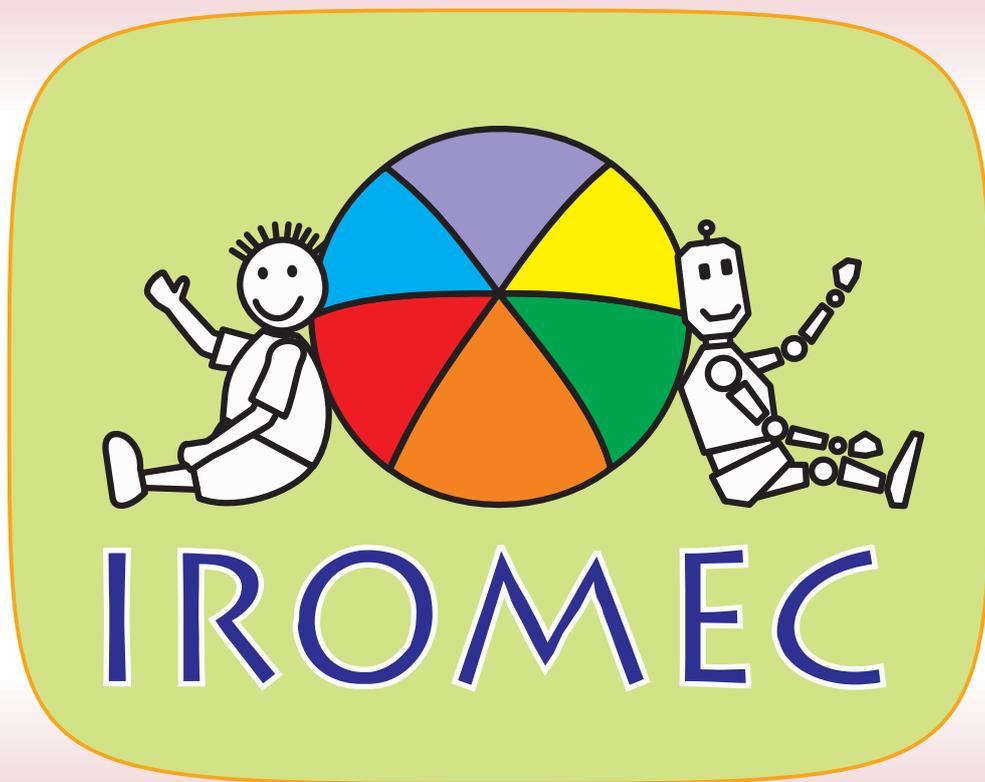


Serenella Besio
(editor)



GUIDELINES FOR USING ROBOTS
IN EDUCATIONAL AND THERAPY SESSIONS
FOR CHILDREN WITH DISABILITIES

IROME C
Interactive RObotic social MEdiators as Companions -IST-FP6-045356

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UNIVERSITÀ DELLA VALLE D'AOSTA - UNIVERSITÉ DE LA VALLÉE D'AOSTE

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Elena Laudanna:	WHO: Special children at play: personal and environmental factors	(ch. 2)
	WHAT: Robots for play	(ch. 3)
Francesca Caprino:	WHY: Play, disability and robotics. The reason of an encounter	(ch. 1)
	HOW: Using robots to promote play in children with disabilities	(ch. 5)

REVISION OF THE ENGLISH LANGUAGE
Dr. Terrence Agneessens



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TABLE OF CONTENTS

Preface	5
1. WHY: Play, disability and robotics. The reason for an encounter	10
1.1 Play definitions and visions	10
1.2 Play in childhood development	11
1.3 Stages, styles and types of play	13
1.4 Play in the ICF-CY perspective	17
1.5 Play in the educative and therapeutic intervention	20
1.6 The role of new robotic technologies	23
2. WHO: Special children at play. Individual and environmental factors	26
2.1 Severe motor impairments	28
2.2 Mild mental retardation or mild cognitive impairments	34
2.3 Autism	38
2.4 Influence of environmental factors on play skills and play opportunities	43
3. WHAT: Robots for play	48
3.1 Definitions of robot	48
3.2 Toy robots for play-based intervention	50
3.3 Features of robots suitable for rehabilitative and educational play interventions	53
3.4 Robots, scenarios and children: possible relationships	54
3.5 Towards a concrete solution: the IROMEC robot	62
4. WHERE: Case studies	63
KASPAR	64
ROLLING PINS	68
PARO	71
LEGO® MINDSTORMS™	74
ADAPTED TOY ROBOTS	79
IROMEC	83
5. HOW: Using robots to promote play in children with disabilities	87
5.1 The initial assessment	87
5.2 Play as an assessment strategy	89
5.3 Objective selection	92
5.4 Selecting play scenarios	94
5.5 The play setting	96
5.6 Teaching how to play: the role of the adult	98
5.7 Promoting inclusion in play: the role of peers	99
REFERENCES	101

