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From cognitive ergonomist to psychotechnologist: a new professional profile in a multidisciplinary team in a centre for technical aids

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Abstract

Objective The aim of this work is to introduce the professional figure of the psychotechnologist, with particular reference to the specific contexts of application of the assistive technology assignation process in a centre for technical aids.

Main content The main differences between the role of psychotechnologists and the professional figures of cognitive ergonomists and clinical psychologists in a multidisciplinary team for assistive solution assignation are described. Psychotechnology is any 'technology that emulates, extends, amplifies and *modifies* sensory-motor, psychological or cognitive functions of the mind' [6, 20]. This definition highlights both the intrasystemic relation between any technology and the user and the interactive role of any artefact within the interaction process.

Conclusion In this perspective, the role of the psychotechnologist in a centre for technical aids is to analyse and evaluate the components emerging from the dynamic relation between user and technology in order to facilitate better autonomy, interaction and participation for people with disabilities.

Keywords. Psychotechnology, Assistive Technology, Psychotechnologist, Psychologist's role, Cognitive ergonomist

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Introduction

The term *psychotechnology* was originally used in the early 1990s to delineate 'any technology that emulates, extends or amplifies sensory-motor, psychological or cognitive functions of the mind' [2]. This definition highlights the role of the artefact as an agent in the person-technology interaction system by emphasizing its potential for widening the human mind to an electronic sensory extension of the central nervous system. Any technology can be seen as an object able to externalize any property of the mind and, at the same time, amplify and extend the human mind, connecting it to other people's cognitive processes [3].

In the last decade the definition of psychotechnology has been expanded to embrace an intrasystemic perspective in which the relation between user and technology is more than the simple addition of both subjective and objective components of an interaction but, since it always derives from human experience, the object can never be considered as an object per se [17]. Therefore, following this approach, psychotechnology would be better defined as any 'technology that emulates, extends, amplifies and *modifies* sensory-motor, psychological or cognitive functions of the mind' [6, 20]. This definition highlights the dynamic and mutual quality of the human-technology interaction by introducing the 'modification' component. That change of approach to the human-technology interaction allows us to overcome the cause-effect perspective by considering human behaviour as the result of the dynamic interaction between personal, environmental and social components: any technology is hence able to permit the human being's adaptation to the environment-system and, at the same time, force users to embrace cognitive and cultural modification and adaptation [9]. In other words, the artefact plays a key role in the evolution of the species by allowing human beings to specialize their abilities through the symbols, the restrictions and the knowledge possibilities which any *psycho*technology brings [1]. Psychotechnologies allow us to process the information they provide by reconfiguring and restructuring the relations within the user's experience, thus becoming both a cause of the insight process – which is close to the concept of affordance [13] – and a 'place' for the whole synchronous perception of a meaningful gestalt [6, 14, 20].

In the following sections the professional figure of the psychotechnologist will be described, with particular reference to the assistive technology assignation (ATA) process in a multidisciplinary team in a centre for technical aids. The main differences between the role of the professional figures of cognitive ergonomist and clinical psychologist will be discussed. Moreover, we will show in detail the role of the psychotechnologist within a centre for technical aids by describing the phases comprising the ATA process.

1. The psychotechnologist: a new professional figure

The growing need for a human factor expert who is able to analyse the dynamic and mutual quality of the human-technology interaction in different contexts of application has led to the development of the new professional profile of the psychotechnologist. The psychotechnologist is an expert in person-technology interaction with a bachelor's or a master's degree in psychology and specializes in information and communication technologies (ICT). The main role of the psychotechnologist is to analyse, with a

systemic approach, the relation emerging from the interaction between people and technology by taking into account all the psychological and cognitive components which are directly involved in the system. This occupation is, however, often confused with two similar professional figures: the cognitive ergonomist and the clinical psychologist. In order to define rather better the tasks with which the psychotechnologist is involved, the distinction between these professions and the role of the psychotechnologist will be outlined.

1.1. From cognitive ergonomist to psychotechnologist

The cognitive ergonomist is an expert in human factors and ergonomics who analyses the mental model of the system resulting from the user-technology interaction in the working context by evaluating any cognitive process (e.g. perception, attention, memory, etc.). During person-technology interaction, the cognitive ergonomist takes into account two components: (i) both the cognitive and behavioural effects arising from the system; (ii) the activities and skills needed to improve productivity and effectiveness and, at the same time, avoid any cognitive or physical overload.

