THE CLINICAL PSYCHOPHYSICS

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Abstract: Introducing the Psychophysics as an applied science in investigating and approaches and clinical diagnostics. Initially, we introduce something of the epistemological and theoretical aspects of the area, we move to approaches that may provide on Psychophysics clinical applicability and finally, we discuss the recent advances in clinical application, we present the experiences of our laboratory for clinical research in psychophysics, ending with the prospects for extending the use of psychophysics to clinical investigations of perceptual functions more complex.

Keywords: Psychophysics. Clinical psychology. Perception. Experimental psychology.

AThe Psychophysics, along with the psychophysiology, is the oldest branch of psychology today, is dedicated to the study of behavior, brain and mental processes, whether an individual or a group (Gazzaniga & Heatherton, 2007; VandenBos, 2010). When Gustav T. Fechner developed Psychophysics, his goal was to present a scientific method of study of the relationship between body and mind, or, more precisely, between physical and phenomenological worlds (Fechner, 1860). For him, the physical and psychological world were just different reflections of the same reality. The processes of the body (brain processes) processes would be an external point of view or purpose, while the mental processes refers to the processes internalized and subjective.

The sensory physiology at the time of psychophysics was developed was supported only in the subjective phenomenon, ie the perception, rather than neural activities and electrical potentials recorded in sensory receptors. However, Fechner developed the concept of inner psychophysical functions to refer to neural or sensory relations and their neural activities that support it. He had with him that the neural events, still largely unknown at the time, were an important part in understanding this relationship between the objective and subjective. Thus, Fechner Psychophysical regarded as the relationship between external sensations (ie, the phenomenon) and the corresponding variations and physical properties of the objects themselves (Scheerer, 1992). The Psychophysics Internal remained at the level of theoretical concepts while Psychophysics Foreign provided the basis for the creation of methods for studying brain and sensory processes.

We understand that designing for Fechner psychophysical put in an extreme physical event characterized by a controlled and systematic presentation of their physical characteristics, connected to the other extreme by subjective event, characterized by sensory or perceptual response. Assuming a central position between these two events, the neural activity Fechner positioned to act as a physiological substrate of the perceptual event. We then have the description of a relationship between subjective events with neural activities, held at the theoretical level. Here is the strong point of Psychophysics. For the common bond that makes Psychophysics Psychophysics with External Affairs by subjective events, we are able to infer rules for sensory or neural processing and transformation of the stimulus.

This strength has attracted the attention of many researchers and the study of internal processes and phenomena with subjective psychophysical methods was the hub through which developed not only to experimental psychology, but also the sensory physiology. Psychophysical methods were used by pioneering researchers in the field of sensory research as Helmholtz, Hering, Mach and Weber (Jung, 1984) providing the basis for many discussions and key findings for understanding the sensory mechanisms.

It is this point a brief aside to mention that Fechner anticipated a major goal of neuroscience today, which seeks to establish correlations between neuronal events (goals) and perceptual (subjective).

With the development of various objective methods such as electrophysiology (including electroencephalography, evoked potentials and recording in isolated cells), magnetoencephalography and functional magnetic resonance imaging, have recently provided the study of sensory processing and brain, as well as their respective anatomical locations and marking time.

The modern conception of Psychophysics proposes a complementary, adding to the concepts of inner and outer psychophysics, neurophysiology. With the ability to objectively measure neural events, there were possibilities of quantitative correlational studies between perception and neural correlates of these. In this current scenario, the external Psychophysics stands as the relationship between changes made to the stimulus and the changes in subjective responses. The inner psychophysical becomes a quantitative assessment of neural activity during the perceptual processes and the acquisition of neurophysiology to the study of the perceptions gap completes the quantitative relations between physical objects and manipulations in their respective neural responses.

