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9 Play in Children with Physical Impairment

9.1 Motricity and Mind

According to numerous researchers (Sechenov, 1952; Pavlov, 1937; Oliverio, 2007), motor actions play an important role in the formation of mind; they affect learning and are at the basis of language development. In fact, movements, motor schemes, and physical relationships with the real world can cause a development in mental logic, underpin logical construct, and are at the basis of the understanding of the cause/effect relationships and of the chaining of sequences of thoughts.

Between motricity and mind, there is a complex interrelation, which could be described as cyclic: a movement can exert some consequence on the surrounding environment, and due to the perception of these consequences, new, modified movements can be produced; this relationship appears very clearly in a newborn (Barbeau, 1990). According to this approach, it is not the movement that satisfies the mind's needs, while it is the mind that performs the actions (Oliverio, 2007). Some authors recently sustain that motor control resides in nervous system, body, and environments "viewed as dynamical systems in continuous interaction" (Turvey, 2009:3).

The ontogeny seems to reproduce in this sense the phylogeny: some neurophysiologists (Calvin, 1990) sustain, in fact, that the evolution of some motor behaviours caused, historically, the creation of a 'motor logic' based on subsequent steps, and this provoked—from the motor and the premotor cortex areas—a sort of contamination towards the Broca area of language, to 'inspire' the generation of sequences of syllables.

For Lurija (1973), the human brain is a sort of archive of complex motor schemes—that he defined 'kinetic melodies' to refer to their fluidity and availability in different moments of daily life. The techniques of brain imaging have then greatly contributed to the knowledge of such schemes. The major achievement in these last decades is the discovery of the role of the mirror neurons (Gallese et al., 1996) located in the premotor areas: it has been demonstrated, in fact, that there is a parallelism between the brain areas fired while acting a movement and in imagining it or viewing it performed by another or even by a robot. Studies concerning these relationships are currently done in the neuroscience field, within the framework of the so-called 'embodied cognition' (Wilson, 2002), and even if final conclusions have not been reached, the undergoing experimentations about the relationships between some areas of cognition (language, memory, visual perception, and so on) and the movement, obtain various results, they always demonstrate interesting clues of secure interconnection (Tomasino & Rumiati, 2013; Tomasino et al., 2011).

The child's motricity depends on a complex mixture of predispositions and experiences, on the brain's capability to record the motor actions perceived by sight, and on the progressive acquisition of motor actions that are corrected and refined through trials and errors; they are finally stored in a memory able to code them as schemes and to make them available in a fluid and stereotyped form (Oliverio, cit.).

9.2 Children with Physical Impairments

As a consequence of what is discussed in the previous paragraph, it is possible that a delay in the development of motor skills, or the presence of various degrees of motor impairments, may have an adverse impact on the mental and cognitive development of the child.

A physical impairment—both congenital and acquired—creates substantial limitations to physical ability or motor skills; when it is related to a problem of the central nervous system—as in the case of cerebral palsy (CP),¹ ataxia, traumatic brain injury—it may be accompanied, at different degrees, by intellectual and neuropsychological impairments,² language and speech disorders, sensory disabilities, as well as emotional and social difficulties (Tingle, 1990). It could also be related to a damage to the peripheral nervous system and/or to the effector organs (muscles, joints, and bones); the functional situation of these children is often severe—as in the case of some types of muscular dystrophy, and of spinal muscular atrophy— with rapid worsening; and also when it is less dramatic—as in the case of juvenile rheumatoid arthritis—it limits the movement possibilities of the children, thus restricting their ability and also their willingness to be active and to participate.

In many cases, motor impairments can prevent the child from acting in an autonomous way in his or her daily activities, and in its turn, these limitations cause insufficient development of his or her sensory and perception capabilities, as well as low self-esteem and self-efficacy.

Very often, these children need the adoption of various assistive devices and supports for movement and for communication. Of course, this implies a special organisation of their daily life, because they need to be trained to the use of these tools for long periods, and in turn, this may create restrictions in social participation as well as difficulties at the psychological level, mainly with respect to self-construction and self-representation.