Following the mental/conceptual model theory discussed by Donald Norman [16], the interaction system is composed of three different models of the technology with which the user is interacting: the user's mental model, the image of the system and the conceptual model of the system. The further the user's mental model is from the conceptual model of the system the more interaction problems will occur [16]. This perspective emphasizes two sub-systems involved in the interaction environment – the user-system and the technology-system – discarding a fundamental part of the interaction process: the socio-environmental system. In this way, psychotechnology overcomes this limitation by embracing a biopsychosocial perspective in order to analyse any situation occurring within the whole interaction system and selects the best combination among all its components [7, 23, 24].

Differently from the cognitive ergonomist, the psychotechnologist also focuses on the user-technology system by contextualizing the users' needs into the social environment surrounding them. Employing an intrasystemic and integrated approach [7, 8, 10, 11], the psychotechnologist heads up a dynamic empirical observation process that can take equal account of the personal, technological and environmental components constituting a whole complex system. Therefore, the methods and techniques the psychotechnologist uses are based on both *top-down* and *bottom-up* methodologies combined to obtain an overall sight of the person-technology-social environment relationship: the top-down methodology allows him/her to assess the compliance of any technological environment with related standard rules and guidelines (for example, the International Standard Organization specifications), whereas the bottom-up methodology permits him/her to evaluate the quality of the interaction between end-users and the interface of a technological system within the specific environment of use. In this way, all the objective and subjective components and relations of the interaction system can be measured and evaluated [7, 11].

1.2. Clinical psychologist and psychotechnologist: two different professional roles for the assessment of person-technology interaction

The clinical psychologist is an expert graduate in psychology with a specialization in different fields of practice, e.g. psychodynamic, humanistic, behavioural/cognitive

behavioural, and systems or family therapy [18]. In the context of analysis of the user-technology interaction both clinical psychologist and psychotechnologist share the object of study that is to say the systems and relations connected to the individual; moreover, both professional figures focus on the cognitive, personal and social factors involved.

The main difference characterizing the distinction between these two professions lies in the object of the relationship between the client/user and the technological system with which he or she is interacting. In fact, whereas the clinical psychologist deals with clients and their social environment by providing psychological treatment and administering and interpreting psychological assessment and tests, the psychotechnologist focuses on the individual, social and environmental components emerging within the interaction system. Although the two professionals share their object of interest, that is to say the relation between human factors and contextual factors, they operate in two distinct phases of the dynamic person-technology relation: the focal point of clinical psychology is centred on the assessment, testing and treatment of client and societal systems whereas the psychotechnologist gathers and applies the results obtained by the clinical psychologist for better understanding of the user-technology relationship context.

In the context of a centre for technical aids these two professional figures work together to drive the client through a complex matching process towards the assistive solution assignation and they are both necessary for effective intervention within a multidisciplinary team. In this context, the clinical psychologist and the psychotechnologist are involved in different but complementary phases of the system analysis in order to satisfy holistic demand by providing social and individual support to users and their caregivers – which is the role of the psychologist – and, subsequently, assessing the best assistive solution – which is the role of the psychotechnologist. The work of the psychotechnologist within a centre for technical aids will be described in detail as follows.

2. The psychotechnologist in a centre for technical aids

The professional figure of the psychotechnologist is part of a multidisciplinary team for the assignment of assistive solutions during the user-driven evaluation process. In a centre for technical aids the matching between users and technological aids is observed and analysed to help them to seek, check and adopt an assistive solution. Throughout the assignation process the multidisciplinary team works together with the client by seeking an assistive solution among several assistive technologies (ATs). fitting with his or her needs.

In this dynamic and iterative process, the psychotechnologist evaluates AT efficacy during the evaluation trial and assesses AT effectiveness in anticipation of its adoption within the end-user's environment. More specifically, the role of the psychotechnologist in a centre for technical aids is to:

- check the pertinence of any technological aid proposed as a possible assistive solution in a user-driven assessment process during the set-up phase [20];
- evaluate the matching between user and technology through participant observation methods, e.g. Cognitive Walkthrough [22] combined with Thinking Aloud [15], or integrated models [8, 11, 12] by means of validated

measures, e.g. the Matching Persons and Technology assessment tools [19] and the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST) [4, 5].

