule (IPL).

The inferior parietal lobule has "mirror properties neurons:" in this area are activated by both observing an action and executing it (Gallese, Fadiga, Fogassi, & Rizzolatti, 1996). This mirroring capacity is believed to mediate an "automatic" understanding of the action, based on the direct matching of the visual information onto the imitator's motor repertoire (Fogassi & Luppino, 2005). The inferior parietal lobule projects to the inferior frontal gyrus (Broca's area).

The inferior frontal gyrus (IFG; Brodmann area 44), plus the adjacent portion of the premotor area, also contains a significant number of mirror neurons, namely, those motor neurons that are activated both when observing and performing a specific action. Crucially, some neurons in this area are also activated by observing and performing nonidentical actions that are related to the same goal. This process allows the attribution of the semantic value of the observed action. In other words, the activation of this region during the observation of the action mediates the mapping of the visuomotor pattern into the imitator's semantic vocabulary of purposeful actions and the goals that are accomplished with them (Kohler, Keysers, Umiltà, Fogassi, Gallese, & Rizzolatti, 2002; Koski, Wohschlager, Bekkering, Woods, Dubeau, Mazziotta, *et al.,* 2002; Rumiati, Weiss, Tessari, Assmus,

Zilles, Herzog, *et al.*, 2005; Iacoboni & Dapretto, 2006). The final step in the neural pathways involves sending efferent copies of motor plans from the IFG back to the STS, so that the visual description of the observed action is compared to the predicted sensory consequences of the planned imitative action (Iacoboni, Koski, Brass, Bekkering, Woods, Dubeau, *et al.*, 2001; Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; Iacoboni, 2005), an evaluative step in the process that allows one to determine if the goal was reached.

Two aspects of the neuropsychological model described above stand out: 1) both the visual and the motor system are involved in the action understanding process. Rather than relying on low-level visuospatial properties of the action to derive a motor representation, we exploit our motor system to represent, or map, what we see via our action repertoire (Grezes & Decety, 2001; Rumiati *et al.*, 2005; Iacoboni, 2008); and 2) seeing an action elicits the motor program for implementing the same goal-that is, the specific conditions of the setting and the observer then determine how the action is imitated (e.g., whether or not the observer has the same effectors available to perform the action, or whether or not the same goal can be achieved with a more familiar or efficient motor program).

This ability to encode goals, in addition to the kinematics of the demonstrator's action, is what makes imitation flexible and selective in typical development. Such a "semantic" coding, as opposed to a "visuospatial" coding, results in a decreased demand on information processing resources, and more efficient imitative performance (Gattis, Bekkering, & Wohlschlager, 2002; Tessari & Rumiati, 2004).

However, when the demonstration's action does not have a goal or a predefined meaning, the imitator cannot "translate" the action into a motor schema using his "semantic vocabulary." The action, rather than being encoded on the basis of its goal, has to be processed in terms of its visuomotor properties via a non-semantic, "sub-lexical" route. Tessari and Rumiati (2004; see also Rumiati *et al.*, 2005; Tessari *et al.*, 2007) documented that the neurocognitive basis of processing "meaningless" actions, which must be mapped via the visual-spatial and kinematic pathways, overlaps only in part with neural network implementing the encoding of goal-directed actions. In particular, during the encoding of meaningless actions, less activation of the inferior frontal gyrus and more activation of the right occipital-parietal junction is observed (Rumiati *et al.*, 2005). These neuroimaging data indicate that when we cannot exploit the semantics of the action (a process mediated by the inferior frontal gyrus), we need to rely on a more pictorial description of the action. In this case the action, rather than being encoded as a unit, has to be broken down into a series of chunks that are each maintained "online" in working memory. Crucially, nothing in the kinematics of the action indicates when the action starts and when it ends. The imitator needs to rely on the demonstrator's ostensive cues to "isolate" the action to be imitated in the stream of the demonstrator's behavior.

These different routes are activated by the properties of the action stimulus. When an action is recognized as familiar and meaningful, the semantic coding is automatically activated; when the action is meaningless and it has no correspondence in the imitator's semantic vocabulary, the "sub-lexical" (more pictorial) route is selected (Press, Bird, Walsh, & Heyes, 2008). For the semantic coding process to take place, the imitator needs to have expertise with the action observed; the action observed needs to be present in his semantic vocabulary. This has important implications for autism, as children with autism, by definition, have a more limited range of activities in their repertoire (American Psychiatric Association, 2000) and less social expertise (Klin, Jones, Schultz, & Volkmar, 2003) than age-mates.

4. New research directions in imitation in autism: the role of action encoding

Research on imitation in autism has mainly focused on motor execution of imitation, or, what kinds of difficulties might impact children's ability to reproduce others' actions. Results of these studies are inconclusive (Vivanti, 2007). The first stage that enables imitation (i.e., the encoding of the action to be imitated) has been much less investigated. Investigating the encoding phase of imitation involves understanding how the imitator forms, retains, and operates on that specific representation (Whiten, 2002). We cannot read the mind of the imitator to see how he or she represents an action; however, we can access this process by 1) observing how the imitator will imitate the same action under different conditions (does the imitator process an action differently if we manipulate variables such as the demonstrator's gaze direction, length of exposure, or the context of the action?), 2) analyzing the imitator's visual attention pattern during the demonstration (what elements of the demonstration is the imitator considering?), and 3) determining what parts of the brain are active during the demonstration (what functional circuitries are implementing the encoding process?). Using these techniques, scientists are starting to uncover information on how actions are encoded in the imitation process by typically developing individuals. The most relevant of these notions, in relation to autism, is that when we encode an action, we encode more than the action itself.

For an efficient imitative learning process to take place, the imitator, given all the potential information available in the demonstrator's behavior, needs to take in some stimuli and ignore other stimuli (Carpenter, *et al.*, 1995; Bekkering, Wohlschlager, & Gattis, 2000; Behne, Carpenter, & Tomasello, 2005; Tomasello, & Carpenter, 2005; Brass, Schmitt, Spengler, & Gergely, 2007; Carpenter & Call, 2007). The demonstrator's goal, and the context in which the action takes place, appear to be particularly relevant in

the imitator's representation of the demonstrator's action (Bekkering *et al.*, 2000; Gergely Bekkering, & Kiraly, 2002; Iacoboni, 2005). Consider the following example: The demonstrator is sitting at a table with a bottle (close to him) and a teacup (on the other side of the table). He moves his arm toward the teacup and grasps it. In doing so, he touches the bottle with his elbow, causing the bottle to move. If, while doing this action, the demonstrator looks at the bottle, the imitator might conclude that his goal was to deliberately move the bottle and then grasp the cup; if, instead, the demonstrator is looking at the teacup the whole time, the imitator might conclude that he is reaching for the teacup and, while doing so, accidentally touched the bottle. If asked to observe and then imitate the model, the imitator will, in the first situation, imitate both actions, and in the second situation, imitate only the action of grasping the teacup (Carpenter & Call, 2007; Southgate, Johnson, & Csibra, 2008). Therefore, the demonstrator's behaviors toward the object that he or she is acting upon crucially influences the way the action is encoded, and, ultimately, reproduced.

The imitator's encoding and reproduction of the action is also influenced by contextual aspects, such as objects and physical constraints in the environment. If the demonstrator is moving aside the bottle with his elbow while holding a large box in his hands, the imitator is very likely to move the bottle aside using his hand rather than the elbow (Gergely, Bekkering, & Kiraly, 2002). However, if the demonstrator's hands are empty, the imitator is more likely to move the bottle with his elbow. This pattern has been found in very young children as well as adults (Carpenter, Akhtar, & Tomasello, 1998; Southgate *et al.*, 2008; Kiraly, 2009). The interpretation of this imitative behavior is that the imitator evaluates the actions of the demonstrator in terms of goals, and means and assumes that another person will generally use the most efficient action available to accomplish a goal. In the example above, the observer assumes that the only reason the person holding the box is using his elbow is because his hands are otherwise occupied, and not because it is important to the task, and so the imitator uses the most rational and common action in order to achieve the same goal. However, if his hands are free, then the observer assumes there is a specific reason to use the elbow, and thus uses it as well.

This tendency of children to interpret an action as goal-directed appears to be a general bias of humans and develops very early. Behavioral data show that encoding an action as goal-directed represents the "default" output of the action understanding process from infancy on (Csibra & Gergely, 2007; Csibra, 2008). However, there are some motor acts that appear to be non-goal-directed. What happens when an observer sees an individual performing actions that are not directed toward any recognizable goal? Behavioral data indicate that children consider the demonstration's actions as goal-directed even when the action itself does not lead to an end-state. When the demonstrator is doing an apparently meaningless action or ges-

ture and he is providing some kind of ostensive cue, then the imitator encodes the action as a deliberate action to be attended to and imitated (in this case, observer interprets the ostensive cue to signal the demonstrator's goal to have the imitator attend and imitate his actions).

Indeed, imitation typically occurs in the framework of a social exchange in which the demonstrator provides communicative cues that help the imitator to understand what and how to imitate (Frith, 2008; Kiraly, 2009). In this framework, the demonstrator adopts a pedagogical stance by deliberately guiding the imitator through gesture, facial expressions, gaze, posture, and or vocalizations; the imitator, in turn, is socially motivated and cognitively able to participate in the exchange, and the imitation process takes place in a sort of mutually reinforcing choreography (Stern, 1985; Fonagy *et al.*, 2007; Gergely, Egyed, & Kiraly, 2007;). These kinds of exchanges are mediated by shared communicative meanings. The ostensive direct gaze is a particularly important communicative signal that precedes actions to which the demonstrator wants the imitator to pay attention (Sperber & Wilson, 1995). Children show special sensitivity to the direct gaze of another person, and appear to ascribe more salience to the actions that follow such a gaze, shown in their increased attention and exact imitation (Senju & Csibra, 2008; Kiraly, 2009). Therefore, the demonstrator's behavior toward the imitator crucially influences the way the action is encoded.

In these examples, the imitator observes the same exact motor action (touching a bottle with his elbow); however, he "sees" and imitates four different actions under specific circumstances. The same input is encoded so as to lead to four different outputs. The reverse phenomenon is also observed in human imitation: different inputs lead to the same output, apparently for the same reason: the underlying interpretation of the goal-directedness of the action. Noy, Rumiati and Flash (2008) documented that variations in features such as the orientation of the action do not change the way the action is imitated. In summary, children go beyond the "literal" information (Bruner, 1957). They do not "echo" an action via imitation, but rather frame the actions they see in a broader context that assumes a logical relation among the demonstrator's action, his intentions, and his communication.

However, another step is necessary for determining how actions will be processed: the properties of the action stimulus, rather than being a datum, depend on the imitator's selective attention to the relevant properties of the action. Encoding of a critical aspect of the demonstrator's action (i.e., where is he looking, what is he doing?) occurs only when attention is directed toward that feature (Klin, 2008). Children are exposed to a myriad of movements in daily life situations – how do they know what are the relevant aspects to be attended and imitated? Empirical data suggest that from infancy, children show very powerful preferential looking behaviors; they are strongly biased to selectively attend to specific features, namely faces, eyes (Morton & Johnson, 1991; Turati, Macchi Cassia, Simion, & Leo, 2006),

and hands (particularly when hands are manipulating objects; Amano, Kezuka, & Yamamoto, 2004). These features are those that are crucially involved in determining how the input is encoded and imitated (see above). This suggests that the mechanism gating perceptual input to the mirror-system-mediated action-understanding process is based on the imitator's preferential orientation toward specific features of the action. In other words, children are "programmed to learn" (Del Giudice, Manera, & Keysers, 2009), and possess a topology of salience (see Klin *et al*., 2003) that biases them to select those features of the demonstration that lead to the semantic encoding of the action. This encoding process allows the child to combine information from past experiences (the semantic store) with information contained in the current experience, allowing the child to "go beyond the information given" to understand the current situation, flexibly learning within a social/pedagogical framework. Do children with autism also go "beyond the information given" when observing and imitating?

5. Preliminary evidence of action encoding abnormalities in autism and their relationship with imitative learning

The process of analysis and interpretation of the demonstrator's action described above, in which information in addition to the action itself is recruited, is mediated by a series of specific abilities, including efficient gaze processing, integration of different sources of information (Vivanti *et al.,* 2008), joint attention (Carpenter *et al.*, 1995; Hobson & Hobson, 2007), and understanding of emotion, intentions, and communicative cues conveyed by the demonstrator's face and body (Carpenter & Call, 2007; Southgate *et al.,* 2008). All of these abilities, which appear to be crucially involved in encoding and understanding, and ultimately imitating, others' actions, appear to be deficient in individuals with autism (Mundy & Neal, 2001; Mundy & Burnette, 2005; Schultz, Chawarska, & Volkmar, 2006; Dawson & Bernier, 2007; Pennington, 2009). Therefore, there are reasons to hypothesize that abnormalities in the way children with autism encode and understand the demonstrator's action might crucially contribute to their imitation deficit.

First of all, do children with autism pay attention to the demonstration? It is very common to hear parents of children with autism saying, "I try to teach him how to do that, but he doesn't pay attention to me!" Is that what really happens? Do they fail to imitate because they do not look at the demonstration? A basic grasp of the demonstrator's actions by individuals with autism is supported by studies using recognition tests (Smith & Bryson, 1998; Bennetto, 1999). In these studies, participants with autism, like comparison participants, were able to recognize the actions they had imitated from an array of actions represented in pictures. Although partici-

pants' observations of the demonstrator's action was adequate to permit later recognition, these studies leave open the question of differences in the focus and relative amount of visual attention during the demonstration.

Recently, Vivanti, Nadig, Ozonoff and Rogers (2008) empirically tested this hypothesis. They employed eye-tracking technology to examine what children with autism and typically developing children look at when actions to be imitated are being demonstrated to them. Their findings indicated that well-matched groups of children with autism and typically developing children look at to-be-imitated actions for similar durations; however, typically developing children, as a group, looked to the demonstrator's neutral face twice as long as the group of children with autism did. In the experiment, children were observing two different types of to-be-imitated actions: meaningful and non-meaningful actions. In the first case, the actions themselves (e.g., drawing a line, striking a xylophone) provided all of the elements necessary for the imitator's interpretation: the actions were "self-explaining," that is, no additional information was needed for the imitator to make sense of them. In the second case, the actions (e.g., flexing the arm at the elbow, moving the arm across the forehead) were ambiguous and did not have an obvious end-state or goal. When observing these latter actions, the group of typically developing children greatly increased their attention to the face of the demonstrator, as if searching for additional information to explain the action.

Interestingly, the group with autism also demonstrated increased looks to the face when the action to be imitated was not goal-directed. What strongly differentiated the two groups was the decreased quantity of visual attention to the demonstrator's face in the group with autism in both conditions.

These eye-tracking data indicate that children with autism, as a group, are actually looking at the demonstration, but they fail to look at the demonstrator as much as typically developing children do. Similar findings in an imitation task were obtained by Hobson and Hobson (2007) using a behavioral paradigm. They found that children with autism, compared to children with other developmental disabilities, were less inclined to look at the demonstrator during both the observation and the execution of an imitative task. Moreover, they found visual attention to the demonstrator's face to be related to better imitative performance. The tendency to look at the demonstrator's face has been documented in infancy as well as childhood in both typically developing children and those with intellectual deficits (Carpenter *et al.*, 1995; Hobson & Hobson, 2007). These data are consistent with the abundant research literature demonstrating that children with autism have reduced attention to social stimuli (Dawson, Munson, Estes, Osterling, McPartland, Toth *et al.*, 2002; Grelotti, Gauthier, & Schultz, 2002; Pelphrey, Sasson, Reznick, Paul, Goldman, & Piven., 2002; Dalton, Nacewicz, Johnstone, Schaefer, Gernsbacher, Goldsmith *et al.*,

2005), difficulties in face processing (Ashwin, Baron-Cohen, Wheelwright, O'Riordan, & Bullmore, 2007; Scherf, Behrmann, Minshew, & Luna, 2008), and abnormal visual scanning patterns (Klin *et al.*, 2003; Anderson, Colombo, & Shaddy, 2006; Speer, Cook, McMahon, & Clark, 2007). Converging evidence is provided by a study by Castiello (2003), which demonstrated that the observation of a person performing a goal-directed movement facilitated imitation only if the observer could see the actor's gaze, though children with autism have not shown this same type of facilitation (Pierno, Becchio, Turella, Tubaldi, & Castiello, 2008). Thus, the current data suggest that, when a child with autism and a typically developing child are observing someone's action, they are both observing the action, but they are not encoding the same breadth of social information (see also Rogers Young, Cook, Giolzetti, & Ozonoff, 2010). Differences in how children with autism imitate others appear to begin in the very first step of the process, with selective attention guiding the perceptual input to the rest of the system.

Imitation in autism might rely mainly on the encoding and reproduction of the motor information (i.e., the action itself), while typically developing children select and integrate extra-motor information to support a semantic coding of the action. Failure to detect cues provided by the demonstrator's face might result in difficulties in processing more complex goal-directed actions, in which information provided by the demonstrator's face is necessary to interpret the goal of the action. Imitation of simple goal-directed actions, in which the action itself is "self-explaining" and no extra-motor information is necessary to understand the demonstrator's goal, might not be affected by this difference in visual attention, thus resulting in the often-replicated finding that children with autism show less deficit in imitating simple actions on objects than other types of imitations.

This interpretation is supported by findings from a recent study (Vivanti *et al.*, 2011) that tested the ability of children with autism to predict the outcome of an action in two conditions: 1) when the end-state of the action could be inferred on the basis of the objects involved in the action; and 2) when the demonstrator's gaze direction was crucial for determining the course of the action. The group with autism performed as well as the group with typical development in the first condition, but were significantly impaired in the second condition. Gaze- pattern analyses revealed that children with autism showed significantly reduced attention to the direction of the demonstrator's gaze compared to the contrast group. Correlation analyses suggested that failure to interpret this social cue to the demonstrator's goal led to their poor performance.

It is tempting to speculate that failure to capture this type of social information results in persons with autism processing the action to be modelled via the "sublexical" route (see above) more frequently than others, and using the "semantic" route less frequently. This interpretation seems to be supported by studies documenting that, in contrast to typically develop-

ing children, children with ASD tend to imitate "accidental" actions performed by the demonstrator, thus reproducing the exact motor pattern observed, without appreciating the difference between "intentional" and "accidental" acts of the demonstrator (D'Entremont & Yazbek, 2007), though see contradictory evidence from Rogers *et al.*, 2010). Moreover, children with autism, unlike those with other developmental disabilities, are more likely to imitate the action itself (the motor pattern) but not the affective style of the demonstrator (e.g., knocking on a door gently versus harshly; Hobson, 1986, 1995; Hobson & Lee, 1999).

However, we also found that children with autism are able to predict the outcome of an action on the basis of the actor's emotions (Vivanti *et al.*, 2011). This dissociation between the ability to understand the goals of an action on the basis of emotional expressions and gaze direction suggests that children with autism, rather than having a general inability to select and appreciate information conveyed from the face, are less sensitive to some specific social cues, in particular referential cues (e.g., gaze direction) that are particularly relevant to understand an action's goals.

6. Autism and imitative learning: conclusions and future directions

The imitative learning deficit in autism cannot be characterized as a unitary phenomenon and is very likely to be the end result of a complex cognitive pathway. Different imitative behaviors and different aspects of the imitative process are based on different neurocognitive processes, and are likely impaired for different reasons in different individuals and different diagnostic groups. We build this concept from two elements: the complementarity of inferential and non-inferential processes in imitation, and the perspective of system inefficiency and vulnerability in autism and other neurological and neurodevelopmental disorders. Inferential and non-inferential processes may both be involved in different types of imitative behaviors and in the same imitative act. It might be the case that simpler forms of mirroring-based imitation occur earlier in development than simpler forms of inferential understanding. Simpler forms of inferential understanding likely precede more complex forms of imitative learning (Hurley, 2008). At the process level, an earlier mirror-based response to the demonstrator's action might be re-scripted in more flexible formats as greater awareness of the attentional and intentional stance of the demonstrator develops, to permit more flexible and selective imitation. In other words, a top-down re-description of the demonstrator's action might be built upon a base grounded in bottom-up perception-action encoding. The nature of the stimulus, the nature of the context, and the learning history of the observer all will influence the nature of the information processes that are involved in any par-

ticular imitative act. This perspective suggests that there is not convincing evidence for either a "bottom-up" or "top-down" account of the imitation deficit in autism; furthermore, framing the problem in such terms may not be the most productive, given our growing understanding of the imitation problem.

