Serenella Besio

(editor)

METHODOLOGICAL FRAMEWORK
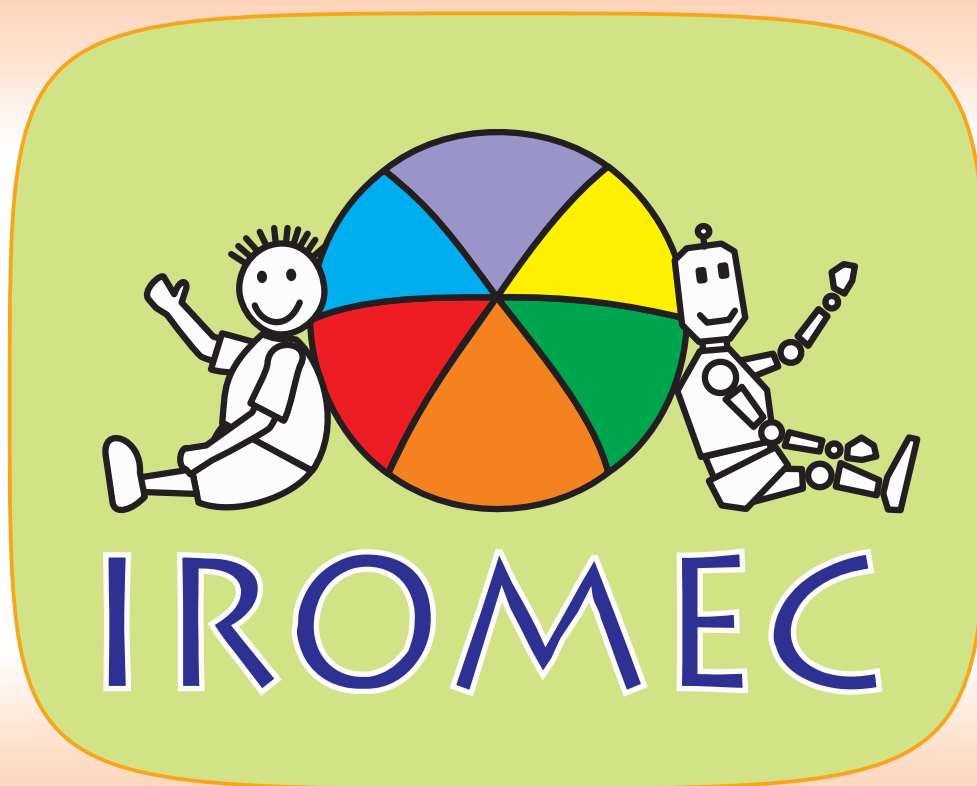# TO SET UP EDUCATIONAL AND THERAPY SESSIONS
WITH IROMEC

Serenella Besio
(editor)

METHODOLOGICAL FRAMEWORK TO SET UP
EDUCATIONAL AND THERAPY SESSIONS WITH IROMEC

(Deliverable D5.2)

IROMEC

Interactive RObotic social MEdiators as Companions

IST-FP6-045356

Editrice | UNI Service

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

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Progetto grafico di copertina: ⊙⊙

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Glossary of acronyms

CF	Critical Factors
ICF	International Classification of Functioning, Disability and Health
ICF-CY	International Classification of Functioning, Disability and Health – Children and Youth version
ESAR	Exercise play, Symbolic play, Assembly play, games with Rules
AUT	Autism
SMI	Severe Motor Impairment
MMR	Medium Mental Retardation
MF-Form	Methodological Framework Form

Summary

This document is part of the products of the IROMEC European project,[1] developed by the University of Valle d'Aosta, as one of the Consortium partners and responsible of the most theoretical aspects of the project itself, related to play and children with disabilities.

In particular, this document concerns two intertwined aspects: from one hand, the development of a general methodological framework to set up a fruitful and effective matching process between the child's competence and ability and the robot's technological features, to develop and realize interesting and useful play scenarios. On the other hand, an in-depth study on the existing literature about the experimental evaluation of the infant play, especially in the case of children with some type of disabilities.

Thus, the document is structured into two Sections, one per each concerned aspect; it is also accompanied by three appendices.

In Section I, the Methodological Framework – one of the IROMEC final results – is presented and described; it will be the basis for one of the main final publications of IROMEC, that is the *Guidelines for using robots in educational and therapy sessions for children with disabilities*.[2]

One of the primary scopes of this framework is to match technical and psycho-pedagogical issues both to clinical challenges and demands and to technological features: to this purpose, a strict connection with the items of the WHO's International Classification of Functioning – Children and Youth (ICF-CY) has been established.[3]

The scientific background for the definition of this framework has been found – and widely used – in one of the IROMEC previous publication, *Analysis of Critical Factors involved in using interactive robots for education and therapy of children with disabilities*.[4]

In this Section a form is proposed – called Methodological Framework Form (shortly, MF-Form) – which is based on a very general methodology designed to support the evaluation phase of the experimental trials, both with the IROMEC prototype in different test sites defined with the Consortium partners and with other available robotics devices.

The aim of the MF-Form (Addendum A – MF-Form) is to test the effectiveness of play-robots in rehabilitation and education of children with disabilities. It is intended to be easily and quickly filled in and it is also strictly dependent on – and linked to – other results and products of IROMEC: scenarios, objectives of scenarios, robot design and technical features.[5]

It will help to collect information useful for choosing and applying the play scenarios that have been developed within IROMEC, and it will give back useful data about the effectiveness of the established connections between the child, the robot and the scenario, thus

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[1] IROMEC: Interactive RObotic social MEdiators as Companions, www.iromec.org. The project is co-ordinated by PROFACTOR, Austria.

[2] Also the development of this publication – IROMEC Deliverable D5.3 – will be managed by the University of Valle d'Aosta.

[3] See the World Health Organisation site, www.who.int/classifications/icf/en/.

[4] The publication, edited by UNISERVICE, Trento (Italy), is freely downloadable at the IROMEC site.

[5] Some partenrs of the Consortium are respectively responsible of these parts: University of Hertfordshire (Great Britain), University of Siena (Italy), Robosoft (France), AIT and PROFACTOR (Austria). See the IROMEC site for further details.

allowing the generalisation from the specific case to a more comprehensive and general approach.

To make it easier to fill in the form, an electronic version is being developed,[6] to speed up the process of data input, to automatize some procedures of selection and, finally, to analyse the information collected by all the partners in the test sites.

The MF-Form is also strictly linked to other results and products of the project, such as play scenarios, objectives of play scenarios, robot design and technical features and for this reason it should be considered a work-in-progress until the end of the project itself.[7]

An important phase of the Methodological Framework development process is the evaluation of the educational/rehabilitative outcomes of the intervention realised to improve the child's functioning, activities and participation. This scope – related to evaluation and outcome measurement – is partially shared with other partners of the Consortium.[8] The contribution of this document is mainly performed by the literature analysis described in Section II, which is related to play assessment procedures with children with disabilities.

The main scope of this analysis, carried out by the University of Valle d'Aosta research group with the collaborative participation of other partners,[9] is to provide the experimental trials with the IROMEC prototype and with other robotic play systems with suitable assessment tools and methodological inputs for the validation of play scenarios.

For this reason, the results of this analysis can be also considered as an input for the development of the work packages in IROMEC, especially for "field studies and evaluation"[10] and for "social play scenarios and evaluation methods",[11] being a possible further source of information to set up proper assessment methodologies within the IROMEC project.

More in detail, the gathered information is meant to be used to find out suitable tools for the IROMEC target groups, to evaluate the scenario objectives and their overall playfulness.

Objectives, methodology and results of the analysed references are described in different chapters while Appendix B – Reference Lists – contains useful additional documentation and gives four different versions of the reference list adopted for the literature analysis.

Appendix C – IROMEC Glossary – the last one of this document – contains the IROMEC Glossary, realised with the contribution of all partners in an ongoing collaborative work. It has been included as an important step in building up and sharing a common language within the Consortium, as well as a common view of some issues related to play and disability.

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[6] The platform will be available on the IROMEC site at the end of the project, after validation through its use during the trials.

[7] See note no. 5.

[8] Especially with VILANS (The Netherlands), University of Hertfordshire (Great Britain), AIJU (Spain). See the IROMEC site for further details.

[9] We would like to cite here Dr. Ester Ferrari of the University of Hertfordshire (Great Britain), Dr. Patrizia Marti, Dr. Leonardo Giusti, Dr. Alessandro Pollini of the University of Siena (Italy), Ing. Andreas Hochgatterrerand, Dr. Barbara Prazak-Arm of the Austrian Institute of Technology (Austria), Gert Jan Gelderblom, Dr. Tanja Bernd of Vilans (Netherlands)

[10] Workpackage "Field studies, Evaluation", managed by AIJU (Spain).

[11] Workpackage "Social play scenarios and Evaluation methods", managed by University of Hertfordshire (Great Britain).

SECTION I

MATCHING CHILDREN WITH DISABILITIES

WITH ROBOTIC TECHNOLOGIES

1. INTRODUCTION

The main goal of this Section is to offer and discuss the Methodological Framework and the derived Form that have been developed by the University of Valle d'Aosta research group to support the use of the IROMEC robot.

Through the validation process following the application of this Form it will be possible to build up a more general methodological framework for setting up therapeutical and educational sessions for using robots with children with disabilities.

By explaining the process that, starting from the IROMEC publication *Analysis of Critical Factors involved in using interactive robots for education and therapy of children with disabilities*[12] (from now on, D5.1) has brought to the development of a very concrete and simplified tool such as this Form, it is possible to offer a consistent theoretical basis both to the research and the clinical work, and possibly – adopting an iterative model – to point out its limits and to offer the opportunity to improve it.

In this Section, first of all the former version of a concept map is described, showing some of the possible relationships among the Critical Factors involved in using robots for play and education of children with disabilities: this first release of the map represents a conceptual link between the Critical Factors and the Methodological Framework.

Then the Methodological Framework is analysed in its single steps; more details about the relationships included will be given: these relationships are presented at the macro-level of the Critical Factors, while the final objective is to identify and to represent the relationships at the micro-level of the items contained in the final checklist of D5.1.[13]

The Form, which is an application of the Methodological Framework – from now on simply MF-Form – has been added as Addendum A – MF-Form of this document in the full version, together with explanations of its aims, instructions for use and appendices.

The next step, the realization of the electronic version of MF-Form, will be only shortly described in its aim and approach as its final implementation is linked to the validation process that will be done during the further evaluation trials.

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[12] See note no.4.

[13] To better understand this point, see D5.1, page 115.

2. From the Critical Factors to the Methodological Framework

During the preliminary phase of the IROMEC project, the main variables – Critical Factors (CF) – involved in robot assisted play in learning and therapy have been investigated, with the aim of developing a background study about the possible use and effects of the IROMEC robot as a tool for therapy and education for children with disabilities.

The Critical Factors analysis has been meant as a scientific and methodological source not only for the development of the IROMEC project but also for *professionals* – who would like to adopt any robotic toy for educative or rehabilitative purposes – for *researchers* – who intend to investigate the possible role of robots to set up learning environments or play therapy sessions – and also for *designers*, looking for key points to consider in robot design.

To better examine the Critical Factors involved, the ICF-CY (International Classification of Functioning, disability and health – Children and Youth) has been chosen as a methodological framework in order to be able to include the variety of aspects of the human life, and also to give the research a clear participative and inclusive perspective.

Furthermore, the choice of ICF-CY also answers to the need of adopting a universally shared language between researchers coming from different backgrounds – psychology, education, design, engineering – and other practitioners or persons involved in the IROMEC project, including primary and secondary users.

Five main clusters of CF have been singled out in this research, related to the play of children with disabilities, mediated by robotic technology:
- factors related to the individual, as detailed in ICF-CY;
- factors related to the context, as detailed in ICF-CY and including the following on-purpose personal factors: sex, age, nationality and culture, family relationships, cognitive styles and adaptability, previous experiences, social background, education styles;
- factors related to technology and robotics;
- factors related to methodology;
- factors related to play.

CF related to the use of robotics in the field of children's play, as well as those related to technology and play and methodology in the field have been studied in-depth, and separately, through a specific and comprehensive literature.

After having singled out the list of the most important variables (the checklist of Critical Factors) in this field, it is also necessary to develop a methodology that allows its practical use and application to the real situations. The first version of the map has been presented in the publication concerning Critical Factors.

A concept map is a diagram (visualization of qualitative data) showing the relationships among concepts used to organize and represent knowledge. Its components are concepts, lines and labels. Concepts, usually enclosed in circles or boxes of some type, are linked by labelled lines describing relationships. Propositions are formed by concepts linked through a labelled line.

The technique of concept mapping was first developed by Joseph D. Novak and his research team at Cornell University in the 1970s as a mean to represent the students' emerging knowledge in science. Concept maps have their origin in the learning approach

called constructivism. In particular, constructivists hold that learners actively construct their own knowledge.

Here the concept map has been used to stimulate the generation of ideas about the possible relationships among Critical Factors to improve the knowledge needed to develop effective methodologies for their use. It is the result of brain-storming sessions and, as it happens often with complex subjects, it is not a fixed and exhaustive result, but it should be considered as a starting point for further explorations.

In what follows the meaning of this concept map will be illustrated to the purpose of transmitting and sharing the complex ideas behind the work.

2.1. Description of the general concept map

The concept map describing the possible relationships among the Critical Factors reported in at the end of D5.1 is shown in Picture 1.

The five main clusters of CF that have been singled out are here represented by oval knots of different colours, while the Critical Factors included in these clusters are represented by rectangular knots of the same colour of the related cluster.
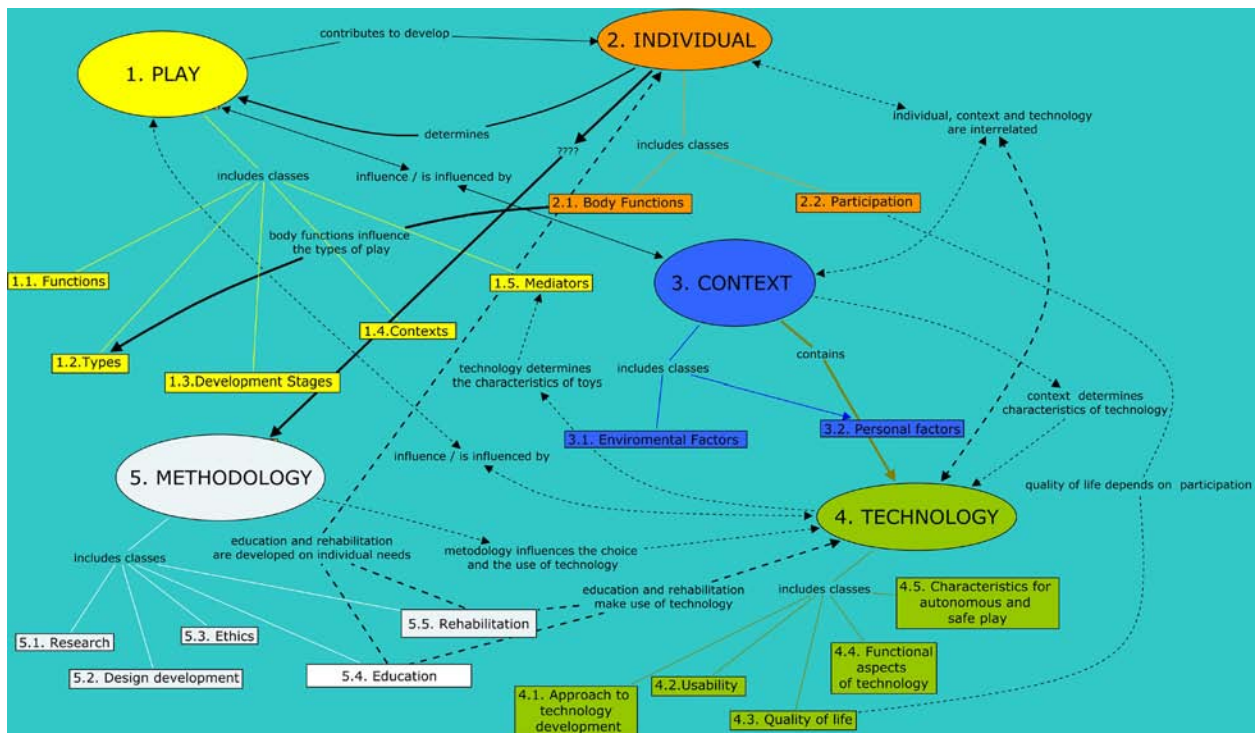
Picture 1. General concept map (from D5.1)

To make it easier the understanding of the relationships showed in this map without loosing its complexity, in what follows some pictures representing different types of relationships have been prepared; furthermore, tables with a more exhaustive description have been added in each picture to explain propositions.