Consequently, the role of the psychotechnologist within the dynamic and iterative ATA process is to observe and analyse the issues emerging during the user-assistive technology matching. The different phases (Figure 1) in which the psychotechnologist is involved are divided into six stages:

1. *Meeting with the multidisciplinary team*: any environmental, personal and technological issue emerging from the analysis of the user's data is evaluated together with the multidisciplinary team to set the framework assessment agreement. The role of the psychotechnologist is to observe the personal and environmental factors which may affect the matching process by (i) analysing whether the social environment will support the solution, (ii) checking the technological equipment during the assessment process (e.g. keyboard supports, mouse emulators or communication software), (iii) selecting an assistive solution;
2. *Setting up*: the psychotechnologist arranges the setting and checks all the technologies previously chosen;
3. *Matching process*: the psychotechnologist, together with other professionals such as the occupational therapist, the architect or the engineer, explains to the client the functions and the features related to the proposed assistive technology and supervises the user's interaction to analyse any critical situation by means of direct and participant observation methods or integrated models of evaluation [9-12, 19]. After any trial, the necessary customizations or configuration will be applied;
4. *Evaluation of the assistive solution with the multidisciplinary team*: in this phase the multidisciplinary team discusses any issue that has previously arisen and the highlighted strengths and weaknesses are then discussed with the client in order for better understanding of the potential and the limitations of the proposed solution;
5. *User support*: following the evaluation process, the psychotechnologist meets the user and his or her family or caregivers to discuss the possibilities and limitations identified during the interaction with the assistive solution;
6. *Follow-up*: periodically, the user's experience of the solution and his or her needs are evaluated with tools such as the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST) [4, 5]. If necessary, a new evaluation process will be carried out.

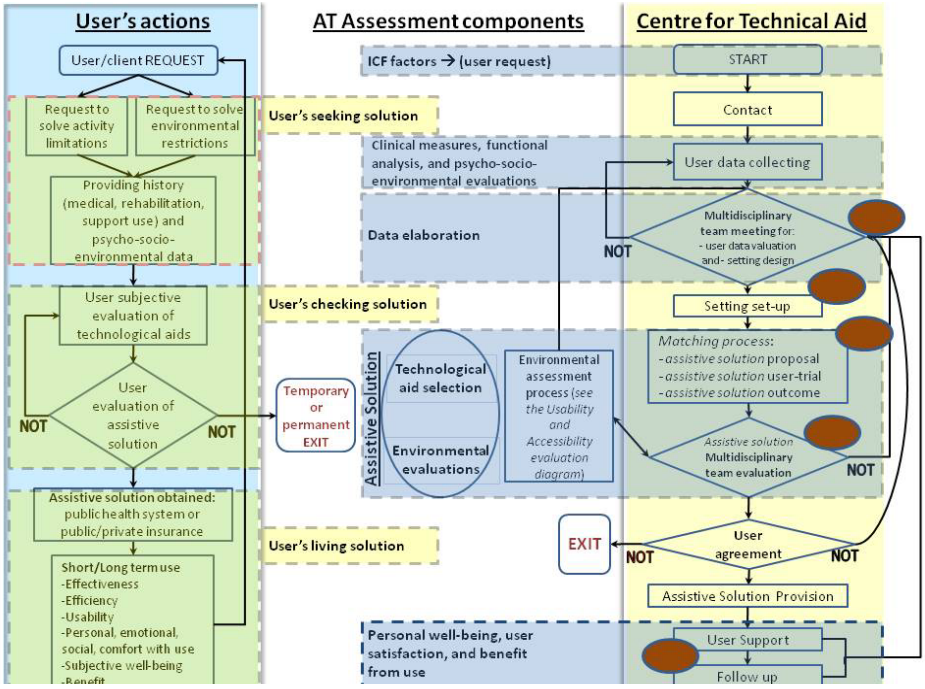

Figure 1. The ATA process flow chart: the brown button indicates the phases in which the psychotechnologist is involved [20, 21].

3. Conclusions

In the last decade a new professional profile able to analyse the dynamic and mutual quality of the human-technology interaction in different contexts of application has developed. Together with a multidisciplinary team, which includes different professionals in the fields surrounding the relation between users and technology, the psychotechnologist operates by adopting an intrasystemic perspective. Differently from the professional figure of the cognitive ergonomist, the psychotechnologist's approach overcomes its dyadic perspective by introducing into the field of observation a third component of the human-technology relation system, i.e. the environmental sub-system. Together with the clinical psychologist, the psychotechnologist pushes clients towards the assistive solution assignment through a complex matching process by providing social and individual support to users and their caregivers and, subsequently, assessing the best assistive solution.

This work shows the role of the professional psychotechnologist within a multidisciplinary team with particular reference to the specific contexts of application of the assistive technology assignment process in a centre for technical aids. Originally, studies on human factors related to information and communication technologies started with the traditional professional figure of the ergonomist: the evolution from this profession to the new profile of the psychotechnologist is explained here. The main differences between the role of the psychotechnologist and the role of the clinical psychologist in a multidisciplinary team for assistive solution assignment are also

described. Finally, we describe in detail the role of the psychotechnologist within a centre for technical aids with particular reference to the different phases of the assistive technology assessment process.

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