The second point we wish to highlight is that imitation and imitative learning competence involves a complex system of neurocognitive processes, including visual attention, social motivation, understanding of communicative cues, integration of multiple sources of information, working memory, transfer of visual input into the body schema (for novel movements and actions) as well as linked observation-action responses for familiar movements and actions, motor planning, executive processes, and inhibitory processes. All will be influenced by development and previous experiences. Imitation must involve much more than the mirror neuron system. Complex information processing systems can be disrupted in many ways, and research in autism has identified many differences in the performance of persons with ASD compared to others. It might be the case that this heterogeneous vulnerability in the components of the system causes the system to be inefficient, thus affecting many, but not all, imitative behaviors, in many, but not all, individuals with autism. The research into neurocognitive componential aspects of imitation in autism is steadily yielding more detailed information about imitative behavior and underlying brain activity. However, there is another question underlying the theories: To what extent does the imitation problem affect symptom expression and development in persons with autism? This question requires a different research approach, particularly from two study designs: longitudinal studies of infants who develop ASD, and treatment studies that allow imitation to be experimentally manipulated. Both types of studies are currently being conducted.

The longitudinal studies of infant siblings of children with autism have the potential to reveal much about the interaction of imitative abilities, developmental trajectories, and symptoms of autism. Zwaigenbaum *et al.* (Zwaigenbaum, Bryson, Rogers, Roberts, Brian, & Szatmari, 2005) have demonstrated that imitation impairments are present by the age of 12 months in children who will later develop autism, though Young *et al.* (Young, Rogers, Hutman, Ozonoff, Rozga, & Sigman, in review) did not find specific imitation deficits until 18 months in a similar sample. However, few longitudinal studies have thus far examined the relation between imitation abilities in the preschool period and social development or autism symptomatology at the level of individual differences, and this type of study is necessary for testing the theory that the imitation problems in autism contribute to the developing autism phenotype. Such studies are badly needed and should begin to emerge from the infant-sibling studies.

The second type of study needed involves treatment. Can one affect outcomes in ASD by teaching imitation early? Does teaching imitation confer

a specific benefit that is not conferred by teaching speech, joint attention, or pretend play? There is only indirect evidence for this at present. The interventions that have demonstrated the most powerful effects of intensive early intervention in ASD focus very heavily on imitation training at the start of the intervention, though it is taught in different ways (Lovaas, 1987; Smith, Groen, & Wynn, 2000; Rogers, & Dawson, 2010). Additionally, Ingersoll and Schreibman (2006) have described secondary advances in joint attention and other core skill areas resulting from imitation training. However, this question needs a design like that provided by Kasari, Paparella, Freeman, & Jahromi (2008), in which two different interventions are delivered to randomized groups with long-term follow-up to examine relative effects.

Both study designs – the longitudinal follow-along and the longitudinal comparative treatment interventions – are expensive and complex to carry out, but these designs are necessary to determine the specific role that imitation skills play in outcomes of young children with ASD. Determining the essential ingredients of early intervention programs is necessary if we are to eventually develop more targeted, individualized, and powerful intervention approaches for specific children, but given both the economic challenges of early intervention for autism and the poor outcomes that still result for so many, we must continue to isolate and examine the nature and the role of the imitation and learning deficit in ASD.

References

Allison, T., Puce, A., & McCarthy, G. (2000). Social perception from visual cues: Role of the STS region. *Trends in Cognitive Sciences, 4*, 267-278.

Amano, S., Kezuka, E., & Yamamoto, A. (2004). Infant shifting attention from an adult's face to an adult's hand: A precursor of joint attention. *Infant Behavior and Development, 27* (1), 64-80.

Anderson, C. J., Colombo, J., & Shaddy D. J. (2006). Visual scanning and papillary responses in young children with autism spectrum disorder. *Journal of Clinical and Experimental Neuropsychology, 28*, 1238-1256.

American Psychiatric Association (2000). *Diagnostic and Statistic Manual of Mental Disorders. Forth Edition- text revision* Washington: A.P.A.

Ashwin, C., Baron-Cohen, S., Wheelwright, S., O'Riordan, M., & Bullmore, E.T. (2007). Differential activation of the amygdala and the "social brain" during fearful face-processing in Asperger Syndrome. *Neuropsychologia, 45* (1), 2-14.

Bandura, A. (1962). *Social Learning through Imitation.* University of Nebraska Press: Lincoln, NE.

Bates, E., Thal, D., Whitesell, K., Fenson, L., & Oakes, L. (1989). Integrating language and gesture in infancy. *Developmental Psychology, 25* (6), 1004-1019.

Behne, T., Carpenter, M., & Tomasello, M. (2005). One-year-olds comprehend the communicative intentions behind gestures in a hiding game. *Developmental Science, 8* (6), 492-499.

Bekkering, H., Wohlschalger, A., & Gattis, M. (2000). Imitation of gestures in children is goal-directed. The Quarterly *Journal of Experimental Psychology: A Human Experimental Psychology, 53*A(1), 153-164.

Bennetto, L. (1999). A componential approach to imitation and movement deficits in autism. *Dissertation Abstracts International, 60*, 8-19

Brass, M., Schmitt, R., Spengler, S., & Gergely, G. (2007). Investigating action understanding: Inferential processes versus action simulation. *Current Biology, 17* (24), 2117-2121.

Bruner, J. (1957). From joint attention to the meeting of minds: An introduction. In C. Moore & P. J. Dunham (Eds.), *Joint attention: Its origins and role in development* (pp. 1-14). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Bruner, J. (1972). Nature and uses of immaturity. *American Psychologist, 27*, 687-708.

Carpenter, M., Akhtar, N., & Tomasello, M. (1998). Fourteen- through 18-month-old infants differentially imitate intentional and accidental actions. *Infant Behavior and Development, 21* (2), 315-330.

Carpenter, M., & Call, J. (2007). The question of "what to imitate": Inferring goals and intentions from demonstrations. In K. Dautenhahn & C. Nehaniv (Eds.), *Imitation and social learning in robots, humans and animals: Behavioural, social and communicative dimensions* (pp. 135-151). Cambridge: Cambridge University Press.

Carpenter, M., Tomasello, M., & Savage-Rumbaugh, S. (1995). Joint attention and imitative learning in children, chimpanzees, and enculturated chimpanzees. *Social Development, 4*, 217-237.

Carr, L., Iacoboni, M., Dubeau, M. C., Mazziotta, J. C., & Lenzi, G. L. (2003). Neural mechanisms of empathy in humans: A relay from neural systems for imitation to limbic areas. *Proceedings of the National Academy of Sciences, 100* (9), 5497-5502.

Castelli, F., Frith, C., Happé, F., & Frith, U. (2002). Autism, Asperger syndrome and brain mechanisms for the attribution of mental states to animated shapes. *Brain, 125*, 1839-1849.

Castelli, F., Happé, F., Frith, U., & Frith, C. (2000). Movement and mind: A functional imaging study of perception and interpretation of complex intentional movement patterns. *Neuroimage, 12*, 314-325.

Castiello, U. (2003). Understanding other people's actions: Intention and attention. *Journal of Experimental Psychology: Human Perception and Performance, 29*, 416-430.

Charman, T., Swettenham, J., Baron-Cohen, S., Cox, A., Baird, G., & Drew, A. (1997). Infants with autism: An investigation of empathy, pretend play, joint attention, and imitation. *Developmental Psychology, 33*, 781-789.

Colombi, C., Liebal, K., Tomasello, M., Young, G., Warneken, F., & Rogers, S. (2009). Examining correlates of cooperation in autism: Imitation, joint attention, and understanding intentions. *Autism, 13* (2), 143-163.

Colombi, C., Vivanti, G., Rogers, S. J. (2011). The Neuropsychology of the imitation deficit in Autism. In D. Fein (ed), *The Neuropsychology of Autism*. Oxford: Oxford University Press.

Csibra, G. (2008). Goal attribution to inanimate agents by 6.5-month-old infants. *Cognition, 107* (2), 705-717.

Csibra, G., & Gergely, G. (2007). Obsessed with goals: Functions and mechanisms of teleological interpretation of actions in humans. *Acta Psychologica, 124*, 60-78.

Dalton, K. M, Nacewicz, B. M., Johnstone, T., Schaefer, H. S., Gernsbacher, M. A., Goldsmith, H. H., Alexander, A. L., & Davidson, R. J. (2005). Gaze fixation and the neural circuitry of face processing in autism. *Nature Neuroscience, 8* (4), 519-526.

Dawson, G. (2008). Early behavioral intervention, brain plasticity, and the prevention of autism spectrum disorder. *Development and Psychopathology, 20*, 775-803.

Dawson, G., & Bernier, R. (2007). Development of social brain circuitry in autism. In D. Coch, K.W. Fischer & G. Dawson (Eds.), *Human behavior, learning, and the developing brain* (pp. 28-55). New York: Guilford Press.

Dawson, G., Munson, J., Estes, A., Osterling, J., McPartland, J., Toth, K., Carver, L., & Abbott, R. (2002). Neurocognitive function and joint attention ability in young children with autism spectrum disorder versus developmental delay. *Child Development, 73* (2), 345-358.

Decety, J., & Grèzes, J. (1999). Neural mechanisms subserving the perception of human actions. *Trends in Cognitive Science, 3*, 172-178.

Del Giudice, M., Manera, V., & Keysers, C. (2009). Programmed to learn? The ontogeny of mirror neurons. *Developmental Science, 12* (2), 350-363.

DeMyer, M. K., Alpern, G.. D., Barton, S., DeMyer, W. E., Churchill, D. W., Hingtgen, J. N. (1972). Imitation in autistic, early schizophrenic, and nonpsychotic subnormal children. *Journal of Autism and Childhood Schizophrenia, 2*, 264-287.

DeMyer, M. K., Hingtgen, J. N., & Jackson, R. K. (1981). Infantile autism reviewed: A decade of research. *Schizophrenia Bulletin, 7* (3), 388-451.

D'Etremont, B., & Yazbek, A. (2007). Imitation of intentional and accidental actions for children with autism. *Journal of Autism and Developmental Disorders, 37* (9), 1665-1678.

Fogassi, L., & Luppino, G. (2005). Motor functions of the parietal lobe. *Current Opinion in Neurobiology, 15* (6), 626-631.

Fonagy, P., Gergely, G., & Target, M. (2007). The parent-infant dyad and the construction of the subjective self. *Journal of Child Psychology and Psychiatry, 48* (3-4), 288-328.

Frith, C. D. (2008). Social cognition. *Philosophical Transactions of the Royal Society B, 363* (1499), 2033-2039.

Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti, G. (1996). Action recognition in the premotor cortex. *Brain, 119,* 593-609.

Gattis, M., Bekkering, H., & Wohlschlager, A. (2002). Goal-directed imitation. In A. Meltzoff & W. Prinz (Eds.), *The Imitative Mind* (pp.183-205). New York: Cambridge University Press.

Gergely, G., Bekkering, H., & Kiraly, I. (2002). Rational imitation in preverbal infants. *Nature, 415*, 755.

Grelotti, D. J., Gauthier, I., & Schultz, R. T. (2002). Social interest and the development of cortical face specialization: What autism teaches us about face processing. *Developmental Psychobiology, 40* (3), 213-225.

Grezes, J., & Decety, J. (2001). Functional anatomy of execution, mental simulation, observation, and verb generation of actions: A meta-analysis. *Human Brain Mapping, 12*, 1-19.

Heimann, M. (1998). Imitation in neonates, in older infants and in children with autism: Feedback to theory. In S. Braten (Ed.), *Intersubjective communication and emotion in early ontogeny* (pp. 89-104). Cambridge: Cambridge University Press.

Heimann, M. (2002). Notes on individual differences and the assumed elusiveness of neonatal imitation. In A. N. Meltzoff & W. Prinz (Eds.), *The imitative mind: Development, evolution, and brain bases* (pp. 74-84). Cambridge: Cambridge University Press.

Hepburn, S. L., & Stone, W. L. (2006). Longitudinal research on motor imitation in autism. In S. J. Rogers & J. H. G. Williams (Eds.), *Imitation and the social mind: Autism and typical development* (pp. 310-329). New York: Guilford.

Hobson, J. A., & Hobson, R. P. (2007). Identification: The missing link between joint attention and imitation? *Development and Psychopathology, 19*, 411-431.

Hobson, R. P. (1986). The autistic child's appraisal of expressions of emotion. *Journal of Child Psychology and Psychiatry, 27*, 321-342.

Hobson, R. P. (1995). Apprehending attitudes and actions: Separable abilities in early development? *Development and Psychopathology, 7*, 171-182.

Hobson, R. P., & Lee, A. (1999). Imitation and identification in autism. *Journal of Child Psychology and Psychiatry, 40*, 649-660.

Howlin, P. (2005). Outcomes in autism spectrum disorders. In F. R.Volkmar, R. Paul, A. Klin, & D. Cohen (Eds), *Handbook of autism and pervasive developmental disorders: Diagnosis, development and behavior* (3rd ed, pp. 201-220). Hoboken, NJ: John Willey & Sons.

Hurley, S. (2008). The shared circuits model (SCM): How control, mirroring, and simulation can enable imitation, deliberation, and mindreading. *Behavioral and Brain Sciences, 31*, 1-22.

Iacoboni, M. (2005). Understanding others: Imitation, language, empathy. In S. Hurley & N. Chater (Eds.), *Perspectives on imitation: From neuroscience to social science* (pp. 77-100). Cambridge, MA: MIT Press.

Iacoboni, M. (2008). The role of premotor cortex in speech perception: Evidence from fMRI and rTMS. *Journal of Physiology-Paris, 102* (1-3), 31-34.

Iacoboni, M., & Dapretto, M. (2006). The mirror neuron system and the consequences of its dysfunction. *Nature Reviews Neuroscience, 7*, 942-951.

Iacoboni, M., Koski, L., Brass, M., Bekkering, H., Woods, R. P., Dubeau, M. C., Mazziotta, J. C., & Rizzolatti, G. (2001). Re-afferent copies of imitated actions in the right superior temporal cortex. *Proceedings of the National Academy of Science USA, 98*, 13995-13999.

Ingersoll, B., & Schreibman, L. (2006). Teaching reciprocal imitation skills to young children with autism using a naturalistic behavioral approach: Effects on language, pretend play, and joint attention. *Journal of Autism and Developmental Disorders, 36*, 487-505.

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child*, *2*, 217-253.

Kasari, C., Paparella, T., Freeman, S., & Jahromi, L.B. (2008). Language outcome in autism: Randomized comparison of joint attention and play interventions. *Journal of Consulting and Clinical Psychology, 76* (1), 125-137.

Kiraly, I. (2009). The effect of the model's presence and of negative evidence on infants' selective imitation. *Journal of Experimental Child Psychology, 102*, 14-25.

Klin, A. (2008). Three things to remember if you are a functional magnetic resonance imaging researcher of face processing in autism spectrum disorders. *Biological Psychiatry, 64* (7), 549-551.

Klin, A., Jones, W., Schultz, R., & Volkmar, F. (2003). The enactive mind, or from actions to cognition: Lessons from autism. *Philosophical Transactions Royal Society of London B Biological Sciences, 358* (1430), 345-360.

Kohler, E., Keysers, C., Umiltà, M. A., Fogassi, L., Gallese, V., & Rizzolatti, G. (2002). Hearing sounds, understanding actions: Action representation in mirror neurons. *Science, 297*, 846-848.

Koski, L., Wohschlager, A., Bekkering, H., Woods, R. P., Dubeau, M. C., Mazziotta, J. C., & Iacoboni, M. (2002). Modulation of motor and premotor activity during imitation of target-directed actions. *Cerebral Cortex, 12* (8), 847-855.

Legerstee, M., Anderson, D., & Schaffer, A. (1998). Five- and eight-month-old infants recognize their faces and voices as familiar and social stimuli. *Child Development*, *69*, 37-50.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55* (1), 3-9.

Masur, E. F., & Eichorst, D. L. (2002). Infants' spontaneous imitation of novel versus familiar words: Relations to observational and maternal report measures of their lexicons. *Merrill-Palmer Quarterly, 484* (202), 405-426.

Meltzoff, A. (1985). The roots of social and cognitive development: Models of man's original nature. In T. M. Field & N. Fox (Eds.), *Social perception in infants* (pp. 1-30). New Jersey: Able.

Morton, J., & Johnson, M. H. (1991). CONSPEC and CONLERN: A two-process theory of infant face recognition. *Psychological Review, 98* (2), 164-181.

Mundy, P., & Burnette, C. (2005). Joint attention and neurodevelopment. In F. Volkmar, A. Klin, & R. Paul (Eds.), *Handbook of autism and pervasive developmental dis*orders, Vol. 3 (pp. 650-681). Hoboken, NJ: John Wiley.

Mundy, P., & Neal, R. A. (2001). Neural plasticity, joint attention, and a transactional social-orienting model of autism. In L.M. Glidden (Ed.), *International review of research in mental retardation* (pp. 139-168). San Diego, CA: Academic Press.

Noy, L., Rumiati, R. I., & Flash, T. (2008). Simple movement imitation: Are kinematic features sufficient to map perceptions into actions? *Brain and Cognition, 69* (2), 360-368.

Pelphrey, K. A., Adolphs, R., & Morris, J. P. (2004). Neuroanatomical substrates of social cognition dysfunction in autism. *Mental Retardation and Developmental Disabilities Research Reviews, 10*, 259-271.

Pelphrey, K. A., Morris, J. P., & McCarthy, G. (2005). Neural basis of eye gaze processing deficits in autism. *Brain, 128*, 1038-1048.

Pelphrey, K. A., Sasson, N. J., Reznick, S., Paul, G., Goldman, B. D., & Piven, J. (2002). Visual scanning of faces in autism. *Journal of Autism and Developmental Disorders, 32* (4), 249-261.

Pelphrey, K., Singerman, J. D., Allison, T., & McCarthy, G. (2003). Brain activation evoked by perception of gaze shifts: The influence of context. *Neuropsychologia, 41* (2), 156-170.

Pennington, B. F. J. (2009). How neuropsychology informs our understanding of developmental disorders. *Journal of Child Psychology and Psychiatry, 50* (1-2), 72-78.

Pierno, A.C., Becchio, C., Turella, L., Tubaldi, F., & Castiello, U. (2008). Observing social interactions: The effect of gaze. *Society for Neuroscience, 3* (1), 51-59.

Press, C., Bird, G., Walsh, E., & Heyes, C. (2008). Automatic imitation of intransitive actions. *Brain and Cognition, 67*, 44-50.

Rogers, S. J. (1999). Intervention for young children with autism: From research to practice. *Infants and Young Children, 12* (2), 1-16.

Rogers, S. J., & Dawson, G. (2010). *Early Start Denver Model for young children with autism: Promoting language, learning and engagement.* New York: Guilford.

Rogers, S. J., & Pennington, B. F. (1991). A theoretical approach to the deficits in infantile autism. *Development and Psychopathology, 3,* 137-162.

Rogers, S. J., Stackhouse, T., Hepburn, S. L., & Wehner, E. A. (2003). Imitation performance in toddlers with autism and those with other developmental disorders. *Journal of Child Psychology and Psychiatry, 44* (5), 763-781.

Rogers, S. J., Young, G. S., Cook, I., Giolzetti, A., & Ozonoff, S. (2010). Imitating actions on objects in early-onset and regressive autism: Effects and implications of task characteristics on performance. *Development and Psychopathology, 22*, 71-85.

Rothi, L. J. G., Ochipa, C., & Heilman, K. M. (1991). A cognitive neuropsychological model of limb praxis. *Cognitive Neuropsychology, 8*, 443-458.

Rumiati, R. I., Weiss, P. H., Tessari, A., Assmus, A., Zilles, K., Herzog, H., & Fink, G. R. (2005). Common and differential neural mechanisms supporting imitation of meaningful and meaningless actions. *Journal of Cognitive Neuroscience, 17*, 1420-1431.

Scherf, K.S., Behrmann, M., Minshew, N., & Luna, B. (2008). Atypical development of face and greeble recognition in autism. *Journal of Child Psychology and Psychiatry, 49* (8), 838-847.