1 Cerebral Palsy affects 2% of the newborns in technologically advanced countries.

2 Some Italian researches have highlighted the high presence (the two-third) of an intellectual disability in children with CP with a mean lower performance of one standard deviation (Cioni et al., 1993).

In the case of CP, the possible association of intellectual and sensorial impairments,³ as well as the possible absence or severe impairment of speech,⁴ may cause a very complicated overall functioning of these children and may make challenging to support and to empower their play abilities.

Speech disorders may disadvantage their communication with peers, as it might be difficult to understand them, or an alternative communication system should be adopted. These aspects, together with the possible difficulties to the emotional sphere reported in the clinic literature,⁵ can result in social participation restriction, if appropriate inclusive contexts are not established.

The most recent interpretative model of CP highlights the spontaneous adaptive effort of the affected children, by considering the symptoms as the result of this effort, within a complex situation of functional and biological systems that are intertwined but superordinate to the performance. Thus, the motor component is no more the only variable to consider, but it should be analysed together with the others: perceptive, attentional, motivational, cognitive, and emotional-affective. All these components tend to reach the best possible balance, while facing the inner and outer needs of the child; in infancy, play is without a doubt the ideal bridge between the external world and the internal world of the child (Voltolin & Obino, 2011).

But, play is also a matter of social inclusion: within the framework offered by the International Classification of Functioning (WHO, 2001), many studies—conducted to single out the possible correlations between the physical impairment and the level of participation of children (Wright et al., 2008)—concluded that they are at risk of reduced participation, interpreted both as a subjective and an objective experience (Law et al., 2006). A comprehensive literature analysis found that they “experience greater participation restriction than their peers without impairment and the participation of children with CP or other neurological impairments was more restricted than that of other disability groups” (Imms et al., 2008:363). Furthermore, activities are more passive, mainly organised at home and lack variety (Shikako et al., 2008). Other surveys (Majnemer et al., 2008; Orlin et al., 2010; Palisano et al., 2011) sustain that the intensity of participation is influenced by some determinants of the child and his or her family: higher participation is related to higher gross motor function, higher enjoyment, younger age, and higher family orientation; moreover,

³ According to the clinical literature, slowness of the thought processes and inertness of thinking are typical of children with CP. Insufficiency of the highest cortical functions can also be shown in a delayed development of the representations of space and time, of the processes of phonemic analysis, and synthesis and problems of astereognosis (Mastyukova & Ippolitova, 1985).

⁴ Speech development of children with CP is characterised by disorders on many components: lexical, grammatical, and phonetic or phonemic. Most frequently, they suffer from dysarthria or even anarthria.

⁵ Emotional excitability or irritability, sometimes mental block, disinhibition. In some cases, low motivation to activity and aspiration to restricted social contacts are referred.

social supports and environmental services also play an important role in increasing the degree of participation. Denmark, with its welfare system, has been singled out as one of the European countries where participation is best sustained (Michelsen et al., 2008); another direct correlation has been found with the type of school system, even if in Italy—a country that can boast a ‘totally inclusive’ system—the level of participation is not so satisfying for families.

9.3 Technologies and Children with Physical Impairments

The severity of the physical impairment of these children has been often considered a scientific challenge to create solutions for supporting both their activities and participation; more than in the case of children with other types of impairments, technologies can become a significant part of their life, and their use as tools for rehabilitation is highly represented in the field literature. In particular, the play of children with physical impairment has been investigated: for this reason, in what follows, a short presentation of the area in more general way is necessary to review, in the next paragraphs, the existing literature with respect to the characteristics of the various types of play.

A particular role can be played by Assistive Technologies (ATs)⁶ whose name should not remind the idea of being passively ‘assisted’ rather the construct of ‘supports for independence’: in fact, they are mainly addressed to support the autonomy of the impaired persons, to let them reach their goals, and to decrease the workload of assistants. Many AT products⁷ have been developed, classified at international level according to their scope,⁸ and made available to the users according to national regulations.