Understanding the internal processes are continually gaining content that allows us to increasingly have access to the most complex mental events. Correlational studies involving psychophysics, electrophysiology and evaluation of brain activity by functional neuroimaging techniques, are on the frontier of knowledge about the mind. Although the inner psychophysical still at the nearest field theory, it is no longer solely dependent on external psychophysical (Snook, 1999). This makes the knowledge of phenomena and subjective responses and, indeed, of mental events get another dimension. The use of knowledge of sensory functions and brain directs the inner psychophysical assessments for increasingly accurate and specific. Thus, the perceptual significance for a given hypothesized mechanism or brain area can be determined by means of psychophysical tests, such as points (Wist, Ehrenstein, Schrauf, & Schraus, 1998).

This paper seeks to show that the psychophysical after receiving extensions and methodological changes, stays active in his scientific activity, contributing to the side of the neurosciences, to the discoveries of the properties of the mind and its relation to the brain. A contribution of psychophysics which is currently gaining the attention of psychologists and neuroscientists are related to the clinical use of psychophysical methods aimed at understanding the development of the neural substrate, the activities and impact of mental disorders in the nervous system on these structures and functions. In addition to developing, psychophysical studies can offer valuable information about measurements and emotional aspects of mental processing (Wesner & Tan, 2006), motivational (Burseg, Linforth, Hort, & Taylor, 2009; Cardello, Schutz, Lesher, & Merrill, 2005; Eisler & Eisler, 1994), social (Dercole & DAVENPOR.WG, 1974), cognitive (Fetterman, 1995) and other neurological and psychiatric patients.

The Psychophysics Clinic

For some readers, the preceding paragraphs may generate an apparent paradox, for the psychophysical point of departure, ie, this requires an objectification of subjective experience. We do not need any tool, instrument or technique to obtain the perceptions. These are immediately displayed and available in each one of us. Therefore, the critical question is how to obtain the perceptions, but to describe and investigate individual perceptions so that they can be shared with others.

The psychophysics deals with this problem very closely linking the physical stimulus to the perceptual experience, using it as a reference system. The characteristics of physical stimuli are carefully and systematically manipulated and observers must report their perceptions. Therefore, your methodology allows the study of conscious events that generate various contributions to many areas related to psychology. We divide these contributions in the paragraphs that follow, only with the object and point out some of the disciplines, they are linked to the clinic, receive more intensely, contributions in this area of psychological science.

Empirical contributions to epistemology

Once in place, and the subjective experience of the physical world events very closely linked, can assume that psychophysical methods can be presented as a method of experimental study to epistemological questions of perception. Historically, the central point about the perception is whether and how beliefs about the physical world can be justified or warranted based on sensory-perceptual experiences (Bonjour, 2007). The psychophysical and empirically directly addresses this crucial point, the epistemological point of view, and indeed, the manipulation of attributes and physical characteristics and their effects and subjective representations are scientific contributions to the epistemology of perception and, consequently, of consciousness (Dodwell, 1985).

The great art of psychophysics is to formulate a simple question and you need enough to get a convincing answer. The psychophysical studies usually begin with simple questions that seek to find the capabilities and limits of simple perceptual event, the detection in a given dimension of a physical modality. Questions such as, for example – you hear this tone? Do you see a light? – Seek to investigate these limitations of the physical world accessible by consciousness. More complex levels of conscious mental processing can be exploited to no more searching

only know about the detection capability, but the ability to identify the physical attribute, ie what are the characteristics of the physical stimulus that can be perceived (Alsaleh, 2004, George, 1957; Rossi, 2007). For example, I can visually perceive a physical stimulus far away, without being able to identify him as it would if it were within the limits that allow this identification.

Solved the problems of detection and identification, experimental situations to pass a level closer to the complexity of the world, seeking to objectively evaluate the discrimination capabilities of the individual. The important difference between the measurement of discrimination and earlier due to the fact that under conditions of physical weak and noisy signals (defined here as the tangle of critical features in a study with other physical elements that affect the performance of our sensory capacities), failed to identify what is and where it comes from or where is the stimulus in question (Rossi, 2007; Stoffregen & Bardy, 2001) in the environment.