Schulz, R., Chawarska, K., & Volkmar, F. (2006). The social brain in autism: Perspectives from neuropsychology and neuroimaging. In S. O. Moldin & J. L. R. Rubinstein (Eds.), *Understanding autism: From basic neuroscience to treatment* (pp. 323-348). Boca Raton, FL: CRC Press.

Senju, A., & Csibra, G. (2008). Gaze following in human infants depends on communicative signals. *Current Biology, 18* (9), 668-671.

Sigman, M., & Ungerer, J. (1984). Cognitive and language skills in autistic, mentally retarded, and normal children. *Developmental Psychology, 20*, 293-302.

Smith, I. M., & Bryson, S. E. (1994). Imitation and action in autism: A critical review. *Psychological Bulletin, 116* (2), 259-273.

Smith, I. M., & Bryson, S. E. (1998). Gesture imitation in autism I: Nonsymbolic postures and sequences. *Cognitive Neuropsychology, 15*, 747-770.

Smith, T., Groen, A. D., & Wynn, J. W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal on Mental Retardation, 105* (4), 269-285.

Southgate, V., Johnson, M. H., & Csibra, G. (2008). Infants attribute goals even to biomechanically impossible actions. *Cognition, 107* (3), 1059-1069.

Speer, L. L., Cook, A. E., McMahon, W. M., & Clark, E. (2007). Face processing in children with autism. *Autism, 11* (3), 265-277.

Sperber, D., & Wilson, D. (1995). *Relevance: Communication and cognition.* Oxford: Blackwell.

Stern, D. (1985). *The interpersonal world of the infant.* New York: Basic Books.

Stone, W. L., Ousley, O. Y., & Littleford, C. D. (1997). Motor imitation in young children with autism: What's the object? *Journal of Abnormal Child Psychology, 25*, 475-485.

Strid, K., Tjus, T., Smith, L., Meltzoff, A. N., & Heimann, M. (2006). Infant recall memory and communication predicts later cognitive development. *Infant Behavior and Development, 29* (4), 545-553.

Tessari, A., Canessa, N., Ukmar, M., & Rumiati, R. I. (2007). Neuropsychological evidence for a strategic control of multiple routes in imitation. *Brain, 139* (4), 1111-1126.

Tessari, A., & Rumiati, R. I. (2004). The strategic control of multiple routes in imitation of actions. *Journal of Experimental Psychology: Human Perception and Performance, 30* (6), 1107-1116.

Tennie, C., Call, J., & Tomasello, M. (2009). Ratcheting up the ratchet: on the evolution of cumulative culture. *Philosophical Transactions of the Royal Society: B*364, 2405-2415.

Tomasello, M. (1999). *The cultural origins of human cognition.* Cambridge, MA: Harvard University Press.

Tomasello, M., & Carpenter, M. (2005). The emergence of social cognition in three young chimpanzees. *Monographs of the Society for Research in Child Development, 70* (1), 1-136.

Turati, C., Macchi Cassia, V., Simion, F., & Leo, I. (2006). Newborns' face recognition: Role of inner and outer facial features. *Child Development, 77* (2), 297-311.

Uzgiris, I. (1981). Two functions of imitation during infancy. *International Journal of Behavioral Development, 4*, 1-17.

Uzgiris, I. (1999). Imitation as activity: Its developmental aspects. In J. Nadel & G. Butterworth (Eds.), *Imitation in infancy* (pp. 186-206). Cambridge: Cambridge University Press.

Vivanti, G. (2007). Competenze imitative e riabilitazione nell'autismo. *Psichiatria dell'Infanzia e dell'Adolescenza, 73* (1) 7-24

Vivanti, G., Nadig, A., Ozonoff, S., & Rogers, S. J. (2008). What do children with autism attend to during imitation tasks? *Journal of Experimental Child Psychology, 101* (3), 186-205.

Vivanti, G., McCormick, C., Young, G., Abucayan, F., Hatt, N., Nadig, A., Ozonoff, S., & Rogers, S. J. (2011). Intact and impaired mechanisms of action understanding in autism. *Developmental Psychology*, in press.

Vygotsky, L. S. (1978). *Mind and society: The development of higher mental processes.* Cambridge, MA: Harvard University Press.

Volkmar, F., Lord, C., Bailey, A., Schultz, R. T., & Klin, A. (2004). Autism and pervasive developmental disorders. *Journal of Child Psychology & Psychiatry, 45*, 135-170.

Whiten, A., McGuigan, N., Marshall-Pescini, S. & Hopper, L. M. (2009). Emulation, imitation, overimitation and the scope of culture for child and chimpanzee. *Philosophical Transactions of the Royal Society, B,* 364, 2417-2428.

Whiten, A. (2002). Imitation of sequential and hierarchical structure in action: Experimental studies with children and chimpanzees. In K. Dautenham & C. Nehaniv (Eds.), *Imitation in animals and artifacts* (pp. 191-209). Cambridge, MA: MIT Press.

Williams, J. H. G., Whiten, A., & Singh, T. (2004). A systematic review of action imitation in autistic spectrum disorder. *Journal of Autism and Developmental Disorders, 34* (3), 285-299.

Young, G. S., Rogers, S. J., Hutman, T., Ozonoff, S., Rozga, A., & Sigman, M. (in review). Imitation in autism from 12 to 24 months: A longitudinal study using a random coefficient multilevel Rasch measurement model.

Zwaigenbaum, L., Bryson, S., Rogers, T., Roberts, W., Brian, J., & Szatmari, P. (2005). Behavioral manifestations of autism in the first year of life. *International Journal of Developmental Neuroscience, 23*, 143-152.

Life Span and Disability / XIV, 1 (2011), 31-44

A study about the Theory of Mind in primary and secondary aging

Lina Pezzuti,[1] *Emiddia Longobardi,*[2] *Katiuscia Milletti*[3] *& Annarita Ovidi*[4]

Abstract

The present study investigates the differences in theory of mind tasks based on cognitive functioning and the influence of status variables: age, gender and education. The sample recruited is composed of 280 subjects aged between 65 and 94. Participants are administered one test to investigate the cognitive functioning and one theory of mind task. Results show that the presence of cognitive impairment appears to increase the difficulty in theory of mind tasks.
Also, the study explores how certain status variables affect the understanding of mental states in the sample with primary or physiological aging (206 subjects). In particular, success in the understanding of the theory of mind task undergoes a decline with increased aging. There is a significant correlation between performance and additional years of schooling. Theory of mind, however, is independent of the variable gender, men and women do not differ in their performance.

Keywords: Theory of mind, ToM, Aging

* *Received*: October 06, 2010; *Revised*: February 15, 2011; *Accepted*: February 20, 2011.

[1] Sapienza University of Rome, Faculty of Medicine and Psychology, Department of Clinical Psychology, Via dei Marsi 78 – 00185 – Rome (Italy); Phone: 0649917939; Fax: 0649917910. E-mail: lina.pezzuti@uniroma1.it

[2] Sapienza University of Rome, Faculty of Medicine and Psychology, Department of Clinical Psychology. E-mail: emiddia.longobardi@uniroma1.it

[3] Sapienza University of Rome, Faculty of Medicine and Psychology, Department of Clinical Psychology. E-mail: katiuscia_84@hotmail.it

[4] Sapienza University of Rome, Faculty of Medicine and Psychology, Department of Clinical Psychology. E-mail: annarita_ovidi@infinito.it

1. Introduction

The Theory of Mind (ToM) is the ability to attribute mental states such as desires, intentions, thoughts and beliefs and to predict and explain each person's behavior based on these inferences (Maylor, Moulson, Muncher, & Taylor, 2002; Camaioni, 2006). This ability is also called *folk psychology* (Fodor, 1987), and describes and explains the naive understanding of others' behavior and creates a sense of the world around oneself.

Theory of mind has been widely studied in children, in order to study the exact period of onset, as well as in a clinical population with patients who had suffered head injury, schizophrenia or autism. Less has been done to know what changes there are over the life span in the ToM, and if age influences the rise, decline or stability of ToM. The Happè, Winner and Brownell study (1998) is considered the first work about theory of mind in the normal aging. In order to explore the effects of age on the theory of mind, the authors have given tasks of theory of mind through stories (*Strange Stories Test*) which ask participants to make inferences about the understanding that a protagonist of the story has about the mental state of another individual. Results show a better performance in the group of 19 elderly aged subjects (mean age 73 years) than the group of 52 young subjects (mean age 21 years). The authors suggest that the increase with aging of wisdom and social intelligence can lead to better performance in the theory of mind tasks. In another study, no differences were found regarding the age influence on the theory of mind (Winner, Brownell, Happè, Blum, & Pincus, 1998; MacPherson, Phillips, & Della Sala, 2002; Keightley, Winocur, Burianova, Hongwanishkul, & Grady, 2006; Slessor, Phillips, & Bull, 2007). In particular, Slessor *et al.* (2007) compare a group of 40 young (mean age 20 years) people and a group of 40 older people (mean age 67 years) in ToM tasks (*Strange Stories Test*) there are no difficulties for the elderly.

However, other recent research which used similar verbal tasks, found that the theory of mind declines with age (Saltzman, Strass, Hunter, & Archibald, 2000; Maylor *et al.,* 2002). Maylor *et al.* (2002) in two experiments, which require an understanding of ToM tasks (*Strange Stories Test*), with or without memory load, compare the performance of a group of 25 young people with one of two groups of elderly (25 young older-mean age 67 years and 25 older older-mean age 81 years). The authors show that the performance in ToM tasks with memory load, is worse for the two groups of the elderly, however when reducing the memory load, the impairment of ToM disappears for the group of young olders.

Charlton, Barrick, Markus and Morris (2009) have done a research on a sample of 106 subjects aged between 50 and 90 years, divided into four age groups: 50-59 years old (n = 27); 60-69 years old (n = 27); 70-79 years old (n = 31); and 80-89 years old (n = 21). The authors have used theory of mind

tasks and tasks designed to investigate the verbal intelligence and the performance intelligence, the executive functions, the speed of information processing, the cognitive impairment and depression. They found a measure of brain structure using magnetic resonance imaging. The results show that the performance of ToM tasks is adversely/negatively affected by the advance of age and that the intelligence performance, the executive functions and the speed of information processing, influence mental tasks. There are also significant correlations between the ToM and the measure of the integrity of white matter, but not the internal volume of the brain.

2. Research objective and hypotheses

There is very little literature on the theory of mind in aging and it is often in contradiction; this work aims to study ToM in normal aging, studying the influence of cognitive and status variables.

The first objective is to investigate the theory of mind in relation to cognitive functioning, by comparing participants with normal or primary aging (Birren & Schroots, 1990) and participants with cognitive impairment (mild and moderate). The hypothesis that is to be studied retains that the ability to understanding other minds is influenced by cognitive functioning, and therefore it deteriorates in subjects with cognitive impairment. A second objective investigates the performance in theory of mind tasks using stories, and whether or not these performances are influenced by status variables as age, gender and education. It is known in the literature that these variables can influence cognitive performance in the aging, both verbal and non verbal measures (cfr. Kaufman & Kaufman, 1990). The first variable studied is the level of education. The research suggests that the level of adult education lessens according to age. These differences influence cognitive and neuropsycological test scores (Stratta, Rossi, Mancini, Cupillari, Mattei, & Casacchia, 1993; Uchiyama, Mitrushina, D'Elia, Satz, & Matthews, 1994). However, the conditioning of this variable on the performance of theory of mind tasks was not evaluated in the past, except by Maylor and other authors (2002) that show how they criticized the work of Happè *et al.* (1998). Hence in the research they recruited older people from universities for older people, therefore more educated than the average of the sample normal aged. In this study we will evaluate the effect on ToM tasks both of education and of the sampling. It is known that the level of education of older people is lower than that of the young older. This variable is very important when studying the effect of age that could be mediated by the effect of education. So, in this work the effect of education is statistically controlled by studying the effects of age.

With regard to the effect of the age on ToM tasks, data in the literature show conflicting results. In fact, sometimes the older subjects have a better of the best

performance (Happè *et al.*, 1998) and other times the younger subjects perform better (Maylor *et al.,* 2002). Age-related changes in neuronal functioning are particularly evident in the frontal and temporal lobes (West, 1996; Greenwood, 2000), the brain regions most often associated with ToM (Frith & Frith, 2003; Apperly, Samson, Chiavarino, & Humphreys, 2004), suggesting that the ToM may decline with age. On the contrary, it is argued that older people have more experience in social skills as, for example, representing the mental states of others (Happè *et al.*, 1998) and given priority to social and emotional information processing (Carstensen, Isaacowitz, & Charles, 1999). This work explores differences by comparing the results of three groups of elderly: young-older (65-74 years), older (75-84 years) and big-older (85-94 years). Finally, the effect of the gender variable will be taken consideration due to the fact that in previous works the possibility of an effect in solving ToM tasks was neglected.

3. Method

3.1 Participants

The sample of this study is composed of 280 participants (149 females and 131 males) aged between 65 and 94 years old, with an average age of 78 years old (*SD* = 7.60) from central Italy (Lazio and Umbria). The participants are divided into three age groups: from 65 to 74 years old (*n* = 94: 50 females and 44 males), from 75 to 84 years old (*n* = 110: 58 females and 52 males) and from 85 to 94 years old (*n* = 76: 41 females and 35 males). The sample is divided into three levels of education: 0-5 years of education (elementary school) (*n* = 78: 42 females and 36 males); 6-13 years of education (middle or high school) (*n* = 54: 26 females and 28 males); 14-18 years of education (degree) (*n* = 44: 21 females and 23 males). The participants have an average of 9 years of education, 46% have at most a primary school education level, 34% have finished middle or high school and 20% have graduated. There is a prevalence of participants with middle or high school level education in the age group from 65 to 74 years old. With the highest percentage of primary school level of education in the other two groups. This distribution is given by a higher level of education of the younger participants, due to social and economic changes, which have improved and widened the possibility and opportunity to further one's level of education.

To verify the presence of participants with cognitive impairment and identify participants with normal or primary aging, the sample was submitted to the *Mini Mental State Examination* (MMSE, Folstein, Folstein, & McHugh, 1975), which is one of the most community used tools in neuropsychological research for a brief screening of cognitive impairment. The MMSE is composed of 11 items that investigate the following: temporal orientation, spatial orientation, immediate memory, attention/concentration, delayed recall, naming, verbal

repetition, verbal comprehension, writing, reading a sentence and constructional praxis. The MMSE has a scoring range from 0 to 30 points, with any score below 24 indicating cognitive impairment. The raw scores are corrected with the table of Magni, Binetti, Bianchetti, Rozzini and Trabucchi (1996) for age groups and level of education. The sample has a medium score corrected by table of Magni *et al.* (1996), equal to 25.32 (SD = 2.63). The analysis made by the MMSE divided the sample into three groups of participants: 1) a *group with normal or primary aging* (with scores on the MMSE higher than the cut-off 24), composed of 206 participants; 2) a *group with mild cognitive impairment* (with scores of 21 to 23), composed of 56 participants; 3) and last *group with moderate cognitive impairment* (with scores of 11 to 20), composed of 18 participants. Table 1 shows the frequency distribution of participants for cognitive assessment, age and gender. Relative to the group with primary aging (n = 206) equally distributed into three age groups and gender, this particular group is influenced by level of education ($F_{(2, 203)} = 3.291, p < 0.05$). In particular, the first age group (65-74 years) had a mean level of education of 10.89 years (SD = 5.06), which is higher than the other two groups of older participants. In regard to participants aging from 75-84 years old the average level of education is equal to 8.96 years (SD = 5.01), and for the participants aging 85-94 years old the level of education is equal to 8.91 years (SD = 5.78). The study does not distinguish differences of level of education between the gender ($F_{(1, 204)} = 0.292, p = 0.589$): the average level of education of the males is 9.45 years (SD = 5.39) and the average level of education of the females is 9.84 years (SD = 5.22). The average level of education of the group with mild cognitive impairment is to 7.12 years (SD = 4.55) while the average level of education of the group with moderate cognitive impairment is to 5.55 years (SD = 3.50).

Table 1 - *Description of the groups according to cognitive evaluation, age and gender*

	65-74 years	75-84 years	85-94 years	Total
Subjects with primary aging: 22 < MMSE < 30	n =7 4 (F = 39, M = 35)	n = 78 (F = 42, M = 36)	n = 54 (F = 26, M = 28)	N = 206 (F = 107, M = 99)
Subjects with mild cognitive impairment: 21 < MMSE < 23	n = 17 (F = 9, M = 8)	n = 22 (F = 10, M = 12)	n = 17 (F = 12, M = 5)	n = 56 (F = 31, M = 25)
Subjects with moderate cognitive impairment: 11 < MMSE < 20	n = 3 (F = 2, M = 1)	n = 10 (F = 6, M = 4)	n = 5 (F = 3, M = 2)	n = 18 (F = 39, M = 35)
Total	n = 94 (F = 50, M = 44)	n = 110 (F = 58, M = 52)	n = 76 (F = 41, M = 35)	n = 280 (F = 149, M = 131)

3.2 Materials

Aside from using the MMSE for a cognitive screening and a questionnaire for biographical data of the participants, to measure the ToM the Stories for Images were used (Baron-Cohen, Leslie, & Frith, 1986). The test was composed of a series of three stories. Each story consisted of four illustrations put in order by the investigator in front of the participant and presented one at a time. The investigator then asked the participant to tell a story by looking at the illustrations. The three stories were correlated to three different situations: a mechanical story, where there is no human characters; a behavioral story, where there are the human characters but the status of their mental status is not asked; and a mentalistic story, where there are human characters and the participant must understand their mental state. In particular, the mechanical story is composed of a sequence of 4 images represented by 4 images: 1) a balloon that escapes the hand of a person; 2) the balloon floating away in the air; 3) the balloon being shown next to a tree; 4) the balloon colliding with on the branches of the tree and bursting. In the behavioral story the sequence of the 4 images is made by: 1) a child walking on the street; 2) the child entering a candy shop; 3) the child buying candies; 4) the child leaving the shop with a bag of candies. At last, the third mentalistic story is represented by the following 4 images: 1) a child hiding a candy in a box; 2) the child going outside to play with a ball; 3) the child's mother opening the box and eating the candy; 4) the child coming back home, opening the box and is surprised to not see the candy in the box.

For the assessment is there has been built *ad hoc* a grid of assessment based on the indications of Baron-Cohen *et al.* (1986) and identified the following three measure that will be considered in this research: the description of the cause and/or effect, the comprehension of causal connection and the psychological lexicon used in the stories.

1) The degree of *description of the cause and/or the effect of the stories* is rated on a Likert scale 4 points, where "0" corresponds at a story that is not codified, "1" at a description of the story where it is not expressed neither the cause nor the effect, "2" corresponds to a description of the story where it is expressed the cause or the effect (partial description), and "3" at a description of the story where it is expressed both the cause and effect. For example, it attributes a capacity for full description of the cause and of the effect at the mechanical story when the participant says: *"the balloon goes near to a tree/branches"* and *"the balloon bursts"*.

2) The capacity to *understand the causal connection* of the story, is defined when the participant inserts in the telling of the story a particular statement (provided by the Authors) that represents this capacity. In particular, the participant is given a positive score when they say: for the mechanical story *"the balloon crashed into branches and bursts"*; for the be-

havioral story *"the character goes out of the shop with a bag of candy"*; and for the mentalistic story *"the character is surprised"*.

3) To analyze the *psychological lexicon* used in the telling of the story the following categories of mental state are considered: perceptual (for example, to see, to feel, to look, to observe and to sight), positive emotional (for example, to love and to like), negative emotional (for example, to be sorry and to be afraid), volitional (for example, to want, to wish and to prefer), cognitive or epistemic (for example, to realize, to think, to know and to remember). That variable is given by the total of the terms to the different mental states (Longobardi, Piras, & Presaghi, 2008).

The answers given in the task stories for images are encoded by the person administering through an evaluation grid. The investigator then reviews all answers to be sure of its assessment. Two independent coders analyzed the answers given by participant to the task. The agreement index of evaluation between the two coders is equal to .95. After all, the investigators, through a big confront, have come to a unified coding.

