AUTISM AND NEW TECHNOLOGIES

Les éDITIONS h
RESEARCH DISABILITY SOCIETY

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SUMMARY

Editions h are the result of a partnership between FIRAH (International Foundation of Applied Disability Research) and the CCAH (National Committee for the Coordination of Disability Action). Edition h booklets are aimed at disabled people, their families, and professionals working in the disability sector. They may prove be useful to researchers and decision makers interested in disability-related questions.

PRESENTATION OF PARTNERS

CCAH
ENSEMBLE, HANDICAP ET SOCIÉTÉ

The National Committee for the Coordination of Disability Action (CCAH) and its members provide support to project leaders in the disability sector. The objective is to improve the everyday life of disabled persons and encourage communal co-existence. In 2018, CCAH members financed 147 projects for a total of 21.5 million euros.
The CCAH relies on its sector-specific expertise to support and finance projects, offer training and advisory services to entities with a focus on disability access, and develop a national platform for communication and exchange.
For more information:
→ **www.ccah.fr**

FIRAH
RECHERCHE APPLIQUÉE SUR LE HANDICAP | APPLIED DISABILITY RESEARCH

Founded in 2009 and listed as a public service organisation in 2011, FIRAH is dedicated to applied disability research. FIRAH was created to meet a number of concerns of its founding members: APF France Handicap, the APAJH, Nexem, and FIRAH President Axel Kahn.
The foundation's objective is to ensure that results of applied disability research are useful to field stakeholders in the field in order to improve the quality of life and social participation of people with disabilities. By field stakeholders we mean disabled persons, their entourage, the professionals who support them, associations, etc.

The foundation aims to bridge the gap between the world of research and everyday life.
It is by encouraging research focused on needs identified by field stakeholders, by supporting collaborative and innovative applied research, and by communicating results in such a way as to enable persons directly affected by this research to appropriate and use the outcomes that FIRAH helps researchers and stakeholders in the field to work together.

FIRAH's three major objectives are:

- Support applied disability research projects.
- Share research results, particularly among field stakeholders.
- Raise awareness of applied disability research worldwide.

→ **www.firah.org**

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THE AUTISM AND NEW TECHNOLOGIES

EDITION H BOOKLET

This Edition h booklet presents information and knowledge gathered from the literature review completed for the «Autism and New Technologies» program coordinated by FIRAH[1].

THE AUTISM ET NEW TECHNOLOGIES PROGRAM

The program is supported by:	Coordinated and lead by:	In partnership with:
UEFA FOUNDATION for children	FIRAH RECHERCHE APPLIQUÉE SUR LE HANDICAP / APPLIED DISABILITY RESEARCH	Autism Europe aisbl

1 - More information on the Autism and New Technologies program: https://www.firah.org/en/autisme-et-nouvelles-technologies.html

WORKING GROUP MEMBERS THAT CARRIED OUT
THE LITERATURE REVIEW:

- Philippe Garnier (INS HEA) – Coordinator of the working group
- Robin Bastien (Université de Mons)
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THIS BOOKLET INCLUDES:

- A summary of the literature review completed for the «Autism and New Technologies» program. This summary includes a selection of researches chosen on the basis of their relevance in terms of providing practical solutions for using new technologies to help non-verbal communication and social interaction for people with ASD.
- A summary sheet of key research outcomes
- Additional resources to help answer the questions raised by the theme of autism and new technologies.

The digital version of this document and all the ressources mentioned are available on the FIRAH website, under «Activities & Publications/Editions h».

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FOREWORD

Autism is a neurodevelopmental disorder that affects communication and social interaction, and symptoms include repetitive behaviours and restricted interests. Persons with Autism Spectrum Disorder (ASD) find it particularly difficult to understand other people's facial expressions and body language, and often have problems interacting with others.

A number of interventions have focused on these aspects, with the aim of helping people with autism to improve their verbal and non-verbal communication as well as social skills. Digital tools have also been designed to address these difficulties. Some are accessible to the general public, others have been developed for research purposes.

The use of digital tools in helping people with autism dates back to the 1970s. However, over the past few years, the use of digital technology has accelerated both in research and in current practice. This is visible in the significant number of websites providing useful digital applications for persons with autism, in comments on apps on blogs and personal websites, and in the growing number of research projects on this subject. For example, the **DART (Development Autism Research Technology)** website offers reviews of apps for autistic people which are divided into 4 categories: Communication, Education, Life Skills and Fun.