Preface

Have you ever seen a boy with a severe motor disability, while sitting in a pram or in a posture support device, watch other children play tag? His body is in a particular position, and his head is bent down because sometimes it's hard for him to hold it up, especially when he has to concentrate and force his eyes to look up while his head is tilted down to observe that wonderful scene. And the laughing! Laughing from the heart, when a playmate falls down, gets tagged, or is set free...

And have you ever seen a girl with Down syndrome observe, with feigned indifference, other children playing with a new (and perhaps technological) toy that she has not yet figured out how to use, or for which she does not yet understand the rules? She mixes with the others who are talking about it, imitating their behaviours to avoid being left out: and perhaps she is only waiting for someone to show her everything that's new...

Or have you ever seen an autistic boy lost in his world of identical and repetitive rhythms, entranced by a noise, or a movement, repeated over and over again, on the same object, to produce the same result, for what seems to be an eternity, oblivious to what's happening around him? Have you ever thought about what it would be like enter that magical spell, to understand it better, but above all to help him enter our world that, because of its variety, seems to offer so much more?

This document, and the resulting research project, provides some answers for those who have had such experiences... and have been moved by them.

Rationale

The previously described situations, not unusual for those who interact with children with disabilities on a regular basis for either personal or professional reasons, easily lead to pressing questions. We have gotten used to the surprising speed with which technological innovation continues to evolve and thus it's natural to think that this sector and the realm of modern research can provide answers for these children. And so here are some of those questions.

Therapist: Can I use robotic technologies to improve the play skills of some of my patients? But also: Which and how many of my patients can benefit from using robotic technologies for play activities? And what are they?

Teacher: Can I introduce play activities with robots in my class to increase the inclusion and participation of students with disabilities? But also: How can the disabled student take part, in a useful manner, in the robot-based teaching that I intend on using in the classroom?

Parent: Can my son or my daughter reap benefits from using a special or adapted robot toy?

Researcher: For what children can the robot functions at my disposal be a good play tool? But also: In what way can I measure the effectiveness of the robot as a play tool?

IROME C - Interactive RObotic social MEdiators as Companions

IROME C is a Specific Targeted Research Project (contract number IST-FP6-045356) co-funded by the European Commission within the RTD activities of the Strategic Objective SO 2.6.1 "Advanced Robotics" of the 6th Framework Programme.

IROME C has targeted children who are prevented from playing, either due to cognitive, developmental or physical impairments which affect their playing skills, leading to general impairments in their learning potential and more specifically resulting in isolation from the social environment.

IROME C has investigated how robotic toys can provide opportunities for learning and enjoyment. The developed robotic system has been tailored to become a social mediator, empowering children with disabilities to discover a full range of play styles, from solitary to social and cooperative play.

Project Consortium

PROFACTOR GmbH	http://www.profactor.at	AT
University of Hertfordshire	http://adapsys.feis.herts.ac.uk/	UK
Robosoft SA	http://www.robosoft.com	FR
VILANS	http://www.vilans.nl	NL
University of Siena	http://www.disco.unisi.it	IT
University of Valle d'Aosta	http://www.univda.it	IT
Toy Research Institute (AIJU)	http://www.aiju.info	ES
Risoluta S.L.L.	http://www.risoluta.com	ES
AIT Austrian Institute of Technology	http://www.ait.ac.at	AT

Official website: www.iromec.org

These Guidelines were developed at the end of the IROME C three-year research project co-funded by the European Commission within the sixth Framework Research and Development programme.

Thanks to the dynamic input of sector professionals and the direct involvement of interested user groups (primary users include children with autism,

mental retardation and severe motor disabilities while, naturally, the secondary users are their parents, educators and therapists), IROME C has developed a new robot toy prototype to be used in school or rehabilitation activities designed for children with disabilities.

IROME C, a consortium of nine European research and development institutions, has also developed a method to apply robotics to all those educational and rehabilitative activities that, through play, can improve and enhance the learning potential of children with disabilities.