3.3 Research design

The battery of tests were administered to participants recruited through random sampling to cascade. All participants were tested individually with a meeting for about an hour, with the same procedure and order of administration: the questionnaire, the MMSE and at last the task of Stories of images. The participants, to have more spontaneity, were interviewed in an environment familiar to them, such as their home, senior center at home of relatives or friends.

4. Results

4.1 Theory of mind and cognitive functioning

To verify the first hypothesis there were considered the scores of the tasks of the three stories (mechanical, behavioral and mentalistic) comparing participants with primary aging ($n = 206$) with those with mild cognitive impairment ($n = 56$) and moderate ($n = 18$). However, since there is a statistically significant difference in the educational level of these three groups, for the comparison of average performance on ToM measures, it was decided to conduct an Analysis of Variance with the education variable as a covariate (ANCOVA).

The results of the tasks of the three stories show that the participants with cognitive impairment (mild and moderate) describe fewer cause and / or the effects of the stories presented ($F_{(2,277)} = 10.59$, $p < .0001$) and show the worst performance in understanding of their causal connection ($F_{(2,277)}$

= 5.64, $p < .005$); on the contrary, they do not differ significantly in the use of psychological lexicon ($F_{(2,277)} = 0.66$, n.s.). Table 2 lists the means and standard deviations of the three groups on the three dependent ToM variables, with post-hoc comparisons that show significant results among the three groups.

Table 2 - *Understanding of the tasks of ToM stories in relation to cognitive functioning of subjects: mean (standard deviation), F values, p and significant post-hoc*

	(A) Older people with primary aging n = 206	(B) Older people with mild impairment n = 56	(C) Older people with moderate impairment n =18	$F_{(2,277)}$	p	Post-hoc* (Fisher LSD)
	(MMSE: 24-30) $Mean_{MMSE}$=26,50 sd_{MMSE}=1,55	(MMSE: 21-23) $Mean_{MMSE}$=21,8 4 sd_{MMSE}=1,20	(MMSE: 11-18) $Mean_{MMSE}$=21,8 4 sd_{MMSE}=1,20			
Description of causes and/or effects in stories	6.26 (2.65)	4.89 (2.92)	2.67 (2.79)	10.59	.0001	A>B; A>C; B>C
Understanding causal connection in stories	0.94 (0.84)	0.53 (0.71)	0.17 (0.38)	5.64	.005	A>B; A>C
Psychological lexicon in stories	4.94 (5.63)	3.98 (4.17)	1.83 (3.05)	0.66	n.s.	

n.s. = not significant
** significant p<0.05*

4.2 Theory of mind and status variables

Since the focus was to be on normal physiological aging, the present study on the effect status variables such as age, gender and education has been carried out on old participants with primary aging ($n = 206$).

- Study of *education* effect. A one-way analysis variance showed how participants with more years of education have better results in both the description of the causes and / or effects inherent in the stories ($F_{(2,203)} = 15.43, p < .0001$), both in understanding of their causal connection ($F_{(2,203)} = 15.81, p < .0001$), and the use of psychological terms ($F_{(2,203)} = 19.66, p < .0001$). Table 3 gives the averages and standard deviations of the three education groups on the three dependent variables studied ToM, with post-hoc comparisons that has showed superior performance as well as those with an average level of education (6-13 years) compared to those who have a low level of education (0-5 years).

Table 3 - *Understanding of the ToM tasks in reference to the numbers of years of schooling of the subjects: mean (standard deviation), F value with their p and significant post-hoc*

	(A) 0-5 years n = 81	(B) 6-13 years n = 81	(C) 14-18 years n = 44	$F_{(2,203)}$	p	Post-hoc* (Fisher LSD)
Description of causes and/or effects in stories	5.20 (2.96)	6.54 (2.30)	7.70 (1.71)	15.43	.0001	C>A; C>B; B>A
Understanding causal connection in stories	0.65 (0.69)	0.94 (0.90)	1.48 (0.70)	15.81	.0001	C>A; C>B; B>A
Psychological lexicon in stories	3.00 (3.45)	4.64 (4.52)	9.04 (8.15)	19.66	.0001	C>A; C>B; B>A

significant p<0.05

- Study *age effect* . Before studying the effect of age one must synthesize two important results of this research: 1) in the older population, the ToM tasks studied were effected by level of education; 2) in the sample of participants with normal aging the level of education is not balanced in the three age groups considered. Infact it was revealed that younger participants have higher educational levels than older participants. Therefore the study of the age effect should not be effected by the level of education of the sample. The ANCOVA was been implemented. The Ancova is the Analysis of Variance using the education variable as a covariate. The results showed that by controlling the education effect, it is evident that an age effect on the variable description of the causes and / or effects ($F_{(2,203)} = 8.59$, $p < .0001$), with the older group showing the worst performance. On the contrary, there are no differences in the age for the variables in causal connection stories ($F_{(2,203)} = 1.91$, n.s.) and psychological lexicon ($F_{(2,203)} = 0.92$, n.s.). Table 4 shows the average performance of the normal older group compared to three age groups with post-hoc.

Table 4 - *Understanding of the ToM tasks with regard to age*

	(A) 65-74 years n = 74	(B) 75-84 years n = 78	(C) 85-94 years n = 54	$F_{(2,203)}$	p	Post-hoc* (Fisher LSD)
Description of causes and/or effects in stories	7.04 (2.29)	6.40 (2.46)	5.00 (2.94)	8.59	.0001	A>C; B>C
Understanding causal connection in stories	1.13 (0.91)	0.90 (0.75)	0.74 (0.80)	1.91	n.s.	
Psychological lexicon in stories	4.88 (4.96)	4.83 (5.69)	5.17 (6.44)	0.92.	n.s.	

n.s. = not significant

- Study *gender* effect. Investigates whether gender influences performance on the ToM story tasks. It was examined whether the two genders differ in educational level and it was found that there is no difference in level of education between females and males ($F_{(1, 204)}$ = 0.292, n.s.: women's average level of education = 9.44 (*SD* = 5.39), men's average level of education = 9.85 (*SD* = 5.22). Thus, there has been an ANOVA one-way with the gender variable as an independent variable and the three ToM variables as dependent variables. The results (see Table 5) emerged as both sexes got similar scores in the three stories. Men and women show a similar capacity for description of the causes and / or effects ($F_{(1,204)}$ = 1,73, n.s.), understanding causal connection ($F_{(1,204)}$ = .63, n.s.) and use the same psychological lexicon ($F_{(1,204)}$ = 2.67, n.s.). Table 5 shows the average performance for the two sexes.

Table 5 - *Understanding of the ToM tasks with regard to age and gender (covariate: education)*

	Males n = 99	Females n =107	$F_{(1,204)}$	p
Description of causes and/or effects in stories	6.49 (2.50)	6.01 (2.79)	1,73	n.s.
Understanding causal connection in stories	0.90 (0.85)	0.99 (0.83)	0,63	n.s.
Psycological lexicon in stories	5.55 (5.82)	4.27 (5.36)	2,67	n.s.

n.s. = not significant

5. Discussion and conclusions

The primary focus of the present research was to understand if the ability to attribute mental states and predict behavior, on the basis of such inferences, changes in relation to cognitive functioning, and to the status variables as age, gender and level of education. It first became clear through a screening test (MMSE, Folstein *et al.*, 1975) how many subjects appeared to share a possibility of cognitive impairment. In order for them to then be compared with primary or physiological aging individuals. It was discovered that 26% of the total sample is shown to have a score below the MMSE cut-off. As suggested, comparing the performance obtained with the tasks of theory of mind by subjects with primary aging with that of subjects with cognitive impairment (mild to moderate both), it was concluded that the latter gets a lower performance in the stories tasks. Subjects with cognitive impairment in respect to those with primary aging, describe to a lesser extent the causes and / or effects derived from the stories. They also understand to a lower extent the causal connections of the stories. However, there are no differences with normal subjects who used the psychological lexicon. Therefore, the results show that the description and understanding of the causal connection of the stories require a higher level of cognitive processing of responses, compared with the ability to use verbal mentalistic labels. This data could indicate that to understand the causal relationships in stories, including mentalistic ones, in which one asks the subject to attribute mental states to the protagonists, requires certain skills. These skills can be deficit in patients with cognitive impairment. Given the results subjects with cognitive impairment were excluded from the subsequent analysis, and analysis was more focused on the theory of the normal aging mind. Inspired by the work of Happè *et al.* (1998) in which elderly people, recruited from senior universities, have a better performance in respect to the young, the study investigates if the level of education influences the performances and if it mediates the effect of age. In the understanding of the theory of mind in regards to the three stories, there is a significant difference between the three levels of schooling considered. There is a clear difference in performance to the task as a function of years of education. Better educated individuals are more successful in responding to the tasks of the stories than those who were less educated. Therefore, by statistically controlling the variable level of education, we tested the effect of age on the ToM performance. The results show that younger subjects have less difficulty in describing the causes and / or effects detectable in the stories than older subjects. However, there are no differences in age in the ability to identify causal connections and the use of psychological lexicon. These results seem to be partly in line with the study of Maylor *et al.* (2002), who noted a better performance of the group of young-elderly (mean age 67

years) compared to the old-elderly (mean age 81 years) in the tasks of *theory of mind* without load memory, while in the tasks of ToM with load memory they showed a decline with age. It should be stated, however, that the ToM tasks used in the present study differ from those used by Maylor *et al*. (2002). The first are visual narrative tasks while the second are a verbal processing of written material tasks (*Strange Stories Test*). The literature does not take into account variables such as gender and level of education. For example, the present study is part of a research area that is still unexplored. The results of this research show that the gender variable does not affect the performance in the three stories, and that there is no significant difference between males and females.

This work opens new development scenarios. It may be to better investigate the behavior of subjects with cognitive impairment and to identify which factors, together with level of education and cognitive decline, could be an obstacle or a strengthening factor in solving tasks of ToM; for example, the level of intelligence and integrity of executive functions may play an important role. Also, the social value of the theory of the mind and its implications in everyday life can lead to a deeper impact on the ability to a steady daily workout that can be implementation into daily life (Laicardi & Pezzuti, 2000).

It could eventually raise interest in the construction of ad hoc incentives for the daily operation of the capacity for mentalization by the elderly in rehabilitation, recovery or entertainment settings.

References

Apperly, I. A., Samson, D., Chiavarino, C., & Humphreys, G. W. (2004). Frontal and temporo-parietal lobe contributions to theory of mind: Neuropsychological evidence from a false-belief task with reduced language and executive demands. *Journal of Cognitive Neuroscience, 16,* 1773-1784.

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1986). Mechanical behavioural and Intentional understanding of picture stories in autistic children. *British Journal of Developmental Psychology, 4* (2)*,* 113-125.

Birren, J. E., & Schroots, J. J. F. (1990). Concept of time and aging in science. In Birren J.E., Schiaie K.W. (editors), *Handbook of psychology of aging* (terza edizione) (pp. 44-64). New York: Academic Press.

Camaioni, L. (2006). *La teoria della mente. Origini, sviluppo e patologia.* Bari: Laterza.

Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously: A theory of socioemotional selectivity. *American Psychologist, 54,* 165-181.

Charlton, R. A., Barrick, T. R., Markus, H. S., & Morris, R. G. (2009). Theory of mind associations with other cognitive functions and brain imaging in normal aging. *Psychology and Aging, 24* (2), 338-362.

Fodor, J. A. (1987). *Psychosemantics: The problem of meaning in the philosophy of mind.* Cambridge, MA: Bradford Books/MIT Press (trad. It. Psicosemantica. Il problema del significato nella filosofia della mente, Bologna, Il Mulino, 1990).

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-Mental State" – A practical method for grading the cognitive state of patients for the clinicians. *Journal of Psychiatric Research, 12,* 189-198.

Frith, U., & Frith, C. D. (2003). Development and neurophysiology of mentalizing. *Philosophical Transactions of the Royal Society of London B, 358,* 459-473.

Greenwood, P. M. (2000). The frontal aging hypothesis evaluated. *Journal of the International Neuropsychological Society, 6,* 705-726.

Happè, F., Winner, E., & Brownell, H. (1998). The getting of wisdom: theory of mind in old age. *Developmental Psychology, 34* (2), 358-362.

Kaufman, A. S., & Kaufman, N. L. (1990) *Kaufman Brief Intelligence Test.* Circle Pines, MN: American Guidance Service.

Keightley, M. L., Winocur, G., Burianova, H., Hongwanishkul, D., & Grady, C. L. (2006). Age effects on social cognition: faces tell a different story, *Psychology and Aging, 21,* 211-220.

Laicardi, C., & Pezzuti, L. (2000). *La psicologia dell'invecchiamento e della longevità.* Bologna: Il Mulino.

Longobardi, E., Piras, R., & Presaghi, F. (2008). Lessico psicologico nelle narrazioni dei bambini della scuola primaria. *Rivista di Psicolinguistica Applicata, VIII*, 1-2, 55-72.

MacPherson, S. E., Phillips, L. H., & Della Sala, S. (2002). Age, executive function, and social decision making: A dorsolateral prefrontal theory of cognitive aging. *Psychology and Aging, 17,* 598-609.

Magni E., Binetti G., Bianchetti A., Rozzini R., & Trabucchi M. (1996). Mini-Mental State Examination: a normative study in Italian elderly population. *European Journal of Neurology,* 3, 198-202.

Maylor, E. A., Moulson, J. M., Muncer, A., & Taylor, L. A. (2002). Does performances on theory of mind tasks decline in old age? *British Journal of Psychology, 93,* 465-485.

Saltzman, J., Strass, E., Hunter, M., & Archibald, S. (2000). Theory of mind and executive functions in normal human aging and Parkinson's disease. *Journal of the International Neuropsychological Society, 6,* 781-788.

Slessor, G., Phillips, L. H., & Bull, R. (2007). Exploring the specificity of age-related differences in theory of mind tasks. *Psychology and Aging, 22* (3), 639-643.

Stratta, P., Rossi, A., Mancini, F., Cupillari., M., Mattei, P., & Casacchia, M. (1993). Wisconsin Card Sorting Test performance and educational level in schizophrenic and controls samples. *Neuropsychiatry, Neuropsychology, and Behavioural Neurology, 6,* 149-153.

Uchiyama, C. L., Mitrushina, M. N., D'Elia, L. F., Satz, P., & Matthews, A. (1994). Frontal lobe functioning in geriatric and non-geriatric samples; An argument for multimodal analyses. *Archives of Clinical Neuropsychology, 9,* 215-227.

West, R. L. (1996). An application of prefrontal cortex function theory to cognitive aging. *Psychological Bulletin, 120,* 272-292.

Winner, E., Brownell, H., Happe, F., Blum, A., & Pincus, D., (1998). Distinguishing lies from jokes: Theory of mind deficits and discourse interpretation in right hemisphere brain-damaged patients. *Brain and Language, 62,* 89-106.

Life Span and Disability / XIV, 1 (2011), 45-54

A Touch Pad and a Scanning Keyboard Emulator to facilitate writing by a woman with extensive motor disability

Claudia Chiapparino,[1] *Fabrizio Stasolla*,[2]
Claudia de Pace[3] *& Giulio E. Lancioni*[4]

Abstract

This study assessed the use of a touch-pad microswitch and a scanning keyboard emulator to facilitate the writing performance of a woman with extensive motor disability. The touch pad allowed the woman to select the letters and write them with a simple movement of her hand, as they were automatically scanned on the keyboard. The data showed that the woman learned to use this writing approach and her writing time improved (i.e., becoming similar to the time she needed with an adapted version of a regular keyboard). The new approach, contrary to the adapted keyboard, was not particularly tiring and the woman chose to use it at each of the 10 preference checks when she could decide which one to use. University psychology students also provided a positive evaluation of the new approach during a social validation assessment. Implications of the findings were discussed.

Keywords: Touch pad, Keyboard emulator, Extensive motor disability

* *Received*: October 08, 2010; *Revised*: February 02 2011; *Accepted*: February 15, 2011.

[1] Department of Psychology, University of Bari. E-mail: claudia.chiapparino@alice.it
[2] Department of Psychology, University of Bari. E-mail: f.stasolla@psico.uniba.it
[3] Department of Psychology, University of Bari. E-mail: claudia_dpc@libero.it
[4] Department of Psychology, University of Bari. E-mail: g.lancioni@psico.uniba.it
University of Bari, Via Quintino Sella 268, 70100 Bari, Italy.

1. Introduction

Persons with extensive motor disabilities can have very serious difficulties using computers. In fact, their disabilities can prevent or make it particularly difficult for them to control the computer mouse and keyboard, that is, the two basic tools for computer access (Evans, Drew, & Blenkhorn, 2000; Betke, Gips, & Fleming, 2002; Turpin, Armstrong, Frost, Fine, Wards, & Pinnington, 2005; Borghetti, Bruni, Fabbrini, Murri, & Sartucci, 2007; Lancioni, Singh, O'Reilly, Sigafoos, Green, Chiapparino *et al.,* 2009). Given this condition, computer-mediated occupation and leisure perspectives and communication (e.g., writing) opportunities can be substantially reduced (Lau & O'Leary, 1993; Chen, 2001; Chen, Chen, Chen, Luh, & Lai, 2003a; Chen, Chen, Kuo, & Lai, 2003b). Various efforts have been made to develop technological support solutions that could alleviate the aforementioned difficulties and their consequences (Chen, 2001; Betke *et al.,* 2002; LoPresti, Brienza, & Angelo, 2002; Turpin *et al.,* 2005; Hori, Sakano, & Saitoh, 2006; Borghetti *et al.,* 2007; Lancioni, Singh, O'Reilly, Sigafoos, Chiapparono, Stasolla *et al.,* 2007).

For example, Evans *et al.* (2000) described the use of a special joystick, which could be operated through the participant's head movements. Essentially, these movements were translated into functional mouse signals through which computer operations could be managed. Similarly, Chen (2001) reported the use of tilt sensors fixed to the headset that the participant wore. The sensors detected the head movements and translated them into movements of the cursor. A further input through a face (cheek) sensor would be added to complete the mouse operations. Betke *et al.* (2002) described a camera mouse system, which was designed to use various forms of movement (and not only head movements) to produce movements of the mouse on the screen. Lancioni *et al.* (2007) introduced a system that relied on the use of a simple, minimal response of the participant (i.e., tongue protrusion or eye turning), a microswitch to monitor it, and a scanning keyboard emulator. The microswitch signal produced by the response could be used to control the key scanning process and ultimately the selection of the keys/letters.

The system developed by Lancioni *et al.* (2007) could be considered (a) fairly simple in terms of response requirements (thus easily used also with persons with pervasive motor disabilities and not likely to be tiring for them), and (b) rather non-invasive (i.e., participants would not be required to wear complex and intrusive materials such as an headset). The preliminary application of the aforementioned system for writing purposes seems to provide it an immediately relevant value. In fact, the perspective of a participant with extensive motor disabilities being able to engage in such an activity without adverse (tiring) effects for relatively long periods of time

would be practically important and have wide-ranging implications (Borghetti et al., 2007; Lancioni, O'Reilly, Singh, Green, Chiapparino, De Pace *et al.,* 2010). Even so, caution may be obligatory until additional evidence is available (i.e., until several successful replications of the preliminary studies have been carried out with various participants). The present study was conceived as (a) a replication effort with a woman with extensive motor disabilities, and (b) a social validation assessment of the system involving university psychology students as social raters (Callahan, Henson, & Cowan, 2008).

2. Method

2.1 Participant

The participant (Beth) was 27 years old, and was considered to be within the typical range of intellectual functioning although no formal testing had been carried out and no IQ scores were available. Due to perinatal hypoxia, she presented with spastic tetraparesis and dysarthria. This condition reduced her motor independence and also interfered with her verbal communication (which was quite tiring for her to produce and very difficult for the listeners to understand). She could easily follow spoken language (i.e., conversations) produced around her and was interested in intervening with her feedback. She could read written text and enjoyed doing so. She was very interested in writing, but the use of a slightly modified keyboard (i.e., a keyboard with a special perimeter to prevent her hand from touching/pressing the keys during its movements) was quite laborious and tiring for her. She had asked for a simpler solution and was eager to use the system available within this study. Her parents provided informed consent for this study, which had also been approved by a scientific and ethics committee.

2.2 Technology and Response

The technology used for the study included a touch pad microswitch, a scanning keyboard emulator (QualiKey by QualiLife UK, Kent TN15 7DA), and a personal computer (PC). The touch pad microswitch could be activated with a small hand stroking response (i.e., a response considered to suitable for Beth because she could perform it fairly quickly, reliably, and without much effort). The touch pad microswitch was adopted because it appeared very practical, simple, and economical.