Thanks to their development, new technologies are now increasingly accessible to parents and institutions, which facilitates its more widespread use by people with autism with the aim of helping them improve in areas in which they have difficulties.

FIRAH initiated a study that is now being led by the INSHEA, the universities of Mons, Freiburg and Paris-Est-Créteil, the NAS (National Autism Society) and the

Fondation Autisme Luxembourg. Feedback is collected from care and institutional professionals, children with ASD and their parents in order to identify which practices they consider interesting, as well as the difficulties they have encountered. The project aims to encourage an exchange between professionals and parents in terms of approaches, and to identify both best practices and potential pitfalls.

The literature review presented in this document on the use of digital tools to help develop non-verbal communication and social interaction skills complete this study.

Philippe Garnier

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SYNTHESIS OF THE LITERATURE REVIEW

The synthesis presented below is a part of the complete literature review completed for the "Autism and New technologies" program. This literature review was overseen by Philippe Garnier (INS HEA), coordinator of the working group of the program.

The names mentioned in brackets refer to the bibliographical references available in the complete literature review.

INTRODUCTION

Digital tools are particularly aligned with the autistic profile, given that digital technology operates on the basis of predictive laws, which corresponds perfectly to the way in which people with autism think. These tools also allow for immediate adjustments, which are often very helpful for children with ASD (Gillespie-Lynch, 2016).

Studies show that for a same type of activity, children with autism increasingly appreciate computer training programmes rather than those without digital technology, and demonstrate that technology can increase a child's motivation.

Also, digital activities are accessible to children that struggle with social communication (Ploog, Scharf, Nelson, & Brooks, 2013) and produce immediate responses that

can be repeated at will, which is necessary for some of these children (Grossard & Grynszpan, 2015).

Digital tools have been shown to be effective in certain areas, such as developing daily skills thanks to video modeling (Bereznak et al., 2012). Beyond the tool itself, it is interesting to look at professional or parental uses of the device. In fact, the use of a digital tool is not a given and is strictly related to underlying pedagogical philosophies (Avramides et al., 2012). Also, field stakeholders must familiarise themselves with the technology and grasp the potential pedagogical approaches prior to using a specific digital tool (Ayres, Mechling, & Sansosti, 2013).
The first general question in terms of using new technologies for persons with ASD concerns the choice and use of tools. In the second part of this synthesis, the use of new technologies in relation to non-verbal communication and social interaction will be discussed.

DEVELOP AND SELECT ADAPTED APPLICATIONS

Studies have been conducted in order to identify what type of software or applications would be particularly useful for people with autism or their families. Applications focusing on social, school and organisational skills were prioritised (Putnam, C., & Chong, L. 2008).

A study was carried out to see whether it was possible to develop an effective working method that would make it possible to select applications adapted to children's specific educational needs. This method was tested with the iPad. It made it possible to select applications that stimulated greater educational engagement among students with autism compared with randomly selected applications (Arthanat, Curtin, & Kontak, 2015). Also, some game publishers enable professionals and parents to create their own games that are adapted to the specific profile of the autistic child with whom they work, in such a manner as to enable social skill development (Boujarwah et al., 2011).

USE OF DIGITAL TOOLS

Digital tools help in daily life, but their implementation is not always easy, particularly in terms of configuring applications and addressing failures (Dale & Grut, 2014). Digital tools and their applications are sometimes used counterproductively by children with autism (King, Thomeczek, Voreis & Scott, 2014). We note that young children or children with intellectual difficulties will benefit even more from a touch interface than a traditional computer (Fletcher Watson, online).

A select few research-actions focusing on the use of digital tools can be found in scientific articles (see for example Cumming, Strnadová, & Singh (2014)). If professionals and parents adopt a positive approach towards new technology, and in particular the iPad (Clark, Austin & Craike, 2015), they are advised to acquire general digital familiarity, and to understand the possible range of uses of new technologies with autistic students beyond the scope of a specific tool (Ayres, Mechling, & Sansosti, 2013).

Now let us take a look at some results concerning the two fields in which we are specifically interested: non-verbal communication and social interaction.

COMMUNICATION NON VERBALE

In terms of non-verbal communication, we have researched the recognition and understanding of emotions and mental states.