The aim of the research team is to make available – not only to sector researchers but above all to those who come in daily contact with children with disabilities – a new activity model that helps children with disabilities fully develop their potential through the use of play supported by robotic technologies.

Purpose of the Guidelines

Children with particularly severe disabilities, as anyone who comes in direct contact with them knows so well, are often unable to play like their peers.

The differences are both qualitative (complexity of the games, type of skills demonstrated, ability to play with others) and quantitative (time that such activities entail). In the most severe cases play may not even be part of the child's behavioural repertoire.

Joyful spontaneity, genuine fun, the electrifying experience of discovery and the richness of social interaction associated with play may be partially or entirely precluded for children with autism or other severe diseases that limit their mobility, language, perception and thought.

There are many environmental and individual factors that prohibit a child from fully experiencing playtime activities in these cases. In addition to the child's physical impairments (motor-based, cognitive or sensorial), other factors not related to him/her – the lack of materials and accessible play areas, for example, or activities that are not compatible with the child's characteristics and potential – contribute to play deprivation which, in turn, because it compromises the child's full development, may generate secondary disabilities.

Identifying and eliminating all these play barriers, where possible, is crucial for those who want, through play, to ensure full development, enhance involvement and improve the quality of life of children with disabilities.

Selecting accessible play materials, adapting everyday toys, using special play support technologies: these are the strategies most often applied, in educational and rehabilitation environments, to improve the play activities of children with disabilities.

The new technologies, that provide clinicians and educators with an important resource for eliminating play obstacles, undoubtedly play the most important role in this sense. This is the case, among others, of the new robotic technologies which, in recent years, have proven to be a resource capable of offering important play opportunities to children with even severe functional impairments.

But if new technologies continue to develop at breakneck speed, they also become obsolete just as fast. Choosing the most suitable technological tools to support play can be quite difficult without up-to-date information.

Furthermore, innovative technologies are not sufficient to ensure that children with disabilities will play effectively: to fully utilise the potential offered by robotic technologies it is also necessary to have a solid methodology which, starting from the real needs of children, makes efficient use of available tools.

These Guidelines are a useful tool for efficiently and systematically implementing the latest robotic technologies to improve the play skills of children with disabilities.

Users of the Guidelines

These Guidelines have been developed mainly for those who, for professional reasons and on a daily basis, work, live and play with children with various types of disabilities.

The main targets of this document are professionals in the fields of rehabilitation (occupational therapists, physiotherapists, speech therapists, psychologists, etc.) and education (teachers, child services operators, recreational and play centres, etc.).

However, the contents can also provide useful ideas also for those who, in various fields (consultants, trainers), work with technologies designed to create independence.

And these guidelines will also provide parents of children with disabilities with a new perspective of the production and market availability of hi-tech toys, while also allowing them to glean information regarding to what extent their children want to play and their involvement in those play activities.

Finally, it is hoped that these guidelines – along with other documents in the IROMEC project – can be utilised as a fundamental source and a useful stimulus for additional research and development of innovative products in the play-oriented robotic technologies sector.

Content overview

These Guidelines have been developed to help the reader choose robotic technologies to support the play activities of children with disabilities.

The reasons for analysing play as a fundamental activity in the development of all children and for using it as an educational tool to facilitate such development are clarified in *Chapter one*. Various types of interventions are described that can be utilised, in school and in the rehabilitation environment, to achieve educational or therapeutic objectives, analysing how robotics can provide effective support within such a setting.

Chapter two describes how children play in relation to their specific disability, analysing, using the International Classification of Functioning as a model (the version for children and adolescents), the individual factors (cognitive, relational, motor or sensorial impairments) that affect development of their play skills. In this chapter the authors also delve into contextual factors that positively or negatively affect how children with disabilities play.

Robotic systems in general, and those that can be used for play activities in particular, are described in *Chapter three* along with a classification of such systems based on their functions and use environments.

Chapter four presents some important experiences involving the use of robots in play activities for children with disabilities. The descriptive charts illustrate the technical characteristics of the robots used, the types of children involved, the intervention methodologies and the results obtained. This chapter also describes the robots that can be acquired through common commercial channels and the systems still in the prototype stage.

Finally, in *Chapter five*, the authors illustrate a possible play-based methodology for using robots, describing the role and interactions of those involved (teachers, therapists, children with disabilities and their peers), the setting characteristics, the initial evaluation of children and the results of the intervention.