First of all, relationships of inclusion among clusters and CF are shown in Picture 2 and described in Table 1. More accurate information about CF with references to literature can be obviously found in D5.1.
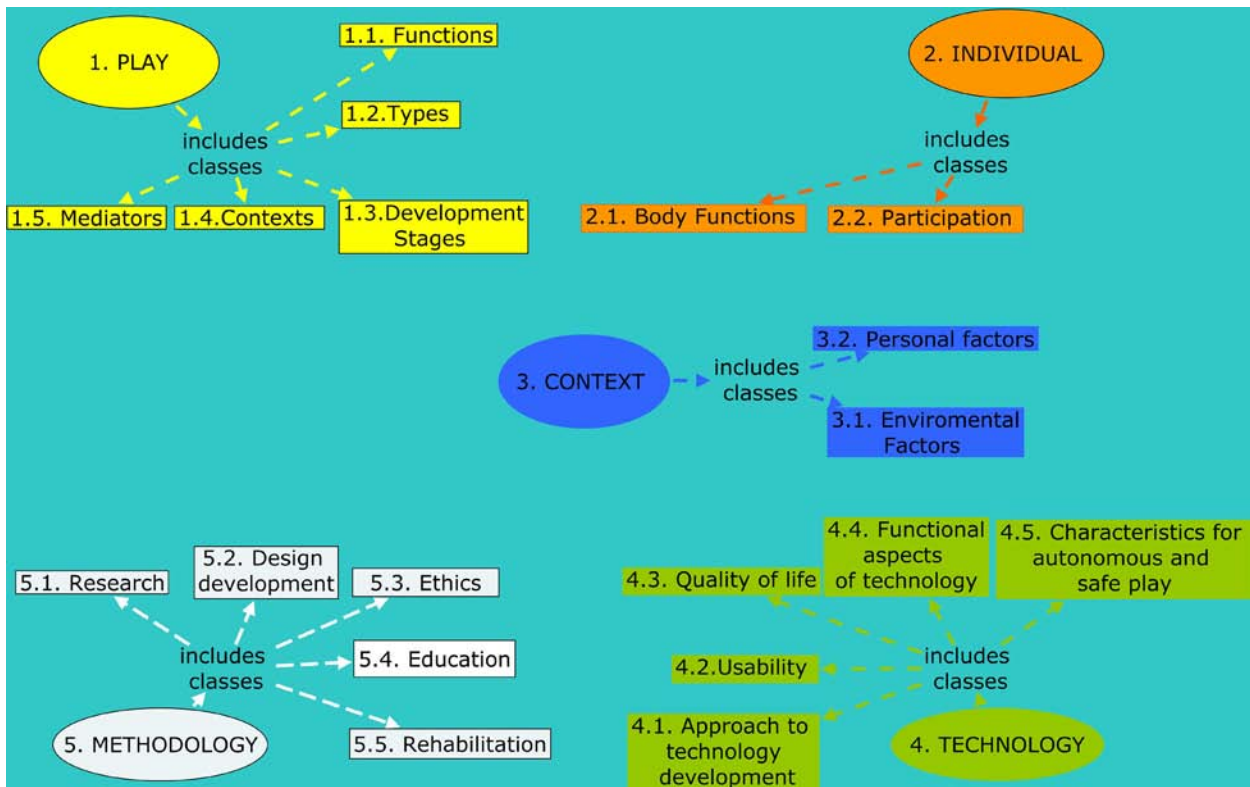
Picture 2. Inclusion of Critical Factors in the five clusters

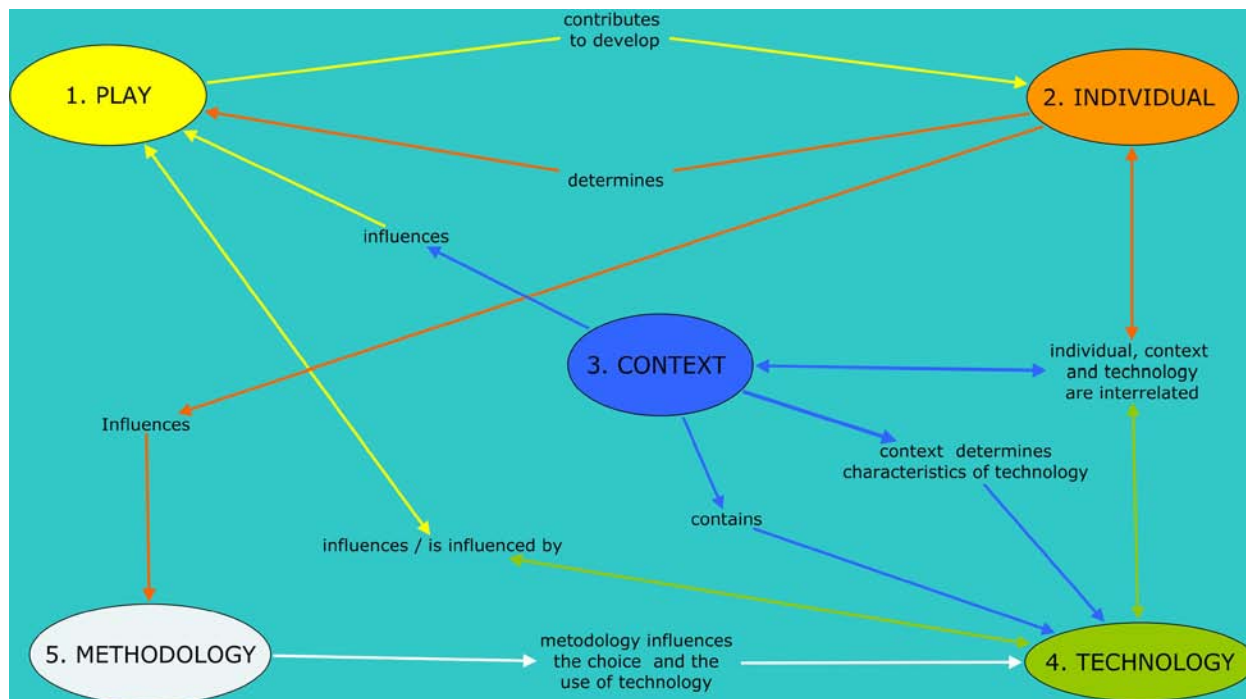| CLUSTER	RELATION	CLASSES	DESCRIPTION (From Checklist of Critical Factors)
1. PLAY	INCLUDES	1.1. Functions	Factors related to the different functions of play in the child's development according to different psychological and pedagogical approaches.
		1.2. Types	Numerous types of play activities have been identified in the history of human thought. Here the ESAR classification is used.
		1.3. Development Stages	Factors related to the different stages that play can assume during the child's development. In the IROMEC Glossary they have been redefined as "Styles of Play".
		1.4. Contexts	Factors related to the different possible contexts of play. Special contexts are education and rehabilitation, since they explicitly promote child's learning.
		1.5. Mediators	Factors related to the description of some mediators of play as peers, adults and toys.
2. INDIVIDUAL	INCLUDES	2.1. Body Functions	Factors related to the physiological functions of the body systems, including psychological functions. They can represent problematic aspects in the robot design activity and for participation to play activities. Individual factors should be evaluated in strict relationship with environmental factors.
		2.2. Activity and Participation	Factors related to the activities in which children can be involved or find difficult to do. Activities in the ICF framework are considered as a bridge to participation to the social contexts of life. Both are linked to the contextual factors and influence the play approach.
3. CONTEXT	INCLUDES	3.1. Environmental Factors	Factors related to the environment aspects that can influence the professionals' choices in setting up education and rehabilitation play activities mediated by robots. These aspects have been singled out in ICF-CY.
		3.2. Personal factors	ICF-CY suggests that personal factors should be included in the evaluation of the individual's health conditions; the personal factors here considered have been chosen for the special purpose of the IROMEC research.
4. TECHNOLOGY	INCLUDES	4.1. Approach to technology development	Technology has a growing influence and great impact on the life of persons with disabilities. The state-of-the-art of the field research has been considered to select the Critical Factors that are inherent the IROMEC project.
		4.2. Usability	Factors related to human-product interaction as regards the device effectiveness and efficiency and the satisfaction with which specified users achieve specified goals in a particular context of use.
		4.3. Quality of life	Critical factors that makes it possible to measure the individual's quality of life, in relation to the use of technology.
		4.4. Functional aspects of technology	Factors related to how technology can substitute or support functional limitations of the primary user group. They are strictly linked to individual factors.
		4.5. Characteristics for autonomous and safe play	Factors related to some specific characteristics implemented in the technology devices allow impaired children to experience play in a safe and autonomous way
5. METHODOLOGY	INCLUDES	5.1. Research	Factors related to the most suitable research approaches for the IROMEC purposes. Special attention is devoted to the necessary involvement of children, both as primary users and as subjects of the taken decisions during the project development.
		5.2. Design development	Factors related to the design development process.
		5.3. Ethics	Factors related to the ethical aspect of the research that involves children with disabilities.
		5.4. Education	Factors related to technology and robotics devices used in educational contexts.
		5.5. Rehabilitation	Critical Factors involved in Rehabilitation, as an active and dynamic process by which a disabled person is helped to acquire knowledge and skills in order to maximise physical, psychological and social functional ability, and minimize impairment and disability.

Table. 1. Description of Clusters and Critical Factors

Picture 3 shows the relationships among Clusters, while a short description is reported in Table 2. Just to show an example, the direct and strong link between individual features of child and play can be considered. As described in depth in D5.1, play has in fact an important influence on cognitive, social and emotional development of the child and, on the other hand, possible functional abilities or disabilities of the child can affect the type and the quality of play activities he/she can manage and develop naturally.

Picture 3. Relationship among clusters

CLUSTER	RELATION	CLUSTER	DESCRIPTION
1. PLAY	Contributes to develop	2. INDIVIDUAL	Play is the driving force for cognitive, social, emotional development of children.
1. PLAY	Influences	4. TECHNOLOGY	Toys, as play mediators, and type of play can influence the features of needed Assistive Technology devices, both as regards devices to access toys and as regards personal AT (for instance mobility devices)
2. INDIVIDUAL	Determines	1. PLAY	Individual factors determine the play activities that a child can manage.
2. INDIVIDUAL	Influences	5. METHODOLOGY	Individual factors will in some way influence the play setting methodology as concerning for example the duration, the location, the number of participants and so on.
3. CONTEXT	Influences	1. PLAY	The environmental factors have a strong influence on the types of play in which a child can be involved. Play can be more or less freely and individually organized and developed or on the contrary can be directed by an educational or rehabilitation professional; in addition, play can be very different depending on environmental factors, such as being indoor or outdoor, the presence of other children and/or the adult, and so on.
3. CONTEXT	Contains	4. TECHNOLOGY	Technology is an important environmental factor and it can be an important instrument of play.
3. CONTEXT	Determines characteristics of	4. TECHNOLOGY	Attitude of context towards technology determines characteristics of technology that can be used for play
4. TECHNOLOGY	Influences	1. PLAY	The type of technology available influences the play activities, for example if assistive technology can help child interaction; toys activated by electric signals can be adapted to the needs of children with motor impairment
5. METHODOLOGY	Influences the use of	4. TECHNOLOGY	The presence of a strong and consolidated methodology allows and makes easier the use of technology

Table. 2. Description of relationship among Clusters of Critical Factors

Going in more detail, Picture 4 shows some of the existing relationships among CF, while Table 3 describes these relationships. The CF *Quality of Life*, for example – here included in the cluster Technology – should be considered strictly linked to the individual's level of *Participation* in social life. Nevertheless, this relationship is bi-directional: a high perceived level of Quality of Life, that means a sense of well-being, brings to a more active *Participation* in social life; on the other hand, a real inclusion and *Participation* in social networks gives a major perception of one's own level of *Quality of Life*. As regards children, it should also be considered that *Play* is one of the main factors that contribute to the level of their *Quality of Life* and one of the most important *Activities*.
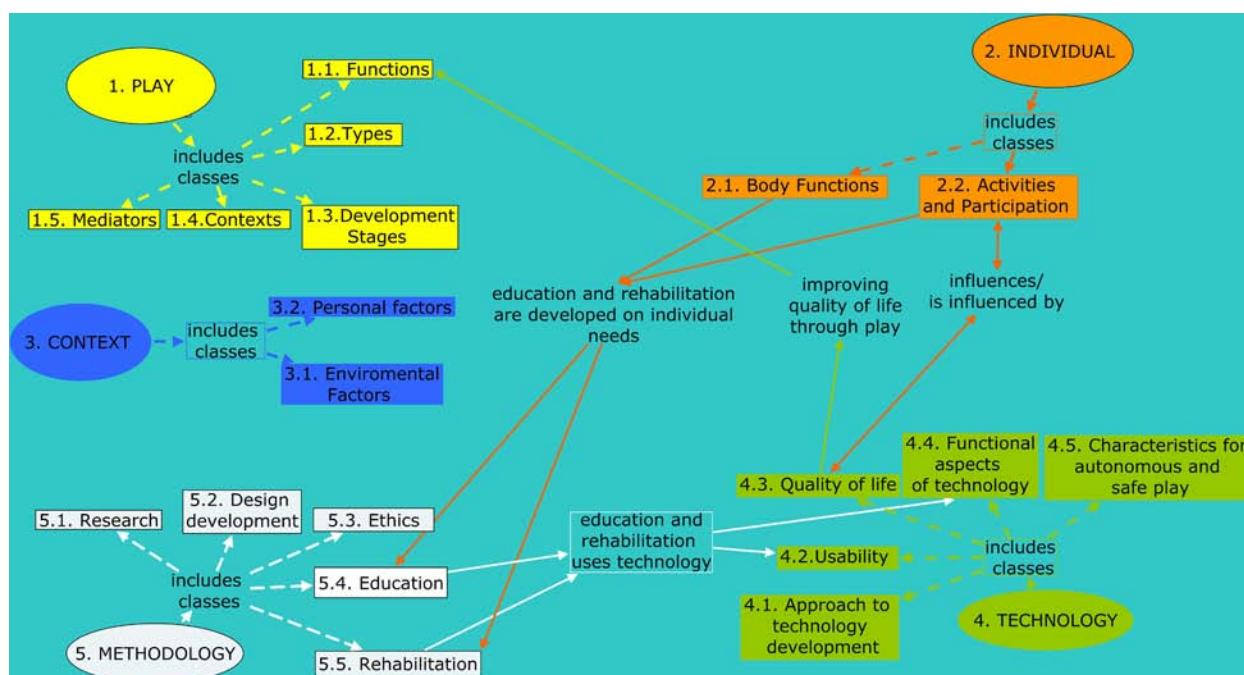
Picture 4. Relationships among Critical Factors

CRITICAL FACTOR	RELATION	CRITICAL FACTOR	DESCRIPTION
2.1 BODY FUNCTIONS	Define	5.4 EDUCATION	On the basis of the analysis of individual functioning and limitation teachers decide educational objectives and methods
2.1 BODY FUNCTIONS	Define	5.5 REHABILITATION	On the basis of the analysis of individual limitations clinicians decide rehabilitation objectives and methods
2.2 ACTIVITIES AND PARTICIPATION	Define	5.4 EDUCATION	To improve individual activities and participation educational process are developed
2.2 ACTIVITIES AND PARTICIPATION	Define	5.5 REHABILITATION	To improve individual activities and participation rehabilitation intervention are developed
4.3 QUALITY OF LIFE (due to technology)	Improves	2.1 PARTICIPATION	When the use of technology improves Quality of Life this happens trough an improvement of Participation

Table 3. Relationships among Critical Factors

2.2. USING THE GENERAL CONCEPT MAP: AN EXAMPLE

As it has been shown, the concept map allows to explore relationships among clusters and Critical Factors whatever the starting point of the analysis process.

An example of use of the map can be the following one. A specific play robotic technology is available and someone wants to explore how to use it with children with disabilities.

In this case the starting point is the cluster of Critical Factors related to Technology. It is possible to start from the exploration of the CF related to *Usability*, that in turn requires also to identify which *Body Functions* the users should have to effectively interact with the robot.

After that, by analysing the factors related to the *Functional Aspects* of technology, the objectives of the use of technology with the child are also explored; they could be, for example, the improvement of communication skills or the manipulation functions of a child with motor impairment. In this way Technology becomes a *Mediator of Play* and factors related to *Autonomous and Safe Play* acquire relevant importance. Through Play, Technology could improve *Activities* the child can perform and, as a consequence, his/her *Participation* to social life.

In the following picture the visualization of this example is shown.
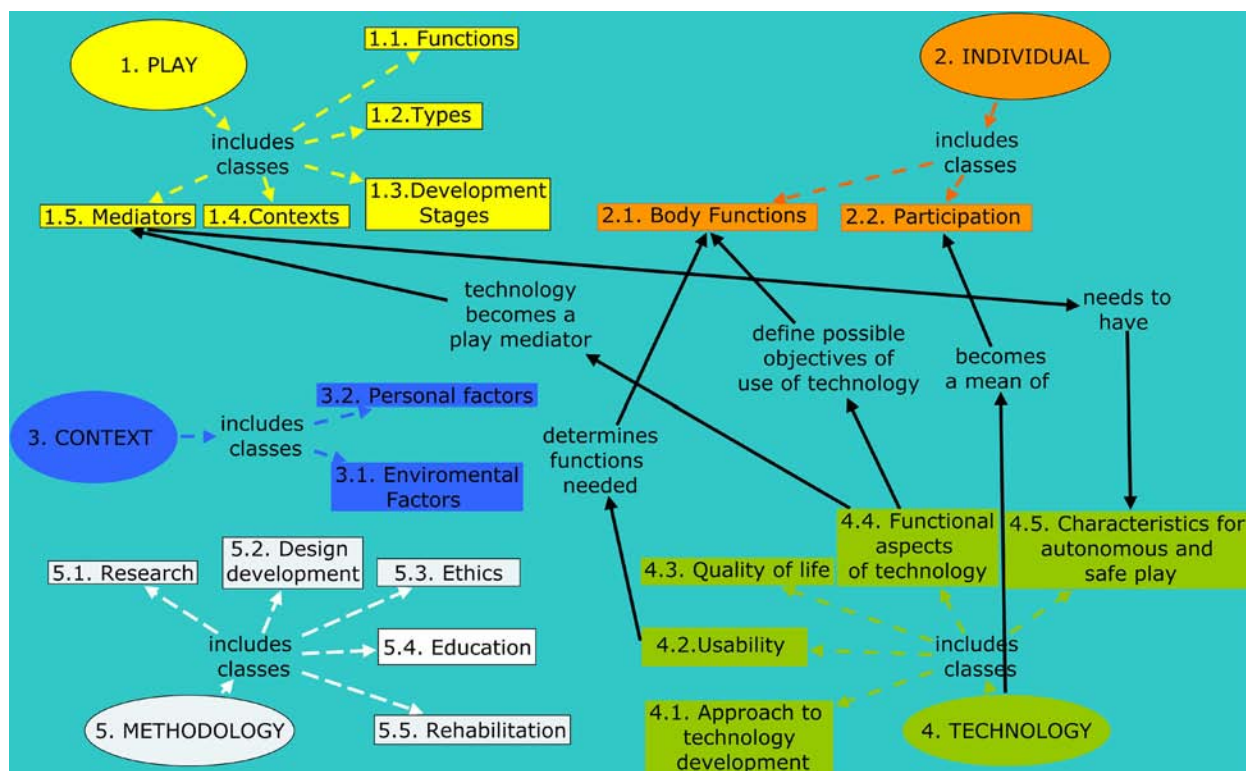
Picture 5. How to use technology for play of disable children

3. The Methodological Framework

Even if, as it has been shown, *D5.1- Analysis of Critical Factors involved in using interactive robots for education and therapy of children with disabilities* and the related results can be used in many contexts with different objectives, the main scope of the present work is to define a Methodological Framework to use the IROMEC robot,[14] and eventually other robots, for setting up rehabilitative and educational contexts of play for children with disabilities, in particular children of the selected user group identified within the IROMEC project.[15]

The final Guidelines[16] (from now on, D5.3) should derive from the Methodological Framework, to support clinicians and teachers approaching the use of the IROMEC robot with children with disabilities in answering to some of the following questions:
- Which objectives should be reached with this particular child?
- With which activity?
- Which robot features are needed?
- How should the robot be used? (setting, time ...)
- Which role should the robot fulfil in the play activity?
- How should the assessment be done before and after the play based intervention?
- Is the robot the best choice to reach the goals from an inclusion perspective?