RECOGNITION AND UNDERSTANDING OF EMOTIONS AND MENTAL STATES (THEORY OF MIND)

A certain number of computer or tablet applications use pictures of static faces expressing emotions. Others use three-dimensional digitised characters that experience a role-play. The user is then asked to find which emotion the character will have in a given situation. It is therefore a question of connecting a context, a situation experienced by the avatar (virtual person) with the emotion that the character should feel in the situation. We note however that in most of these experiments, control groups were not created where students would receive similar training, without the digital interface. When this is taken into account, the description of the control situation is highly summary and makes it impossible to assess the superiority of the digital version versus the non-digital version.

A study of the implementation of the Mind Reading programme made it possible for children with autism to improve their recognition of facial and vocal emotions (LaCava et al., 2007). Another research project assessed the contribution of the "Les Transporteurs" DVD, in which trains with the faces of human actors expressing emotions go on adventures. Children that experienced this programme improved in terms of emotion recognition and were able to transfer this skill to other entities than the Transporters

(i.e., real human beings) (Golan et al., 2010).

Some sophisticated software programmes make it possible to modify certain parameters in real time by means of virtual characters. We can, for example, modify facial expressions to make them more realistic or, on the contrary, tone them down by limiting the range of information expressed (Arellano et al., 2015). Research on emotion recognition has also been carried out within the framework of virtual universes (Mantziou, Vrellis, & Mikropoulos, 2015).

An interesting article focuses on a social skills and emotion recognition training programme for children with Asperger's syndrome (Beaumont & Sofronoff, 2008). The programme consisted of 7 sessions over 7 consecutive weeks with several types of interventions: the digital game itself, but also non-digital group interventions, and training for parents and professionals. Children who experienced the intervention were compared with others who did not go through the experience, and both groups were equivalent in terms of age, IQ, and scale of autistic disorder. Target skills were diverse: recognise and control fear and anxiety, recognise facial expressions and body language. In the first level of the computer game, the child had to assess how a person felt on the basis of the person's facial expression, intonation and physical posture. In the second level, the user had to infer a character's emotions based on non-verbal and environmental indicators. In the third level, assignments were suggested, like knowing how to act when playing a game, or when being harassed. In addition to the computer game, group sessions focused on emotion recognition and social skills were organised in such a manner as to generalise the trainings carried out on the computer. Role play games or at-home exercises were created for this purpose. Parents received training. Written advice was also issued to teachers. Children made progress in terms of social skills, and this was maintained after the intervention period (two assessments were carried out, 6 weeks and 5 months respectively after the intervention). On the other hand, no progress was observed in terms of facial expression and body language recognition.

Other applications were designed to develop theory of mind skills. These experiences were not very conclusive, particularly given that the digital aspect would be an added value in developing this type of skill (Swettenham, 1996). We nevertheless note that a study focused on training in other people's point of view using video enabled children with autism to develop this skill (Charlop-Christy & Daneshvar, 2003).

EXPRESSING EMOTIONS

A certain number of experiments were created using video modelling, a technique

in which desired skills are shown in a video, in order to develop social skills and notably express emotions. Certain studies compare a test group who experience video modelling sessions, with a control group that experience direct modelling sessions, without video. A study showed video's superiority in rapidly acquiring the target behaviour of expressing emotion, compared with direct modelling (Charlop-Christy, Le & Freeman, 2000). Serious games, using an autonomous virtual agent, were designed to develop joint attention skills (Alcorn et al., 2011).
Nevertheless, in an article comparing human interventions with digital interventions, autistic children's verbal and physical communication were strongest with the therapist and weaker with the software's cartoon character (Carter et al., 2014).

BODY MOVEMENT IMITATION AND NON-VERBAL COMMUNICATION

A study used robots and Kinects, in such a way that a child with autism is able to imitate a robot, and, thanks to the Kinect, the robot can imitate the child's movements (Taheri et al., 2014). According to the authors, the study shows promising results in terms of using robots with children with ASD.

People with ASD's imitation of robots rather than people has a scientific basis. Experimental research shows that people with ASD imitate movement made by a robot more quickly than the same movement made by a human being, contrary to non-autistic persons who imitate the movement of another human being more quickly (Pierno et al., 2008).