The keyboard emulator appeared in the lower half of the computer screen. The composition and functioning of the keyboard were adapted to Beth's condition. That is, the keyboard included only the letter keys, which were arranged in three rows. The automatic scanning (i.e., illumination) of

the letter rows and of the single keys (letters) of the rows was set at 2 seconds (see below). In practice, the first response (i.e., microswitch activation) led to the scanning of the first row of letters for 2 seconds. If none of the letters of that row served for the word to be written, Beth refrained from responding and the scanning automatically moved to the next row at the end of the 2 seconds. If Beth responded during the scanning of a row, the scanning process moved immediately to the single keys/letters of that row (2 seconds per key). Responding during the scanning (illumination) of a letter wrote that letter on the upper half of the computer screen. This was followed by the re-illumination of the row and a continuation of the process as described above.

The technology used before the study (i.e., adapted keyboard connected to a computer and related screen) served as a control condition during the study. Specifically, it served for the initial sessions of the study and for the alternating treatments period of the study (see Experimental Conditions).

2.3 Sessions and Data Collection

Sessions involved the writing of six to eight familiar words, which were presented individually by a research assistant. Sessions were followed by brief conversations which the research assistant, on Beth's favorite topics, such as television programs and perfumes (i.e., by events that could be pleasing for Beth and motivating for her efforts). Data collection consisted of recording (a) the time required for writing each word, (b) Beth's responses to 10 preference checks (i.e., Beth's choices of the new technology or of the old technology at the start of preference-evaluation sessions), and (c) the scores provided by the psychology students involved in the social validation process on a 4-item questionnaire (see below). Interrater agreement was assessed over about 20% of the words written during the study and on all preference checks. No agreement was assessed on the students' scores, as they were permanent data. The percentages of agreement were above 95 (allowing a discrepancy of 5 seconds between raters) on the words, and 100% on the preference checks.

2.4 Experimental Conditions

The study included four procedural phases followed by the social validation assessment. During the first procedural phase, Beth was provided with her conventional technology. The second phase involved the use of the new technology system. The third phase compared the two (old and new) systems according to an alternating treatments design (Barlow, Nock, & Hersen, 2009). The fourth phase served for the preference checks.

First phase (traditional technology). This phase included 12 sessions reproducing Beth's normal writing conditions.

Second phase (new technology). This phase included 37 sessions, which differed from those used in the first phase in that they (a) included the new technology and (b) were introduced by practice sessions on the use of this technology. The practice sessions consisted of four periods of about 30 minutes each, during which the research assistant provided any help that Beth would require to use the technology.

Third phase (alternating conditions). This phase included 20 sessions. Ten of them corresponded to those of the first phase and the other 10 corresponded to those of the second phase. The two types of sessions were alternated regularly.

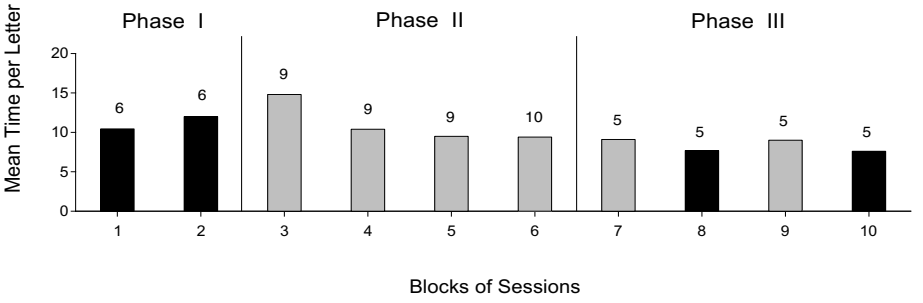
Fourth phase (preference checks). This phase included 10 sessions. Prior to each of them, Beth was asked to indicate which system she wanted to use for the session. The session was then carried out with the system that Beth chose.

Social validation assessment. This assessment involved the participation of 42 psychology university students ranging in age between 21 and 46 ($M = 24$) years. The students watched two 4-minute video clips in groups of two to five members. For one-half of the students, the two video clips concerned Beth's performance in sessions with the traditional technology and in sessions with the new technology, respectively. For the other half of the students, the order of the video clips was reversed. The clips had been selected by two research assistants out of a pool available for the two types of sessions occurred during the alternating conditions phase. The selection was based on the view that they were most representative of Beth's performance during those sessions. After watching the clips, the students were to score the two writing conditions on their presumed suitableness and effectiveness for Beth, on Beth's enjoyment of them, and on the students' personal liking of them. For each item, scores of 1 to 5 were available with 1 being the least positive and 5 the most positive.

3. Results

Figure 1 summarizes Beth's writing data during the first three procedural phases of the study. The sessions are grouped into two blocks for the first phase, four blocks for the second phase, and four blocks (two per technology condition) for the third phase. The number of sessions included in each block (bar) is indicated by the numeral above it. Each bar represents the mean writing time per letter over a block of sessions (i.e., computed over all the words of the sessions included in the block). The writing time per letter of the single words was computed by dividing the number of seconds needed for writing the word by the number of letters written correctly.

Figure 1 - *Each bar represents the mean writing time (in seconds) per letter computed over all the words of a block of sessions with the old technology (black bar) or with the new technology (gray bar). The numbers of sessions included in the bars/blocks are indicated by the numerals above them*



The mean writing time per letter over the two blocks of the first phase exceeded 11 seconds (with a range of 4 to 29 seconds per letter across the single words). The mean writing time per letter over the first block of sessions of the second phase (i.e., immediately after the introduction of the new technology) was about 15 seconds. The range per letter of the single words was 7 to 36 seconds. The mean writing time per letter over the next three blocks of the phase was about 10 seconds (with a range of 5 to 20 seconds per letter across the single words). The mean writing time over the two blocks of sessions of the third phase concerning the new system was about 9 seconds. The mean writing time over the two blocks of sessions concerning the old system was below 8 seconds. During the fourth phase of the study, Beth chose the new system at each of the 10 preference checks. Her writing performance (not reported in Figure 1) was comparable to that observed during the third phase.

The social validation data are summarized in Table 1. The scores of the 42 students had mean values of about 4 and about 2 at each item of the questionnaire for the new and the old technology systems, respectively. Post-hoc paired *t* tests indicated that the score differences were statistically significant on each of the items. The t (41) values were between 10.1 and 14.2 ($p < 0.01$) (Bourke, Daly, & McGilvray, 1985).

Table 1 - *Means (M) and Standard Deviations (SD) of the Students' Scores on the two Technology Conditions across the four Questionnaire Items*

Items	Old Technology		New Technology	
	M	SD	M	SD
1	2.00	0.73	4.26	0.59
2	1.90	0.76	4.19	0.55
3	2.31	1.09	4.12	0.61
4	2.12	1.02	4.14	0.56

4. Discussion

The data of this study indicate that the new system involving the touch pad microswitch and the scanning keyboard emulator allowed Beth to write with a speed similar to that she could manage with the old system. The new system, however, appeared much less demanding for her, and indeed she chose to use it at each of the preference checks. The university psychology students involved in the social validation assessment indicated a clear difference between the systems and attributed much higher (more positive) scores to the new one.

The availability of a writing system that is simple and non-tiring is essential if one has to establish writing as a communication activity or as an instrument to access Internet and engage in information-gathering or leisure activities (Davies, Mudge, Ameratunga, & Stott, 2010). For Beth, the new system may be an important step in this direction (i.e., an opportunity to develop writing along the aforementioned lines with wide-ranging implications for an overall improvement in her condition (Moisey & van de Keere, 2007; Kehoe, Neff, & Pitt, 2009; Lathouwers, de Moor, & Didden, 2009).

The writing speed reported for Beth seems quite modest, and efforts would be needed to improve it. A first effort could concern the adoption of a new response and microswitch that might allow some advantage over the response and microswitch used. For example, one might think of (a) vocalization as a response that can be fast and non-tiring and thus potentially advantageous, and (b) a voice detecting device with a throat and an airborne microphone (Lancioni, Singh, O'Reilly, & Oliva, 2005). A second effort might concern the grouping of two or three letters within each keyboard key (Bache & Derwent, 2008; Lancioni *et al.,* 2010). The person could stop the key when this is scanned and then choose one of the letters included in it with one or more (hand or vocal) responses.

In conclusion, this study provides additional positive evidence as to the possibility of using a simple response and microswitch combined with a scanning keyboard emulator to allow persons with pervasive motor disabilities to write without particular efforts (i.e., without getting tired). These findings support the view that writing may eventually be used for long periods of time, as a tool for elaborate communication and Internet access (Dobransky & Hargittai, 2006; Weber, 2006; Lathouwers *et al.,* 2009). The relative slowness of the writing process, however, calls for new research efforts to find ways of improving this aspect. The aforementioned suggestions of trying new responses and grouping letters within the single keyboard keys could be taken as immediate targets of new research.

References

Bache, J., & Derwent, G. (2008). Access to computer-based leisure for individuals with profound disabilities. *NeuroRehabilitation, 23*, 343-350.

Barlow, D. H., Nock, M., & Hersen, M. (2009). *Single-case experimental designs: Strategies for studying behavior change* (3rd ed.). New York: Allyn & Bacon.

Betke, M., Gips, J., & Fleming, P. (2002). The camera mouse: Visual tracking of body features to provide computer access for people with severe disabilities. *IEEE Transactions on Rehabilitation Engineering, 10,* 1-10.

Borghetti, D., Bruni, A., Fabbrini, M., Murri, L., & Sartucci, F. (2007). A low-cost interface for control of computer functions by means of eye movements. *Computers in Biology and Medicine, 37*, 1765-1770.

Bourke, G. J., Daly, L. E., & McGilvray, J. (1985). *Interpretations and uses of medical statistics* (3rd ed.). London: Blackwell.

Callahan, K., Henson, R. K., & Cowan, A. K. (2008). Social validation of evidence-based practices in autism by parents, teachers, and administrators. *Journal of Autism and Developmental Disorders, 38*, 678-692.

Chen, Y. L. (2001). Application of tilt sensors in human-computer mouse interface for people with disabilities. *IEEE Transactions on Rehabilitation Engineering, 9,* 289-294.

Chen, Y. L., Chen, S. C., Chen, W. L., Luh, J. J., & Lai, J. S. (2003a). Application of SEMG in computer mouse access for the disabilities. *Disability and Rehabilitation, 25,* 218-223.

Chen, Y. L., Chen, W. L., Kuo, T. S., & Lai, J. S. (2003b). A head movement image (HMI)-controlled computer mouse for people: Analysis of a time-out protocol and its applications in a single server environment. *Disability and Rehabilitation, 25,* 163-167.

Davies, T. C., Mudge, S., Ameratunga, S., & Stott, N. S. (2010). Enabling self-directed computer use for individuals with cerebral palsy: A systematic review of assistive devices and technologies. *Developmental Medicine and Child Neurology, 52*, 510-516.

Dobransky, K., & Hargittai, E. (2006). The disability divide in internet access and use. *Information, Communication and Society, 9,* 313-334.

Evans, D. G., Drew, R., & Blenkhorn, P. (2000). Controlling mouse pointer position using an infrared head-operated joystick. *IEEE Transactions on Rehabilitation Engineering, 8,* 107-117.

Hori, J., Sakano, K., & Saitoh, Y. (2006). Development of a communication support device controlled by eye movements and voluntary eye blink. *IEICE Transactions on Information and Systems*, E89D, 1790-1797.

Kehoe, A., Neff, F., & Pitt, I. (2009). Use of voice input to enhance cursor control in mainstream gaming applications. *Universal Access in the Information Society, 8*, 89-96.

Lancioni, G. E., Singh, N. N., O'Reilly, M. F., & Oliva, D. (2005). Microswitch programs for persons with multiple disabilities: An overview of the responses adopted for microswitch activation. *Cognitive Processing, 6,* 177-188.

Lancioni, G. E., O'Reilly, M. F., Singh, N. N., Green, V., Chiapparino, C., De Pace, C., Alberti, G., & Stasolla, F. (2010). Use of microswitch technology and a keyboard emulator to support literacy performance of persons with extensive neuro-motor disabilities. *Developmental Neurorehabilitation, 13*, 248-257.

Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Sigafoos, J., Chiapparino, C., Stasolla, F., Oliva, D. (2007). Using an optic sensor and a scanning keyboard emulator to facilitate writing by persons with pervasive motor disabilities. *Journal of Developmental and Physical Disabilities, 19*, 593-603.

Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Sigafoos, J., Green, V., Chiapparino, C., Stasolla, F., & Oliva, D. (2009). A voice-detecting sensor and a scanning keyboard emulator to support word writing by two boys with extensive motor disabilities. *Research in Developmental Disabilities, 30*, 203-209.

Lathouwers, K., de Moor, J., & Didden, R. (2009). Access to and use of internet by adolescents who have a physical disability: A comparative study. *Research in Developmental Disabilities, 30*, 702-711.

Lau, C., & O'Leary, S. (1993). Comparison of computer interface devices for persons with severe physical disabilities. *American Journal of Occupational Therapy, 47,* 1022-1030.

LoPresti, E. F., Brienza, D. M., & Angelo, J. (2002). Head-operated computer controls: Effect of controlmethod on performance for subjects with and without disability. *Interacting with Computers, 14,* 359-377.

Moisey, S., & van de Keere, R. (2007). Inclusion and the Internet: Teaching adults with developmental disabilities to use information and communication technology. *Developmental Disabilities Bulletin, 35*, 72-102.

Turpin, G., Armstrong, J., Frost, P., Fine, B., Wards, C. D., & Pinnington, L. L. (2005). Evaluation of alternative computer input devices used by people with disabilities. *Journal of Medical Engineering and Technology, 29,* 119-129.

Weber, H. (2006). Providing access to the Internet for people with disabilities: Short and medium term research demands. *Theoretical Issues in Ergonomics Science*, *7*, 491-498.

Life Span and Disability XIV, 1 (2011), 55-74

How couples re-organized themselves following divorce: adjustment, co-parenting and family alliance

Marisa Malagoli Togliatti,[1] *Anna Lubrano Lavadera*,[2] *& Rosa di Benedetto*[3]

Abstract

Divorce represents a breakdown of the individual and familiar life-span, and requires relevant psychological process(es) of reorganization for the components of the broken families. The challenge for divorced parents is that divorce introduces elements of continuity and discontinuity in the evolution of the family. The ex-partners, even though they are no longer married, continue to be co-parent. The aims of this work are to analyse the process(es) of reorganization, in a sample of Italian divorced families (N=93), with regards to the constructs of adjustment to divorce, co-parenting and family alliance and to explore their relationships. Multimethod procedures involve both self report measures for the evaluation of representations' level and observational measures for the evaluation of interactive models. Preliminary results indicate functional and dysfunctional pathways between the families and show the association between representation level and interactive practices.

Keywords: Divorce, Co-parenting, Adjustment to divorce, Family alliance, Family functioning

* *Received*: March 08, 2011; *Revised*: May 11, 2011; *Accepted*: May 16, 2011.

[1] Department of Dynamic and Clinical Psychology, 'Sapienza' University of Rome, Italy. E-mail: marisa.malagoli@uniroma1.it

[2] Department of Dynamic and Clinical Psychology, 'Sapienza' University of Rome, Italy. E-mail: anna.lubrano@uniroma1.it

[3] Department of Dynamic and Clinical Psychology, 'Sapienza' University of Rome, Italy. E-mail: rosa.dibenedetto@uniroma1.it
Corresponding Author. Tel.: +39 06 49 91 7622. Fax: +39 06 49 91 7622
Via dei Marsi, 78, 00185 Roma, Italy

1. Introduction

Divorce represents a breakdown of the individual and familiar life-span, and requires relevant psychological process(es) of reorganization for the components of the broken families.

The aims of this work are to analyse the process(es) of reorganization, in a sample of Italian divorced families, with regards to the constructs of adjustment to divorce, co-parenting and family alliance. These aims are pursuant to those which guided previous research[4], conducted at a national level, and whose objectives included: the possibility that the children of divorced parents, in a conflictual relationship, can enjoy a normative three-way relationship with their parents – a basic prerequisite for the achievement of intersubjectivity (Stern, 2004) – and, moreover, to what degree this possibility may affect their development. The results of this study were consistent with the findings reported in literature (Amato, 2000; Emery, 2004): that is; the existence of a link between family re-organization and the well-being/maladjustment of children following their parents' divorce. For this reason the authors decided it would be of interest to study the process of families' reorganization, following separation, in terms of *emotional adjustment*, *co-parenting* and *family alliance*.

According to Ahrons and Miller (1993) divorced families need from 18 to 24 months to settle and reorganize in a functional way. Literature identifies three major psychological challenges which are specific to divorce adjustment: coordinating parenting with a former partner, the loss of the intimate partner and the loss of social networks associated with the former partner (Sweeper & Halford, 2006). Following divorce, individual well-being tends to decline, in a condition of psychological distress, and the most frequent symptoms are anxiety, depression, psychosomatic symptoms, persecutory ideas, substance abuse or bad habits linked to physical health (Amato, 2000; Kalmijn & Monden, 2006). Such physical and emotional upheaval can last for several years following separation. Some adults are more resilient, while others are more vulnerable to the effects of divorce (Booth & Amato, 1991).

For these individuals, the losses of divorce are difficult to process and couples may display a destructive conflict – *despairing bond* (Cigoli, Mombelli, & Galimberti, 1998) – and dysfunctional co-parenting. Sbarra and Emery (2005) underlined that some parents (15% of sample), 12 years later report on-going co-parenting difficulties and display on-going difficulties in accepting the end of their marriage.

Co-parenting is defined as the parents' ability to support each other in raising children for whom they share responsibility for many years after

[4] Supported by Italian Ministry of Education and Research, 2006-2007.

their divorce (McHale, 1997, 2007). Although the educational needs of children and the consequent roles modify over time, the lives of children and their parents are interdependent (McHale & Rasmussen, 1998). Even some 20 years after parental divorce, children, who are now themselves adults, need contact with their parents, especially in special circumstances such as birthdays, graduations, weddings, etc.

Family alliance is defined as the degree of coordination which family members can achieve and their ability to work together as a team (Fivaz-Depeursinge & Corboz-Warnery, 1999).

2. Aims

Several studies have emphasized the prominent role played by the (parental) non-acceptance of the breakup of the marital bond, as evidenced by impairment in family reorganization following a divorce (Kaslow, 1981; Amato, 2000; Cigoli, 2006).

We tested this hypothesis and if there was any relation between the variables examined: adjustment, co-parenting and family alliance.

Traditionally, these constructs have been studied separately; only in the 1990s did scholars begin to study the relationship between them. McHale and Fivaz-Depeursinge (1999) examined the relationship between co-parenting and family alliances in a sample of families and they hypothesized a relationship between co-parenting typologies and family alliance. Lubrano Lavadera, Di Benedetto and Malagoli Togliatti (2008) examined these constructs in a pilot sample of 33 families undergoing separation, which resulted in some initial indications, which we propose putting to the test and will be indicated in this current paper. Since this work is not longitudinal, we did not give ourselves overly ambitious goals in terms of the epigenesis of processes.

3. Method

The research procedure was multi-method and used both self-reporting and observation. As for Reiss (1989), it is important to examine family processes on both a representative and practicing level. Interactive models and representations may not be the same.

Research protocol consisted of observing the families through *Clinical Lausanne Trilogue Play* (LTPc) during the third or fourth meetings with the consultant. A clinical expert in the procedure conducted the observation session according to rules of LTPc. Participation was obtained through a procedure of informed consent. Both parents provided consent for children. In the same session the mother and father separately completed two

questionnaires about their adjustment to divorce. Two weeks later, the parents were met again with a follow-up observation session. The counsellor was given a diagnostic report on the observation.

3.1 Participants

The sample for this study was composed of 93 heterosexual, 2-parent families. All the families were undergoing judicial divorce and were recruited into counselling by three different court experts in the Rome County Court, located in the urban district of Rome (Italy). These families were in conflict with each other and had great difficulties in defining *"alone"* the transition from family unit to divorced family; they need the intervention of the Court to define the questions about their children: i.e. custody, visit plannings, parental and co-parental roles.