To be able to answer to all these questions, the framework (picture 6) derived from the relationships in the previous general concept map should be used as a top-down procedure, composed by five simple steps.
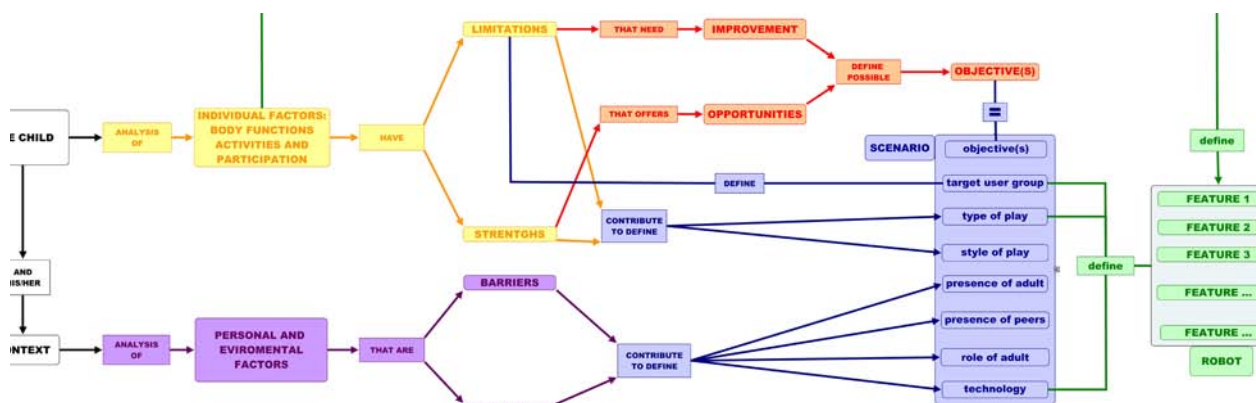
Picture 6. The Methodological Framework

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[14] This is also one of the main scopes of the research work of the University of Valle d'Aosta within the IROMEC Consortium.

[15] This was made mainly within the workpackage "Involvement of users and carers", managed by VILANS (The Netherlands).

[16] The reference is to D5.3, *Guidelines for using robots in educational and therapy sessions for children with disabilities,* the final publication of the University of Valle d'Aosta within IROMEC.

The further work, with the aim of developing D5.3, will go into a more detailed description of the decision process and it will be illustrated by a flow chart[17] and then implemented in practice in a software.

But before going into more detailed explanations a short clarification is due.

3.1. Rehabilitation and/or Education?

Since the very beginning of the project these two words, *rehabilitation* and *education*, have been used but during the development of the work discussions about their meanings arose. Education is naturally intended as the process that allows children to fully develop individual competences and personality; rehabilitation is intended as a process of "abilitation" – or "re-abilitation" – of individual functions, to allow activities and participation. The distinction between the two fields is not very and always clear, with reference to different cultural contexts and backgrounds that are inside the Consortium and the European Community; in addition, this is particularly true after the publication of ICF, in which participation is indicated as one of the main domains of the individual's life, and this objective belongs to both processes, especially in an inclusive perspective. Rehabilitation can imply educational aspects, and effective educational activities can also have positive influence under the rehabilitation respect. Consequently, this distinction is not really useful, and maybe sometimes impossible for the purposes of this project; for this reason in the following part of the document the two settings will be considered together: rehabilitative/educational objectives, rehabilitative/educational contexts, rehabilitative/educational intervention, and so on.

3.2. Step 1 - Analysis of Individual Critical Factors

In the usual clinical practice as well as in the research field, a deep knowledge of the child is the starting point to set up a rehabilitation/educative intervention. This can be made through informal observation and/or validated assessment tools. Sometimes the concrete experience of clinicians and educators is really consolidated and the process of analysis and decision seems to be so easy and fast that an external observer could think that there is "no process of analysis at all". But when asked about the reasons of their decisions, clinicians and educators often show clear ideas about their goals.

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[17] A flow chart is different from a concept map for its top-down structure, for the precise definition of possible relationships and for the use of decisions steps inside the process.

Due to the adoption of ICF-CY as the basis for the Methodological Framework, first of all this process will ask professionals to make "explicit" their assessment analysis of the child by using this classification.

Consequently, in the first step of the process, all the Individual Factors that have been outlined in D5.1 – and derived from ICF-CY – should be considered. If only the ICF-CY qualifiers[18] are used to "measure" the levels of impairment, only information about the possible limitations of these Factors can be derived.

On the contrary, the *Individual Factors* can represent for the child either a *limitation* or a *strength* (see Picture 7) and this distinction is particularly useful for the purposes of this study.

The meaning of *limitation* is linked to the usual medical approach to disability: if an individual function, activity or participation does not reach the "normal" expected functional level for the age and the analysed context, it represents a limitation.
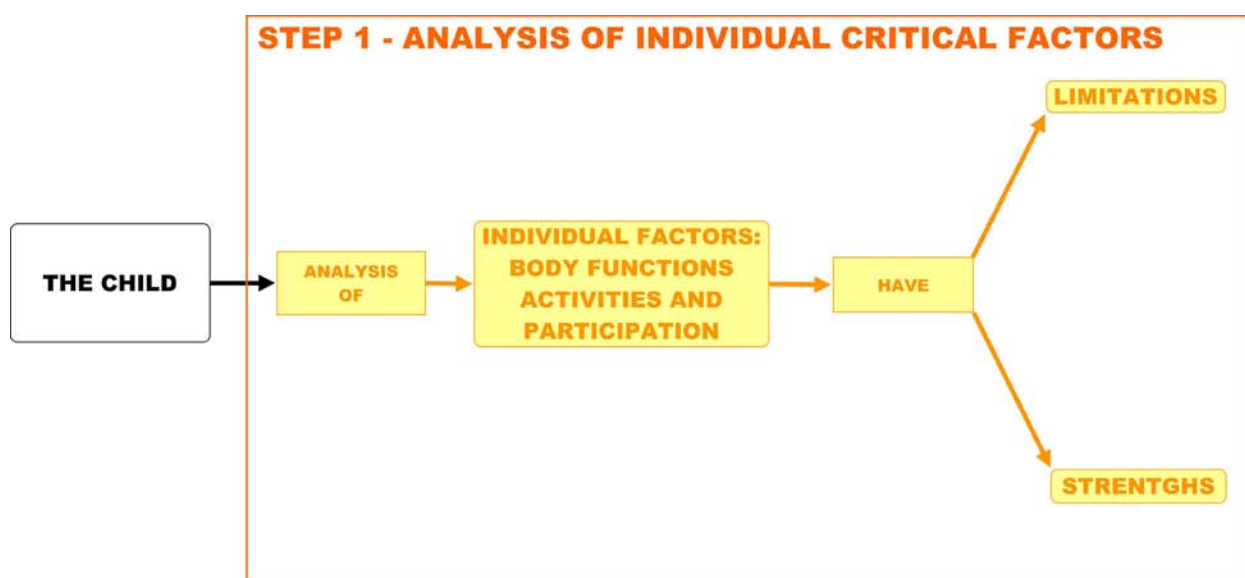
Picture 7. Step 1: Analysis of Individual Critical Factors

The concept of *strength* is quite new for the traditional medical approach and it indicates an individual's function, activity or participation that has no limitation but, on the contrary, could be a good resource as a basis for setting up a rehabilitative/educational program.

For example, in the case of a child with a low motor functioning, with no fine hand use and mobility allowed by an electronic wheelchair, the fact that the communication functions are normally developed could be considered a strength for his/her future development, since they can usefully support many social play activities and they could also become in the future an effective mean for environmental control.

It can be supposed to use the ICF-CY qualifiers (a scale from 0 – no problem – to 4 – total problem) to "measure" levels of impairment or *limitation* but as regards *strengths* no help can be derived from this classification. How to attribute – and if – a numeric value

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[18] Qualifiers support standardization and the understanding of functioning in a multidisciplinary assessment. They enable all team members to quantify the extent of problems, even in areas of functioning where one is not a specialist (Rauch, A., Cieza, A., & Stucki, G. (2008). *How to apply the International Classification of Functioning Disability and Health (ICF) for rehabilitation management in clinical practice*. "European Journal of Physical and Rehabilitation Medicine", 44, 329-342.

to *strengths,* still remains an open question at a general level but we have decided, in the context of this work, to consider as possible strengths only factors inside the cluster of Activity and Participation, identifying them without assigning any qualifier. This means that an Activity and Participation factor can be or not a strength with no other additional information.

3.3. STEP 2 – ANALYSIS OF CRITICAL FACTORS RELATED TO CONTEXT

According to the social model on which ICF-CY has been developed, each child – as well as each individual – is totally immersed in his/her life context and his/her level of activity and participation is influenced not only by the individual functioning, but also by environmental and personal factors.
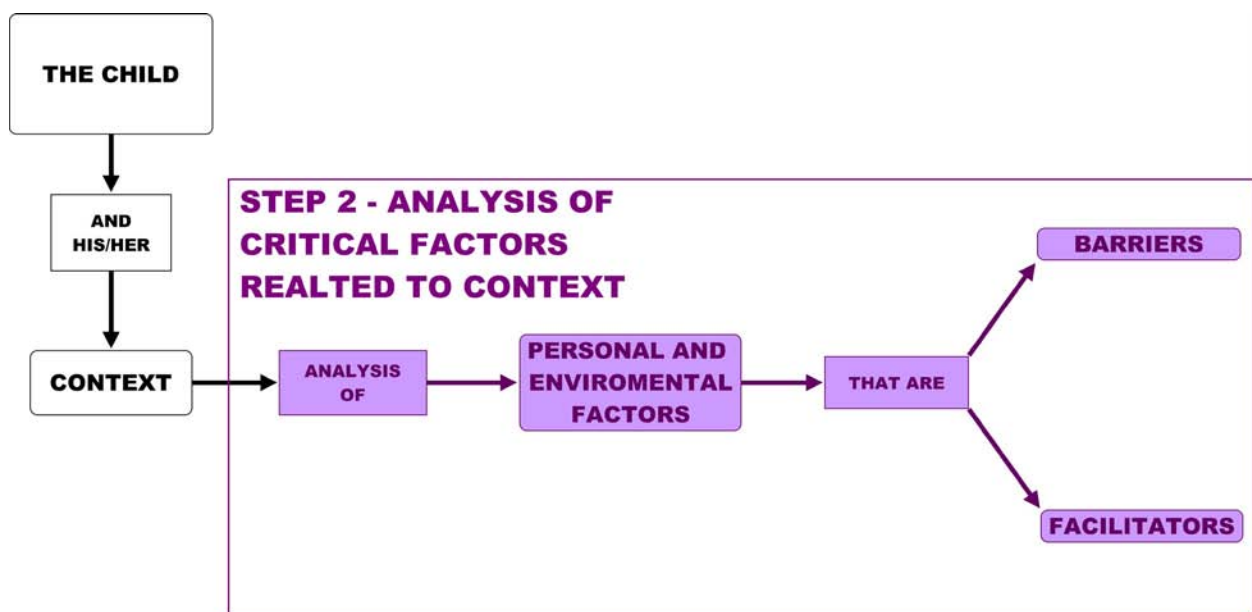
Picture 8. Step 2: Analysis of Critical Factors related to Context

The second step of the process is therefore the analysis of these factors: they should be classified as *barriers*, if they could be an obstacle to the play activity, or as *facilitators*, if they can support this activity. Factors related to the context should be considered only from the point of view of the considered user and also in relation to the planned intervention, and not with an "absolute" or "abstract" value.

Just to make an example, attitudes of classmates towards disability may be a strong *facilitator* that makes it possible to implement an educational intervention by involving them in a cooperative activity. If the planned intervention will not occur at school, attitudes of classmates of course are not relevant at all and should not be considered.

On the contrary, the fact that a child with severe motor impairments has no access to assistive technology for education, maybe due to the lack of funding or because of the

educators' poor competence in technology, can be considered a *barrier* to the use of more advanced robotic technology for play.

3.4. STEP 3 – DEFINITION OF OBJECTIVES

After the first two steps of the analysis, it will be probably clear that the child presents more than only one limitation with different degrees of severity of the impairments; clinicians or educators can select within this list of limitations which ones could have the priority to set up the most important objectives of the intervention.
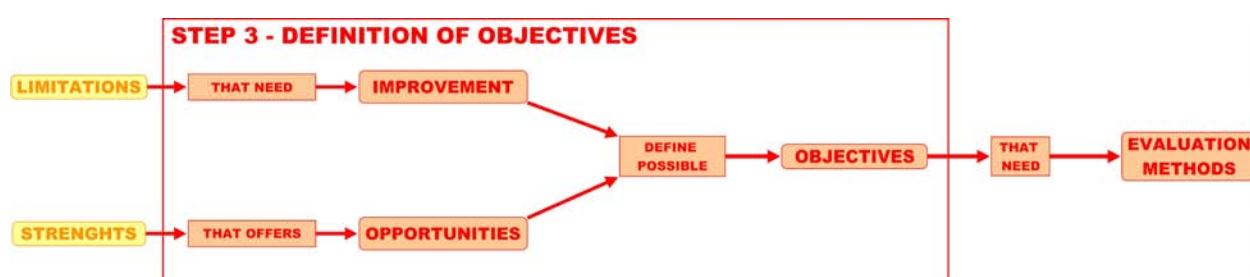
Picture 9. Step 3: Selection of possible Objective(s) of intervention

These objectives will be chosen due to different reasons: for example, because they can be reached with a mid-term intervention, because they are important for the child's autonomy or quality of life, in relation to the prognosis, or even because they can be useful for inclusion in social activities.

This means that this step represents a free choice – but sustained by clear reasons – of the professionals, based on their own experience, competence and knowledge of the child.

In particular, objectives can be chosen to improve some *limitation*, by taking advantage of some *strengths*.

To explain this approach an example can be useful. If a child with a diagnosis of autism has also limitations in the sustaining attention functions – due to difficulties in concentrating for the length of time required to complete a particular task – it is possible to establish the educational objective "increasing the attention time length", by taking advantage of his/her great interest to computer and high technology devices (strength).

Since the MF is the support for the selection process of activities and technological instruments required for a particular child, it should be used BEFORE starting the rehabilitative and educational intervention, but it cannot have any sense without it. The intervention, on the other hand, from a practical, but also ethical, point of view, is justified only if it has a positive impact on the child him/herself. To evaluate this impact some "measurements" are required. This measure should be done before the intervention (baseline) and after it (outcome). Some suggestions about possible evaluation methods are supplied in Section II.

3.5. Step 4 – Definition of Play Activity

In Step 4, after having collected the needed information about the child and his/her context, the play activity can be defined.

Picture 10. Step 4: Definition of play activity

In D5.1 play has been described along five Critical Factors.

First of all there are six possible *Functions of Play*: in fact, play can foster cognitive, social, communication, emotional or motor development of the child; but play can be a goal in itself and one of the *Function of Play* can be also the improvement of play skills. Rehabilitative/educational objectives decided in step 3 can be linked to these 5 possible functions.

Moreover, play can have another important function, since it can be related to Quality of Life, that is the playfulness itself, the joy a child has the right to feel when playing without any other scope.

The second Critical Factor in this Cluster is the *Type of Play*. Among the different existing theories in the field we decide to adopt the ESAR system, inspired in the Piaget's theories on child development, that identifies four different hierarchical types of play during childhood, although they can occur simultaneously as children grow. So in this context the classification of stages and types of play activity overlap (See Appendix C – IROMEC Glossary). *Type of Play* can be: Exercise Play, Symbolic Play, Assembling Play and Play with Rule. The *Type of Play* can be defined on the basis of what the child is able to do, that means his/her strengths, so that the most appropriate for him/her, according to the theory of the Zone of Proximal Development by Vygotskij, can be chosen.[19]

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[19] For more Details see D5.1 – Factors related to Play, pages 11-30.

The child's functioning contributes also to define the *Style of Play* that, for the purpose of the project, concerns social aspects of play activities. Many classifications can be found in the related literature but we used the "engagement in play" part contained in ICF-CY classification, as this document is the most authoritative one (See Appendix C – IROMEC Glossary). *Style of Play* can be: Solitary, Onlooker, Parallel, and Shared Cooperative.

The *Style of Play* determines the role that adults or peers can have as *Play Mediators*, that is also influenced by environmental factors: if the child attends a special school, probably it could be difficult to realize a shared cooperative play activity if his/her peers show a severe degree of impairment too. Another important component of the Critical Factor *Play Mediators* is *Technology,* that in this particular case is represented by robots.

As regards the CF *Context of Play,* this can be: structured or unstructured. In the former case its main scopes can be rehabilitative and/or educational. Since within the IROMEC project the main focus is on the educational and rehabilitation functions of play activities, organized and supervised by an adult, a clinician or a teacher, in this case only the structured play should be considered.

To supply a practical example of this step it could be supposed that a child with a diagnosis of mental retardation is also affected by limitation of mental functions of language. The main objective chosen by the therapist could be the improvement of his/her competence in producing complex sentences (cognitive *function of play*). A scenario based on developing a symbolic play activity (*type of play*) with a robot representing a pet, in cooperation with peers (*style of play*) could be implemented. In this case there are three *play mediators*: the robot, the peers as a source of stimulus and communicative interaction, and the adult(s) as a scaffolder.