The application of psychophysical ratings in a clinical setting, therefore, can provide empirical evidence for the study of epistemological issues of perception, conscious mental skills development and research of how the physical world is perceived by patients with different diseases, such as cerebral palsy, schizophrenia, autism, depression, the poisoning, among others.

It is not in this paper to dwell on this topic, but the psychophysical experiments can provide data to assist in the epistemological discussions of perception, such as perceptual relativism, the question of illusions, both related to the immediate experience of the object, they can also address issues of external justification, known as reliability, studying the changes of physical stimuli and whether or not the perceptual processes.

Contributions on the Functional Assessment

The study of sensory and perceptual functions is certainly the most obvious and clear application to psychophysics provides clinical trials: a systematic and quantitative evaluation of sensory functions and seeking the understanding of perceptual development of these functions and the impact that damage to the system nervous and peripheral sensory structures lead in their respective functions (Rossi, 2007; Stoffregen & Bardy, 2001).

The high accuracy of the responses, in part because it is a systematic and quantitative process, conducted in a controlled environment and partly by the wealth of information that the psychophysical methods allow you to access in their measurements,

made many other areas of knowledge as if they used the psychophysical complementary method. With respect to clinical attachment, our focus in this text, the medical and paramedical absorbed many diagnostic procedures for their psychophysical tests. To name a few, have held that speech audiometric sensitivity curves, ophthalmology measures the visual acuity, contrast sensitivity and color vision, neurology tests for pain etc.

However, the procedures they have in common is the fact that all measurements of sensory-perceptual thresholds.

The basic function of any sensory system is to capture energy from the environment. This energy can be chemical – as in the case of taste and smell, can be electromagnetic – as in the case of vision, mechanics, such as hearing, touch and proprioception, or thermal energy. For a given stimulus is perceived, there is a need for a certain amount of energy. Consequently, a measure that makes sense is that the absolute threshold is the smallest amount of energy emitted by a stimulus needed to be realized or, as Fechner said, "raise your feeling on the threshold of consciousness" (our translation) (Fechner, 1860).

We have then, that the absolute threshold is the intensity that only an observer can detect. Much of the psychophysical methods search the quantitative assessment of these thresholds. These measures tell us how are the functional capabilities of a given sensory system for a given characteristic of the physical world. Because it is a very accurate measure, it undergoes changes due to structural changes and tissue damage related to sensory systems.

Changes in thresholds are used for early diagnosis of many systemic diseases and nervous system, because often the changes detected are subclinical, ie, occurring before the possibility of identification of anatomical and physiological changes in the respective tissues of sensory organs (see in examples of clinical applications).

The quantification of the threshold, therefore, gives us the value of detectability for a given stimulus. Besides the extent of that value, we can extract important information that will help us to have more complete clinical features of early stages of perceptual and mental function conscious. Measures of variability sensory perception of linear behavior with the physical dimensions manipulated (Houstoun & Shearer, 1930; Stevens, 1957), functional capacity discriminating in comparison tasks (Baranski & Petrusic, 1992, Hanna, von Gierke, and Green, 1986; Hecht, 1924; Mallery, Olomu, Uchanski, Militchin, & Hullar, 2010; Ross, 1997), perceptual measures of values for groups and populations (Deco & Rolls, 2006; Dzhafarov & Colonius, 2007; Sturzel & Spillmann, 2004, Warren, 2006) are just some examples of how information is psychophysical assessment and will be enriched as the

clinical knowledge of diseases that affect mental processes, with the addition of a clinical psychology.

Because they are reliable methods, the psychophysical measurements can be used to monitor the evolution of diseases, the clinical effects of therapeutic treatment, medication or surgery. The psychophysics has in recent years, gained even more space within the clinical activities, and certainly presents a very promising future as a psychological activity.