Authors

This document was prepared by the team from the University of Valle d'Aosta. Chapters 1 and 5 were developed by Francesca Caprino and chapters 2 and 3 by Elena Laudanna. Serenella Besio was involved in the initial design stage and edited the final version of the entire document. The preface was written in a joint effort by the three authors. Chapter 4 was written together with the partners of the IROMEC project, each for the product under its specific area of competence.

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As the final product of the IROMEC project, these Guidelines widely reflect the thought and knowledge that have been developed within the Consortium since its inception three years ago. They also effectively implement the information, studies and skills acquired and presented over time in other documents developed by the same project. For this reason heartfelt thanks are extended to all members of the research team.

Our most sincere thanks also go to: all the children who took part in the various experiments, which helped to improve our work and encouraged us within the context of the research carried out; the parents who "trusted" us with their children, allowing us to test the robot; and finally, all the operators involved with the experiments and the various interviews, allowing us to share the knowledge acquired from years of experience.

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REFERENCES

- Bateson, G. (1956). *The Message "This Is Play"*. Princeton, NJ, USA: Josia Macy Jr. Foundation.
- Besio S. (ed.) (2009). *Methodological framework to set up educational and therapy sessions with robotic technology: the IROMEC proposal*. Trento, Italy: UNI Service.
- Besio, S. (ed.) (2008). *Critical factors involved in using interactive robots for education and therapy of children with disabilities*. Trento, Italy: UNI Service.
- Besio, S., Caprino, F., Laudanna, E. (2008). Profiling Robot-Mediated Play for Children with Disabilities through ICF-CY: The Example of the European Project IROMEC. In K. Miesenberger, J. Klaus, W. Zagler, A. Karshmer (eds.), *Computers Helping People with special needs*. Berlin, Germany: Springer, 545-552.
- Bettelheim, B. (1987). *A Good Enough Parent. A Book on Child-Rearing*. New York, NY, USA: Knopf.
- Brodin, J. (1999). *Play in Children with Severe Multiple Disabilities: Play with Toys – A Review*. "International Journal of Disability, Development and Education", 46 (1), 25-34.
- Bruner, J.S., Jolly, A., Silva, K. (eds.) (1976). *Play. Its role in development and education*. New York, NY, USA: Penguin.
- Fink, E. (1986). *Oasi della gioia. Idee per una ontologia del gioco*. Salerno, Italy: Masullo (orig. ed., *Oase des Glücks. Gedanken zu einer Ontologie des Spiels*, Freiberg/München: K. Alber, 1957).
- Fantuzzo, J.W. (1998). *Contextually-relevant validation of peer play constructs with African American Head Start children: Penn Interactive Peer Play Scale*. "Early Childhood Research Quarterly", 13(3), 411-431.
- Ferland, F. (2005). *The Ludic Model – Play, Children with Physical Disabilities and Occupational Therapy*. Ottawa, ON, Canada: Canadian Association of Occupational Therapist.
- Fewell, R. (1986). *Play Assessment Scale (5th revision)*. Seattle, WA, USA: University of Washington.
- Freud, S. (1977). *Al di là del principio di piacere*. Torino, Italy: Boringhieri (orig. ed., *Jenseits des Lustprinzips*, 1920).
- Fröbel, F. (1967). *L'educazione dell'uomo e altri scritti*. Firenze, Italy: La Nuova Italia (orig. ed., *Die Menschenerziehung*, 1826).