3.6. FROM PLAY ACTIVITIES TO SCENARIOS

In the specific context of the IROMEC project, the play activities have been described as scenarios,[20] each of them showing a precise set of features. This means that relationships between the play scenarios and the Critical Factors related to play should be established and investigated and also that the Critical Factors described in D5.1 and used for describing the play activity, should be connected with these further findings and development of the IROMEC project.

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[20] This was the research work "Social play scenarios and Evaluation methods" managed and co-ordinated by the University of Hertfordshire (Great Britain).
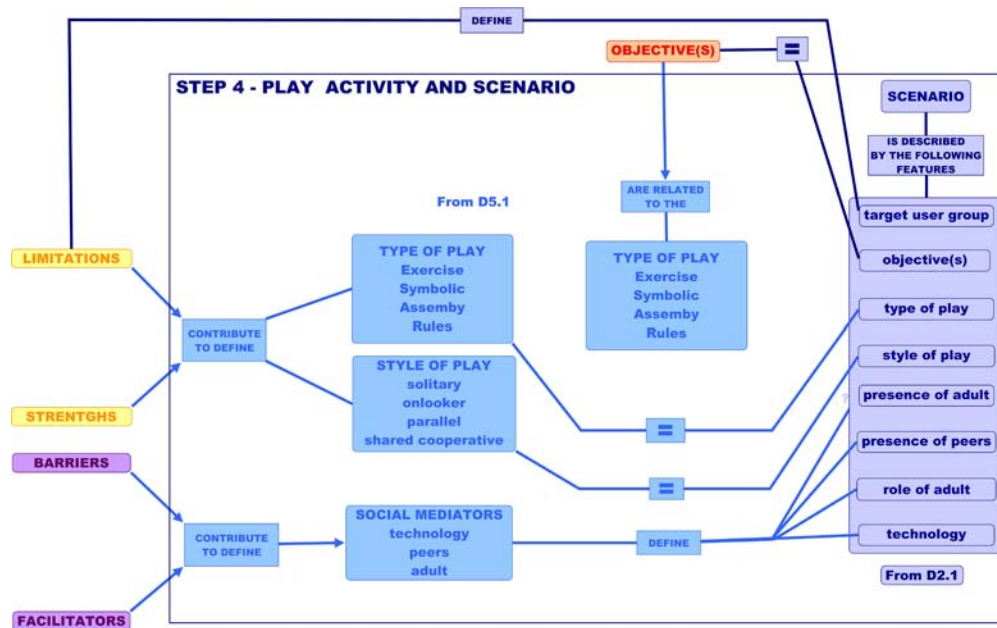
Picture 11. Play Activity and Scenario

10 scenarios, each of them with a certain number of variations, have been described through the following features.[21]

- Target user group: main target user group and other user groups among those identified by User Panels with clinicians and teachers (AUT, SMI, MMR).
- Type of play, according to the ESAR System.
- Actors: number and type (adult and/or peers).
- Activity: description of the play activity with the robot.
- Setting: description of the place where the activity occurs.
- Time: duration of the activity.
- Objective(s): educational/rehabilitative goals that are supposed to be reachable through the play activity.

The description of scenarios and their main features should find, within the Methodological Framework, their connections with the Critical Factors identified in Step 4 (see Picture 10).

In particular, for each variation of the 10 scenarios, the following aspects should be clearly identified mainly on the basis of Contextual Factor described in Step 2: the style of play, the presence and the role of the adult, the presence and the role of peers, as well as the technology used.

Picture 11 shows the links between the two different ways used to describe play activity: the one on the left used within D5.1. and the other on the right used within D2.1a.

With the introduction of the scenario description, Step 4 in this process can be "re-represented" as shown in Picture 12; the "old" representation has been left here in pale colour.

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[21] The internal document is the D2.1a, *Final IROMEC Scenarios for robot assisted play.*

An additional note should be supplied as regards scenario's objectives: to evaluate the outcome of the rehabilitative and educational intervention, the child functioning should be evaluated before (baseline) and after (outcome) the intervention, with a particular attention to the identified objective(s). The assessment method could be chosen by professionals, also with the suggestions supplied in Section II of this document, or methods related to scenario description could be used.
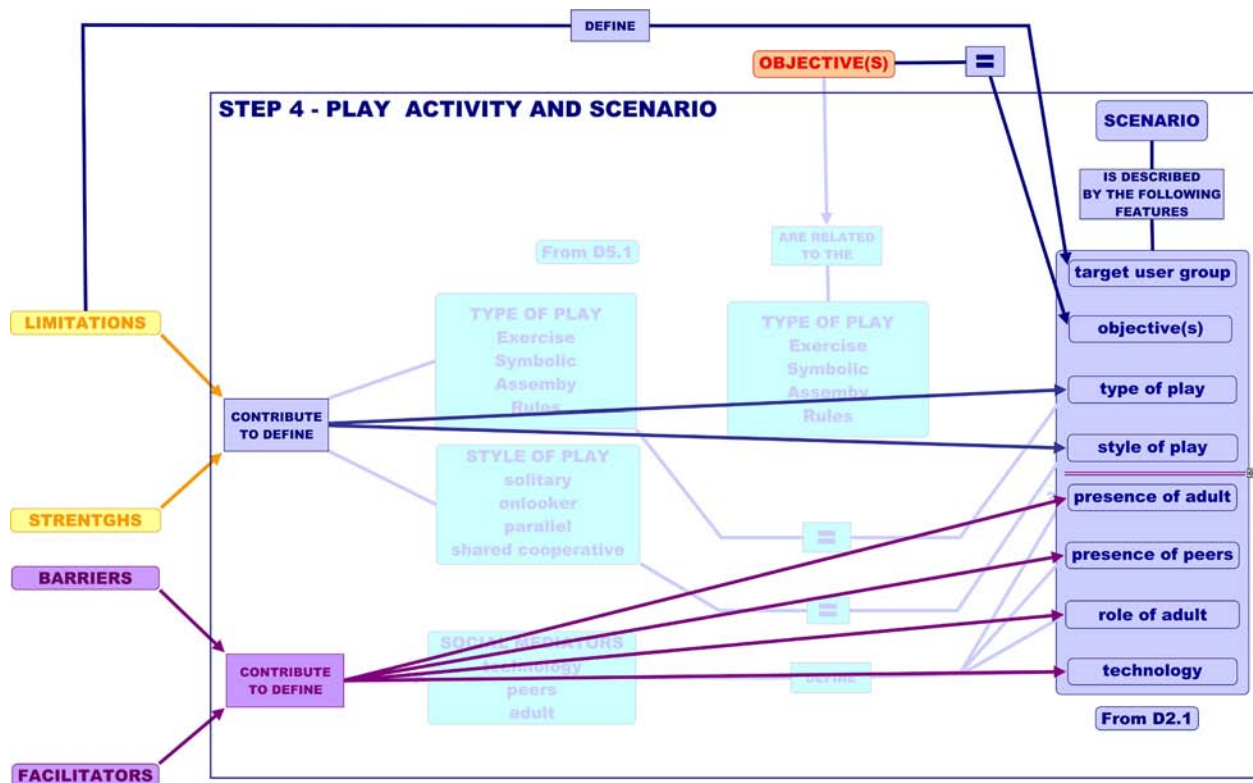
Picture 12. Step 4: Definition of Scenario(s)

3.7. STEP 5 – DEFINITION OF ROBOT FEATURES

After the definition of the play activity into the form of scenarios (step 4), the next step is to define the technology needed for its implementation.

Some features of the robots are defined by the scenarios themselves;[22] other features are related to the type of interaction that the child with disability is able to manage and, for each particular scenario, should be defined on the basis of individual factors.

This is the fifth step of the process (see Picture 13), that should allow to select the "most appropriate" robotic toy among a possible set of available technologies or the "most ap-

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[22] See again D2.1a.

propriate" configuration of the same robot, as it could happen in the case of the IROMEC robot.

Future work – within the IROMEC project – will develop a list of these possible features on the basis of that developed in the design process and used in the first version of MF-Form and show their appropriate links both with the child's individual functions and the play scenarios.
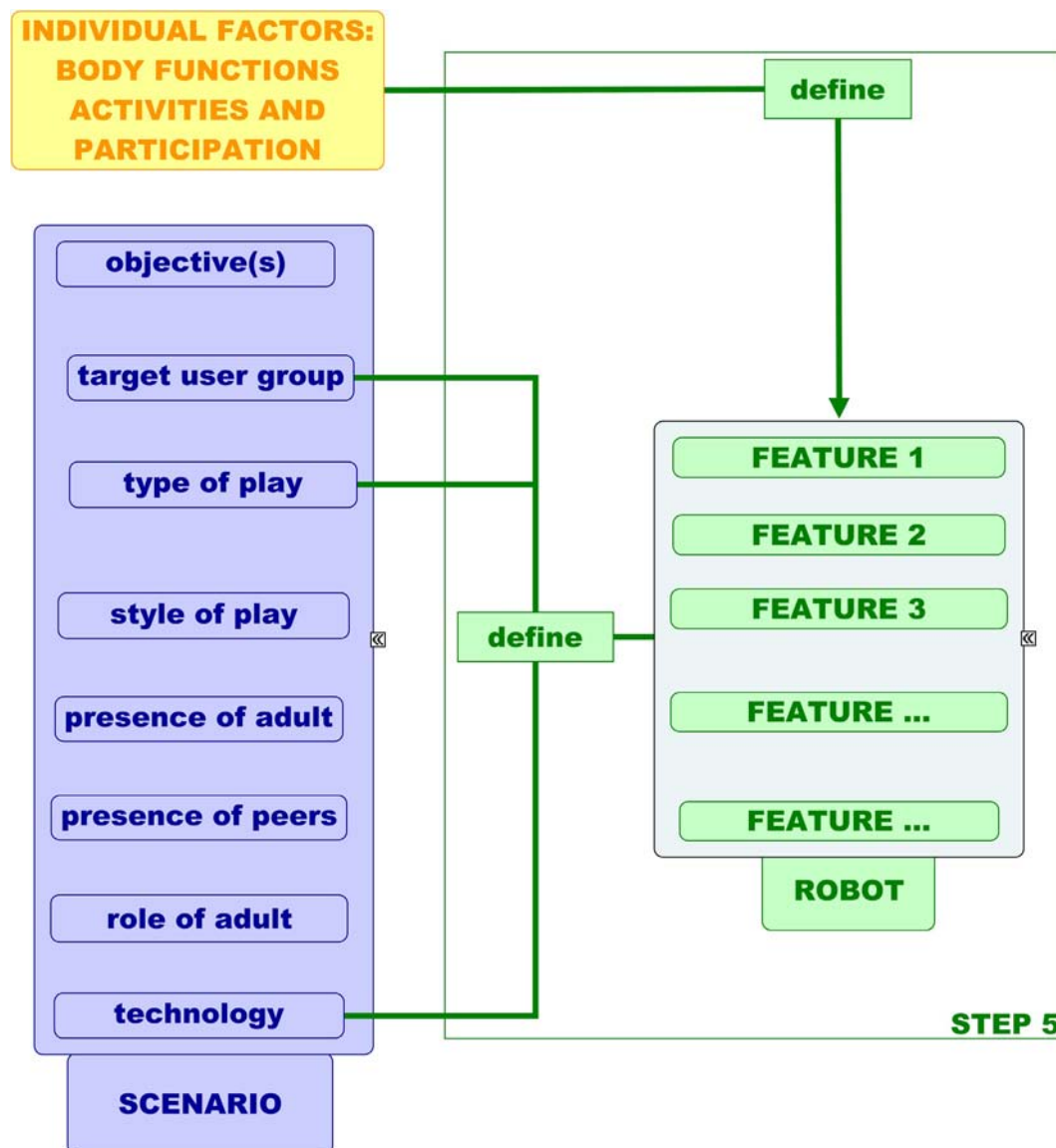
Picture 13. Step 5: Definition of Robot Features

3.8. THE COMPLETE PROCESS

Picture 14 represents a new shape of the Methodological Framework, already shown in Picture 6; the MF is in fact here represented in a comprehensive way, through all the identified steps needed to transform the network of relationships in a top-down process.
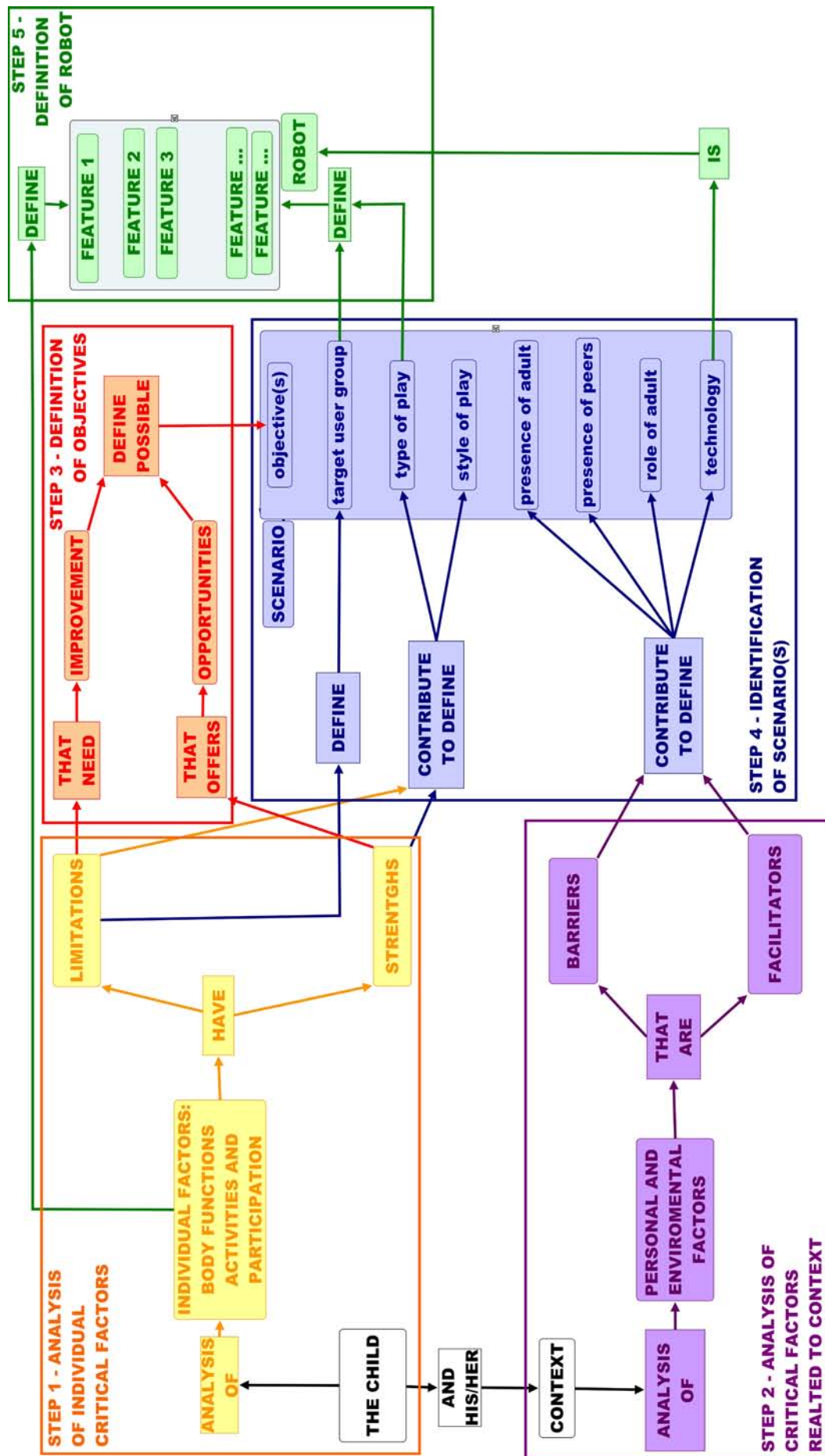
Picture 14. General Methodological Framework and Steps

4. THE MF-FORM

4.1. THE FIRST VERSION: THE VALIDATION PHASE

A first version of the MF-Form has been created on the basis of the Methodological Framework process previously described.[23] The MF-Form has been intended to be easily and quickly filled in and is strictly linked to other results and products of the IROMEC Project: scenarios, objectives of scenarios, robot design and technical features. During the on-going work, the MF-Form will include and integrate new results.

One of its primary scopes is to match technical and psycho-pedagogical issues with clinical challenges and demands: to this purpose, a strict connection with the items of the WHO's International Classification of Functioning – Children and Youth (ICF-CY) has been established.

First feedback received from other partners brought to the version of MF-Form which is presented in Addendum A – MF-Form of this document.

The form consists of 7 steps and 3 Appendices (to compile each step instructions are provided):
  - step 0 is intended as a first phase where general data are collected;
  - steps from 1 to 5 correspond to the steps of the process previously described:
    o step 1 - Analysis of Individual Critical Factors
    o step 2 - Analysis of Critical Factors related to Context
    o step 3 - Selection of possible Objective(s)
      ▪ Step 3.a - Definition of the evaluation method(s) that can be used to "measure" the possible educational/rehabilitative outcome(s) of the intervention
    o step 4 - Definition of Scenario(s)
    o step 5 - Definition of Robot Features (future integration with updated design and technical outcomes)
  - step 6 offers professionals the opportunity to record information about each single play session (probably to be redefined on the basis of evaluation process needs and results);
  - MF-Form – Addendum A and MF-Form – Addendum B facilitate the reference respectively to ICF-CY Individual and Contextual Factors, as they have been identified and singled out within D5.1;
  - MF-Form – Addendum C supports the evaluator in finding out the educational and rehabilitation objectives that are to be reached with the play activity selected.

Partners have been asked to use the first version of the form during the experimental trials to be done with the IROMEC prototype, thus giving rise to a validation phase.

The aim of this phase is to test the effectiveness of the proposed methodology for introducing play-robots in rehabilitation and education of children with disabilities; this methodology, improved thanks to the partners' feedback, will be afterwards generalized to develop D5.3, the last expected publication for the University of Valle d'Aosta.