Contributions to Sensory Physiology

This point takes the concept of inner psychophysical, which seeks the relationship between perceptual events and neural events. The Internal Psychophysics, therefore, after remaining in theory, was increasingly gaining ground in research in psychophysiology of sensation and perception, and currently is one of the most interesting areas of psychological sciences and health. The psychophysical can, by the intrinsic characteristics of their methodology, inferences about the physiological processes of sensory and perceptual pathways active in a given context of environmental stimulation.

Remember that, as science, psychology studies the behavior, not restricted to humans but it is up to the behavioral study of living things. Arguments that we can not know what an animal perceives do occur frequently. But we must bear in mind that this problem is relevant for both animals and for us humans. The challenge of psychophysics is exactly the design and control of stimuli and experimental conditions that eliminate all possible clues or external events that may influence the success of a detection or discrimination (Baird & Harder, 2000; Braddick, 1997; Harrad, 1996; Palmer, Verghese, & Pavel, 2000; Soechting & Flanders, 1995; Treutwein, 1995; Yarnitsky, 1997; Green, 1990). Animal studies have advanced greatly in the development of experimental paradigms task of sensory detection and discrimination (Celebrini & Newsome, 1994; Guilhardi, MacInnis, Church, & Machado, 2007; Harmening, Nikolay, Orlowski, & Wagner, 2009; Hodos, Weiss, & Bessette, 1988; Merchant, Battaglia-Mayer, & Georgopoulos, 2003). These advances have allowed many of these methods were extrapolated for use in humans, especially in infants and nonverbal children as reported by Janette Atkinson, developmental psychology at University College London, with research in the areas of research methods to the development and neuroscience visual development (Atkinson & Braddick, 1999).

In the late 19th century, psychophysical studies have shown the existence of three sensory inputs to the perceptual composition of the full range of colors that are able to see (Maxwell, 1890). Only in the 60s of the 20th century is that there was a corresponding physiological findings showing the existence of sensory receptors (photoreceptors) that had three different peaks of sensitivity at different wavelengths of light (WALD, 1964).

Other examples include the various sensory modalities and studies that explain the physiological mechanisms by means of psychophysical measures. Damage to visual pathways caused by glaucoma, a disease characterized by increased intraocular pressure and death of retinal neurons, are intensely studied by psychophysical methods and provide, more and more knowledge about the physiological changes of eye disease (Anderson, 2006; Hitchings, 1993). Studies have found electrophysiological measures that support the perception and analysis of spatial orientation (Wenderoth & Johnstone, 1987). The variation in the proportion of photoreceptors with peak sensitivity to medium wavelength and long has been evident with extreme precision by psychophysics (Kremers et al., 2000). Studies of taste have received great depth of knowledge in the areas of molecular sciences, however, psychophysical measures are used to determine physiologically different tastes (Bartoshuk, 1988; Bartoshuk & Beauchamp, 1994). Suppressive effects of binocular rivalry have helped neuroscientists in understanding the neural mechanisms in the face of unconscious processing (Breitmeyer, Koc, Ogmen, & Ziegler, 2008). The physiology of the senses of touch and pressure is known, in part, by the results of psychophysical experiments (Labs, Gescheider, Fay, & Lyons, 1978; Lak, Arabzadeh, Harris, & Diamond, 2010).

The possibility that the psychophysical to offer empirical studies of consciousness, sensory and perceptual functions, besides elucidating physiological mechanisms, with non-invasive techniques, makes this area of psychology, a strong ally for the clinical issues. We will see briefly some applications of psychophysics in clinical psychology and its contribution to the understanding of normal human development or not, as well as in disease processes.

Recent Clinical Applications of Psychophysics

One of the characteristics of psychophysics is need for a considerable amount of presentations of stimuli in each condition to be tested. Of course, the transition of psychophysics "laboratory" for the psychophysical applied in a clinical setting is due to an intense attention spent on the development of experimental paradigms, which were able to maintain

the accuracy and reliability of ratings, but to present a time assessment subject to a clinical application (Anderson, 2003; Bardin, 1978; Bonnet, 1994; Brown, 1996).