Divorce proceedings are, on average, begun 2.3 years before court expert interventions. The presence of at least one child was a requirement for inclusion in the sample. The mean age of the Mothers was 40.70 yrs. old (*SD* = 5.57, age range, 26-54) whilst the father's mean age was 44.20 (*SD* = 6.16, age range, 33-64). The parents' Educational level was in line with the Italian national rate (33% of parents had received junior-school education, 36% secondary-school education and 31% had completed an academic degree).

With regards to the life cycle of the families we recruited, most of them had children of school age. The number of children for each family was in line with the national socio-demographic trend which tends towards the constitution of families with only one child and the lack of large families with 3 or more children (in line with, moreover, the lower tendency for divorce in larger families): 49 families had only 1 child; 38 families had 2 children; 5 families had 3 children and 1 family had 4 children. The mean age of the children was 8.82 yrs. (*SD* = 3.72). Male was 74 and female 69.

3.2 Measures

Separation Adaptation Scale (Ardone & Lucatello, 1999) was used to measure the adjustment to divorce. SAS is a self-reporting instrument created from an Ahrons' questionnaire (1980) and validated on the Italian population (Ardone & Lucatello, 1999). It assesses different features of co-parenting couples following divorce. It is a 60 item questionnaire on a 5-point Likert scale (1 = functional; 5 = dysfunctional) divided into 10 dimensions which are factored into two major dimensions: the *parental dimension*, which refers to parental cooperation for children's wellbeing – involved the following areas: conflict; parental collaboration; attitudes about the other as a parent; parental interaction; parental involvement - and the *dimension of emotional involvement with the former partner* which includes marital interaction, anger; guilt; positive feelings and psychological distance. The SAS displays good reliability: Cronbach α coefficients of *Parental Dimension* range between .65 and .95; Cronbach α coefficients of

Emotional Dimension range between .60 and .89. Cronbach α coefficient of 2 Dimension was .80.

Co-parenting Scale-revised (McHale, 1999), was used to assess co-parenting. It is a self-reporting instrument made up of 23 items on a seven-step Likert scale (1 = never; 7 = always). It is designed to assess separated parents' perception of the frequency with which they engage in several activities related to co-parenting and to promoting their children's sense of family. The scale is presented as two distinct sets of questions: 5 items involve behaviour regarding each parent alone with the child and 18 items involve behaviour regarding the family triad or as a group. The scale measures four dimensions of the co-parental relationship: *Family Integrity* involves both overt and covert behaviour promoting a sense of united family; *Disparagement* reflects active criticism of the co-parent and undermining of his or her authority and credibility. It measures the frequency with which one parent derides the absent parent in the child's presence: thus undoing the co-parent's discipline. *Conflict*: frequency with which parents argue in front of child in a strong or moderate manner. *Reprimand*: frequency with which parents are involved in co-parental disciplinary activities and it includes behaviour indicating both parental limit-setting and the family unit during an interaction with the child. The Co-parenting Scale displays good reliability: Cronbach α coefficient of Reliability for the 4 Scales ranges between α = .50 and α = .80. Cronbach α coefficient of 4 scales = .76.

Clinical Lausanne Trilogue Play (LTPc; Malagoli Togliatti & Mazzoni, 2006). Triadic interactive processes have been explored through LTPc. LTPc was a semi-structured observational procedure which assesses the construct of "family alliance". Observation takes place in a semi-structured setting, i.e.: in a room with 2 cameras and a two-way mirror which enabled observation of play from outside the play-room. The setting consisted of a round table around which we arranged chairs according to the number of participants. To facilitate interaction with the child (ren), the parents' seats were turned towards the child's seat – which is (are) put between them – rather than facing towards each other.

According to the child's age, we provided toys, LEGO© (for children aged from 2 to 10), or sheets of white paper and a single pen (for children aged from 11 to 17). The family was asked to build something together with LEGO© bricks or, for older children, to write a story about a week end spent separately from parents. The families were instructed to play together following the rule of alternating 4 distinct phases: one parent had an active role and the other observes (2+1); the parents switched roles (2+1); both parents played with the child together (3 together) and in the fourth phase, the child was the third phase, while parents interact with each other (1+2).

The total duration of play was a standard time of 15/20 minutes, but the duration of each individual phase of the play (i.e.: 2+1; or 3 together) was not established by the researcher. The duration of each phase was regis-

tered and codified according the coding system. The consultant gave the instructions and then observed the family through the two-way mirror.

The coding followed the procedure outlined in the handbook (Castellina, Franci, & Mazzoni, 2006). Based on *structural* and *functional/clinical* readings coding system regarded mother, father and child/children during each phase of play and for each functional level (*participation, organization, focalization, affective contact)* and provided *dimensional* and *categorical* assessments. A handbook provides the coding criteria and examples (Castellina *et al*., 2006). *Dimensional assessment* is carried out by judges through *structural reading* and provides a family functioning global score between 0 and 40. The higher the score, the more the family alliance is considered to be functional.

Through a macro-analytic coding system it is possible to codify the 4 *functional levels* which lie at the basis of family functioning*:* a) *participation;* b) *organization;* c) *focalization;* d) *affective contact* (Fivaz-Depeursinge & Corboz-Warnery, 1999), differentiated according to 3 levels of appropriateness (0 = inappropriate; 1 = partially appropriate; 2 = appropriate). *Categorical assessment* is carried out by judges through the *functional and clinical reading* after the *structural reading.* The *functional and clinical reading* outlined family functioning on the basis of the global characteristics of interaction. It involves a narrative report of the play, in which coders described everything which took place during the play session.

Functional and clinical reading assessed the clinical diagnosis of family alliance(s). Four family alliances can be diagnosed, following these operative definitions: (A) *the cooperative alliance*. Families were able to reach the goal of affective sharing and of the play. All the 4 phases were correctly played out and each functional level was processed in a functional way. (B) *The stressed alliance* appeared in families who were able to reach the goal of affective sharing, but who committed interactive mistakes; mistakes which were, however, repairable later, restoring a tone of collaboration. The affective tone was one of warmth. (C) *The collusive alliance* was typical of families who didn't carry out all phases of the play (i.e.: omitted one or more phases); didn't reach the aims of play and did not share positive affects. Regarding the functional level, these families maintained an appropriate level only in *participation*. (D) *The disordered alliance* displayed the highest degree of dysfunction. The main characteristic is the exclusion of one member from family: the basic functional level of *participation* was in-appropriate, so as the levels of *organization, focalization* and *affective contact*.

LTPc displays good validity and reliability (Lubrano Lavadera, Mazzoni, Malagoli Togliatti, & San Martini, 2007). Reliability for the functional level (*participation, organization, focalization* and *affective contact*) (interclass coefficients) ranges between $\alpha = .43$ and $\alpha = .75$. These results showed acceptable levels of internal coherence for the functions of participation,

focalization and affective contact, whereas the function of organization showed a low level of internal coherence. The item analysis for this last functional level showed that the absence of the score of the fourth phase created a slight improvement of internal reliability index of this functional level: $\alpha = .46$; $\check{r} = .22$. Cronbach α coefficient of 4 functions is .88 and a mean correlation coefficient among the 4 functions is $\check{r} = .67$. These results justified the use of a global score (cross-function).

4. Data Analysis

The Statistical Package for Social Science (SPSS) was used to conduct bi-variate and multi-variate analyses relating to independent variables. For the statistical tests we used more conservative levels of critical alpha for single comparisons: .01, instead of .05 as a critical level in order to control I° type error. Furthermore, given the low number of subjects, we did not adopt a more rigorous method to control type I error inflation in order that the efficacy of the test not be excessively lowered. We made post-hoc comparisons among mean results, only after measuring F omnibus significance, using the LSD procedure (*Least Significant Difference*).

4.1 Results

Family alliance

Only 83 families were observed through the LTPc. Clinical LTP captures different relational and co-parental patterns in the family following parental divorce. According to the research questions we found different coordination capacities among divorced parents in conflict: indeed, results show that it is possible to observe different relational patterns in the family following divorce. Families with dysfunctional alliance(s) prevailed (noted as families with a collusive alliance and families with a disordered alliance) in the sample: in these families the trans-generational relationship is *pathological*. More specifically, we found 30 families with collusive alliance; 28 families had a diagnosis of disordered alliance; 19 families presented a stressed alliance, while 6 families presented a cooperative alliance (Tab. 1).

The overall average score of families was 18.81 ($SD = 8.32; n = 83$) and the overall average scores of each participant were: 17.04 for mothers ($SD = 6.73$; $n = 83$), for the fathers 17.16 ($SD = 6.92$; $n = 83$), for the 1st child 18.6 ($SD = 7.01, n = 83$) and the 2nd child 17.22 ($SD = 6.45, n = 40$). Participants obtained scores that did not differ significantly between each other, that is; there does not seem to be an individual who works better or worse than the other [$F_{(1,82)} = 2.93$, $p = .07$]. Furthermore, a significant effect of phase [$F_{(3,80)} = 92.01, p < .01$] was found. Post-hoc tests showed that the average score of the last phase is significantly lower than those of the other phases, thereby demonstrating greater difficulty for families to carry out the last phase of play.

Table 1 - *Alliance frequences*

	N	%	Global score
Disordered alliance	28	33.72%	8.12
Collusive alliance	30	36.13%	19.93
Stressed alliance	19	22.97%	27.92
Collaborative alliance	6	7.23%	40.05
n	83	100%	

Adjustment to divorce

SAS and Coparenting were completed by 68 couples of parents. Parents had similar perceptions about their own adjustment to divorce (Tab. 2 & 3): there was no difference between the mean scores of fathers and mothers as regards to the *parental dimension* [$F_{(1,67)} = .06; p > .01$] and the *affective dimension* [$F_{(1,67)} = 1.31; p > .01$]. However examining the subscales of the *parental dimension* we found a significant difference between the mean scores of fathers and mothers in *parental involvement* subscales [$F_{(1,67)} = 6.27; p < .01$]: mothers claimed to be more involved in their childrens' lives than fathers; and in the "*attitudes toward each other as a parent"* subscale [$F_{(1,67)} = 5.67; p < .01$] i.e.: fathers evidenced a better view of mothers as parents. Here, too, the difference in *parental involvement* is significant: the mothers describe themselves as being more involved in the daily lives of their children [$F_{(1,67)} = 7.22; p < .01$].

In the *affective dimension* we found a significant difference between mothers and fathers *psychological distance* [$F_{(1,67)} = 4.86; p < .01$]: the fathers describe themselves as more emotively distant than the other parent. Both parents described themselves as less prone to conflict and less collaborative.

Mothers and fathers had not reached an appropriate psychological distance, despite a denial of feelings of anger or guilt towards the other parent. These data suggest ambivalence in the elaboration of the divorce.

Table 2 - *Parental Dimension - Mothers' and fathers' mean scores*

	Mothers			Fathers			
	n	*Mean*	*SD*	*n*	*Mean*	*SD*	*F*
PARENTAL DIMENSION	68	2.96[a]	.50	68	2.92[a]	.67	.06
Conflict	68	2.74[a]	1.28	68	2.65[a]	1.06	.72
Cooperation	68	1.74[a]	.76	68	2.01[a]	.75	2.93
Attitude about the other as a parent	68	2.73[a]	.83	68	3.19[b]	1.03	5.67
Parental interaction	68	2.36[a]	.99	68	2.23[a]	1.12	.02
Parental involvement	68	4.32[a]	.82	68	3.77[b]	1.12	7.22

Post hoc test; a, b: different letters indicate means significantly different, $p < .01$.

Table 3 - *Emotional Involvement Dimension - Mothers' and fathers' mean scores*

	Mothers			Fathers			
	N	*Mean*	*DS*	*n*	*Mean*	*DS*	*F*
EMOTIONAL DIMENSION	68	1.93[a]	.51	68	2.02[a]	.58	1.31
Marital interaction	68	1.35[a]	.32	68	1.42[a]	.52	.51
Anger	68	1.83[a]	.48	68	1.88[a]	.45	.13
Guilt	68	2.08[a]	.94	68	2.13[a]	.85	.00
Positive feelings	68	2.12[a]	.66	68	2.34[a]	.94	1.31
Psychological distance	68	1.89[a]	.98	68	2.35[b]	1.13	4.86

Post hoc test; a, b: different letters indicate means significantly different, $p < .01$.

Table 4 - *Co-parenting Scale-revised - Mothers' and fathers' mean scores*

		Mothers		Fathers		
	N	*Mean*	*DS*	*Mean*	*DS*	*F*
Family Integrity	68	3.51[a]	.92	4.2[b]	1.10	4.06
Disparagement	68	2.13[a]	.75	2.46[a]	.72	.87
Conflict	68	2.56[a]	1.35	2.34[a]	1.46	.51
Reprimand	68	3.24[a]	.63	3.05[a]	.82	.62

Post hoc test; a, b: different letters indicate means significantly different, $p < .01$.

Co-parenting

The mean scores obtained from mothers and fathers did not differ in some subscales of the Co-parenting subscale: *Conflict, Disparagement* and *Reprimand* (Tab. 4). The sole difference is to be found in the *Family Integrity* subscale [$F_{(1, 67)} = 4.06; p < .01$]. These parents report that they rarely implement behaviours designed to evoke the family unit. However, fathers are those who describe themselves as more inclined to implement this type of behaviour.

Both mothers and fathers reported that they did not implement behaviour(s) which undermine the authority or credibility of the other parent (*Disparagement: Mother* = 2.13, *SD* = .75; *Father* =2.46, *SD* = .72). In the *Conflict* subscale both referred no discussion in the presence of the child (*Mother* = 2.56, *SD* = 1.35; *Father* = 2.34, *SD* = 1.46).

Mothers and fathers intervened early to standardize the behaviour of children, without delegating this task to the other parent (*Mother* = 3.24, *SD* = .63; *Father* = 3.05, *SD* = .82).

Parental adjustment (SAS) and family functioning (LTP)

There were no significant correlations between the overall score obtained by the family at LTPc and the two variables measured by SAS. The only significant correlation was between the mothers' *affective dimension* and the forth part of LTPc ($r = .38, p < .01, n = 68$): if mothers perceived the emotional relationship with father as functional then there was better functioning in the fourth part of the LTPc. Higher scores for fathers in the *parental dimension* were associated with higher scores in the *organization dimension* ($r = .43, p < .01, n = 68$).

Parental Adaptation (SAS) and co-parenting

The results displayed statistically significant correlations. The principal correlation regards the correlation emerging between the mothers' *Family Integrity* scale to the Co-parenting Scale and the scores obtained in *Parental Dimension* of the SAS ($r = .69$, $p < .01$, $n = 68$). The more the mothers perceive a sense of family unity, the more they feel the parental dimension to be functional and *vice versa.*

For fathers, though, *Family Integrity* was correlated both to their own scores in the *Emotional Dimension* of SAS ($r = .54$, $p < .01$, $n = 68$) and also to the scores obtained by the mothers ($r = .57$, $p < .01$, $n = 68$). For fathers, family integrity is related to the management of both their own emotional aspects and those of the other partner. For mothers, however, the only significant results are those regarding: correlation with the subscale of *positive feelings* (SAS) ($r = .56$, $p < .01$, $n = 68$); and non-parental interaction ($r = .70$, $p < .01$, $n = 68$): that is; mothers perceive more positive feelings towards the other partner and are more willing to interact with each other on a non-parental level and *vice versa*.

Compared to the scale of *Devaluation* of Co-parenting it can be seen that the score obtained from fathers was positively and significantly correlated to the score obtained in the *Emotional Dimension* ($r = .4$, $p < .01$, $n = 68$) i.e.: the more fathers tend to seek a non-parental relationship with the other partner, the more they tend to implement devaluating behaviour towards that partner and *vice versa*. No significant correlations between the scale of the *Conflict* of Co-parenting and the principal dimensions of SAS emerged. However, there was a positive correlation between the score obtained by fathers on this scale and the score obtained by both parents in the SAS sub-scale of *Conflict* (parents $r = .63$, $p < .01$, $n = 68$).

Lastly, a negative and statistically significant correlation was found between maternal ratings on the Co-parenting scale of *Blame,* and paternal ratings of the SAS *Parental Dimension* ($r = -.55$, $p < .01$, $n = 68$). No significant correlation with the *Emotional Dimension* emerged.

Triadic family functioning (LTPc) and Co-parenting

The scale of *Family Integrity* of both the father and the mother was positively correlated with the overall score of the father ($r = .35$, $p < .01$, $n = 68$) and mother ($r = .41$, $p < .01$, $n = 68$) to LTPc. Likewise, the Co-parenting *Conflict* scale of the father correlated negatively with several different scores obtained by families in LTPc; most notably, the family's *global score* ($r = -.68$, $p < .01$, $n = 68$). The scale of Conflict then correlated with the functional levels of *Participation* ($r = -.62$, $p < .01$, $n = 68$), *Organization* ($r = -.72$, $p < .01$, $n = 68$) and *Attention* ($r = -.68$, $p < .01$, $n = 68$), with scores of 1nd child ($r = -.68$, $p < .01$, $n = 68$), of mother ($r = -.59$, $p < .01$, $n = 68$), of father ($r = -.58$, $p < .01$, $n = 68$) and with the score of the family in the third phase of LTPc ($r = -.66$, $p < .01$, $n = 68$). No other significant correlations emerged.

5. Discussion

The current work represents a study aimed at understanding family functioning and parental adaptation to divorce in relation to specific dimensions in a sample of couples involved in conflictual divorce proceedings. Moreover, it should be noted that this sample recruited couples in judicial divorce proceedings, a procedure which, in Italy, usually lasts more than three years. The families under consideration are characterized mainly by a dysfunctional operation, with problems relating to the management of family roles and competition between parents (collusive alliances) or to participate in family interaction, with the dynamics of exclusion or self-exclusion (disturbed alliances).

The result is in line with similar studies (Malagoli Togliatti & Lubrano Lavadera, 2006; Lubrano Lavadera *et al*., 2008; Lubrano Lavadera, Laghi, & Malagoli Togliatti, *in press*). The data is interesting in relation to the timing of our observations: the observed families are divorced by an average of two years and, according to several authors (Ahrons & Miller, 1993), it is at this moment that a divorced family unit should reorganize itself in a functional way. These families, therefore, belong to that minority of cases: families who experience difficulties in achieving this aim.

This result is, however, easily explained; given that we are dealing with divorced families, where their conflict is expressed in the Court Room. It is, though, surprising to observe the high number of families with a type B, stressed, functional alliance. It should be remembered that, when speaking of a stressed alliance, we intend an alliance where the family manages to reach the goal of playing together, but encounters some obstacles along the way. The *relational dance* on the whole is positive. Families observed with a stressed alliance, on average, have difficulties in the last phase. These couples that fall into this typology manage to conceal their own level of conflict in the parental relationship, even though they are in conflict within the marital sphere. This interesting result is in line with other researchers' findings (McHale, 1995) according to which the conjugal and co parental subsystems are constructs neither completely independent nor completely super-imposable(Schoppe-Sullivan, Mangelsdorf, Frosch, & McHale, 2004).

Most families show a collusive alliance: these are the families that are not able to adequately coordinate themselves especially regarding (re)organization. In these families, the members have shown difficulty in staying inside their own roles and respecting the role of the family's other members (organization level). The characteristic peculiar to these interactions is that of open or hidden competition between parents and the elevated level of the child's involvement in parental conflict. These parents demonstrated the incapacity to separate their marital role from their parental role, i.e.: that the dysfunctional marital aspects of their relationship are the domi-

nant ones. Through the process of *spill over* (Katz & Gottman, 1996), marital conflict can invade the parental and co-parental functions, and make parenting more inconsistent and less authoritative: thereby making parents less willing to deal with the emotional problems of their children. Erel and Burman (1995) suggested that parents may balance their dissatisfaction in the marital relationship, through the intensity of the relationship with the child. However, this compensatory mechanism fails to protect the children and involves them in a dysfunctional relationship.

Families with a disordered alliance have also been observed in our study. Data show that these are families in which, during structured observation with the LTPc procedure, not even the participation of all the divorced family's members is guaranteed. These couples display dysfunctional co-parenting and have frequently discrepancies in their involvement with their child (McHale, 1995).