Also, mainstream technologies are often used as tools for rehabilitation, enjoyment, and leisure time. Due to the extraordinary and rapid changes in the technological field, it is quite natural to think that they could offer these children what they need, provide experiences they might not do by themselves, and consequently, improve the perception of their own capabilities, thus enhancing their self-efficacy (Bandura, 1977). This has been the case, for example, of some proposals to use the virtual reality (VR) environments (Reid & Campbell, 2006), which can provide these

⁶ “Any product or technology-based service that enables people of all ages with activity limitations in their daily life, education, work or leisure” (AAATE, 2003; www.aaate.net). Other definitions have been established by international bodies, such as ISO 9999.

⁷ WHO prefers the expression *Assistive Health Products* to underline their importance to support the person’s health condition, that is, a status of complete well-being: physical, psychological, and social: http://www.who.int/phi/implementation/assistive_technology/gate_full_final_report_july_2014.pdf.

⁸ The Standard ISO 9999:2011 classifies the assistive products for persons with disabilities according to their function in three hierarchical levels: www.iso.org/obp/ui/#iso:std:iso:9999:ed-5:v1:en.

children a sense of mastery and self-efficacy. In effect, VR has proved to provoke fun in children with physical impairment, also when it is used for rehabilitation purposes (Bryanton et al., 2006).

Nowadays, AT and mainstream technology are often used together to create original systems called ‘assistive solutions’,⁹ which can also assemble environmental modifications and even some personal assistance. They are highly personalised, as the solution found for one individual is usually different from the one that proved useful for another individual (Andrich, 2013). In addition, the same AT products are not useful to the same degree for different persons, and they can play different functions according to the users’ needs; a single piece of technology cannot solve a situation, rather it should be adapted to the type and context of use (Besio, 2007). For all these reasons, the process of choice of AT should be managed by a multi-professional team with the active participation of the child and also of his or her parents during the decision phase.

Another important field in which technology is fast developing and experimenting is robotics. Play has been adopted as a promising testing area:¹⁰ “the underlying assumption is that providing tailored means to encourage play through a robotic toy will break down barriers for development through play, fostering individual development up to the persons full potential” (Kronreif, 2009:222). These researches also intend to envisage a ‘new potential role for advanced robotics in society’, seen as a possible contributor to enhance the following three aspects: quality of life, social inclusion, learning, and therapy. A very promising area of development of this field is the use of robots to reveal cognitive skills of children with disabilities, which is particularly difficult in case of severe impairments (Cook et al., 2010).

Any AT—including robotic tools—that supports the motor actions of the child “may enable development” (Cook & Polgar, 2008:67). Unfortunately, finding the suitable assistive solution for children with severe physical impairment could be difficult and challenging for them, and they should be supported and motivated to gain the desired result: their major involvement can be, obtained, again, by recurring to technologies that can be able to playfully engage them in the training activities (Adams et al., 2013).

Bringing together a very broad discussion, we can say that products, technologies in general, and AT solutions, which are all included within the ICF domain of Environmental Factors, can become powerful facilitators—if correctly identified and

⁹ See also the ‘Position Paper’ of AAATE, 2012. http://aaate.net/wp-content/uploads/sites/12/2016/02/ATServiceDelivery_PositionPaper.pdf.

¹⁰ Anyway, the application of robotics to disability, and in particular to physically impaired children is mainly addressed to rehabilitation; experimentation results are frequently assessed with respect to rehabilitation objectives, even when they are used for engaging and ludic activities (Rahman et al., 2015).

situated in a person's daily life—for the activity of a person with disability and his or her social participation. In the case of the child with a physical impairment, they are used as a support for typical activities of the age, including play; they can, in fact, offer occasions to experiment, to grow, to have fun, to become autonomous, to increase participation and social inclusion.