Included in this aspect, strongly directed to the methodological innovation, the creation of computer programs that allow the construction of psychophysical complete routines (Brainard, 1997; Peirce, 2007), development of adaptive methods that change dynamically, but based on specific rules, the strategies of presentation of stimuli (Anderson, 2003; Brainard, 1997; Fitzke, 1988, Garcia-Perez, 1998, Garcia-Perez, 2002), the construction of mathematical and statistical algorithms allowing a manipulation of the parameters based on empirical data and prior assessments references to quantitative probabilistic (Garcia-Perez & Alcala-Quintana, 2007, Garcia-Perez & Alcala-Quintana, 2009; Hurlimann, Kiper, & Carandini, 2002; Jazayeri, 2008; King-Smith, Grigsby, Vingrys, Benes, & Supowit, 1994; King-Smith & Rose, 1997, Lewis & Maurer, 1986; Maclin, Peterson, Hashman, & Flach, 2009; Roesch, Sander, Mumenthaler, Kerzel, & Scherer, 2010; Zychaluk & Foster, 2009) and certainly, the very advances in technology that allows us to serve more and more sophisticated computational techniques and equipment of high accuracy with increasingly lower costs and increasing portability.

Over decades of study and methodological improvement, clinical contributions are increasingly part of the universe of psychophysics. Here are some examples of clinical extension achieved. Studies on the ability of discrimination of elements and their spatial variations in light intensity is used as a procedure for diagnosing and monitoring treatment of eye diseases such as retinal changes caused by diabetes mellitus type 2 (Zeman, Knight, & Cullen, 1990; Winkler, 1981; Bek, Moller, & Klausen, 2000; Jerneld & Algvere, 1987; Gualtieri, Nishi, Lake, & Ventura, 2005), glaucoma, characterized by anatomical changes of the optic nerve and increased intraocular pressure (Bhola, Keech, Olson, & Petersen, 2006), optic neuritis is an inflammation of the optic nerve (Beck, Kupersmith, Cleary, & Katz, 1993; Beck et al., 1997) and loss of visual perception, no organic cause eye, apparent on clinical examination, called amblyopia (Barnes, Hess, Dumoulin, Achtman, & Pike, 2001). Other studies are concerned with measures that could be sensitive to changes in optical pointing our eyes and the ability to detect visual stimuli (Blommaert, Heynen, & Roufs, 1987), for example, cataract (Catalano, Simon, Jenkins, & Kandel, 1987; Chia & Martin, 2001; Gwiazda, Wolfe, Brill, Mohindra, & Held, 1980; Howes, Caelli, & Mitchell, 1982). Measures of dynamic events are often used as indicators of damage to the visual sensory system, as in poisoning by therapeutic drugs for clinical use (Al Khamis & Easterbrook, 1983).

Neurological diseases or central nervous system effect very often affect the sensory and perceptual processing. Among these, the visual

system is the most presents reports of damage to their functions (Hoyt, 2003; Huo, Burden, Hoyt, & Good, 1999; Massof, 2002). Examples are changes in depth perception and color perception in patients with lesions in the left cerebral hemisphere (Jerneld & Algvere, 1987, Koh et al., 2008), impaired depth perception in dementia of vascular origin (Massof, 2002; Mittenberg, Choi, & Apple, 2000), changes in spatial discrimination in hydrocephalus (Oud, Steggerda, Nanninga-Van den Neste, Gooskens, & Van Nieuwenhuizen, 1999), spatial and color discrimination in multiple sclerosis (Mowry et al., 2009), and one of the most common neurological diseases in childhood, cerebral palsy (Arp & Fagard, 2005; Barca Cappelli Di Staccioli, & Castelli, 2010; Black, 1982; Dutton, McKillop, & Saidkasimova, 2006; Govind & Lamba, 1988; Hertz, 1987; Kozeis et al., 2007, Porro et al., 1998, Costa et al. 2002; Coast, Solomon, Berezovsky, Haro, & Ventura, 2004).