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[23] This version has been presented to the IROMEC Consortium during the meeting which was held in July 2008.

4.2. The second release

Due to the fact that the IROMEC prototype is not yet available at this stage of the project, the University of Valle d'Aosta research team decided to test the usefulness of the MF-Form during a first cycle of experimental trials carried out in Italy with robots supplied by Profactor.

AIBO by Sony and another robotic prototype realized by Profactor were tested with some scenarios among those described in D2.1a. Results about these experimental trials, that represent an important feedback for the MF-Form, have been developed as contribution to the research work of other partners.[24]

MF-Form has been distributed to clinicians and teachers involved in these trials with the children chosen for the play activities. The results of this first phase were partially limited because only few scenarios and robot configurations were available and the process of selection of both on the basis of objective(s) and individual functioning was not tested.

Anyway this phase allowed to identify two main limits.

The first one concerns a linguistic aspect; in fact, the form was distributed in English, but due to its very specific contents, especially those related to ICF-CY, the task has proved to be more complex than expected. Consequently, to facilitate the use of the form in the different countries of the Consortium involved in the experimental process, it should be foreseen the need to translate it.

The second limit is related to the complicated management of the long list of CF, even if the Appendices have been provided. This point is really challenging, since from one hand the huge quantity of information is unavoidable, but on the other hand its management should be easy, quick and practical.

The solution to which the research team is currently working at is the development of a piece of software for analysing the information: this means that data within the form will be supported by an electronic format. The software will be freely available at the IROMEC site, after validation, at the end of the project.

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[24] Mainly to workpackage "Robot design and Prototyping" – managed by Robosoft (France) – and to workpackage "Design of Interaction and Interfaces" – managed by the University of Siena (Italy); the internal document is called *IROMEC Report AOSTA first trials.*

5. THE MF PLATFORM

The need to implement the MF-Form in a new electronic version, to make it easier to manage the huge set of items required to describe the child, causes some problems in the timing of the work, since the theoretical structures of data and the concrete procedures and algorithms should be almost defined and clear to realize the software. Currently, the Methodological Framework has been described as a general process, but it should be further defined in every particular aspects. Moreover only a testing phase can confirm the usefulness and coherence both of the theoretical structure and of the practical implementation. This testing phase is programmed during the evaluation trials at the end of the project period and for this reason the finalization of the MF will be obtained too late to start the realization of the final software.

A solution can be to work on a web-based platform: it can allows to realize some parts of the software and to test them during the realization of the others.

The MF Platform will be realised with three main relational database.

The first database is related to *Children*: they will be described by IROMEC researchers according to the Individual (Step 1) and Environmental (Step 2) Factors.

The second database is related to *Scenarios* according to description given in D5.2a.

The third database concerns the different features and configurations of the IROMEC robot as defined by partners involved in the design and in the development phases.[25]

The software will allow to visualize in a synthetic but comprehensive way all the information introduced about the child, his/her functioning, strengths and possible rehabilitative and educational objectives, supporting the researchers in selecting the most appropriate objective(s) (Step 3). Then it will propose the suitable scenario(s) for the objective(s) selected pointing out information related to different aspect of play (type, style, and so on),stimulating the researchers in considering different aspects of the scenarios according to individual and environmental factors. Finally the software will give suggestion about the right configuration of the IROMEC robot in each particular case.

Using a web-based platform some important advantages will be obtained: the partial work already realised will be tested before the final implementation of the software architecture; the realisation of the software in the chosen programming language can be kept separate from the introduction of the contents (items, descriptions, helps); malfunctioning can be solved in "real time"; accesses actions made by users can be recorded.

During the first part of the work, before the end of the project, access to the WP5-MF Platform will be allowed only to partners and in some cases to professionals involved in trials, through the creation of an user's account with a password.

Each user will fully see data about his/her owns children, but will not be able to see sensible data (name, family name and date of birth) of children introduced by others.

If time and resources will allow it, an additional database will be added to record information about the intervention cycle followed to the selection of scenario and robot configuration. Both quantitative data, as measurements of outcomes, scenarios used, number and duration of sessions, as qualitative data, as comments and observation, will be recorded according to the IROMEC experimental design.[26]

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[25] See note no. 24-

[26] This research work, entitled "Field studies, Evaluation" has been managed by AIJU (Spain).

After the end of the IROMEC project, when the MF platform will be realised in its final version after having proved its utility during the evaluation trials, it could be freely accessible to all the researchers and professionals interested in sharing their experiences about the use of technology for play in educational and/or rehabilitative settings. IROMEC partners will be able to continue in exchanging information about their experiments with IROMEC and other researchers will be able to propose and introduce new scenarios and new technologies.

The MF-Platform will be then funded, administrated and improved by the University of Valle d'Aosta.

SECTION II

LITERATURE ANALYSIS ON PLAY

ASSESSMENT METHODOLOGIES

1. INTRODUCTION

This second Section presents the main findings of the analysis conducted about the existing scientific literature on play assessment procedures with children with disabilities.

After a short presentation of the objectives of this work, a detail about the adopted methodology in this literature analysis has been provided.

The main aspects related to play assessment have been then described (analysis results) and synthetic forms summarizing data on play assessment tools described in the literature are reported.

Four different version of the reference list adopted for the literature analysis are attached to this document in Appendix B – Reference Lists:

- the first one presents all the references analyzed so far by the IROMEC Consortium;
- the second one presents only the references labelled as "play assessment references";
- the third one presents the references labelled as "play-based assessment references";
- the fourth one presents the references labelled as "other studies".

2. LITERATURE ANALYSIS: OBJECTIVES

The analysis of literature is a sub-task of the work package "Robot assisted play in learning and therapy" of the IROMEC project, managed by the University of Valle d'Aosta research group, in order to bring together data concerning the assessment of infant play.

The main scope of this analysis is to support the experimental trials with the IROMEC prototype and with other robotic play systems with suitable assessment tools for the validation of play scenarios.

The main research questions could be summarized as follows:
- Which tools and procedures are available for the assessment of infant play?
- Which are the tools and procedures to assess the infant play that could be applied with the IROMEC target groups?
- Which areas of the child's developmental are usually investigated by means of play activities?
- Which are the most critical aspects to set up play sessions and to evaluate their outcomes?

This document is intended to answer to these questions by offering an extended analysis of the existing international literature concerning the assessment methods and procedures of play of children with disabilities.

This analysis is meant to be used as an input for other work packages within IROMEC – especially "Field studies and evaluation" and "Social play scenarios and evaluation methods" – as a useful source of information to set up proper assessment methodologies within the IROMEC project.

More in detail, the information gathered through this Literature Analysis is meant to be used to find out suitable tools for the IROMEC target groups, to evaluate the scenario objectives and their overall playfulness.

The Literature Analysis, together with the Methodological Framework[27] will form the basis of the publication D5.3 – *Guidelines for using robots in education and therapy sessions for children with disabilities*.

The part dedicated to methodological issues of D5.1 – *Analysis of Critical Factors involved in using interactive robots for education and therapy of children with disabilities* – has been applied as a theoretical background for this study.

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[27] See Section I.

3. Methodology

Literature references have been collected selecting from reputable data sources articles and other scientific studies in English language with the key-words "play", "assessment", "disability".

A small group of reference was already available as it was owned by the partners.

Studies specifically addressed to blind and deaf children have been excluded as not included in the IROMEC target groups, while studies on children with multiple disabilities have been included.

Both qualitative and quantitative studies have been included in the literature collection.

At a second stage, in order to collect more detailed information on play assessment methodologies, it has been decided to include in the considered literature some studies on play evaluation methodologies describing typically developing children; this selection has been made adopting the same criteria described above, using as key-words "play" and "assessment".

At the end of this phase of data collecting, the whole corpus of the gathered studies is formed by 80 different references, published from 1976 to 2007.

Due to previously described inclusion/exclusion criteria and due to the collection methodology which included researching materials in scientific data-base and documents that were in the partner's availability, this analysis is not meant to have a statistic validity concerning the existing literature on play assessment in children with disabilities.

The references collected include monographs, book chapters, articles published in international scientific reviews and papers presented at national and international conferences.

The studies included in the literature have been then assigned to one of the following three categories, according to the main role attributed, for each study, to the infant play.

1) *Play assessment*. This category includes assessment tools, experimental studies and intervention methods having as main objective the investigation of play and its assessment (e.g., *Test of playfulness)* in children with disability, children at risk and typically developing children.

2) *Play-based assessment*. This category contains assessment tools, experimental studies, intervention methods investigating some aspects of child development by means of play activities observation and intervention. In these studies play can be an instrument to assess, for example, the child's cognitive or social development or his/her communication skills. These studies as in the play assessment ones are addressed to children with disability, children at risk and typically developing children.

3) *Other play-related issues*. This category includes books, articles and other studies which don't describe analytically any specific methodology for assessment and/or intervention. Studies assigned to this category are represented by field literature reviews, general studies on play of children with disabilities, general studies on play-based interventions (for example, in psychotherapy and in occupational therapy) and other texts related to play assessment issues not reporting specific data on play assessment tools or procedures.

The tool developed for the analysis is a worksheet made of three different sheets, one for each of the three categories previously mentioned (play assessment, play-based asses-

sment and other studies). This tool has been designed after a preliminary research carried on a selected sample of references.

As concerns the first two categories (*play assessment* and *play-based assessment*), information has been gathered through a table reporting 21 different descriptors.

The references labelled as *other studies*, not describing any specific methodology, have been analyzed by drawing up a short description and a concise report including important aspects on play assessment issues; these data have been integrated in the analytical report of the results in the fourth paragraph.

The 80 references have been shared out into smaller lists that have been assigned to the partners to be analysed.

The main descriptor for this analysis has been labelled as 'tag' and it refers, for each document of the literature that has been analyzed, either to the tool/s (test, scale, questionnaire, etc., both standardized and unstandardized) that is/are cited, analyzed or applied in order to assess children's play (name of a standardized test or other evaluation tool e.g. Transdisciplinary Play-based Assessment, Play Assessment Scale, Child Initiated Pretend Play Assessment) or to the experimental investigation on play that has been conducted and referred to (e.g., symbolic play assessment, assessment of pretend play behaviours). This means that information has been worked out by the partner from each examined reference.

In the case that no specific assessment tool was mentioned in the reference analysed, the partner had to put into the 'tag' field a short label describing the assessment procedure described in the reference itself (e.g., pretend play assessment or non directive play therapy).

Since in some reference analyzed more than one tool and/or research have been described – e.g. either reporting the findings of the application of the same assessment tool in different experimental settings with different target groups or analysing experimental research carried on using different evaluation methodologies – the same reference could be 'tagged' more than once within the analysis.

To avoid any confusion, from now on each collected information concerning a single evaluation tool or research will be referred to as "study", to distinguish from the "reference", which represents the single piece that has been analyzed (that means the article, the paper, etc.) and can contain more than one study and consequently be tagged more than once in the worksheet.

After this preliminary part, each assessment tool or assessment procedure – either quantitative or qualitative – identified by a tag and described in one or more studies has been analyzed through 21 different descriptors grouped into four main categories.

- **References Typology**: in this filed data have been included about the considered reference (basic information about the article or the book reporting title, authors and date of publication) and about the typology of evaluation described – qualitative or quantitative.
- **Objectives and Results**: in this field information has been reported about the aim and the results obtained with the assessment tools, the experimental studies or the intervention methods described in each analyzed document.
  Possible aims include: the assessment of developmental areas such as cognitive, social, or language skills. The results field describes the data obtained through the assessment methodology applied like general scores, play age, mental age.
- **Methodology**: this is the "core" field, which includes all the basic aspects related to the applied assessment procedures (e.g., target group characteristics, setting, play materials, other actors involved as adults and/or peers, etc.)

- **Experimental aspects**: in this field other critical methodological aspects has been reported, including the availability of data about validity and reliability of the assessment procedures.

4. Results of the Literature Analysis

In this paragraph the main findings of the literature analysis on play assessment methodologies are reported, by discussing the data collected for each field.

4.1. Reference Typology

In this field information concerning the source of information and its typology has been drawn up. The literature analyzed so far contains 80 different references including books, books' chapters, articles and papers presented at international conferences.

The references analyzed have been published between 1976 and 2007; most of the studies analyzed (62 out of 80) has been written in the last eleven years (62 out of 80) while only 18 references have been published before the 1995.

Typology	Publication year		
	1976-1985	1986-1995	1996-2007
Articles and papers	4	11	57
Books and books' chapters	1	2	5
TOTAL	*5*	*13*	*62*

Table 1. Reference typology per publication year

As it has been already said, in the cases in which the analyzed reference reported more than only one study on play assessment methodologies (e.g. an article or a book's chapter could describe the administration of the same play test to different target groups or in different settings), it has been included the times needed to analyze each methodology exhaustively.

Due to this fact, the total amount of studies reported by the 80 references analyzed is 98.

These studies have been in their turn included in one or more of the three worksheets previously arranged: 45 references were labelled as *studies on play assessment*, 30 as *studies on play-based assessment* and 23 as *studies on other related issues.*

In 19 out of 30 studies on play-based assessment and in 19 out of 45 studies on play assessment a specific tool applying either quantitative or qualitative methods was the main subject of the article or it was briefly described, sometimes within comparative studies referring to different tools (e.g. Kelly Vance and Ryalls 2005).

Methodologies applied	Play assessment studies	Play-based assessment studies	TOTAL
Specific tools	19	19	23
Other methodologies	26	11	37
TOTAL	*45*	*30*	*75*

Table 2. Methodologies applied in play and play-based assessment

The remaining studies – both in the play assessment category and in the play-based one – don't mention any specific assessment tool, rather presenting the results of experimental studies on play, such as for example studies investigating the correlations between play and language (McCune 1995), the influence of contextual factors on play (Bornstein et al. 1996; Varga 2003), the relationship between cognitive development and play (Loizou 2005).

4.2. OBJECTIVES AND RESULTS

4.2.1. Objectives

The scientific studies included in this literature analysis on play assessment methodologies present a wide range of objectives to be reached through the evaluation of play that refer to different interpretations of the play functions; these interpretations are mainly dependent upon the authors' theoretical approach (e.g. piagetian vs. psychoanalytic).

The studies on play-based assessment methodologies usually describe strategies of evaluation that use play as a mean to investigate either different developmental areas (cognitive, social, and emotional functions, attention, adaptive behaviour, language) or the child's global development.

9 out of 30 studies belong to this latter category, and they describe play-based assessment methodologies which have been applied as diagnostic measures of children's overall functioning; in some cases they had the main aim of making a diagnosis or taking a decision about the children's eligibility for special education services or early intervention programs. Among this second group of studies, the investigation of social development is the most recurrent aim.

Main objective	No.
Global development	9
Cognitive development	3
Social development	8
Language development	3
Other	7
TOTAL	*30*

Table 3. Aim of the studies on play-based assessment

As regards the studies on play assessment, the following three main objectives have been identified.

- To investigate *playfulness*, a dimension that does not have until now a unique definition, which can vary according the author/s' theoretical approach. Nevertheless, it is interesting to notice that 7 out of 10 studies on playfulness refer to the same assessment tool, the *Test of Playfulness* (Harkness and Bundy 2001).
- To investigate the child's progress through the *social play styles* (onlooker, solitary, parallel, shared cooperative). These methodologies observed both peer play and play with adults.
- To investigate the *play type* displayed by the child, through the observation of his/her skills in playing with objects. The presence and complexity of symbolic and pretend play represent the main focus of these methodologies.

Main objective	No.
Playfulness	10
Play style	8
Play type	27
TOTAL	*45*

Table 4. Aim of the studies on play assessment

4.2.2. Results

In this paragraph the results obtained through the play assessment methodologies described in the analyzed studies will be described, having as main focus the analysis of the information which can be gathered by administering specific play and play-based assessment tools (e.g. play age, play profiles, etc.).

The results which can be obtained by administering play and play based assessment tools can be shared into two main categories: qualitative and quantitative results.

Qualitative results comprehend narrative descriptions of play behaviors and analysis of environmental factors related to child's participation in play activities .

Quantitative results comprehend:

- Standardized scores norm referred: the child's play performances are compared to the performances of a representative sample of typically developing children of the same age (e.g. ChIPPa, FEAS, PIECES, TPBA); in some cases the score obtained by the assessed child is labelled as "play age".
- Standardized scores criterion referred: the child's play performances are evaluated (e.g.CCPT and Social Play Continuum).
- Correlation index between a play or a play based assessment tool and other developmental scales (e.g. PAS, TPBA).

Quantitative results are obtained by transforming raw data as for example: presence of specific play behaviours, play behavior duration (e.g. amount of time spent in each play behavior category), frequency (occurrence of play behavior), or other behavorial indicators related to the playing experiences (e.g. smiling, laughing).

As regards studies not applying any specific assessment tool, the results are represented by the findings of the experimental protocol mainly describing the correlation (positive or negative) between play performance (e.g. symbolic play) and other behavorial or environmental variables (e.g. language complexity or maternal involvement).

4.3. Methodology adopted in the analyzed studies

In this paragraph the first findings will be described about methodological issues on play assessment emerging from the literature analysis.

Data emerging form the analysis of play-based and play assessment have been integrated with issues presented in the references labelled as 'other studies'.

4.3.1. Target Group Typology

The most critical aspect in the studies examined is the widespread tendency to use broad or ambiguous categories in the description of the target group.

Many studies refer to vague expressions, such as *children at risk*, *children with developmental delays* or *children with developmental disabilities*, without providing more detailed information on the functional disabilities displayed by the children that are being assessed.

Four studies describing the target group mention as an inclusion criterion the fact that the children were enrolled in special education programs. Furthermore, according to Farmer Dougan and Kaszouba (1999), approximately the 50% of the children attending *Head Start Program*[28] are eligible for early childhood screening; for this reason it is difficult to distinguish in such researches the presence or absence of disabilities within the target groups.

In those studies in which the type of disability of the target group is clearly defined, the most represented diagnosis is the *autistic disorder* (11 different studies out of 75 reported in the play assessment and play-based assessment worksheets refers to this category).