But, products and technologies can also pose to be barriers for play: this could happen in the case of toys and playgrounds that are not usable or accessible to the child with physical impairment, for example, if they are not easy to grasp, to be explored, manipulated, used.

The need to develop effective technologies to support these children's play has become a meaningful objective of the scholars in the field, while abilities to assess and improve the usability and the accessibility of play tools, technologies, and contexts are still to be implemented and widely disseminated.

9.4 Play and Children with Physical Impairments

The scientific interest towards the play activities of children with motor and/or physical impairments has increased during the last 20 years. Playfulness has been found significantly lower in children with CP than in typically developing ones (Okimoto et al., 2000): in particular, their 'play age' is referred to their mental abilities and not to their chronological age. Something similar was reported by Harkness and Bundy (2001): their experimentation resulted in scores of 'exuberance' higher in children with physical impairment—but without any intellectual impairment—than in typically developing ones.

The presence of an intellectual impairment and its complex interrelation with the physical impairment seems to be extremely relevant data; in particular, it can determine the capacities, the possibilities, and the preferences of the motor-impaired child when playing. Dallas et al. (1993a) found that children with CP showed a deficit of assertiveness during play, while Brodin (1999) stresses passivity, lack of attention, and concentration.

Howard (1996) hypothesised a possible correlation between these behavioural data and the living habits of these children, often obliged to reduce drastically leisure time and fun, due to the intense and frequent rhythms of physical rehabilitation.

The lack of initiative not only seems to be a consequence, but also a cause of a reduction of the play occasions. This is true, for example, for physically impaired children who show a significant delay in speech development and a consequent reduction of communicative competence, or who depend on others for their movement. In such cases, their social interactions decrease, and as a consequence, they acquire a reduction in play initiative and in peer relationships (Harper & McCluskey, 2002).

The most recent research results put specific emphasis on the role of the environmental competence and proposals; a wide inter-individual variety exists

among children, and child neurologists stress that differences should not always be considered pathological: it is important to observe, interpret, and exploit the child's adaptive capabilities, or, as Brazelton says, the 'best performance' within the limitation (Bottos, 2003). As some severely impaired children can express their will and ability to act and participate, any prognosis should be made with caution, taking advantage of their desires as well as of the environmental proposals; and this is true also—or mainly—for what concerns play (Mortenson & Harris, 2006).

Certainly, adaptability and modifiability can occur only within an environment that is competent to welcome, interpret, and support the child's needs and proposals of interaction. On the one hand, the environment should be correctly structured and oriented towards the cognitive development (Bronfenbrenner, 1975), and on the other hand, the children's activities should be facilitated, for example, by choosing the right toys, which can be usable and contemporarily can offer the right level of challenge to stimulate their motivation, their fun, and finally, their development (Brodin, 2005).

In what follows, the main aspects that the different types of play reveal in the case of children with physical impairment will be presented.

9.4.1 Practice Play

Through exploratory activities, the child becomes able to make inferences on the surrounding reality, to integrate perceptive and motor schemes in a sort of elementary interpretation of the world. The child with physical impairment is particularly disadvantaged in such activities: the inferential processes seem to proceed from the motor abilities, and particularly, from their use within the play activities.

In fact, there are physically impaired children who due to their functional limitations cannot reach, manipulate, use the objects and are only onlookers of their peers' play activities; some of them do not know the special condition of tension and density that can be related to play because they do not perceive themselves as the owners of their own thoughts, or they cannot understand the rules, the peers' proposals and suggestions.