The development of the basic elements for the formation of mental processes and the generation of behavior remains intensely studied by psychophysics. The perception of physical space presents a significant amount of research. The minimum separation between two spatial elements, classically known as visual acuity, visual function is one of the most studied during development (Allen, Tyler, & Norcia, 1996, Atkinson & Braddick, 1978). Our ability to understand the functional elements as separate space is very rudimentary at birth, which causes us to notice only the elements of great size. During the first six months of life is that after an intensive development of a quasi-plateau. Around 18 months we have another period of development, and another at 30 months (Teller & Movshon, 1986; Teller, 1990). Perceptual capacities are similar to those obtained for adults aged 36 and 48 months (Solomon & Ventura, 1995; Woodhouse, Morjaria, & Adler, 2007).

Not only are interested in measuring the thresholds of vision for fine details of the space, but another key attribute is the spatial relationship between the levels of brightness, or luminance, of these elements. Elements separated in space, but with the same brightness, can not be perceived. However, with the development of sensory-perceptual abilities we are able to perceive differences between the contrasts that can reach values as small as 0.03% (Adams & Courage, 1996). Unlike the visual acuity, the perception to light intensities has a slower development and only in adolescence (aged 15-18) is that we get our functional capacity (Gwiazda, Bauer, Thorn, & Held, 1997). Studies show that healthy babies at 18 weeks of life, they are able to differentiate between absolute and relative motion (Banton & Bertenthal, 1996).

This not only allows us to follow the development of perceptual functions, but also make inferences about the predictive ability of these measures, including patients (Zubcov et al., 2002) as children with Down syndrome (Courage, Adams, Reyna, & Kwa, 1994) and hemiplegia (Gunn

et al., 2002). These are a few examples of studies of perceptual development and its clinical applications. There are many other related studies covering other visual functions, such as color discrimination (Gwiazda et al. 1997; Knoblauch, Vital-Durand, & Barbur, 2001; Morrone, Burr, & Fiorentini, 1990; Morrone, Burr, & Fiorentini, 1993) and perception of dynamic events and perception of motion (Banton & Bertenthal, 1996; Ellemberg, Lewis, Maurer, Brar, & Brent, 2002, Hamer & Norcia, 1994; Schrauf, Wist, & Ehrenstein, 1999; Stein, 2003; Wattambell, 1994).

Recently, psychophysical studies have contributed to the understanding of mental events present in many physiological and clinical developments of related diseases such as autism, dyslexia and neuropsychiatric disorders such as schizophrenia, Parkinson's disease and depression.

Autistic children exhibit an intriguing aspect regarding integration of sensory information essential for perceptual construction. Studies show that sensory abilities, ie, capture and process the environmental stimuli are similar or even better than children with normal development ([Anon], 2009, Cascio et al., 2008). However, flaws evident in perceptual processing occur from events such as the movement of spatial elements (Bertone, Mottron, Jelenic, & Faubert, 2003; Blake, Turner, Smoski, Pozdol, & Stone, 2003) and perception of form (Spencer & The O'Brien, 2006) until the ability to recognize mental states of facial expression, impairing the efficient social contact (Back, Jordan, & Thomas, 2009; Pellicano, Gibson, Maybery, Durkin, & Badcock, 2005; Pellicano, Jeffery Burr, & Rhodes, 2007).

Deficits in visual processing are well known in individuals with schizophrenia and has potentially important clinical implications: the pattern of changes for different visual tasks can help you understand the pathophysiological mechanisms of visual dysfunction; rehabilitation treatment strategies show an improvement in many of these functions (Brittain, ffytche, McKendrick, & Surguladze, 2010). Studies point to a loss of visual functions for all types of schizophrenia, however, in cases of patients with mild and moderate visual deficits were less pronounced when compared to deficits of more severely affected individuals (Doop & Park, 2009; Marsh & Williams, 2006; Nelson, Combs, Penn, & Basso, 2007).