- Garon, D., Chiasson, R., Fillion, R. (2002). *Le système ESAR. Guide d'analyse, de classification et d'organisation d'une collection de jeux et jouets*. Paris, France: Electre.
- Garon, D., Fillion, R., Doucet, M. (1996). *El sistema ESAR: Un método de análisis psicológico de los juguetes*. Alicante, Spain: AIJU.
- Garvey, C. (1990). *Play*. Cambridge, MA, USA: Harvard University Press.
- Gitlin-Weiner, K., Stalker, A., Schaefer, C. (eds.) (2000). *Play Diagnosis and Assessment*. New York, NY, USA: Wiley.
- Huizinga, J. (1979). *Homo ludens*. Torino: Einaudi (orig. ed., *Homo ludens. A study of the Play Elements in Culture*, London, United Kingdom: Routledge, 1938).
- Kelly-Vance, L., Ryalls, B.O. (2008). Best practice in play assessment and intervention. In: Grimes, J., Thomas, A. (Eds.), *Best practices in school psychology*. Silver Springs, Maryland: National Association of School Psychologists, 549-560.
- Klein, M. (1969). *La psicoanalisi dei bambini*. Firenze, Italy: Martinelli (orig. ed., *Die Psychoanalyse des Kindes*, Wien, 1932).
- Lewis, V., Boucher, J. (1997). *The Test of Pretend Play*. London, United Kingdom: Harcourt Brace.
- Linder, T.W. (1993). *Transdisciplinary Play-Based Intervention: Guidelines for Developing a Meaningful Curriculum for Young Children*. Baltimore, MD, USA: Brookes Publishing.
- Lowe M., Costello A.J. (1988). *Symbolic Play Test, 2nd edition*. Windsor, UK: NFER-Nelson.
- Parten, M.B. (1932). *Social participation among pre-school children*. "Journal of Abnormal and Social Psychology", 27, 243-269.
- Pellegrini, A.D., Smith, P.K. (2005). *The Nature of Play: Great Apes and Humans*. New York, NY, USA: Guilford Press.
- Piaget, J. (1980). *Il giudizio morale del fanciullo*. Firenze, Italy: Giunti Barbera (orig. ed., *Le jugement moral chez l'enfant*, Neuchâtel, Switzerland: Delachaux et Niestlé, 1932).
- Piaget, J. (1980). *La formazione del simbolo nel bambino*. Firenze, Italy: Giunti Barbera (orig. ed., *La formation du symbole chez l'enfant. Imitation, jeu et rêve, image et représentation*, Neuchâtel, Switzerland: Delachaux et Niestlé, 1945).
- Rubin, K.H., Fein, G., Vanderberg, B. (1983). Play. In: P. Mussen & E.M. Hetherington (eds.) *Handbook of child psychology: Vol. 4. Socialization, personality, and social development*. New York, NY, USA: Wiley, 693-774.

- Skard, G., Bundy, A.C. (2008). Test of Playfulness. In Parham, L.D., Fazio, L.S. (eds.), *Play In Occupational Therapy For Children* (rev. ed.). St Louis, MO, USA: Mosby Elsevier.
- Smilansky, S. (1968). *The effects of socio-dramatic play on disadvantaged preschool children*. New York, NY, USA: Wiley.
- United Nations (1989). *Convention on the Rights of the Child*. Retrieved January 4, 2010 from <http://www2.ohchr.org/english/law/crc.htm>
- Various Authors (2008). *Robotics for Health care. Final report*. Retrieved January 4, 2010 from http://ec.europa.eu/information_society/activities/health/docs/studies/robotics-final-report.pdf
- Visalberghi, A. (1958). *Esperienza e valutazione*. Turin, Italy: Taylor.
- Vygotskij, L.S. (1962) *Thought and Language*. Cambridge, MA, USA: MIT Press (orig. ed., *Myšlenie i reč' Psichologičeskie issledovanija*. Gosudarstvennoe Social'no-Ekonomičeskoe Izdatel'stvo, Moskva-Leningrad, 1934).
- Winnicott, D.W. (1971). *Playing and Reality*. London, United Kingdom: Tavistock Publications.
- WHO – World Health Organization (2007). *International Classification of Functioning, Disability and Health Children and Youth Version*. Retrieved January 4, 2010 from www3.who.int/icf/onlinebrowser/icf.cfm?undefined&version=7
- WHO – World Health Organization (2001). *International Classification of Functioning, Disability and Health*. Geneva, Switzerland: WHO. Retrieved January 4, 2010 from <http://apps.who.int/classifications/icfbrowser/Default.aspx>

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The aim of this work is to make available a new activity model that helps children with disabilities to fully develop their potential through the use of play supported by robotic technologies.

“Guidelines for using robots in educational and therapy sessions for children with disabilities” is addressed to all the people that everyday work, live and play with children with different types of disability: occupational therapists, speech therapists, psychologists, teachers and professionals working inside recreational or educational centres can find useful ideas and methods to support their work in the Guidelines, but also parents can find suggestions for their children's leisure time.

This work can be a good starting point also for researchers that aim at deepening the interesting subject of applying robotic technologies to play of children with disability: they can find ideas to improve their prototypes, to develop new devices and to suggest new methodological approaches.

Serenella Besio is Assistant professor of special education at the University of Valle d'Aosta (Italy) and her main research interests are in the field of disability studies and Assistive Technology, particularly about the use of new technologies in clinical rehabilitation and educational settings for the social inclusion of persons with disabilities.

The play of children with motor impairments has been her main research topic in the last years.

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