Bruner (1968) sustained that the concrete motor act is not decisive to determine the child's development, while it is important the intention to make it, the capability to formulate a hypothesis, and to plan the activity; this reflection could be interesting to explain why in some cases children with severe motor impairment can show typically developing intellectual abilities. But, this interpretation should not lead to underestimate the possible consequences—for the child's development—of a reduced motor activity and particularly of a lack of practice play. To elicit play abilities, to favour curiosity, and to increase relationships of the young motor-impaired children, some solutions have been experimented (Butler, 1986) in trying to give them as much mobility as possible, as early as possible; this brought to the development of some robotic vehicles for children, such as PALMIBER (Ceres et al., 2005; Raya et al.,

2013). These projects are based precisely on the need to offer these children proper opportunities to explore and interact with space, 3D objects, and people around them (Cook & Polgar, 2008). Therefore, to drive these vehicles, children should be able to carry out purposeful actions, to interact with objects and use them as tools; to make this possible for children with physical impairment, who cannot manipulate objects directly, on-purpose adaptations and assistive solution systems have been implemented, including switches or other devices (Cook et al., 2000). Verburg (1987) found a decrease in parents' protectiveness while the child is able to demonstrate more confidence in mobility.

Another productive line of research and intervention is conducted in a less-strict technological area, and it is aimed to increase awareness of teachers and professionals in the field and to improve their knowledge and competence in assessing and choosing products, toys, and technologies for the play of children with physical impairment: in fact, these objects must be suitable for their functional needs and their further development.

9.4.2 Symbolic Play

As already noted, in some children, especially in the case of CP, severe physical impairment is accompanied by a deep impairment in language and/or speech acquisition and use. The development of effective and competent symbolic functions is also related to the integrity of the gross and fine motor functions: this means, the ability to use objects for pretend play, but also to use language to create and 'inhabit' invented worlds. Anyway, some findings in literature (Martinoni & Scascighini, 1997) describe cases of symbolic play in the absence of a completely developed speech capability, mostly if strategies of alternative communication have been established.

If some researches indicate significant differences in play abilities between children without and with developmental language difficulties, being lower in this last case (Casby, 1997), other ones demonstrate that pretend play does not show a stable correlation with the use of verbal language (Lyytinen, 1991) even if language seems to have a pulling role for the development of the symbolic function as a whole.

Other studies underline the strong influence exerted on symbolic play by the child's socio-economical context and by the parents' educational styles (Bornstein et al., 1996).

Symbolic play can be greatly compromised in the case of children with physical impairment due to motor difficulties—think, for example, to play with dolls that should be manipulated in a fine manner; very often the play companion helps the child in overcoming these difficulties “becoming the child's hand” (Brizzolara et al., 2005).

The developmental leap for this type of play is the ability to deal symbolically with objects, and ATs can be of great help if they are designed accordingly to these

children's possible needs: play activities can now be organised along sequential steps—like within a narration—and, in case that their speech skills are poor, the symbols of augmentative codes should be implemented on their toys and play objects. Research demonstrates that the adoption of the suitable ATs to support symbolic play can enable learning and associated development.

An interesting high-tech perspective in this sense is the 'social robotics', which creates a direct interaction between the user and the robot; an example of this type is IROMECS,¹¹ which was tailored towards becoming a social mediator, to foster social and cooperative play. More than having 'symbolic' features in itself, IROMECS has been used as a mediator for building up symbolic play activities (thus also overcoming some limits it demonstrated about its attractiveness as an enjoyable tool), as it happened during experimentations: "Between the first and the last session, the adults try to enhance the play situation. They try to enrich it, to build more stimuli and ideas to make children's attention more focused on the activity; in terms of play theory, it could be said that they try to enhance the play scenarios available on the IROMECS, that mainly belong to the sensorimotor level, by translating them to a symbolic and imaginative level" (Besio et al., 2013:147).

9.4.3 Constructive Play

It was Smilansky who first stressed the need to separate, in the child's development, the acquisition of gestures from their use for doing things, creating, constructing. This idea opened the possibility of separating the practice from the constructive play, which includes in fact the growing child's abilities of planning and realising ideas that are in his or her mind and very quickly mingle with the newly acquired symbolic abilities, in a developmental spiral of incremental complexity (Smilansky & Shefatya, 1990).