Besides these brief accounts, the psychophysical assessment has become increasingly insertion in clinical psychology, neurology and psychiatry. Psychophysical studies are increasingly investigating sensory-perceptual changes in several diseases and mental states, is to understand the physiology of its own functions, either to the understanding of the clinical picture of the respective diseases.

Our Experience in Clinical Psychophysics

We develop our studies in the Laboratory of Clinical Psychophysics Vision, belonging to the Department of Visual Psychophysics and Clinical Electrophysiology, Department of Experimental Psychology, University of São Paulo. Two main lines of research simultaneously follow: sensory and perceptual development and study of perceptual functions in neuropathology, including genetic and acquired diseases that lead to losses in the central nervous system. The sensory-perceptual functions of the visual system have been adopted as an experimental model and are systematically studied, aiming at clinical application of this knowledge.

The ability to discriminate spatial elements and their development is the subject of intense study, both for the establishment of normal values (Solomon & Ventura, 1993; Ventura & Solomon, 1995), and for the application in the clinic as a screening method for functional changes vision (Solomon, Berezovsky, Haromunoz, & Ventura, 1994). The development of standards for perceptual function tests are of fundamental importance in clinical practice, serve as parameters for classification and diagnosis. Studies comparing the normal development of these functions were compared with the development of premature babies (Solomon et al., 1994, Solomon et al. 2000; Solomon, Berezovsky, De Haro, Goldchmit, & Ventura, 2001), as well as in infants eye diseases (Haromunoz, Berezovsky, Ventura, Moreira, & Solomon, 1995) and genetic (Lima, Bonci, Grotzner, Ribeiro, & Ventura, 2003). Correlational research is also done with the intention of obtaining information relating to the physiological sites responsible for processing and the change in spatial perception (Costa et al., 2001, Costa et al. 2004; Oliveira, Costa, & Ventura, 2005, Oliveira, Costa, Souza, & Ventura, 2004, Solomon et al., 1999, Ventura et al. 2003c; Ventura et al., 2004).

The color vision and its development are also topics. Theoretical and methodological studies seek to identify factors associated with testing conditions and performance in color discrimination tasks (Costa, Ventura, Perazzolo, Murakoshi, & Silveira, 2006), as well as understand how to process the perceptual development of this function (Goulart et al., 2008, Ventura et al., 2002, Ventura et al., 2003b). The knowledge of normal development for the perception of color is crucial to understand the limitations and shortcomings presented by specific population groups, such as children with Duchenne Muscular Dystrophy, which has a high loss rate perceptual color for axis green-red (Costa, Ventura, Pavanello, Cerqueira, & Zatz, 2004, Costa et al. 2005; Costa, Oliveira, Feitosa-Santana, Zatz, & Ventura, 2007).

An important conclusion drawn by studies with color is that this visual function is presented as a powerful indicator of nervous system lesions, even in subclinical stages, ie, the patient was considered normal. Diabetes mellitus type 2 (Feitosa-Santana et al. 2006a; Gualtieri et al., 2005, Rodrigues et al., 2007, Ventura et al., 2003a) and occupational intoxication by mercury vapor conditions were involved in these studies (Barboni et al. 2008; Barboni et al. 2009; Canto-Pereira et al. 2005; Feitosa-Santana et al. 2006b; Feitosa-Santana, Costa, Lake, & Ventura, 2007; Feitosa-Santana et al., 2008, Gualtieri et al., 2004, Rodrigues et al., 2007, Ventura et al. 2003c; Ventura et al., 2004). The latter also have an important social factor, since the patients had exposure occurred in the workplace.

Genetic diseases such as Leber's Hereditary Optic Neuropathy, a disease that affects adolescents and young-adult male, leading to sudden blindness has received great contribution of our psychophysical assessments. We show that there is already a reduction in visual function in men who are only carriers of the gene for the disease (Sadun et al. 2004; Ventura et al. 2005a; Ventura et al., 2005b), and that there are specific visual pathways affected while others remain functionally normal (Gualtieri et al., 2004, Gualtieri et al., 2008, Ventura et al., 2007).