This prevalence could be partially explained by the fact that literature on some disabilities (play assessment methodologies applied with deaf and blind children) have been excluded form the analysis, even if it is most likely to reflect the numerousness of studies on play in autism children since the presence of abnormal play behaviours is one of the parameters applied for the diagnosis of autism.

Just 8 studies explicitly refer to *children with motor impairment* nevertheless the number of studies referred to children with motor impairments could be underestimated due to the lack of information on the diagnosis of the evaluated children.

Assessment tools or experimental studies mentioning as their target group *children with mental retardation* or cognitive disabilities are only 3 out of 75 (Weiss et al. 2003; Mc-

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[28] The *Head Start* is a program created in 1965 by the U.S. Department of Health and Human Services in order to provide for comprehensive social services to low-income families and to their children.

Conkey 1985; Malone and Langone 1998); nevertheless, as in the case of children with motor impairment, the presence of children with mental retardation is likely to be under-estimated.

4.3.2. Target Group Age

«In assembling the research sample it is important to refer not simply to the chronological age of the children, but also to their mental age. Comparing two children with the same chronological age is inappropriate when their mental age is completely different. For this reason it is useful to be aware of the mental age for each child involved in the research».[29]

Although many scholars suggest that the chronological age is not a reliable guide as a selection criterion in play assessment research (McConkey et al., 1995) and also that to assess play skills data on mental or developmental age should be rather provided, most studies refer only to the children's chronological age.

Due to the importance generally attributed to the development of play skills in the early years of childhood, a prevailing number of studies are addressed to preschoolers: in fact only 12 out of 75 studies are referred to children older than 6 years.

Although play assessment tools for older children are available, the lack of scientific data for this population seems to represent a challenging aspect and suggests the need of developing on purpose assessment methodologies addressed to older children.

4.3.3. Target Group Gender

As regards the influence of gender in play development, scholars underline the presence of gender differences in play (e.g. sex-stereotypic preferences on toys and play activities), emerging since the second year of life (Rubin 1983; Garvey 1990).

Sex segregation is the norm in many kinds of play activities, during the primary school period: despite cultural differences, children generally prefer to engage in same-sex groups and show clear preferences for playmates of the same sex.

In the literature analyzed so far a wide awareness emerges among scholars about gender differences in play: sample/target group of the studies included both male and female subjects, in most cases specifying their number.

Including gender differences in experimental samples of children with disabilities could be difficult due to the genetic prevalence of some disabilities, for example «involving girls in the research is particularly difficult for autistic subjects since autism is about four times more prevalent in boys than in girls».[30]

Some examples coming from the analyzed literature can be useful: in the experimental research reported by Delinicolas et al. (2007) on joint attention in children with autistic disorder, the sample was made of 51 boys and 5 girls; in Muys's study (2006) on playfulness

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[29] D5.1. *Analysis of Critical Factors involved in using interactive robots for education and therapy of children with disabilities,* pp. 95-96.

[30] D5.1. *Analysis of Critical Factors involved in using interactive robots for education and therapy of children with disabilities,* page 98.

in autistic children a playfulness scale was administered to 17 boys and to 7 girls; Anderson et al. (2004) assessed social interaction in autistics, by observing 9 boys and 1 girl.

Only one study (Tardif et al. 2005) with a target group of children with autism, provide a small sample comprehending both sexes (5 girls and 5 boys).

In the studies on play assessment with children with motor and cognitive disabilities, as well as the ones referred to children at risk or children typically developing, no difference in the gender composition of the target group can be noticed as all the studies analyzed so far comprehend both genders, equally distributed.

4.3.4. Setting

Play setting is an aspect that deserves careful attention, as the characteristics of the setting can influence the results of the assessment: «the type of play demonstrated by children is dependent to some degree upon the setting in which the play is observed» (Malone and Stoneman 1995).

The settings where play sessions described in the literature analyzed were carried out can be subdivided into four main categories: home, educational settings (school and preschool classes, playgrounds or playrooms, including special classes such as in the case of the *Head Start Program* or other early childhood educational programs), therapeutic settings (day care centres, hospitals, other clinical settings) and laboratories placed in universities or other research centres.

Setting	Play assessment studies	Play-based assessment studies
Home	10	5
School	10	9
Therapy	6	10
Laboratory	3	1
Not specified	16	5
TOTAL	*45*	*30*

Table 5. Assessment settings

The most recurring settings are the naturalistic ones: school and home place are described in 14 out 30 studies on play-based assessment and 20 out of 45 on play assessment. Only 4 studies in total refer to assessment procedures carried out in laboratories.

As one could foresee, the choice of therapeutic settings is more frequent in the play-based assessment studies than in the play assessment ones.

In a small number of studies (6 out of 75) more than 1 setting has been arranged in order to evaluate children's play. In 21 out of 75 cases the play setting has not been specified.

Only 5 studies (all in the play assessment category) refer that the assessment of play has been conducted in an open-air play space such as a school playground, (3) a home garden (1) or in a not better specified open space (1).

10 studies refer to critical dimension of the setting, such as the width of the room (which should offer enough space to move and explore) and its overall comfort. Another aspect

which deserves attention is the disposition of the play materials in the setting place: toys and other materials should be accessible and placed in different areas of the room to facilitate their visibility (Athanasiou 1991).

Malone (Malone et al. 1995) observed that children with disabilities may display a richer play repertoire in individual play than in playing with peers: in this case, some settings such as the school or the playground may be too chaotic for them.

4.3.5. Play materials

Toys and other play materials represent one of the most important contextual factors in the assessment of play (Malone 1995) as some play materials have proved to prompt more likely some play behaviours than others (Rubin 1983; Ivory and McCollum 1999).

The novelty of play materials is an aspect which can influence play behaviours. Toys and other materials used in assessment phases should be familiar to the child, since in a novel situation the child tends to explore the play materials before starting to play with them while familiar toys are more likely to prompt play behaviours (Athanasiou 2000).

The typology of play materials used to assess play both in typically developing children and in children with disabilities can be classified according to the different types of play in which they can be used. In what follows, first traditional toys and secondarily adapted toys or assistive technologies for play are analyzed.

4.3.5.1. Play materials: toys

Although the studies refer to a wide range of materials for play, the most popular play materials are represented by toys or toy sets. The play materials described in the literature cover a wide range of toys with the prevalence of toys for symbolic play. Many studies don't mention explicitly the type of toy or play materials that have been used for assessment purposes, rather referring to generic standard toys or mentioning a classification of toys, for example as social, isolate or symbolic (Lowehthal 1996).

No significant difference, except for the target group of children with motor impairments, is found in the choice of play materials in relation to the child's disability.

Only 1 study discusses the gender appropriateness of the materials proposed to the children during the evaluation sessions (Swindells and Stagnitti 2006).

In 1 study (Wetting et al. 2006) the authors specify that no play materials was used during the sessions as child and therapist acted characters in pretend play sessions, without the aid of any toy.

Following the ESAR play classification, proposed by Garon et al.,[31] the toys mentioned in the studies can be classified as follows with reference to the four stages of play.

Toys for Exercise play

«The ESAR system defines exercise play as that which involves the continual repetition of an action for the immediate pleasure it gives. The repetition of actions such as biting,

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[31] Garon, D., Chiasson, R., Filion, R. (2002), *Le système ESAR. Guide d'analyse, de classification et d'organisation d'une collection de jeux et jouets*. Paris, France: Electre.

throwing, sucking, beating, manipulation, babbling, moving, etc., may be considered forms of exercise play, and may or may not involve the use of toys».[32]

Toys for exercise play cited in the literature analyzed include: bubble blower, nesting barrel, foam rubber ball, paddleball, foam climbing equipment, ring-stacking toy, nesting barrels, reactive toys, music box, and movie viewer.

Toys for Assembling play

«The ESAR system defines assembling play as that which involves assembling, stacking, piling, joining and fitting pieces together, etc. This type of play takes place when the child sets him/herself a specific aim – to build something, and through a series of coordinated movements or actions, achieves this aim».

Toys for assembling play cited in the literature analyzed include: colouring books, puzzles, blocks, crayons, paints, paintbrushes, chalks, scissor, crayons and markers, Lego bricks, construction blocks, other construction materials (cylinders rocking toys, pyramids) plastic maze, shape sorter.

Toys for Symbolic play

«The ESAR system defines symbolic play as that which involves the use of one object to represent another. It is the type of play in which the child ascribes different kinds of significances – some more obvious than others – to objects; he or she acts out imaginary events and real-life scenes through role-play of fictional or real characters. Through symbolic play, children imitate adults, pretending to be daddies, mummies, doctors, teachers, hairdressers, lorry drivers, etc., and this category includes all games in which the adult world is recreated in one way or another, be it through everyday situations or fictional characters».[33]

Toys for symbolic play cited in the literature analyzed include: dolls and their accessories, tea set, toy phone, toy train, vehicles, puppets, housekeeping materials, farm set, toy house, kitchen set, dressing-up clothes, teddy bear and stuffed animals, miniatures, vehicles.

Toys for Play with Rules

«The ESAR system defines play with rules as that which involves a series of instructions or rules (simplex or complex) which players have to learn and observe in order to achieve a given aim».[34]

Toys for play with rules cited in the literature analyzed include: table hockey game, pinball machine, bowling kit.

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[32] Appendix C – IROMEC Glossary.

[33] Appendix C – IROMEC Glossary.

[34] Appendix C – IROMEC Glossary.

4.3.5.2. Play materials: Assistive Technologies and adapted toys

Due to their impairments, children with disabilities usually need special adapted toys to fully participate in play activities: «Some people believe that children with disabilities should play with normal toys. In theory I share this view but in practice I sometimes find it is a goal to aim at» (Lear, cited in Brodin 1999, pp. 27).

Only in 8 of the experimental studies examined (Besio 2001, 2002, 2003, 2004; Reid 1999; Miller and Reid 2003; Weiss et al. 2003; McConkey 1985), the use of adapted play materials or assistive technologies is reported.

Following the ESAR system assistive technologies and adapted toys that are cited within the literature analyzed can be classified as follows.

Assisitve technology and adapted toys for Exercise Play

Switch activated toys, cause and effect software.
Ring-stacking toy adapted (lights and sounds are controlled by the adult)

Assistive technology and adapted toys for Symbolic Play

Cars, trucks, cranes, controlled by the AGIO/DIGIO system;[35] doll house with small battery powered elements (lights, washing machine); software for drawing and colouring activities. fairy tales and communication software.

Assistive technology and adapted toys for Assembling Play

Software to make puzzles

Assistive technology and adapted toys for Play with rules

Software to activate toys, software to program robots (Lego Mindstorms[36]), virtual reality software: soccer, volley ball, dance.

4.3.6. Assessment and intervention materials

In this field partners contributing to this literature analysis reported the typology of materials applied for the assessment of play, for the experimental investigations on play behaviours or for the evaluation of play therapy outcomes.

As regards studies on play and play based assessment applying specific tools (38 out of 75), standardized or not, the assessment materials are represented by a variable number of items, ranging from 5 (Observed Peer Play in Unfamiliar Settings, OPPUS) to 150 (Child - centred Play Therapy Instrument, CPTI).

The items of the assessment tools belong to 2 main categories:

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[35] AGIO- DIGIO is an hardware and software system allowing children to interact with several devices (powered toys and other devices).

[36] LEGO® Mindstorms is a line of Lego® sets wich combines programmable bricks with electric motors, sensors, traditional Lego® bricks, and other components.

- a check list of behavioural indicators which have to be scored by the mean of a Lickert point scale or just evidencing their presence/absence;
- a structured interview or a questionnaire.

Usually the checklists are provided with coding guidelines applied both during direct observation and during on videotaping coding phase.

Studies not administering any specific test make use of materials like field journals or evaluation protocols designed for experimental purposes.

Several assessment tools for the evaluation of other developmental areas (see 4.4.2.) were applied in the assessment processes reported by the literature.

4.3.7. Role of the adult

Some studies examined for this analysis take into account the role that the adult can assume when participating to the child's play activity. Malone and Langone (1999) propose the following classification of the possible roles: manager; mediator; co-player; observer; planner; instructor; leader.

Malone classifies along a continuum the possible strategies used by the adult in playing with the child for intervention purposes: non direct, indirect, guided, directed. In *non direct* and *indirect* strategies the adult role is limited to the selection of suitable toys for the child (or the children), the arrangement of play spaces and the play time scheduling. *Guided strategies* include the use of reinforcement (suggestive or implicit verbal guidance), the provision of play models through imitation and mirroring behaviours (ibidem); *direct strategies* include physical prompts, direct training and giving explicit directive to the child.

As it is predictable, 20 out of 75 studies on play and play-based assessment getting into focus free play activities, set up play session where the adult's role is to observe the child's play without any kind of intervention (such as suggesting or initiating some activity), sometimes the children are even observed with the aid of a one-way mirror in order to exclude potential influences by the observer (Slade 1987).

Adult role in play	Play Assessment	Play-based assessment
Observer	13	8
Facilitator	6	5
Instructor	1	1
No adult involved	2	0
Other	6	6
Not specified	15	10
TOTAL	*45*	*30*

Table 6: Adult role in play

Only 6 out of 30 studies on play-based assessment and 5 out of 45 studies on play assessment mention the application of facilitation strategies. The adult plays an instructor role applying modelling techniques and giving instructions in just 1 out of 30 studies (Kennedy

et al. 1991) on play-based assessment, and in one out of 45 on play assessment (Lewis et al. 1992).

Other roles include "non directive therapist", communication assistant and trainer.

4.3.8. Assessors/Observers' number, typology and role

The presence itself of an adult may influence the observed play behaviours. This fact is usually considered within the studies collected and analyzed.

For example Garvey (1990) found that the availability of adults in an experimental play group made of triads of children decreased the children's conversation, since a greater number of verbal exchanges were addressed to the adults (researchers or teachers) than to peers.

In one single assessment tool, the Transdisciplinary Play-based Assessment, the assessment procedures are conducted by an observation team comprehending familiar people such as parents or teachers (Thomas and Smith 2004; Rutheford et al. 2007; Kelly Vance e Ryalls 2005, 2007; Athanasiou 1991; Lowenthal 1996); in the other cases there are just one or two observers, often the experimenters themselves. The familiarity between the observer and the child or children assessed is recommended (Leyytines 1991). The exact number of the assessors is specified in about 30 out of 75 studies.

4.3.9. Presence of peers

During childhood, the child gradually overcomes his/her initial egocentrism becoming increasingly able to take the perspective of others, to understand social cues and to interact with others, thus passing from solitary or parallel play to shared cooperative one (Garvey 1990).

The presence of familiar play mates has a relevant influence on children's quality and quantity of play: Researches in the field demonstrate that children and even toddlers prefer to play with other children they are already familiar with, thus achieving more complex play behaviours (ibidem). The presence of children without disability in the play assessment sessions is a factor which deserves attention as it can prompt social play behaviors in children with disabilities (McHale 1983). This factor should be considered when designing and setting up experimental trials in which social play should be observed.

The presence of peers is reported in 8 out of 30 studies on play-based assessment and in 13 out of 45 studies on play assessment.

4.3.10 Number of session/time/phases

The number of the experimental or testing sessions is a crucial factor in the assessment The number of the experimental or testing sessions is a crucial factor in the assessment procedures.

Duration of a single session	Play Assessment	Play-based Assessment
0-10'	1	2
10'-20'	6	2
20-30'	3	5
30-40'	4	1
40'-50'	2	2
50'-60'	1	3
≥ 60'	3	2
Not specified	25	13
TOTAL	*45*	*30*

Table 7. Duration of a single session in play assessment and play-based assessment studies

In the studies on play assessment and play-based assessment, the duration of each play assessment session varies from 8 minutes to 4 hours.

3 different experimental studies provide a warm-up phase (Muys 2006; Lewis et al. 1992; Harkness and Bundy 2001).

The mean duration of each play session, considering both play assessment and play-based assessment studies, is about 60', but the presence of 5 different studies reporting very long play assessment sessions (lasting 3 or 4 hours) has to be considered in the evaluation of this datum.

The mode is on 10'-20' session duration for play assessment and 20'-30' for play-based assessment.

The mean of play sessions is 5 in the case of play assessment studies (23 studies provide information with the total amount of sessions, while in 22 studies there is no mention about the session number) and 6 in the case of play-based assessment studies (20 out of 30 studies provide information with the number of sessions).

There is just 1 study explicitly relating the number of session with the severity or the typology of children's' disability (Wetting et al. 2006).

A few data is available on the overall duration of the assessment and on the time interval between one session and the following one; only 9 out of 30 studies on play-based assessment and 11 out of 45 on play assessment provide some information on these aspects.

As regards the data available on the overall assessment duration, a wide variety can be noticed.

Some studies, mainly in the case of longitudinal studies, were carried out over a period of one year or more while other experimental studies have been conducted in a shorter period (range 1 day - 36 months).

When assessing children with severe impairments the possibility to carry on long-lasting session is recommended (Ferland 2000) in order to elicitate more complex play skills, best reflecting the child's learning potential, even if from a statistical point of view longer observation sessions may affect the validity of the assessment (Smith et al. 1985)

4.3.11. Description of the methodology

In this field supplementary data have been reported, not included in the other fields, describing the methodology applied for the assessment of play.

As regards specific assessment tools designed to assess play or to assess other developmental areas through play, the information has been reported in the fifth paragraph in single charts describing the main characteristic of these tools.

Some general consideration can be done form the analysis of these methodological descriptions.

Even if the methodologies applied for the evaluation of play, reflecting the different theoretical definition of play, can largely vary, most of the experimental research on play assessment and play intervention outcomes hypothesizes that play follows a predicable developmental sequence (e.g. form solitary or onlooker to shared cooperative one, from functional play to pretence).

Play with object is the behaviour observed to evaluate the play type while play interactions with peers and with adults are the behaviour observed to determine the play style.[37]

In the play based assessment studies the play behaviours displayed by the child – reflecting a play style or a play type – are used to determine his/her social, cognitive, emotive or communicative development as well as the global development of the child.

On the contrary, in play assessment studies the evaluation of play is not a mean for the assessment of other areas, since play is considered an independent developmental area.