Smilansky's approach is particularly productive and rich in new ideas for studying the play of children with physical impairments because it has facilitated the raising of research projects in the field of engineering and robotics. One interesting example of this is given by the robot system Play ROB, designed as an assistive system to help severely impaired children in playing with Lego bricks; in this case, the robot is not the toy, but it helps to use the toy (Kronreif et al., 2005).

Some authors suggest that, for the cognitive development of children with motor impairment, it is not essential to be able to act on the objects of the world around them, rather to be able to make inferences on it and to represent these actions in their minds. Anyway, this assertion has been somehow questioned by some case studies

¹¹ It is the acronym of *Interactive Robotic Social Mediators as Companions*, IST-FP6-045356, Specific Targeted Research or Innovation Project.

that used educational and robotic technologies (Besio, 2004; Kronreif et al., 2005). They put into evidence, in fact, a not complete effectiveness of these representational mechanisms, as children, when asked to act concretely on objects according to precise plans, showed weaknesses in planning exactly their actions and in verifying the obtained results, as well as in correcting the actions that were wrong according to what they had in mind.

More recently, some contexts of ‘constructive play’ with commercial robots have been used to study the cognitive skills of children with disabilities (Cook et al., 2010); the detailed analyses of the subsequent so-called ‘micro-behaviours’ needed to manage and control a robot within a constructive play activity as well as the categorisation of the increasing cognitive skills implied by these play activities are the basis to build up a theoretical framework for relating robot skills with child-developing cognitive skills. This result will be unavoidable in the future to foster new knowledge and develop new tools in the field.

Starting from this point, for example, the use of Lego Mindstorms robots as ATs for giving children with physical disabilities the possibility to play through manipulation has been tested for the purpose of measuring the possible effects on playfulness (Rincon et al., 2013a); robots were used for play at home with the intention of supporting free play of a child with CP. The results demonstrated that playfulness increased with the introduction of a robotic intervention, and, even more interesting, this happened thanks to the creation of play scenarios in which robots became the mediator of symbolic activities with dolls, blankets, and ‘scenes’ to represent. The results related to the previous study indicate that the child’s communicative utterances increased as well as the mother’s responsiveness to the child’s initiative (Rios et al., 2013b); this was interpreted as a consequence of a major engagement and motivation in play of both.

9.4.4 Play with Rules

Children with physical impairments can approach this type of play in many cases by recurring to the use of an IT tool; if the accessibility issue is correctly solved and the suitable game is chosen in relation to their cognitive abilities, it is possible to offer them a virtual environment that is adaptable and usable.

These kind of games have been already experimented successfully (Weiss et al., 2003; Reid, 2004): for example, adolescents with CP showed appreciation and enjoyment in using these tools, in strict correlation with the cognitive workload requested by the game.

Reid and Campbell (2006) reported a successful use by children with CP (with non-disabled peers) of a VR environment—managed by a video camera as a device for capturing and tracking—for playing games of volleyball and snowboarding. They

perceived VR as an ‘equaliser’ of abilities with their peers, and this fostered feelings of competence and acceptance by the others.

One of the main problems of mainstream videogames for these children is their requirement of playing fast and being action-oriented. Hernandez et al. (2013) created a specially designed videogame—called ‘exergame’—to avoid the need for time-sensitive actions and to keep the game pace slow, which have been tested with children with CP, both to achieve the right physical activity and fun.

9.5 Social Aspects of Play in Children with Physical Impairments

Since decades, we know that the mere exposition to toys is not sufficient either to increase the number of play activities or to adopt new types of play, while the adult’s mediation reveals much more importance in this respect, to model the child’s play behaviour.

But, in case of children with disabilities, there is a risk that parents adopt a ‘diagnostic’ attitude (Brodin, 2005),¹² focussed on recovery and rehabilitation of the impairment, rather than on ‘unproductive’ activities such as play, which is considered a ‘wasted time’. The same author proposes that parents should be trained to adopt specific abilities, such as withstanding the slowness of gesture execution of their children and their delayed comprehension of play situations, as well as acquiring the needed competence to liven concentration on the task and to maintain it for long time.