Overall, digital technology interventions aimed at developing non-verbal communication proved effective in terms of recognising emotions. The use of video modelling or robots shows promise in terms of enabling autistic children to develop a form of gestural communication.

SOCIAL INTERACTION TRAINING

Several technology-based interventions have been created in order to develop the social interactions of persons with ASD. We first list some research projects focused on this theme. We will then consider in greater detail some promising experiments using a range of new technology mediations, which are organised on the basis of the type of media used.

GENERAL SOCIAL INTERACTION INTERVENTIONS

An intervention was carried out using tablets to develop social skills among children with autism. The results show progress in terms of social behaviour and collaboration, and moreover encouraged an interest in social activities among the child participants (Hourcade, Bullock-Rest, & Hansen, 2012). The combination of activity sequences using video in order to develop autistic children's social skills may prove an interesting strategy (Kimball et al., 2004).

Research using video modelling to develop a game played in pairs among children with autism led to improved social interactions and general game cooperation after the intervention (MacDonald et al., 2009). Another research project studied the development of social initiation (that is, the action of initiating a social interaction) by children with autism, thanks to video modelling. This method made it possible to increase the number of social initiations among these children (Nikopoulos & Keenan, 2003).
Research into social scenarios for children with autism show that computer training in this field improves children's skills (Hagiwara & Myles, 1999). Also, using a computer-based digital programme may enable children with autism to resolve social problems, by relying on highly visual animations (Bernard-Opitz, Sriram, & Nakhoda-Sapuan, 2001).

INTERVENTIONS USING SPECIFIC MEDIA

Collaborative work using digital tools to improve social interactions

Research has investigated whether collaborative work using digital tools could improve social interaction skills. A collaborative computer project enabled students with ASD to improve their social interaction skills (Lewis, Trushel & Woods, 2005; Bauminger-Zviely, Eden, Zancanaro, Weiss, & Gal, 2013).

A digital workshop enabling young boys with high-functioning autism to create 3D constructions enabled them to increase social interactions between each other, as well as with their parents and grand-parents (Wright et al., 2011). This article focuses on participative action research. A seminar was organised with the parents, grand-parents and teachers of seven high-functioning autistic boys from 8 to 17 years old. All had difficulties in terms of social interaction. All except one were in mainstream schooling.

The children with autism participated in five training sessions using the software. The children were taught to use SketchUp and carried out projects using this software. The

researchers wanted to share the experiences of this experiment: children could ask for help from their paired partner, and their families were invited to teaching sessions. Parents could ask questions. The researchers helped the children to be able to present their work to other children in the class. Focus groups were held with the parents and grand-parents. The change in perception among parents and grand-parents is testimony to the impact these technological workshops has in facilitating intergenerational exchanges. Parents found that these workshops made it possible to build real friendships between children. Seeing their children in a position of success made it possible to change parents' as well as grand-parents' opinions, by showing the positive side of their children's skills. According to parents, this experience of success increased children's confidence, which led to the children sharing more of their experiences with their parents, which they were not in habit of doing. The children became experts and were able to share their knowledge. This led to conversations with the parents. For the same reasons, the experiment improved relationships with brothers and sisters. For professionals, it is interesting to see that an experiment that encourages students' strengths stimulated these students' personal investment in activities and helped them build a positive image for themselves, combined with a desire to share their creations. It is therefore indirectly, by focusing on the strengths of children with ASD, that these experiments have been able to develop social interaction skills, by encouraging children to share their areas of interest and creations.

Collaborative work with sensory tables to improve social interactions

Articles address experiments that make use of an uncommon digital device: cooperative games on a sensory table. For example, this device was used with the aim of stimulating social interactions among 8 boys with autism aged 9 to 12 years old (Zancanaro, Giusti, Gal & Weiss, 2011). It provokes a thoughtful reflection on the role of the teacher or therapist in collaborative games on sensory tables, given that the adult can, using the device, initiate an action on the table which will have an influence on the rest of the game. This is a question to be considered by field stakeholders who will also be able to make choices using a digital tool, even if these choices only involve adjusting certain parameters in order to optimise skill development among children with ASD.