We found that families encountered greater difficulties during in the last phase of play: when we asked parents to interact with each other and to let their children play alone. In divorced families the last phase of the play can be much more difficult and the parents were unable to interact with each other; thus excluding the child from interaction. This is a two-way process: from the parents' side; parents did not avert their attention from the child, whilst from the child's side; the child him/herself intervened in a *protective* manner in those parental interactions perceived to be at risk (of conflict). The fourth phase is the only phase in which the ex-couple is involved on two relationship levels: the marital level (explicit) in that they must interact directly with each other; and the parental level (implicit) in that the child observes them as parents and is under their responsibility. The families can show difficulties in separating themselves from the child. Marital conflict, in fact, can invade co-parental relationship through *spill over* process, and make co-parenting more hostile and less affective.

As regards the *adaptation of parents to the divorce*, mothers and fathers perceive themselves averagely adjusted to the *parental dimension*, but less adjusted on an *emotional* level. As highlighted in literature (Wang & Amato, 2000; Ahrons & Tanner, 2003), these are ex-partners who are still emotionally involved and who experience difficulties in reorganizing marital separation. No significant differences emerge in perceptions of ex-spouses, except for some subscales of the two main dimensions of the SAS. In particular, mothers report a greater commitment and involvement in activities concerning children *(parental involvement)* than fathers (it should be remembered that mothers are the parent to whom the child has been awarded). Di Benedetto (2009) showed similar results.

Similarly, literature (Katz & Gottman, 1996) about the involvement of fathers in the lives of children following separation appears to corroborate this fact. Ahrons and Tanner (2003) consider that, in most cases, the involvement of fathers in the lives of children increases or remains stable. It

can be compromised by the persistence of destructive forms of inter-parental conflict. Marsiglio, Amato, Day & Lamb (2000) indicate that it is precisely the mother's role of "guardian" which hinders the involvement of fathers in the lives of. This refers to the concept of *gatekeeping*: that is; the mother's role of *moderator* in promoting or hindering the involvement of fathers in the lives of their children (Fagan & Barnett, 2003).

Fathers, then, are those most affected by the conflict, and tend, therefore, to react with disengagement (Katz & Gottman, 1996; Lamb, 1997). In the scale of *psychological distance*, it is fathers who, on average, obtain higher scores in the degree of distance-involvement in the relationship with the ex-partner. The mothers describe themselves as less emotionally involved with their ex-spouse than the fathers do. This finding is consistent with the study by Wang and Amato (2000), in which women seem to display a better degree of adaptation to separation. In this study, not only did the women participants report that their ex-partner's welfare was of lesser concern to them, but also that they were overall less involved with him. Moreover, according to the authors, it is men who evidence a greater attachment to their ex-partners than women do.

Sweeper and Halford (2006) argue, in fact, that the loss of the intimate relationship with each other is one of three divorce challenges which couples face, and that this is a significant predictor of adaptation to separation. For the other scales, no significant differences emerge: mothers and fathers do not seem to be afflicted by feelings of guilt for the separation, whilst they seem to deny feelings of anger and resentment towards each other: fathers, especially, report that they display positive feelings of affection and interest, as also found in searches of Lubrano Lavadera *et al*. (2008) and Di Benedetto (2009).

These results suggest ambivalence within the process of elaboration towards the – still incomplete – separation and reveal the difficulty for both parents to recognize the other as an interlocutor, when faced with the reciprocal desire for them both to be present in the lives of their children (ibid.). The process of individual and relational adaptation and reorganization as a result of the divorce is a long, non-linear process (Bohannan, 1970; Kaslow, 1981; Cigoli, 2006) and it is possible that the ex-partners can remain "stuck" in a phase, unable to overcome it, and consequently fail to develop the event of divorce, with the risk of developing problems of adjustment.

As regards assessment of the *co-parental* relationship, there were no significant differences in the perceptions of either mothers or fathers. Both parents perceive the presence of a conflict on matters pertaining to their children and state that they do not implement behaviours which can promote a sense of family unity. That is, the possibility of establishing functional co-parenting with the other parent following divorce, as the processes of *spill-over* (McHale, 2007), seem to be related to each spouse's adaptation to the separation from their spouse, or to their ability to relate to one another

in a manner free from feelings of anger, guilt, disappointment (Kaslow, 1981; Amato, 2000; Cigoli, 2006). However, neither of the two parents, state that they implement conduct designed to disqualify the other. The prevailing style seems to be a competitive style. Similar results were found by Lubrano Lavadera *et al*. (2008).

The breakdown of the marital bond may be associated to a "decline of parental ability" (Cigoli, 1998) and parents can be less sensitive to the needs of their children (Dowling & Gorell Barnes, 2000). For mothers, the presence of both covert and overt behaviour which promotes the sense of a team and a sense of family unity *(Family Integrity)* is associated with the perception of a good level of co-operation with the father in raising children *(Parental Dimension).* However, where mothers perceive fathers to be little present and uninvolved, they intervene of their own initiative to regulate the behaviour of their children and *vice versa*: the more mothers manage parenting alone, the more fathers tend to disengage. Literature finds that that co-parental interaction of fathers with mothers is correlated to the emotional aspects inherent in divorce. The more ex-spouses are perceived to have become 'adapted' towards the separation, the more fathers perceive positive feelings of family integrity; similarly, the more a sense of family integrity is perceived, the more parents will be willing to engage in non-parental interaction (that is; about matters not regarding parenting) and the less they will devalue each other (Lubrano Lavadera *et al. 2008*). For mothers, the perception of positive feelings toward the ex-spouse is an important factor in promoting behaviour which is designed to lead to family integrity, or a sense of family unity. Likewise, Katz and Gottman (1996) found that mothers are very sensitive to the removal of the spouse in exercising their emotional co-parenting.

Lastly, data reveal significant relationships between *family functioning* and *co-parenting*. Both parents obtain higher scores in LTPc – or, more precisely, more adequate levels of functioning – where they perceive a sense of family unity (and *vice versa*). Additionally, fathers' assessments of the frequency with which discussions take place in the presence of the child *(Conflict)* correlate with the LTPc *family functioning*. As evidenced in literature (Katz & Gottman, 1996; Marsiglio *et al*., 2000; Ahrons & Tanner, 2003), fathers are more affected by conflict than mothers, something which would seem to condition the functioning of the family as a whole. Mothers seem to be able to preserve more of their parental role from unresolved emotional issues. These issues are correlated, in fact, only to their functioning in the fourth stage of LTPc, which is the stage where non-parental interaction is more greatly required (Katz & Gottman, 1996).

These correlations between the constructs also provide information about the concurrent validity of the instruments. In particular, the *parental dimension* – measured by SAS – appears to be correlated to various measures of the Co-parenting Scale, indicating that both instruments measure constructs which are partially similar or related.

6. Conclusion

We found different patterns of family coordination among parents involved in a conflictual divorce and who continue to enact their conflict in court after two years of divorce. There was a prevalence of families with a dysfunctional alliance. These parents evidenced difficulty in separating their marital role from their parental role: most mothers and fathers had not reached an appropriate psychological distance - despite denying feelings of anger or guilt towards the other parent. They displayed ambivalence in their elaboration of the divorce and, at times, showed difficulties in separating themselves from the child. Marital conflict, in fact, can invade the co-parental relationship through *spill over* processes, and make co-parenting more hostile and less affective. The father's co-parenting skills and LTPc functioning seemed to be more associated to their affective adjustment to divorce than to the mothers themselves. However, as pointed out by Katz and Gottman (1996), mothers and fathers are affected by different factors: fathers were seen to be more influenced by marital hostility, towards which they react with behaviours of disengagement towards their children; mothers, on the other hand, were seen to be more affected by the partner's emotive distancing and became more hostile and less collaborative in carrying out educative processes.

A limitation of the study regards the size of sample which is too small to consent complex statistical elaboration; moreover the sample's characteristics – i.e.: situated in Rome district – limit the generalizability of results. Another limitation of present study is that it is correlational and not longitudinal. Only longitudinal research can solve some questions about processes and causal relationships.

This study may be useful in promoting specific interventions to help divorced parent to redefine the boundaries of their relationship in terms of co-parenting. The results of this research may be useful, in fact, in designing specific interventions for divorced families by selecting the level – "point of entry" – from which to implement the intervention itself. For example, for some families it may be more effective to begin with the co-parental relationship, that is; work through Family Mediation. For other families, it will be necessary to begin with the parent-child dyadic relationship; that is, Intergenerational Mediation. For still others it will be necessary to work upon the family as a whole via Family Divorce Therapy; whilst in some other cases, it will be necessary – as a starting point – to carry out individual work on the development of negative experiences related to the divorce. Properly structured intervention decreases the risk of mistakes or failures and increases the compliance of individual family members to treatment.

Moreover, in terms of social policies, the results of this study are useful in understanding the real difficulties which, despite the legislative guidelines (Italian Law 54/2006), still remain in applying shared custody

(Malagoli Togliatti, Lubrano Lavadera, Caravelli, & Villa, 2009; Malagoli Togliatti & Lubrano Lavadera, 2011; Lubrano Lavadera, Caravelli, & Malagoli Togliatti, *in press*). There are, in fact, some families for whom separation is an insurmountable, evolutive task, which amplifies any individual problems present, and makes it difficult, if not impossible, to conceive of maintaining a relationship with the other party as a parent. For these families it will be necessary to create 'ad-hoc' interventions so that they can identify themselves as parents and effectively manage functional co-parenting. These initial results are also indicative of the validity of the instruments used to assess constructs related to each other and to indicate a relationship between the level of representations and the interactive practices of the divorced family (Reiss, 1989).

References

Ahrons, C. R. (1980). Divorce: A crisis of family transition and change. *Family Relations,* 29, 533-540.

Ahrons, C. R., & Miller, R. B. (1993). The effect of the postdivorce relationship on paternal involvement: A longitudinal analysis. *American Journal of Orthopsychiatry*, *63*, 441-450.

Ahrons, C. R., & Tanner, J. L. (2003). Adult children and their fathers: relationships changes 20 years after parental divorce. *Family Relations*, *52*, 340-351.

Amato, P. R. (2000). The consequences of divorce for adults and children. *Journal of Marriage and the Family, 62*, 1269-1287.

Ardone, R., & Lucatello, V. (1999). *Separation Adaptation Scale.* Unpublished manuscript.

Bohannan, P. (1970). The six stations of divorce. In P. Bohannan (Eds.) *Divorce and after* (pp. 29-55). New York: Doubleday.

Booth, A., & Amato, P. (1991). Divorce and psychological stress. *Journal of Health and Social Behavior, 32*, 396-407.

Castellina, I., Franci, M., & Mazzoni, S. (2006). Il Lausanne Trilogue Play clinic (LTPc). In M. Malagoli Togliatti & S. Mazzoni (a cura di), *Osservare, valutare, sostenere la relazione genitori-figlio: il Lausanne Trilogue Play clinic (LTPc)* (pp. 55-91). Milano: Raffaello Cortina.

Cigoli, V., Mombelli, M., & Galimberti, C. (1988). *Il legame disperante*. Milano: Cortina.

Cigoli, V. (1998). *Psicologia della separazione e del divorzio*. Bologna: Il Mulino.

Cigoli, V. (2006). *L'albero della discendenza.* Milano: Franco Angeli.

Di Benedetto, R. (2009). *La riorganizzazione delle relazioni familiari in situazioni di rottura del legame coniugale: adattamento, stili di gestione del conflitto e coordinazione co-genitoriale*. Tesi di Dottorato, Biblioteca Centrale di Roma e Firenze.

Dowling, E., & Gorell Barnes, G. (2000). *Working with children and parents through separation and divorce*. Basingstoke: MacMillan.

Emery, R. E. (2004). *The truth about children and divorce. Dealing with the emotions so you and your children can thrive*. New York: Plenum Press.

Erel, O., & Burman, B. (1995). Interrelatedness of marital relations and parent-child relations: a meta-analytic review. *Psychological Bulletin, 118*, 108-132.

Fagan, J., & Barnett, M. (2003). The relationship between maternal gate-keeping, paternal competence, mothers' attitudes about the father role, and father involvement. *Journal of Family Issues*, *24*, 1020-1043.

Fivaz Depeursinge, E., & Corboz Warnery, A. (1999). *The primary triangle.* New York: Basic Books.

Kalmijn, M., & Monden, C. W. S. (2006). Are the negative effects of divorce on well-being dependent on marital quality? *Journal Of Marriage and Family, 68*, 1197-1213.

Kaslow, F. W. (1981). Divorce and divorce therapy. In A. S. Gurman & D. P. Kniskrern (Eds.), *Handbook of Family Therapy* (pp. 662-696). New York: Brunner and Mazel.

Katz, L., & Gottman, J. (1996). Spillover effects of marital conflict: In search of parenting and co-parenting mechanisms. In J. McHale e P. Cowan (Eds.), *Understanding how family level dynamics affect children's development: Studies of two parent families* (pp. 57–76). San Francisco: Jossey-Bass.

Lamb, M. E. (1997). *The Role of the Father in Child Development*. New York: Wiley.

Lubrano Lavadera, A., Mazzoni, M., Malagoli Togliatti, M., & San Martini, P. (2007). LTPc: attendibilità di un metodo di osservazione diretta delle relazioni familiari. *Rivista di Studi Familiari*, *2*, 29-50.

Lubrano Lavadera, A., Di Benedetto, R., & Malagoli Togliatti, M. (2008). Il processo di riorganizzazione delle relazioni familiari delle famiglie separate: adattamento, co-genitorialità e alleanze familiari. *Rivista di Studi Familiari, 2*, 76-94.

Lubrano Lavadera, Laghi, F., & Malagoli Togliatti, M. (*in press*). Assessing family coordination in divorced families. *American Journal of Family Therapy*.

Lubrano Lavadera, A., Caravelli, L., & Malagoli Togliatti, M. (*in press*). Joint custody and shared parenting: analysis of practices in the Civil Court of Rome. *Family, Interdisciplinary, Research*.

Malagoli Togliatti, M., & Mazzoni, S. (2006) (a cura di). *Osservare, valutare e sostenere la relazione genitori-figli. Il Lausanne Trialogue Play Clinico (LTPc)*. Milano: Cortina.

Malagoli Togliatti, M., & Lubrano Lavadera, A. (2006). Il LTP clinico come strumento a tutela del minore nelle separazioni conflittuali. *Infanzia e adolescenza, 5*, 125-135.

Malagoli Togliatti, M., & Lubrano Lavadera, A. (2011). *Bambini in Tribunale*. Milano: Raffaello Cortina.

Malagoli Togliatti, M., Lubrano Lavadera, A., Caravelli, L., & Villa, F. (2009). Affidamento condiviso e condivisione della genitorialità all'indomani della rottura coniugale. *Minorigiustizia*, *2*, 30-51.

Marsiglio,W., Amato, P. R., Day, R. D., & Lamb, M. E. (2000). Scholarship on fatherhood in the 1990s and beyond. *Journal of Marriage and the Family*, *62*, 1173-1191.

McHale, J. P. (1995). Co-parenting and triadic interactions during infancy: the roles of marital distress and child gender. *Developmental Psychology, 31*, 985-996.

McHale, J. P. (1997). Overt and covert co-parenting processes in the family. *Family Process, 36*, 183-201.

McHale, J. P. (1999). The Co-parenting Scale. Unpublished Manuscript.

McHale, J. P. (2007). *Charting the bumpy road of co-parenthood*. Washington: Zero to Three Press.

McHale, J. P., & Rasmussen, J. L. (1998). Co-parental and family group-level dynamics during infancy: early family precursors of child and family functioning during preschool. *Development and Psychopathology*, *10*, 39-59.

McHale, J. P., & Fivaz-Depeursinge, E. (1999). Understanding triadic and family group process during infancy and early childhood. *Clinical Child and Family Psychology Review*, *2*, 107-127.

Reiss, (1989). The represented and practicing family. In A. J. Sameroff & R. N. Emde (Eds.), *Relationships disturbances in early childhood. A developmental approach* (pp. 191-220). New York: Basic Book.

Sbarra, D. A., & Emery, R. E. (2005). Co-parenting conflict, nonacceptance, and depression among divorced adults: Results from a 12-year follow-up study of child custody mediation using multiple imputation. *American Journal of Orthopsychiatry*, *75*, 63-75.

Schoppe-Sullivan, S. J., Mangelsdorf, S. C., Frosch, C. A., & McHale, J. L. (2004). Associations between co-parenting and marital behavior from infancy to the preschool years. *Journal of Family Psychology, 18*, 194-207.

Stern, D. N. (2004). *The present moment in psychotherapy and everyday life*. New York: Norton.

Sweeper, S., & Halford, K. (2006). Assessing Adult Adjustment to Relationship Separation: The Psychological Adjustment to Separation Test (PAST). *Journal of Family Psychology*, *20*, 632-640.

Wang, H., & Amato, P. R. (2000). Predictors of divorce adjustment: Stressors, resources and definitions. *Journal of Marriage and the Family, 62*, 655-66.

Life Span and Disability / XIV, 1 (2011), 75-84

Positive effects of the placement of students with intellectual developmental disabilities in typical class

Renzo Vianello[1] *& Silvia Lanfranchi*[2]

Abstract

This paper is aimed at summarizing the results of the comparison of five different papers published on this journal. Those papers analyzed how including scholars with intellectual and developmental disabilities in a typical (instead of special) class might have effects on psychological development, academic and adaptive performances. Results are the following: a typical class fosters a better psychological development (particularly from a social point of view since their inclusion promotes, for example, friendship and social acceptance), higher school performances, better adaptive abilities. The present contribution considers also what characteristic typical class should have to offer an excellent inclusion model.

Keywords: Intellectual disabilities, Inclusive education, Deficit, Surplus effect

* *Received*: February 03, 2011; *Revised*: February 08, 2011; *Accepted*: February 08, 2011.

[1] University of Padua, Department of Development and Socialization, via Venezia 8, 35100 Padua (Italy). E-mail: renzo.vianello@unipd.it

[2] University of Padua, Department of Development and Socialization. E-mail: silvia.lanfranchi@unipd.it

1. Introduction

In a previous work (Vianello & Lanfranchi, 2009) we described some results of research carried out in Italy on cognitive and adaptive profiles of participants (children and youth) with Intellectual developmental disabilities due to genetic syndromes (Down, Fragile X, Cornelia de Lange, Prader-Willi).

In the majority of the cases the participants have performed above what expected on the basis of their mental age in a variety of areas (reading, writing, math, social adaptability).

Since in the past Zigler (Zigler & Bennet-Gates, 1999) found the opposite situation, named "deficit" respect to mental age, we have defined "surplus" respect to mental age the opposite phenomenon.

If we consider individuals affected by the same syndrome, deficit and surplus can be due to the intrasyndromic variability and/or to the different educational, scholastic and abilitative situations.

It is widely assumed that the cognitive, adaptive and behavioural profile of every syndrome is characterized by strength and weaknesses. For example we know that in Down syndrome social development is a strength and verbal communication is a weakness (Dykens, Hodapp, & Finucane, 2000; Bargagna, Perrelli, Dressler, Pinsuti, Colleoni, Astrea *et al*., 2004; Vianello, 2006, 2008).

The presence of surplus respect to mental age in participants in our research may be attributable to the fact that almost (more than 97% of the students with disabilities) all the students with intellectual disabilities in Italy are educated in typical classrooms alongside their peers without disabilities, rather than in special education classes, as is often the case in many other countries.

On the contrary, in the United States only 16% of students with intellectual disabilities receive their education in general education classrooms (U.S. Department of Education, 2007).

Also in Europe the placement in inclusive classes is not frequent. More than 2% of the students attend special schools or classes (more than 4% in Belgium, Estonia, Germany, Czech Republic and Switzerland and less than 1% in Cyprus, Greece, Ireland, Italy, Malta, Norway, Portugal, Slovenia e Spain, European Agency, 2008).

On this theme in previous issues of this Journal papers were published by Michael F. Giangreco (2009), Thomas E. Scruggs & Kim Michaud (2009), Nancy L. Waldron e James McLeskey (2010), Elena Tanti Burlo' (2010).

For a correct interpretation of the results of studies carried out in Italy it is important to highlight that participants did not participate in groups that received particular educational or habilitative training. For example a study

on Down syndrome analyzed adolescents attending the second and the third class of the high junior school and none of them attended special schools or other kinds of residential institutes. Moreover it is important to highlight that surplus effect is not due to particularly low performances in intelligence tests. An important information originating from several researches (see Vianello, 2006 for a review) is that mean mental age of Italian adolescents with Down syndrome range between 5 and 6 years. It is a result that is very different from results of research conducted several years ago. For example Baroff (1989) summarize studies that state that at every chronological age, mean mental age in individuals with Down syndrome does not go beyond 4 years.