In some studies of the field, children with physical impairments have been described as frustrated by their motor impairment and poorly trust in themselves as players and play companions (Pollock et al., 1997); they have been also described as snivelling and emotionally unstable, not very friendly (Sprinkle & Hammond, 1997). Spencer-Cavaliere and Watkinson (2010) sustain that they feel ‘included’ in a physical activity when they gain entry to play, feel like a legitimate participant, have friends. According to Skär (2002), they improve their own perception if they use ATs that can give them more autonomy in play activities, without recurring to the aid of an adult.

On the other hand, their limitation on activity and restriction in participation causes a huge decrease in their possibility to make choices and may even produce loss of awareness on their right to have control on their own lives; this is an important loss because it is exactly the possibility to influence one’s own environment and to interact with people that makes it possible to reduce the feeling of helplessness (Weiss et al., 2003).

But, the real and most important infant social learning happens during play activities with peers. Children with disabilities, mainly those with severe impairments

¹² Not all the studies are in the same frame (Malone & Landers, 2001; Lane & Mistrett, 1996).

such as CP, tend, regardless of the chronological age, to adopt subaltern roles in the group (Dallas et al., 1993a, 1993b); play dyads are, for this reason, more fruitful if the impaired child is the youngest one, thus benefiting by control behaviours adopted by the other (McGillicuddy-De Lisi, 1993).

Cooperative behaviours in siblings (one of them with CP) increase in time as well as pro-social and care behaviours; time probably increases the awareness about the reciprocal needs and supports in building a good relationship: the non-disabled sibling becomes more and more competent in interpreting the sister or brother's wishes and in complying with them, maintaining attitudes of support and physical proximity. This also results in increasing the impaired child's participation and attention to the play activities.

Therefore, children with CP find it difficult to start an interaction with their siblings, and this causes less probabilities to be involved in play activities and a major probability that the siblings take the control over the situation (Dallas et al., 1993a).

Specific characteristics related to the impairment can greatly influence the acquisition of play competences. The linguistic abilities play a primary role: children with good verbal competences are more likely to be involved in the peers' play activities (Stoneman et al., 1989; Harper & McCluskey, 2002); also, the cognitive competences influence the associative and collaborative types of play, because sometimes these activities prove to be too complex for an impaired child. Furthermore, children who are not autonomous in their movements and need some support for moving tend to rely on adults for entering the peers' group.

An Italian research some years ago (Catullo, 1984) verified that children with motor impairment but without any associated cognitive impairment were more popular among their peers, unless children who showed behavioural problems and difficulties to understand the rules or to comply with them, who were often left out. In addition, only 6% of the drawings of peers depicting children with motor impairments put into evidence signs of their impairments, for example, their technical aids. This fact was interpreted as a positive demonstration that these children are not seen as 'lacking' something, no child seemed interested in the 'disabling' aspects. The same experimental model has been reproduced in Italy (Besio, 2011), but different results were found. In fact, it was confirmed that only 8% of the children depicted wheelchairs or other technical aids of their peers, but these drawings were found in classes where the inclusive process was well established and effective, in which impaired children with disabilities obtained high preference scores in sociograms. This result seems to lean towards the opposite conclusion of the previous experiment: more precisely, it is possible that a positive experience and relationship with an impaired peer can contribute to improve general attitudes towards disability in general and to the perception of technical aids and other possible 'strange objects' as simply normal in the school context, as if they belonged to the whole inclusive community.

This conclusion could be interpreted within a line of studies, which identifies a direct correlation between the attitudes towards ATs and disability in general: negative

attitudes towards disability (seen as weakness and dependence) are associated to a negative perception of AT (McMillen & Söderberg, 2002; Bender Pape et al., 2002), while in the meantime, positive attitudes towards disability also include a positive conception of technologies that are considered as tools that make it possible or favour the autonomy of a person.

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