In the experiment described in the article, certain actions need to be carried out simultaneously by the supervising adult and the children in order to obtain the reward. The adult may therefore choose not to collaborate for a moment, in such a manner as to ensure that the phase of the game continues for the children, and even has the option of playing for children, if the adult deems it useful. Also, it is technically possible for the supervising adult to intervene in order to ensure that one of two children that proves too dominant over the other may be made less so through the

choice of actions. Game sessions were filmed, and participants were interviewed. The article discusses how the adult intervenes, in such a manner as to elicit maximum commitment from the autistic child. This might be of interest to field stakeholders, who are confronted with these questions.

In emphasising the role of the supervising adult, the article enables practitioners to think of the complementarity between the structure of the software and their own intervention. What does the application do, how can the professional provide added value in terms of optimal social interaction development between children with autism?

Another experiment used a digital table to create collective stories. Participants were six boys with high-functioning autism from 8 to 11 years old. The table enables different users to carry out several actions at the same time. Children were assessed before and after the intervention in order to assess their progress, as progress was observed in terms of social interaction initiation (Gal et al., 2009).

Another project (SIDES) was designed around a collaborative game device on a sensory table. Children with autism enthusiastically participated in this project and were able to work in a group (Piper et al., 2006).

Some examples of the use of augmented or virtual reality to improve social skills

Augmented reality was used successfully in certain experiments in order to improve the social skills of children with APD (Escobedo et al., 2012). Virtual reality techniques may be highly sophisticated, using motion detectors for example (Georgescu et al., 2014).

An experiment aimed at developing social skills through a virtual environmental may be carried out in various ways. For example, while accompanied by an adult, children with ASD were able to experience these virtual worlds of a café and a bus in order to develop their social skills (Parsons, Leonard, & Mitchell, 2006).

Two types of virtual environments may be offered to a student with Asperger's, in order to develop social interaction skills: an experience of a virtual environment in which the child is the only participant, or a virtual environment in which several children participate simultaneously (Cobb et al., 2002). This article presents a number of systems that use virtual reality. A person with autism must go into a virtual café and sit at a table, and some café tables are already occupied by customers. Two game modes are proposed: one is a game that is played alone, in which the autistic person

meets virtual persons with whom the child may interact. The other mode is collective, in which several persons with autism can interact in the virtual universe of the café. The individual virtual environment makes it possible to develop specific social skills; there is less uncertainty, as the user is the only one who has the freedom to act, others being programmed digital characters. The author specifies that this type of environment may initially help develop skills within a certain context which can then be widened to other contexts using another virtual environment. For example, in the café game, the autistic participant may train himself to sit down at a table, a skill which he can then transfer in another virtual game located in another context such as public transport, where he also needs to take a seat. The authors were able to obtain results, both from persons with autism and teachers. Teachers had difficulties in terms of generalising skills to real life situations.

Using interfaces with tangible and connected objects

An experiment that used the interfaces with tangible objects made it possible to develop social game skills among children with ASD. These children also experienced social interaction by playing the game on a touch interface and playing with simple legos (Farr, Yuill & Raffle, H., 2010).

The use of robots and virtual tutors

Robots may encourage children with autism to develop prosocial behaviours (Feil-Seifer & Mataric, 2009). In another study, children were in the presence of a humanoid robot for a number of sessions over several months. Children showed improved imitation, role playing and communication skills (Robins et al., 2005). Certain studies compare robot interventions with the same interventions by human beings, in encouraging the development of adapted behaviours and skills (Diehl et al., 2012). A study used virtual autonomous agents to teach social and conversational skills. Progress was made by students with ASD in this field. Children also appreciated the virtual tutor (Milne et al., 2010).

CONCLUSION: FROM RESEARCH TO PRACTICE

Despite a certain number of studies demonstrating the efficiency of digital tools in developing socio-emotional skills, we cannot generally affirm that the use of digital tools is an absolutely effective strategy that makes it possible to develop these skills. In fact, research has shown heterogeneous results. These might be considered

promising leads that could in time lead to undeniably proven efficient practices (Ramdoss et al., 2012). Also, the digital tools used in the studies are not always available to the professionals in the field. Few studies concerning professional practices with new technologies were carried out. We also note that there were few studies that looked at the use of digital tools with children that have both an intellectual disability and ASD. Therefore, at the current time, we cannot provide absolutely certain recommendations to practitioners who would like to use digital tools with children with ASD. Nevertheless, certain papers make the link between research and practice, and may provide useful avenues for professionals.