In these last studies dimensions not developmentally sequenced, like *playfulness* and *enjoyment* in play are used for assessment.

The most relevant difference emerging form these methodologies both in the play assessment category and in the play based one, is the choice between free play observation and structured play one.

While in methodologies based on free play observation no specific prompt is provided to the child, in the structured play observation the play performances are elicited by the experimenter or by other adults participating to the assessment.

Play observation methodology	Play Assessment	Play-based assessment
Free play	18	14
Structured play	11	5
Free play and Structured play	5	5
Not specified	11	6
TOTAL	*45*	*30*

Table 8. Play observation methodology

It seems that most of researchers in the field accorded their preference to free play observation, a choice that seems to reflect the need to set up ecologically valid observation methods and the assumption that play, being an intrinsically motivated behaviour, has to be observed in its spontaneity.

Most of the methods described are focused on the individual play behaviours assessment. Some other tools (e.g. the ToES, Test of Environmental Supportiveness) or some experimental studies investigate instead the role of environmental factors (e.g., play materials and adults' interaction) on play (Bornstein et al. 1996, Ivory and McColumm 1999; Umek and Musek 2001).

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[37] For the definitions of "play style" and "play type" see Appendix C – IROMEC Glossary.

4.4. Experimental aspects

4.4.1. Data collecting

The methodologies used for data collecting are critical aspects in the assessment of play behaviours.

The evaluation methods described in the literature include: direct observations, video taping, audio recording, photographing, administering questionnaires and interviews to parents, teachers and carers.

8 out of 30 studies on play-based assessment and 9 out of 45 studies refer to mixed methodologies that apply in the same study different strategies for data collecting.

The most popular observational technique is the video recording (it is used in 20 out of 45 studies on play assessment and in 14 out of 30 studies on play-based assessment).

As regards the procedures of observation reported in the analyzed studies, unstructured methodology (naturalistic observation) is preferred in just 3 cases out of 30 in play-based assessment and in 1 out of 45 studies on play assessment; in the other studies videotaped play behaviours are afterwards coded through specific checklists (for the inter rater reliability of these measures see also the paragraph on reliability); real time observations can be also reported by the mean of stenographic notes. Videotaping, together with other data collecting methods, is present in 22 out of 45 play assessment studies and in 14 out of 30 studies on play-based assessment.

Data Collecting	Play Assessment	Play-based assessment
Direct observation	9	7
Video taping	16	5
Audio taping	1	0
Interviews or questionnaires	1	1
Direct observation + videotaping	4	2
Direct observation + questionnaires or interviews	4	2
Videotaping + questionnaires or interviews	0	5
Videotaping + direct observation + interviews or questionnaires	1	2
Videotaping + audio taping	1	
Other	1	0
Not specified	7	6
TOTAL	*45*	*30*

Table 9. Methods for data collecting

1 single study (Tardif et al 1995) refers to software applied for the observation data analysis.

In the audio recorded procedures which has been reported only by 2 studies (Miller and Reid 2003; McCooey 2004), data are transcript and then evaluated.

Interviews an other indirect measurement procedures are used as a supplementary tool to collect data on the child's play behaviours. Interviews are mentioned in 4 out of 75 studies.

In 1 case interviews were administered to children in order to assess their play skills development (Thomas and Smith 2004).

1 study refers imprecisely that a questionnaire has been administered (Patrice et al. 2003).

4.4.2. Other assessment tools

A consistent number of studies describing play-based and play assessment procedures, mentions the use of other assessment tools applied.

These assessment tools have been applied in order to obtain information to be used as inclusion/exclusion criteria of the children participating to the experimental studies (e.g. having to evaluate play skills in children with autism some studies first assessed the children participating to the experimentation by the mean of a specific autism rating scale) or in correlational studies investigating the relation between play and other developmental dimensions (e.g. language, social skills).

These tools, often standardized tests, can be classified following the ICF-CY classification, as tools for the assessment of:

Motor functions
- Gross Motor Functioning Classification has been applied with children with severe motor impairments (Miller e Reid 2003)

Social functions
- SSRS-T: Social Skills Rating Scale - Teacher Form has been applied with children at risk (Brotman et al. 2005; Kelly Vance and Ryalls 2005; Farmer Dougan and Kazouba 1999), and typically developing children (Fantuzzo et al. 1998)
- PIPPS: Parent rating scales of peer play applied with children at risk (Miller Brotman et al. 2005; Fantuzzo et al. 1995; 1998)

Communication functions
- REEL-2 (Receptive Expressive Emergent Language scale), applied with children with developmental disabilities and severe communication disabilities (Sigafooos 1999)
- Language Development Survey (Delinicolas and Young 2007), used with autistic children
- ESCS: Abridged Early Social Communication Scales, used with autistic children (Delinicolas and Young 2007)
- Preschool language scale revised applied with children with severe motor impairments, autism and other developmental disabilities (Kennedy et al. 2001)
- Early Language Inventory Peabody Picture Vocabulary Test revised, applied with children with severe motor impairments, autism and other developmental disabilities (Kennedy et al. 2001) and with children with autism (Anderson et al. 2004)
- MLU: Brown's Mean Length of Utterance, a measure applied with children with severe motor impairments, autism and other developmental disabilities (Kennedy et al. 2001)
- RDLS Reynell Developmental Language Scales applied with typically developing children (Bornstein et al. 1996)

Cognitive functions
- WPPSI-R: Wechsler Preschool and Primary Scale of Intelligence, applied with typically developing children (Ballard 1981) and with children with autism (Anderson et al. 2004)

- WISC-III: Wechsler Intelligence Scale for Children, applied with typically developing children and children with autism (Anderson et al. 2004)
- Bayley Scales of Infant Development, administered to children with autism (Thomas and Smith 2004)

  Emotional functions
- PAQ: Personality Assessment Questionnaire, administered to typically developing children (Bornstein et al. 1996)
- Ainsworth's strange situation applied to typically developing children (Slade 1987)

  Basic learning functions
- MSEL (Mullen Scales of Early Learning) applied to children with autism (Thomas and Smith 2004)
- Bayley Scales of Infant Development, applied to typically developing children (Leyytines 1991)
- BDI: Battelle Developmental Inventory, applied with preschool children at risk (Kelly-Vance and Ryalls 2005)

Other assessment tools reported by the literature are focused on environmental factors:
- PSQ: Parental Support Questionnaire, applied to typically developing children (Bornstein et al. 1996)
- MATCH: Matching Assistive Technology and Child, applied to children with motor disabilities (Besio 2002, 2003, 2004)
- Peer sociometric data applied to typically developing children (Fantuzzo et al. 1998)
- SPPR Self Perceptions of the Parental Role applied to typically developing children (Bornstein et al. 1996)
- PAQ Parents Attributions Questionnaire, applied to typically developing children (Bornstein et al. 1996)
- KIDI The Knowledge of Infant Development Inventory, applied to typically developing children (Bornstein et al. 1996)
- M-C. SDS Marlowe – Crowe Social Desirability Scale, applied to typically developing children (Bornstein et al. 1996)

Another category of assessment tools cited in the references is formed by several diagnostic mostly applied in experimental studies as inclusion criteria of the research subjects:
- ADI-R: Autism Diagnostic Interview – Revised (Tardif et al. 1995)
- ADOS-G: Autism Diagnostic Observation Schedule – Generic, (Thomas and Smith 2004)
- PEP-R The Psycho Educational Profile Revised (Tardif et al. 1995)
- PARS: The Pre-school Autism Rating Scale (Solomon et al 2007)
- Diagnostic and Statistical Manual of Mental Disorder III (Tardif et al. 1995)
- CBCL: Children Behaviour Checklist behavioural assessment (Webster-Stratton and Wolley Lindsay 1999)

4.4.3. Sample of the study

The sample size is the factor that can affect in major degree the results of any experimental study, as the generalizability of a study is considered a function of the sample size (Malone et al. 1995).

The studies on play assessment and play-based assessment analyzed so far, reporting the findings of an experimentally research, usually give data on the sample dimensions. The sample size is not specified in 8 out of 45 studies on play assessment and in 4 out of 30 studies on play-based assessment.

The mean of the sample is 31 as regards play assessment (range 2-150) and 68 in play-based assessment studies (range 1-523). This great difference is due to the fact that, while some experimental studies carried out with typically developing children in schools can involve more than 500 children, studies addressed only to the assessment of children with disabilities are based on sample necessarily small, perhaps due to the difficulty in recruiting children with specific disabilities. After exclusion of the experimental studies with a target of only typically developing children, the mean sample size is 39 in play-based assessment (range 1-219) and 23 in play assessment studies (range 2-84).

4.4.4. Validity

To make reliable research in the psycho-pedagogical field, the experimental design should be valid both internally and externally. «Internal validity is concerned with the degree of certainty that observed effects in an experiment are actually the result of the experimental treatment or condition (the cause), rather than of intervening, extraneous or confounding variables (Trochim 2000). Internal validity is enhanced by increasing the control of these variables. External validity is concerned with the degree to which research findings can be applied to the real world, beyond the controlled setting of the research. This is the issue of generalizability. Attempts to increase internal validity are likely to reduce external validity since the studies in these cases are conducted in a manner that is increasingly unlike the real world.

For qualitative research obtaining multiple sources of data is essential to producing valid results (Nelson and Poulin 1997). When qualitative analysis is used, the best way to achieve valid results is to accompany these results with numerical data from surveys, questionnaires, or observational procedure».[38]

Only some studies examined (11 out of 45 studies on play assessment and 7 out of 30 studies on play-based assessment) provide data on validity. 3 different studies (Kelly Vance and Ryalls 2005, 2007) report data on criterion validity – which reflects the capability of the measures applied to predict or estimate a result – of a single play-based assessment tool (*Play Assessment Scale*, PAS).

Data on content and construct validity are reported in 2 studies (McDonough et al. 1997; Kelly Vance and Ryalls 2007; Fantuzzo et al. 1998).

4.4.5. Reliability

«A valid measure must also be reliable. Reliability is an essential pre-requisite for the validity of the research. It concerns the extent to which the instruments used yield the same results on repeated trials. (...) When observations are made, the inter-rater reliability score, that shows the agreement between different observers, should be measured. Inter-rater

[38] *D5.1. Analysis of Critical Factors involved in using interactive robots for education and therapy of children with disabilities*, page 97.

reliability is defined as the extent to which observers in the same study agree that they see the same thing. It can be expressed in terms of percentages of agreement or correlation between different observations of the same behaviour and ensure a certain degree of objectivity of the observations. The percentage of agreement is calculated by comparing the occurrence of agreement to the total occurrence of behaviour».[39]

As regards the literature analyzed, about 50% of the studies reporting the application of observation techniques like direct observation and/or observation of videotaped play sessions report data on inter-rater reliability (17 out of 35 studies on play assessment and 16 out of 25 studies on play-based assessment).[40]

Test-retest reliability is reported only in 2 cases of the references analyzed (Muys 2006; Swindels and Stagnitti 2006).

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[39] Ibidem.

[40] Studies not describing observation techniques have been excluded from this calculation.

5. ASSESSMENT TOOLS

Following the framework adopted within this literature analysis, the assessment tools, listed in alphabetical order, have been divided into two main categories: tools for play assessment and tools for play-based assessment.

For each specific assessment tools basic data have been summarized in a table reporting:
- The assessment tool name
- The author's name
- The year of publication of the test (if published) or the year of publication of the reference first mentioning the tool
- The provenience of the tool
- A short description
- The objectives
- The target group
- The presence of standardization procedures adopted in the tool's development
- The setting
- The length and number of sessions
- The play materials
- The references

All the information given here is reported from the studies and the articles analyzed.

5.1. Play assessment tools

In this paragraph the assessment tools classified as 'play assessment' evaluation methods are described; they include tools for the assessment of 'playfulness', and tools for the evaluation of play types and play styles.

Assessment of Ludic Behaviour (ALB)	
Author	Francine Ferland
Year	2005
Provenience	Canada
Short Description	The Assessment of Ludic Behavior is an evaluation tool, based on an extensive two year research, designed to assess the development of the social and object play in children with motor disabilities to set up play based interventions. The assessment procedure includes a parent's interview and the observation of child's free play behaviour. Five different areas are examined: - General level of interest and motivation - Interest in the use of space and objects for play purposes - Object play abilities - Ludic attitude - Communication in play - Each item is scored in 3-point scale. The assessors scores the items with the aid of a check list while the child is playing; at the end of the session if some item has not been observed the evaluator can initiate the play activity trying to involve the child.
Objectives	Assessment of pleasure in play
Target groups reported in the literature	Children with physical disabilities
Standardization	Standardized
Setting	Occupational Therapy setting, familiar setting (home, school)
Time /sessions	The length of the play sessions can vary (medium length 1 hour)
Play materials	Conventional toys adapted by mean of assistive technologies if necessary
References	Ferland, F. (2005). *The Ludic Model – Play, Children with Physical Disabilities and Occupational Therapy.* Canadian Association of Occupational Therapist

Children's Playfulness Scale (CPS)	
Author	Lynn A. Barnett
Year	1990
Provenience	USA
Short Description	The children's' playfulness scale is a 23 items questionnaire based on 5 dimensions of play: - Physical spontaneity - Social spontaneity - Cognitive spontaneity - Manifest joy - Sense of humour Each item contains a statement such as *the child uses unconventional objects in play* which is scored on a 5-points Likert-type scale; the observer's answers rate from *sounds exactly like the child* to *doesn't sound like the child.* It has been designed to be scored by an adult who knows the child well or who has spent a minimum of 30 hours with him/her becoming familiar with his/her general playful style, across situations and contexts. A warm-up phase (approximately 5 min.) is used. It helps the child to familiarize with all the different types of toy and play materials. Then the child is encouraged by the parent and therapist to play independently and freely using the play material for 15 minutes (unstructured play). Afterwards, the adult interacts with the child in cooperative and social interactive play for a further 15 min (structured play).
Objectives	To assess pleasure in play
Target groups reported in the literature	Children with autistic disorder aged from 41 to 81 months
Standardization	Data not available
Setting	Clinical setting
Time /sessions	1 single session lasting approximately 35'
Play materials	Toys for: - Sensor motor play - Construction and manipulative play - Symbolic and sociodramatic play
Reference	Muys, V. (2006). *Assessment of playfulness in children with autistic disorder: A comparison of the Children's Playfulness Scale and the Test of Playfulness.* "Occupational Therapy Journal", 26 (4), 159-170

OPPUS (Observed Peer Play in Unfamiliar Settings)	
Author	Laurie Miller Brotman
Year	2005
Provenience	USA
Short Description	The OPPUS is a short method for assessing peer-group entry and play behaviours in preschoolers (Outcome Measure). The assessed child is observed during free play interactions with unfamiliar peers in a play room. No specific instruction is provided to the peers while the assessed child is told to play with anyone or anything he/she wants. Observers do not encourage or reinforce child's behaviours. Observers with minimal training are able to reliably rate these behaviours during the OPPUS procedure. Data on validity and reliability of this measure are available.
Objectives	Social skills assessment
Target groups reported in the literature	Preschoolers at risk for psychopathology aged 2-5 years
Standardization	Not standardized
Setting	Large play room in unfamiliar school setting
Time /sessions	1 session lasting 30'
Play materials	Conventional toys
References	Miller Brotman, L., Gouley, K.K., Chesir-Teran, D. (2005). *Assessing Peer Entry and Play in Preschoolers at Risk for Maladjustment.* "Journal of Clinical Child and Adolescent Psychology", 34 (4), 671-680

Parten Scale adapted	
Author	Keith D. Ballard
Year	1981
Provenience	New Zeland

Short Description	The Parten scale, adapted by Ballard identifies six possible observable free play behaviours:
	  - Unoccupied
	  - Solitary independent play
	  - Onlooker
	  - Parallel play
	  - Associative play
	  - Cooperative play
	
	The child's play style is observed and scored through a six point scale (1 point if he/she is unoccupied, 6 points if is showing cooperative play abilities). The final Play Score is calculated by multiplying the number of occurrences in each category by its weighting, summing these scores, and dividing by the total number of occurrences

Objectives	Play style assessment
Target groups reported in the literature	- Typically developing children aged 3-6 years - Children with autism aged 3-7 years
Standardization	Data not available
Setting	School
Time /sessions	5-12 sessions
Play materials	Data not available
References	Reid, D. (2005). *Correlation of paediatric volitional questionnaire with test of playfulness in a virtual environment: the power of engagement*. "Early child development and care", 175 (2), 153-174

PAS (Play Assessment Scale)	
Author	Rebecca R. Fewell
Year	1987
Provenience	USA
Short Description	The Play Assessment Scale (PAS) is a tool designed to assess the play development of very young children. The PAS scale is made of 45 different items developmentally sequenced designed to elicit a wide range of play skills. Play materials are represented by eight different sets of toys, age appropriated. The assessment occurs in two different phases: in the first phase spontaneous play is observed while in the second one elicited play sessions are foreseen, in which the observer has the role of prompting specific play activities. Children's play behaviours are observed and coded by mean of the scale having as a result a 'play age' score. No particular professional requirement is needed to administer the PAS.
Objectives	Developmental assessment
Target groups reported in the literature	Children with multiple disabilities, children with developmental concerns (2-36 months).
Standardization	Data not available
Setting	Data not available
Time /sessions	One single session, time not specified
Play materials	8 standardized toy sets
References	Athanasiou, M.S. (2000). Play-based approaches to preschool assessment. In: Bracken, B. A. (Ed.), *The Psychoeducational Assessment of Preschool Children*, 412-427. Boston, MA: Allyn and Bacon Kelly-Vance, L., Ryalls, B.O. (2005). *A systematic, reliable approach to play assessment in preschoolers.* "School Psychology International", 26, 398-412 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 V.* Silver Springs, Maryland: National Association of School Psychologists, 549-560