According to these findings, the surplus effect emerges significantly because individuals with Down syndrome, in the presents years, have a mental age higher than in the past. Perhaps an international comparison of data would be necessary to better judge the effects of inclusion in normal classes.

2. The surplus effect is more present in inclusive classes

On the whole all the authors agree that surplus effect in academic and adaptive performances respect to performances in intelligence tests is more frequent in inclusive classes than in special ones.

However the debate brought also contributions regarding the comparison between special and normal schools in terms of results, of general and social development, on academic performances, on adaptive performances, on social acceptance, on school performances of peers. Those aspects will be described in the following paragraphs. Finally a specific paragraph will be devoted to conditions of inclusive schools that give the best results.

3. Academic outcomes are greater in inclusive class

Most of the research has revealed that:

- segregated placements can have negative effects on social development and academic achievement or produce a deficit (Carlberg & Kavale, 1980; Madden & Slavin, 1983; Epps & Tindal, 1988; Freeman & Alkin, 2000; Salend & Duhaney, 2007);
- inclusive placements tend to produce outcomes that are at least as positive, and sometimes significantly more positive than separate class placements, in particular while academic outcomes tend to be higher for students with mild intellectual disabilities, academic outcomes for students with severe intellectual disabilities were at least as high, and sometimes higher than outcomes for peers who were educated in separate settings (Carlberg & Kavale, 1980; Giangreco, Dennis, Cloninger, Edel-

man, & Schattman, 1993; Hunt & Goetz, 1997; McGregor & Volgelsberg, 1998; Freeman & Alkin, 2000; Kim, Larson, & Lakin, 2001; McDonnell, Thorson, Disher, Mathot-Buckner, Mendel, & Ray, 2003; Cole, Waldron, & Majd, 2004; Downing & Peckham-Hardin, 2007; Felce e Perry, 2009);
- this advantage can be due also to the fact that in a normal context students with intellectual developmental disabilities can better express the abilities that they already have (Kim *et al.*, 2001; Felce & Perry, 2009);
- have more access to academic instruction (Logan & Keefe, 1997; Helmstetter, Curry, Brennan, & Sampson-Saul, 1998).

4. The social development is greater in inclusive classroomes

Most of the research has revealed for students with intellectual disabilities that there is a greater social development in inclusive classrooms (Freeman & Alkin, 2000; Buckley, Bird, Sacks, & Archer, 2002; Fisher & Meyer, 2002; McDonnel *et al*., 2003; Buckley, Bird, & Sacks, 2006).

Studies comparing special education versus general education classes have found that students with intellectual disabilities placed in general education classes:
- had increased social interactions with classmates (Salend & Duhaney, 2007);
- had more friendships (Salend & Duhaney, 2007);
- had better self-concepts (Salend & Duhaney, 2007);
- exhibit higher levels of "happiness behaviour" when interacting with typical peers (Logan, Jacobs, Gast, Murray, Daino, & Skala, 1998);
- had less disruptive behaviour (Salend & Duhaney, 2007).

5. Social acceptance is greater in the inclusive class

Previous research showed that students with intellectual disabilities are less accepted than their typically developing peers; however their level of acceptance seems to be positively correlated to the time they spend in the general education classroom (Freeman & Alkin, 2000). Similar results were found in research carried out in Italy that found that a crucial variable in determining the level of social acceptance is the amount of time spent together.

It is interesting to highlight that in this research results show that social acceptance is differentiated according to the situations taken into consideration; in particular acceptance is lower for what concerns academic achievement and higher in helping situations. Specific training for teacher and scholar can enhance social acceptance (Freeman & Alkin, 2000).

6. Schoolmates of students with developmental intellectual disabilities do not learn less

Only few studies assessed performances of typically developing children attending classis where there is a child with intellectual developmental disability.

McDonnel *et al.* (2003) showed that learning levels are the same in students attending inclusive classes versus traditional ones. Accordingly, we can hypothesize that the presence of students with developmental disabilities do not have a negative influence on the learning processes of students without disabilities.

Moreover Cole, Waldron and Majd (2004) showed that typically developing students attending inclusive class had higher academic performances than scholars attending normal class.

7. What inclusive class?

Although several studies showed the advantages of inclusion in normal classes compared to special schools, several studies showed that this was not always the case (Carlberg & Kavale, 1980; Epps & Tindal, 1988; Freeman & Alkin, 2000). Considering that one could ask what are the characteristics that bring the best results.

Several studies highlight the importance of adequate programming and the adaptation of general instruction to the needs of the students with disability.

As highlighted by Waldron e McLeskey (2010) the following variables seems to be critical:

(Dyson, Farrell, Polat, Hutcheson, & Gallannaugh, 2004; Farrell, Dyson, Polat, Hutcheson, & Gallannaugh, 2007; Giangreco, 2009).

- Welcoming attitude towards all the students
- Teaching assistants (e.g. support teachers)
- A flexible instruction
- Systems for monitoring student progress, and use of the data to plan individual student support and interventions
- Inclusive programs, which are good for any school
- Teaching students with disability should be considered a “normal” responsibility of the teacher.

Moreover according to Giangreco (2009) it is important not to treat those students as eternal children, not able to learn or share profound cultural experiences.

Moreover he highlights that simple and repetitive activities (such as threading pearls) are negative for these students and how important is al-

lowing them to participate in complex learning experiences, as those present in Shakespeare drama.

8. Discussion and open questions

Certainly suggestive are the two hypothesis (one implicit and the other explicit) that have been proposed in the paper that initiated this debate:

- attending normal classes, instead of special ones, can enhance cognitive and social development, school and adaptive performances;
- attending normal classes can allow students with disability to reach higher results in school and adaptive performances than we would expect on the basis of performances on intelligence tests.

Those two hypothesis have been at least partially confirmed by research carried out in Anglo-Saxon countries and in Italy. The study by Vianello and Lanfranchi (2009), in fact, highlighted the presence of surplus effect. However this study did not compare scholars in normal classes and in special schools.

Several problems remain open.

The surplus effect is not present only in students attending inclusive schools (see for example Hatton, Wheeler, Skinner, Bailey, Sullivan, Roberts *et al.*, 2003; Hardiman, Guerin, & Fitzsimons, 2009), because for some syndrome it is part of the profile typical for this syndrome. For example in Down syndrome adaptive performances are higher than cognitive and linguistic ones. This aspect is very important and should be kept in mind when we compare scholars in special and in normal classes. In order to confirm the higher value of attending inclusive classes we should find not only surplus in social adaptability, but this surplus should result greater than in special classes.

It follows that similar reasoning should be done for what concerns academic performances.

Assuming that inclusion in normal schools has enhanced cognitive and social development and brought school and adaptive performances to a higher level than those of scholars attending special schools outside Italy (at the moment it is not possible to make a direct comparison in Italy since we do not have specials schools), we should explore what variables determine this surplus.

According to Scruggs and Michaud (2009), that refer to a study by Palladino, Cornoldi, Vianello, Scruggs and Mastropieri (1999), one aspect that could be important is the attitude of the Italian teacher who delegates less responsibilities to the paramedical staff.

According to Waldron and McLeskey (2010) the following aspects are also important:

- an attitude that is more or less welcoming towards all the scholars
- teaching flexibility

-good teaching methods for everyone.
-good abilities in detailed and personalized planning
- support to the teachers

We wish that the Italian researchers, at the moment quite absent on those research themes, might actively collaborate with foreigner researchers on those topics. Our hypothesis is that, if on one hand in Italy teachers have a positive attitude toward inclusion (in comparison to foreign colleagues), there could exist some "gaps " (apart from some exceptions) in planning teaching methods and in teacher support. This means that our students with intellectual disabilities have still a wide range of potential improvement.

Moreover it means that if we are able to find how to better improve their development and performances, we will also find out how to propose a more effective school for all students apart from their differences.

References

Bargagna, S., Perelli, V., Dressler, A., Pinsuti, M., Colleoni, A., Astrea, G., Rafanelli, V., & Chilosi, A. M. (2004). Rapporti tra abilità linguistiche, cognitive e profili di sviluppo adattivo in giovani adulti con Sindrome di Down. *Psicologia Clinica dello Sviluppo*, *3*, 459-484.

Baroff, G. S. (1989). *Mental Retardation: Nature, Cause and Management. Second Edition.* U.S.A.: Hemisphere Publishing Corporation.

Buckley, S. J., Bird, G., Sacks, B., & Archer, T. (2002). A comparison of mainstream and special education for teenagers with Down syndrome: implications for parents and teachers. *Down Syndrome News and Update*. *2* (2), 46-54.

Buckley, S. J., Bird, G., & Sacks, B. (2006). Evidence that we can change the profile from a study of inclusive education. *Down Syndrome Research and Practice*, *9* (3), 51-53.

Carlberg, C., & Kavale, K. (1980). The efficacy of special versus regular class placement for exceptional children: A meta-analysis. *Journal of Special Education, 14,* 295-309.

Cole, C. M., Waldron, N., & Majd, M. (2004). Academic progress of students across inclusive and traditional settings. *Mental Retardation, 42,* 136-144.

Downing, J. E., & Peckham-Hardin, K. A. (2007). Inclusive education: What makes a high quality education for students with moderate-severe disabilities? *Research and Practice for Persons with Severe Disabilities, 32,* 16-30.

Dykens, E. M., Hodapp, R. M., & Finucane, B. M. (2000). *Genetics and Mental Retardation Syndromes. A New Look at Behavior and Intervention*. Baltimore: Paul Brookes Publishing.

Dyson, A., Farrell, P., Polat, F., Hutcheson, G., & Gallannaugh, F. (2004). *Inclusion and* education. In H. Daniels & P. Garner (Eds.), *World yearbook of education 1999: Inclusive education* (pp. 36-53). London: Kogan Page.

Epps, S., & Tindal, G. (1988). The effectiveness of differential programming in serving. *Exceptional Children, 35*, 5-22.

Farrell, P., Dyson, A., Polat, F., Hutcheson, G., & Gallannaugh, F. (2007). Inclusion and achievement in mainstream schools. *European Journal of Special Needs Education, 22* (2), 131-145.

Felce, D., & Perry, J. (2009). Living with support in the community: Factors associated with quality of life outcome. In S. L. Odom, R. H. Horner, & M. E. Snell (Eds.), *Handbook of developmental disabilities* (pp. 410-428). New York: Guilford.

Fisher, M., & Meyer, L. H. (2002). Development and social competence after two years for students enrolled in inclusive and self-contained educational programs. *Research and Practice for Persons with Severe Disabilities, 27*, 165-174.

Freeman, S., & Alkin, M. (2000). Academic and social attainments of children with mental retardation in general education and special education settings. *Remedial and Special Education, 21*(1), 3-18.

Giangreco, M. F. (2009). Opportunities for children and youth with intellectual developmental disabilities: Beyond genetics. *Life Span and Disability*, *XII* (2), 129-139.

Giangreco, M. F., Dennis, R., Cloninger, C., Edelman, S., & Schattman, R. (1993). "I've counted Jon:" Transformational experiences of teachers educating students with disabilities. *Exceptional Children*, *59*, 359-372.

Hardiman, S., Guerin, S., & Fitzsimons, E. (2009). A comparison of the social competence of children with moderate intellectual disability in inclusive versus segregated school settings. *Research in Developmental Disabilities, 30*, 397-407.

Hatton, D. D., Wheeler, A. C., Skinner, M. L., Bailey, D. B., Sullivan, K. M., Roberts, J. E., Mirrett, P., & Clark, R. D. (2003). Adaptive behavior in children with Fragile X syndrome. *American Journal on Mental Retardation, 108*, 373-390.

Helmstetter, E., Curry, C., Brennan, M., Sampson-Saul, M. (1998). Comparison of general and special education classrooms of students with severe disabilities. *Education and Training in Mental Retardation and Developmental Disabilities, 33*, 216-227.

Hunt, P., & Goetz, L. (1997). Research on inclusive educational programs, practices, and outcomes for students with severe disabilities. *Journal of Special Education, 31,* 3-29.

Kim, S., Larson, S. A., & Lakin, K. C. (2001). Behavioral outcomes of deinstitutionalization for people with intellectual disability: A review of US studies conducted between 1980 and 1999. *Journal of Intellectual and Developmental Disability, 26,* 35-50.

Logan, K., & Keefe, E. (1997). A comparison of instructional context, teacher behavior, and engaged behavior for students with severe disabilities in general education and self-contained elementary classrooms. *Journal of the Association for Persons with Severe Handicaps, 22*, 16-27.

Logan, K., Jacobs, H. A., Gast, D. A., Murray, A. S., Daino, K., & Skala, C. (1998). The impact of typical peers on the perceived happiness of students with profound multiple disabilities. *Journal of the Association for Persons with Severe Handicaps, 23*, 309-318.

Madden, N., & Slavin, R. (1983). Mainstreaming students with mild handicaps: Academic and social outcomes. *Review of Educational Research, 53* (4)*,* 519-569.

McDonnell, J., Thorson, N., Disher, S., Mathot-Buckner, C., Mendel, J., & Ray, L. (2003). The achievement of students with developmental disabilities and their peers without disabilities in inclusive settings: An exploratory study. *Education and Treatment of Children, 26*, 224-236.

McGregor, G., & Volgelsberg, R. T. (1998). *Inclusive schooling practices: Pedagogical and research foundations: A synthesis of the literature that informs best practices about inclusive schooling*. Baltimore: Paul H. Brookes.

Palladino, P., Cornoldi, C., Vianello, R., Scruggs, T. E., & Mastropieri, M. A. (1999). Paraprofessionals in Italy: Perspectives from an inclusive country. *The Journal of the Association for Persons with Severe Handicaps, 24* (4)*,* 254-258.

Salend, S., & Duhaney, L. (2007). Inclusion: Yesterday, today, and tomorrow. In J. McLeskey (Ed.), *Reflections on Inclusion: Classic articles that shaped our thinking* (pp. 125-159). Arlington, VA: CEC.

Scruggs, T. E., & Michaud, K. (2009).The "surplus" effect in developmental disability: A function of setting or training (or both)? *Life Span and Disability*, *XII* (2), 141-149.

Tanti Burlò, E. (2010). Inclusive education: a qualitative leap. *Life Span and Disability*, *XIII* (2), 203-221.

U.S. Department of Education (2007). Table 2-2. Students ages 6 through 21 served under IDEA, Part B, by disability category, educational environment and state: Fall 2007 [Data file]. Available from Individuals with Disabilities Education Act (IDEA) Web site: https://www.ideadata.org/PartBdata.asp

Vianello, R. (2006). *La sindrome di Down. Sviluppo psicologico e integrazione dalla nascita all'età senile*. Bergamo: Junior.

Vianello, R. (2008). *Disabilità intellettive.* Bergamo: Junior.

Vianello, R., & Lanfranchi, S. (2009). Genetic syndromes causing mental retardation: Deficit and surplus in school performance and social adaptability compared to cognitive functioning. *Life Span and Disability, XII*, 41-52.

Vianello, R., & Moalli, E. (2001). Integrazione a scuola: le opinioni degli insegnanti, dei genitori e dei compagni di classe. *Giornale Italiano delle Disabilità*, *2*, 29-43.

Waldron, N. L., & McLeskey, J. (2010). Inclusive school placement and surplus/deficit in performance for students with intellectual disabilities: Is there a connection? *Life Span and Disability, XII* (1), 29-42.

Zigler, E., & Bennett-Gates, D. (1999). *Personality development in individuals with mental retardation.* Cambridge, UK: Cambridge University Press.

Notes for Contributors

The Journal will publish original papers (not early published nor in press). Papers submitted for publication should be sent in electronic format, using one of the versions of Microsoft Word, through the e-mail address indicated below. A supplementary version in pdf format (built by means of Acrobat Reader), added to the word file, may be useful to allow a clear vision of the format foreseen for printing. The most recent edition of the Publication Manual of the American Psychological Association (Washington, APA), should be used as the style guide for the preparation of the manuscripts.

The first page of the manuscript should give the title, authors' names and affiliations, and the complete mailing address of one of the authors (included fax number and e-mail address). At least three keywords should be indicated.

The abstract should not exceed 200 words. Theoretical aspects, goals and methods, results and a short discussion should be clearly reported.

The text of the paper should clearly indicate the following sections (example for an empirical paper):

1. Introduction
2. Aims and hypothesis
3. Methods: Sample, Instruments, Procedure
4. Data analysis
5. Discussion

Tables and Figures should be in a limited number. They should be typed in a separate page, and they should report a descriptive title (e.g.: Table 3, Figure III) followed by the legend. Illustrations should be made according to the linked models, and kept modifiable for an editorial work. The approximate location of figures and tables should be clearly indicated in the text.
Decimal point should be used both in the tables and the text. For descriptive statistics, correlations, inferential statistics, etc., two decimal digits have to be reported. Omit zero before decimal digits when the value cannot be greater than 1 (e.g., correlations and significance level)

Citations in the text should be indicated with the author's name, year of publication and page number, e.g.: Achinstein (1968, p. 32). A letter should be added to the year of publication if there are two references of the same author in the same year: Orne (1973a). According to A.P.A. norms, in the quotations with more than one author the symbol & should be used if the quotation is enclosed in parenthesis (Estes & Skinner, 1940), otherwise "and" has to be used: e.g. Estes and Skinner (1940).
For three to six authors, all surnames should be cited the first time the reference occurs (es. Wasserstein, Zappulla, Rosen, Gerstman, & Rock, 1994). Subsequent citations should use *et al.*: Wasserstein et al., 1994. If the authors are more than six, use *et al.* after the six name. For subsequent citations use *et al.* after the first author's name.
References list should be given at the end of the article in alphabetical order, conform to the A.P.A. reference list, as illustrated by the following examples:

Achinstein, P. (1968). *Concepts of science*. Baltimore: John Hopkins Press.

Anisman, H., Remington, G., & Sklar, L. S. (1979). Effects of inescapable shock on subsequent escape performance: Catecholaminergic and cholinergic mediation of response initiation and maintenance. *Psychopharmacology*, *61* (1), 107-124.

Grossman, H. J. (Ed.). (1973). *A manual on terminology and classification in mental retardation* (Rev. ed.). Washington, DC: American Association on Mental Deficiency.

Harter, M. R., & Aine, C. J. (1984). Brain mechanisms of visual selective attention. In R. Parasumaran & D. R. Davies (Eds.), *Varieties of attention* (pp. 293-319). New York: Academic Press.

Lanktree, C., & Briere, J. (1991). *Early data on the trauma Symptom Checklist for Children* (TSC-C). Paper presented at the meeting of the American Professional Society on the Abuse of Children, San Diego, CA.

Piaget, J.(1967). *Biologie et connaissance*, Paris: Éditions de la Pléïade. (Engl. transl., Biology and Knowledge. Chicago: University of Chicago Press, 1971).

Shallice, T. (1972). Dual function of consciousness. *Psychological Review*, *79*, 383-393.

Please be sure that all the citation in the text are reported in the bibliography, while references not quoted in the text should not be included.
Footnotes should be avoided as possible. When their use is absolutely necessary, footnotes should be numbered consecutively using superscript numbers for citation in the text, and inserted in the text according to Microsoft Word criteria for notes at the foot of the page.
The Authors have to sign the statements regarding Conflict of Interest, Informed Consent, and Human and Animal Rights. Please follow the instructions included in the linked file.

Correspondence should be addressed to the editorial secretary:
Dr. Tommasa Zagaria, Associazione "Oasi" Maria SS. I.R.C.C.S., via Conte Ruggero 73, Troina, 94018 Italy.
Phone: ++39-935-936263/ 936233/ 936111; Faxline: ++39-935-653327; E-mail: tzagaria@oasi.en.it.

Research articles submitted for publication will be sent anonymously to two members of the editorial board. The evaluation will be sent to the corresponding author normally within three months after the reception of the version prepared according to the notes for contributors.

Authors will receive two free copies of the issue including the printed article. Reprints may be ordered on a form sent to the authors together with the communication that article is accepted for the publication.

LIFE SPAN AND DISABILITY