A document developed by Fletcher Watson is very interesting, as it was designed on the basis of research results whilst at the same time giving practical advice to parents of children with autism in order to ensure their best use of technological tools (Fletcher Watson, online). This document is notably part of a study that was specifically carried out among 200 parents of children with ASD in Great Britain.

The great interest of this article is that it enables parents new to this information to benefit from the experience of parents who have already used digital tools with their autistic children. As such, those who want to use these tools will already be able to have practical information concerning their use.

Points of caution were noted. Some advice was given to parents of children with autism that are dependent, or addicted to new technologies, in order to ensure that digital tools are used without their becoming a major problem. Other advice was given in terms of choosing the right digital tools based on a child's profile. For example, young children or children with intellectual difficulties will benefit even more from a touch interface than a traditional computer.

In terms of software and applications, it is recommended to first try the app, or a light version of the app, before buying. The parent will be able to try it and see whether the application is suited to the child's needs. It may also be interesting to use applications that were not specifically designed for autism; it all depends on the objectives for the outcome of the use of this application.

Social skills training offered to the child by the digital programme may have limits. Trainings offered to children with ASD in order to improve their social interaction skills should be sufficiently rich and diverse to enable children to transfer this training to real life situations. However, this transfer is often limited due to the difficulties that people with ASD have in generalising a specific knowledge to other contexts.

IN SHORT: WHAT RESEARCH TELLS US IN 6 KEY POINTS

- Digital tools are well adapted to the autistic profile

- Specific applications have been created in order to develop non-verbal communication and social interaction skills in children with ASD.

- Some of these applications were scientifically tested on commonly used digital tools (computers, tablets), others on more sophisticated technical systems (tabletop device, virtual reality, robots, etc.).

- Digital tools help children with ASD in everyday life, but they are not always easy to integrate into services offered to children with ASD, particularly in terms of configuring applications and addressing failures.

- Young children with ASD or children with intellectual difficulties benefit even more from a touch interface than a traditional computer.

- Scientific research provides promising results but does not currently make it possible to definitively determine the added value of digital tools compared with non-digital approaches in developing non-verbal communication and social skills for children with ASD.

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FOR MORE INFORMATION

THE COMPLETE LITERATURE REVIEW

If you would like additional information and ressources, the full «Autism and New Technologies» literature review is available on the FIRAH website under «Activities & Publications/Literature reviews».

You will find the literature review chapters presented in this booklet as well as additional information such as:

- The bibliography, including research projects cited in the summary and other references.
- Reading notes with detailed information on some research projects.

Some works can also be directly accessed (full reports, articles and other information).

FEEDBACK

The Tips booklet presents «tips» used by parents and professionals to address difficulties encountered by children with ASD when using new technologies.

Tips is available on the Autism and New Technologies page on the FIRAH website, under «Activities & Publications/Thematic programs/Autism and New Technologies».

SUMMARY ANALYSIS

For this project, online questionnaires were issued to children or adolescents with ASD, as well as parents and professionals supporting these children or adolescents in their use of new technologies. The purpose was to gather information on the use of new technologies. The questionnaires included questions on the digital tools used as well as their mode of use, purpose (education, communication, logic, etc.), appropriation and specific questions concerning verbal communication and social interaction. The questionnaires were completed by 111 professionals, 137 parents and 90 children or adolescents with ASD from Belgium, France, Luxembourg, Ireland, the United Kingdom and Switzerland.

Questionnaire responses were summarised in one report per country and were analysed in a general summary. These reports are available on the FIRAH website, under "Activities & Publications/Thematic Programs/Autism and New Technologies".

Thanks to their development, new technologies are now increasingly accessible to parents and services or schools, which facilitates its more widespread use by autistic people with the aim of helping them improve in areas in which they have difficulties.

This Edition h booklet presents information gathered from the literature review completed for the «Autism and New Technologies» project. It provides resources that help answer the questions raised by the use of new technologies by autistic people.

les éDITIONS h

Editions h publications are the fruit of a collaboration between the CCAH (National Committee for the Coordination of Disability Action) and FIRAH (International Foundation of Applied Disability Research). The booklet for each specific theme presents the research outcomes for the project. These booklets encourage critical thinking and discussion in order to positively contribute to field practices. The «Editions h» are aimed at a wide audience, in particular disabled persons and their families, as well as disability sector professionals, researchers and political decision-makers.

ARMELLE & LES CRAYONS