Smilansky's socio-dramatic play Inventory Scale	
Author	Sara Smilansky
Year	1990
Provenience	Israel
Short Description	Smilansky's sociodramatic play Inventory Scale has been first developed to assess play skills in children at risk coming form low- income Israeli families. This assessment tool is based on the author's play classification: functional play, constructive play, symbolic play and games with rules: «functional play resembles and mirrors Piaget's sensorimotor period, and consists of simple movements or actions of the body with objects, while constructive play involves doing something with these objects, such as building a tower with blocks. Symbolic play also develops starting from the make-believe activity and the actual acting out of made up scenarios to the game with rules»[1]. Six different play categories are evaluated: - Imitative role play - Make-believe play with objects - Make-believe play with actions and situations - Persistence in role play - Interactions with others in sociodramatic play - Verbal communication in the play context. Each socio-dramatic subdomain item is evaluated and a score form 0 to 3 is attributed to the play behaviour (0 if the behaviour is not observed, 1 if is present in a limited degree, 2 if is present in a moderate degree and 3 if is consistently present and frequently occurring)
Objectives	Play-stage assessment
Target groups reported in the literature	Typically developing children, adults and adolescents with disabilities
Standardization	Not standardized
Setting	Play room in familiar settings (school)
Time /sessions	Data not available
Play materials	Standard toy set for doctor play (bandage, injections), picture book
References	Umek, L.M., Musek, P.L., Pecjak, S., Kranjic, S. (1999). *Symbolic play as a way of development and learning of preschool children in preschool institutions.* "European Early Childhood Education Research Journal", 7 (1), 35- 44

Test of Environmental Supportiveness (ToES)	
Author	Anita Bundy
Year	2001
Provenience	Canada
Short Description	The Test of Environmental Supportiveness has been developed through the review of scientific literature on the influence of environmental factors on infant play and through expert panels. It measures both the influence of human beings (e.g. parents, teachers, caregivers, peers and siblings) and non-human factors related to the context on playfulness, by evaluating the presence of environmental barriers or facilitators, through the use of 17 items. This tool is designed to be administered simultaneously with the Test of Playfulness is based on the observation of the play interactions between caregivers and peers and on the evaluation of the physical and sensorial features (accessibility, degree of sensorial stimulation provided) of the play environment. The administration of ToES takes about 20'. The test provides evidences on validity and reliability.
Objectives	Assessment of the influence of environmental factors on play
Target groups reported in the literature	Children with developmental disabilities, typically developing children aged from 1,5 to 15 years and
Standardization	Standardized test
Setting	Indoor familiar setting
Time /sessions	One session lasting 15'-20'
Play materials	No specific equipment required
References	Hamm, E.M. (2006). *Playfulness and the Environmental Support of Play in Children With and Without Developmental Disabilities*. "OTJR Occupation, Participation and Health", 26 (3), 88-96
Note	The full version of the test is annexed in Appendix C – Assessment Tools

Test of Playfulness (ToP)	
Author	Anita Bundy
Year	1997
Provenience	Australia
Short Description	Elaborated by the occupational therapist Anita Bundy, this standardized tool refers to a 'playfulness model' which describes playfulness as a combination of 4 different factors: - intrinsic motivation - internal control - reality suspension - *framing* (ability to read and give cues in play interactions) These four factors combined define the degree of playfulness of play behaviour. The ToP is suitable for the assessment of play in children from 6 months to 18 years in outdoor and indoor play settings. In its latest version this test comprises a set of 29 items that can be scored by direct observation, without videotaping. Each item is scored by evaluating its intensity, its time extension; or the skill demonstrated by the child. This test has to be administered in at least two different familiar settings.
Objectives	Assessment of playfulness
Target groups reported in the literature	Children with motor disabilities, children with autism, typically developing children aged from 6 months to 18 years
Standardization	Standardized test
Setting	Familiar indoor and outdoor play settings
Time /sessions	20 to 30 minutes for each setting (the number of sessions depends on the number of settings)
Play materials	No special test equipment required

References	Hamm, E.M. (2006). *Playfulness and the Environmental Support of Play in Children With and Without Developmental Disabilities*. "OTJR Occupation, Participation and Health", 26 (3), 88-96 Harkness, L., Bundy, A.C. (2001). *The test of playfulness and children with physical disabilities*. "Occupational Therapy Journal of Research", 21 (2), 73-89 Muys, V. (2006). *Assessment of playfulness in children with autistic disorder: A comparison of the Children's Playfulness Scale and the Test of Playfulness.* "Occupational Therapy Journal", 26 (4), 159-170 Reid, D. (2004). *The influence of virtual reality on playfulness in children with cerebral palsy: A pilot study.* "Occupational Therapy International", 11(3), 131-144 Stagnitti, K. (2004). *Understanding play: The implications for play assessment.* "Australian Occupational Therapy Journal", 51 (1), 3-12
Note	The full version of the test is annexed in Appendix C –Assessment Tools

Warwick Symbolic Play Test (WSPT) - Prototype	
Author	Vicky Lewis
Year	1992
Provenience	UK
Short Description	The Warwick Symbolic Play test is an evaluation tool developed to assess symbolic play with objects by observing the occurrence of those play behaviors: - The child uses an object as if it were another object - The child attributes to the objects novel properties - The child refers to absent object as if they were present This test is designed to be administered to typically developing children and children with disability; as a minimum language is required for the test administration (most items can be administered in non verbal ways) this tool is suitable for children with language impairments. The test consists in first phase of free play observation and in a second one of elicited play.
Objectives	Test-Phase (13 items) divided into 4 Sections (in each single session specific and defined toys are provided)
Target groups reported in the literature	Typically developing and children with disability aged 13-72 months
Standardization	Not standardized
Setting	Play room, not specified
Time /sessions	One single session
Play materials	Structured (bowel and spoon, doll, teddy bear) ad unstructured standardized play materials (bottle top, cotton wool, wooden box, cotton reel)
References	Lewis, V., Boucher, J., Astell, A. (1992). *The assessment of symbolic play in young children: A prototype test*. "European Journal of Disorders of Communication", 27, 231-245

5.2. PLAY-BASED ASSESSMENT TOOLS

In this category the assessment tools classified as play-based assessment methodologies have been described.

They comprehend tools for developmental assessment, or tools design to evaluate particular developmental areas (e.g. emotional, cognitive or social competences).

Children's Play Therapy Instrument (CPTI)	
Author	Saralea E. Chazan, Paulina F. Kernberg, Lina Normandin
Year	1998
Provenience	USA
Short Description	The CPTI is a qualitative assessment tool, not standardized, design to be applied in the measurement of the outcomes of play-based interventions in individual child psychotherapy. At a first stage the play behaviors are classified as follows: - Pre-play activity (the child is engaged in preparing the set for play) - Play activity (presence of positive affects, taking initiative or showing play intents, attention focusing, use of play materials) - Non-play activity (the child is not participating) - Play interruptions (cessation of the play e.g. leaving the room). At a second stage play activities segments (longer or more significant ones) are further analyzed in three different dimensions: descriptive, structural, functional to determine the child's play profile. Each dimension consist in different subscales, the total amount of the items is 150. At the end of the assessment the play behaviour exhibited by the child can be classified into one of four clusters: adaptive, neurotic, borderline, psychotic. The CPTI can be used to measure change in psychotherapy.
Objectives	Psychological assessment
Target groups reported in the literature	Children with psychological concerns, children with autism aged 2:5 years
Standardization	Not standardized
Setting	Psychotherapy setting
Time /sessions	2 sessions one at the beginning of the therapy, on at the end of the therapy; each session lasts about 60'
Play materials	Conventional toys

References	Chazan, S.E. (1999). *Using the Children's Play Instrument (CPTI) to measure the development of play in simultaneous treatment: a case study.* "Infant Mental Health Journal", 21 (3), 211-221
Note	Further information on CPTI is provided in Appendix C – Assessment Tools

Child Initiated Pretend Play Assessment (ChIPPA)	
Author	Karen Stagnitti
Year	2004
Provenience	Australia
Short Description	ChIPPA is a norm referenced standardized test of child's initiated pretend and imaginative play skills. The ChIPPA assesses the child's level of complexity and self-organisation in pretend play, the child's use of symbolic skills in play and his/her ability to initiate a play. Children are assessed through items investigating: the percentage of elaborated pretend play actions, the number of object substitutions, and the number of imitated actions. Through the ChIPPA assessment it is possible to identify play themes and play styles emerging in the observation of child's play behaviours, highlighting the presence of possible play deficits. The ChIPPA can be administered both in clinical and in natural settings such as school or home.
Objectives	Developmental assessment
Target groups reported in the literature	Children typically developing (age 3-7 years)
Standardization	Standardized
Setting	Home, school, clinical settings
Time /sessions	Assessment procedures take about 18 to 30 minutes
Play materials	Conventional toys, gender neutral and unstructured play materials
References	Swindells, D., Stagnitti, K. (2006). *Pretend play and parents' view of social competence: The construct validity of the Child-Initiated Pretend Play Assessment.* "Australian Occupational Therapy Journal", 53, 314-324

FEAS (Functional Emotional Assessment Scale)	
Author	Stanley I. Greenspan
Year	2003
Provenience	USA
Short Description	The FEAS is a reliable, age-normed, clinical rating scale that can be applied to videotaped interactions between children with autism and their caregivers It has been used as assessment tool at baseline and the end of the play therapy study to measure changes in caregiver behaviours and in children's functional (social/pragmatic) development. The test is made of 8 developmental sequenced sub-scales: 1. Self regulation and interest in the world (3 months) 2. Forming relationships, attachment and intimacy (5 months) 3. Intentional two-way communication (nine months) 4. Complex sense of self-behavioural organization (13 months) 5. Complex sense of self-behavioural elaboration (18 months) 6. Emotional ideas – representational capacities (24 months) 7. Emotional ideas – representational elaboration (30 months) 8. Emotional thinking (36 months)
Objectives	Emotional assessment
Target groups reported in the literature	Children with autistic spectrum disorders (18 months – 6 years)
Standardization	Standardized
Setting	Clinical setting
Time /sessions	Data not available
Play materials	
References	Solomon, R., Necheles, J. Ferch, C., Bruckman, D. (2007). *Pilot study of a parent training program for young children with autism: The PLAY Project Home Consultation program.* "Autism", 11 (3), 205-224
Note	The full version of the test is annexed in Appendix C – Assessment Tools

PIECES	
Author	Lisa Kelly Vance
Year	2005
Provenience	USA
Short Description	The PIECES is a test designed to evaluate cognitive development through play and is based on Linder's TPBA cognitive development items. In the assessment procedure only free play is observed; no specific toy or setting is required. Sessions can be videotaped. «The procedures are dissimilar from Linder's TPBA in that the child usually plays alone and without any facilitation on the part of adult observers. Parents and a session facilitator are present and free to praise the child and to repeat what the child says, but are instructed not to ask questions or suggest new play behaviours. Because the PIECES focuses exclusively on cognitive development, a multidisciplinary team of observers, while certainly allowable, is not necessary. The guidelines are broken down into multiple scales examining different domains of cognitive development. The PIECES coding scheme contains one core subdomain (exploratory/pretend play) as well as several supplemental sub domains. The supplemental sub domains (e.g., problem-solving skills and planning, categorization, quantitative skills) are adapted versions of several of Linder's subscales. […] In the PIECES coding system, every play behaviour produced by the child can be classified on the core subdomain whereas the supplemental sub domains are reserved for specific types of behaviours (such as trial-and-error problem solving, sorting, and drawing), which may or may not occur in any given play session. The information obtained from this coding procedure is then compared to norms for typically developing children to determine if the child has specific areas that require intervention. Interventions are targeted at the core and/or supplemental subdomain skills found to be discrepant from peers». (Kelly-Vance and Ryalls, 2008: 552).
Objectives	Cognitive assessment
Target groups reported in the literature	Typically developing children, children with developmental concerns
Standardization	Not standardized
Setting	Preschool setting
Time /sessions	Sessions last about 30–45 minutes

Play materials	Standard toy set (kitchen area, blocks, colouring area, puzzles, farm, dolls and accessories and mechanical toys).
References	Kelly-Vance L., Ryalls B.O. (2005). *A systematic, reliable approach to play assessment in preschoolers*. "School Psychology International", 26, 398-412 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 V.* Silver Springs, Maryland: National Association of School Psychologists, 549-560
Note	In Appendix C – Assessment Tools the table describing the pretence play subdomain has been presented as an example

PIPPS (Penn Interactive Peer Play Scale)	
Author	John W. Fantuzzo
Year	1998
Provenience	USA

Short Description	The PIPPS is an evaluation tool design to assess the social competence of preschool children by observing their play interaction with peers.
	Three different behaviours can be observed and scored through this rating scale:
	   - Play disruption
	   - Play disconnection
	   - Play interaction
	
	Play disruption describes the lack of peer interaction abilities characterized by aggressive behaviours.
	Play disconnection describes the inability to engage in play with peers and to maintain interaction behaving in a quit passive way.
	Play interaction describes the child's play skills in social play and the degree of leadership in the group.
	A teacher and a parent version of the test are provided.
	A Lickert scale ranging from 1 point to 5 points is used to score the observed play behaviour.

Objectives	Social competences assessment
Target groups reported in the literature	Children at risk aged 36-63 months
Standardization	Data not available
Setting	School
Time /sessions	Data not available
Play materials	Conventional toys
References	Fantuzzo, J.W., Coolahan, K., Mendez, J., McDermott, P., Sutton-Smith, B. (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
Note	The full version of the scale is annexed in Appendix C – Assessment Tools

Social Play Continuum (SPC)	
Author	Pat Broadhead
Year	2004
Provenience	UK
Short Description	The Social Play Continuum is an observational tool based on the Vigotskjy's theory of *zones of proximal development*, designed to assess learning development of preschool children through the evaluation of their social play skills. The 40 items, describing the degree of reciprocity in verbal exchanges and in play actions, are subdivided into 4 main domains representing a continuum from associative play (similar to parallel play), social play, highly social and cooperative play. Play actions, degree of reciprocity in the interaction and language are observed in order to determine the child's progress in the play continuum. This tool also provides information on the social and cognitive development as well as on language skills.
Objectives	Learning assessment
Target groups reported in the literature	Typically developing children aged 3-6 years
Standardization	Not standardized (still in progress)
Setting	School (reception classes, nursery)
Time /sessions	Observations' length and sessions' number may vary; the authors recommend to have extended observations
Play materials	Conventional toys: large and small construction materials, small world (miniatures), water, sand
References	Broadhead, P. (2006). *Developing an Understanding of Young Children's Learning through Play: The Place of Observation, Interaction and Reflection*. "British Educational Research Journal", 32 (2), 191-207

Transcdisciplinary Play-Based Assessment (TPBA)	
Author	Tony Linder
Year	1990
Provenience	USA
Short Description	Transdisciplinary Play-Based Assessment (TPBA), is an assessment tool designed to assess children's developmental stage. The assessment is meant to be carried out by a multidisciplinary team (this methodology has been defined as "arena format") through the observation of free and facilitated play sessions. Videotaped play sessions are then scored by the team through specific guidelines, identifying the child's strengths and his/her areas in need of intervention. Preliminary information on the child's global functioning are gathered through interviews to parents and caregivers. Whose structure takes into account any information obtained from the parents.
Objectives	Developmental and cognitive assessment
Target groups reported in the literature	Children typically developing, children at risk and children with disabilities from birth to age six
Standardization	Standardized
Setting	School, clinical setting
Time /sessions	One single session lasting 55'-75'
Play materials	Conventional toys

References	Athanasiou, M.S. (2000). Play-based approaches to pre-school assessment. In: Bracken, B.A. (Ed.), *The Psychoeducational Assessment of Preschool Children*, 412-427. Boston, MA: Allyn and Bacon Kelly-Vance, L., Ryalls, B.O., Glover, K.G. (2002).*The use of play assessment to evaluate the cognitive skills of two- and three-year-old children.* "School Psychology International", 23 (2), 169-185 Kelly-Vance, L., Ryalls, B.O. (2005). *A systematic, reliable approach to play assessment in preschoolers*. "School Psychology International", 26, 398-412. 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 Lowenthal, B. (1997). *Useful early childhood assessment: Play-based, interview and multiple intelligences.* "Early Child Development and Care", 129, 43-49 Rutheford, M.D., Young, G.S., Hepburn, S., Rogers, S.J. (2007). *A longitudinal study of pretend play in autism.* "Journal of Autism and Developmental Disorders", 37 (6), 1024-1039 Thomas, N., Smith, C. (2004). *Developing play skills in children with autistic spectrum disorders.* "Educational Psychology in Practice", 20 (3), 195-206

FOOTNOTES

1 *D5.1. Analysis of Critical Factors involved in using interactive robots for education and therapy of children with disabilities*, p.20

This document is part of the products of the IROMEC (Interactive RObotic social MEdiators as Companions - IST 045 356) European project, and it has been developed by the University of Valle d'Aosta, one of the Consortium partners and responsible of the most theoretical aspects of the project itself, related to play and children with disabilities. In particular, this document concerns two intertwined aspects: on one hand, the development of a general methodological framework to set up a fruitful and effective process to match the child's competence and ability and the robot's technological features, with the purpose of developing and realizing interesting and useful play scenarios. On the other hand, an in-depth study on the existing literature about the experimental evaluation of the infant play, especially in the case of children with some type of disabilities.

Thus, the document is structured into two Sections, one per each concerned aspect; it is also accompanied by three appendices.

In Section I, the Methodological Framework – one of the IROMEC final results – is presented and described; it will be the basis for one of the main final publications of IROMEC, that is the *Guidelines for using robots in educational and therapy sessions for children with disabilities*.

One of the primary scopes of this framework is to match technical and psycho-pedagogical issues both to clinical challenges and demands and to technological features: to this purpose, a strict connection with the items of the WHO International Classification of Functioning – Children and Youth (ICF-CY) has been established.

The scientific background for the definition of this framework has been found – and widely used – in one of the IROMEC previous publication, *Analysis of Critical Factors involved in using interactive robots for education and therapy of children with disabilities*.

An important phase of the Methodological Framework development process is the evaluation of the educational/rehabilitative outcomes of the intervention realised to improve the child's functioning, activities and participation. This scope – related to evaluation and outcome measurement – is partially shared with other partners of the Consortium. The contribution of this document is mainly performed by the literature analysis described in Section II, which is devoted to a review of play assessment procedures with children with disabilities.

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