Final Critique

The aim of this paper was to outline some of the major theoretical and methodological issues of psychophysics and present their contributions to clinical psychology, or by assessing sensory and perceptual functions for purposes of classification and diagnosis, both for clinical research purposes. Besides the obvious clinical role, we show briefly that psychophysics can be applied to research on various aspects of problems involving the sensations and perceptions, theoretical and philosophical and compared to basic research.

The Psychophysics remains an active area of psychology today. More and more often, other areas of psychology are discovering the psychophysical methods as a form of experimental access mental events and behaviors, their interests. An important part of modern social psychology research has been focusing on how the social context in which we live our mental lives can affect the way we enjoy the social reality. Such studies have shown that social knowledge can affect not only the thoughts and judgments of people but also their perceptions to basic elements such as physical magnitude of a stimulus (Stapel & Koomen, 1997).

Other investigations in which psychophysics is increasingly present are related to studies of attention (Avrahami, 1999), recognition of

mental states by facial expressions (Back et al., 2009), imagination and mental images (Baird & Harder, 2000; Petrusic & Baranski, 1992), the development of social disorders (Barton, Hefter, Cherkasova, & Manoach, 2007) and even to resolve epistemological questions of perception (Bonjour, 2007).

We conclude by saying that we see the future of research on sensation and perception with much enthusiasm, as well as, increasingly, insertion of Psychophysics in the clinical setting of psychology and health sciences. Visionary and lucid to the journey through the decades of Psychology where she teaches and how researchers in the field of psychophysiology, the Laboratory of Vision was founded by Prof. Dora Fix Ventura 15 years ago and today, it falls between the main centers of research in psychophysics and Clinical Electrophysiology of Vision International.

A clínica da psicofísica

Resumo: Apresentamos a Psicofísica como uma ciência aplicada nas investigações e nas abordagens e diagnósticos clínicos. Inicialmente, introduzimos algo dos aspectos epistemológicos e teóricos da área, passamos para as abordagens que a Psicofísica pode apresentar na aplicabilidade clínica e, por fim, discutimos os avanços recentes da aplicação clínica, apresentamos as experiências de nosso laboratório de pesquisa clínica em psicofísica, finalizando com as perspectivas de ampliação do uso da psicofísica para investigações clínicas de funções perceptuais mais complexas.

Palavras-chave: Psicofísica. Clínica psicológica. Percepção. Psicologia experimental.

La psychophysique clinique

Résumé: Présentation de la psychophysique comme une science appliquée dans les enquêtes et les approches et les diagnostics cliniques. Au départ, nous introduire quelque chose des aspects épistémologiques et théoriques de la zone, nous passons à des approches qui peuvent prévoir, sur Psychophysique applicabilité clinique et enfin, nous discutons les récentes avancées dans l'application clinique, nous présentons les expériences de notre laboratoire pour la recherche clinique en psychophysique, en terminant par les perspectives d'extension de l'utilisation de la psychophysique aux enquêtes cliniques sur les fonctions perceptives plus complexe.

Mots-clés: Psychophysique. Psychologie clinique. Perception. Psychologie expérimentale.

La psicofísica clínica

Resumen: Presentación de la psicofísica como una ciencia aplicada en la investigación y los enfoques y los diagnósticos clínicos. Inicialmente, se introduce algo de los aspectos epistemológicos y teóricos de la zona, nos trasladamos a los enfoques que pueden proporcionar a la aplicabilidad Psicofísica clínica y, por último, se discuten los avances recientes en la aplicación clínica, se presentan las experiencias de nuestro laboratorio para la investigación clínica en la psicofísica, que termina con las perspectivas para ampliar el uso de la psicofísica en las investigaciones clínicas de las funciones perceptivas más complejas.

Palabras clave: Psicofísica. Psicología clínica. Percepción. Psicología experimental.

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Received: 21/10/2010

Accepted: 29/11/2010