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Definitions and Explanations in Language, Reading and Dyslexia Research

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1. Introduction

This chapter aims to analyze and clarify some fundamental issues in language, reading and dyslexia research. In particular, questions and problems concerning definition, explanation and understanding are addressed. A central idea is that the cognitive and linguistic approach has had a limited significance when it comes to explanation of causal mechanisms in reading and dyslexia research. The reasoning brought forward in this chapter takes as starting point that we first need precise definitions of the phenomena to be studied, such as 'reading', 'dyslexia' and 'language', before we choose methods that in a best possible way may capture the important characteristics of the phenomenon. In the field of reading and dyslexia 'skill' is emphasized as an important phenomenon, and the core of this concept is considered to be potentiality. We suggest that language primarily should be defined as a skill and not as a system that exist more or less independently of humans and speech acts. The position taken is that mainstream definitions of 'language' are not well suited for the empirical study of language skills, because they were formulated to serve other objectives. Inspired by the philosophy of science from Karl Popper we suggest that the study of language, reading and dyslexia must be based on a more radical and consequent empiricism. First, we will present some characteristics of the cognitive and linguistic approach to reading and dyslexia. Second, we will identify some problems and limitations in this approach. In our suggestions for future research we first focus on conditions that should be imposed on definitions in research. Next, we propose a definition of 'skill' in general and 'language skill' in particular.

2. The cognitive and linguistic turn

Although dyslexia research had its early start in the late 1800 century, the broad interest and increase of research activity in this field took place first in the 1970s. When we take a historical view on dyslexia research, there are remarkably few critical presentations of the historical development. The short presentations that exist have in common that they lack analyses grounded in philosophy of science. In this part of the chapter we will raise some fundamental questions and point at possible answers with relevance for this field of research.

Since the different researchers and approaches use somewhat different terminology, it is difficult to capture and categorize the history of dyslexia with concepts from a specific

tradition. With some reservation we believe that we may lend inspiration from the history of medicine. However, this does not mean that we claim the medical approach to be the most fruitful. In the historical overviews – which are remarkably few - over the history of dyslexia research we have not found any better classification (c.f. Miles & Miles, 2001; Beaton, 2004; Sawyer, 2006; Vellutino et. al., 2004; Shaywitz, 2006; Collins & Rourke, 2003; Alexander & Fox, 2004)

A first preliminary sorting involves a distinction between practical and theoretical research. In the history of dyslexia research these approaches overlap and have been mutually beneficial. Until 1970, the focus and emphasis was on practical research, while the theoretical research later on has increased in volume and importance. In the early start of dyslexia research the studies emerged from clinical and practical work with students and patients. If we use the medical terminology, the main emphasis was on diagnosis, treatment and prognosis. In the later theoretical approach there has been a larger emphasis on symptoms, causal mechanisms and aetiology.

As we in the following will concentrate more on the theoretical approach, we will illustrate the terminology with some examples from this part of the history of dyslexia research. In the 1920s it was common to claim that 'inversion' - or mirror images of letters and words - was common in reading and writing among dyslexics. The term 'strephosymbolia' (distorted symbols) was therefore used instead of 'wordblindness' which was then the most common term. The neurologist Samuel Orton explained the mechanism underlying these symptoms by referring to the interplay between the two hemispheres of the brain. He claimed that when the signals from the hemispheres are processed in a way that they distract one another, a distortion in the perception occurs. In this way Orton described the locus and the sequence of events related to the problem, but important questions remained: Why have some people abnormal interplay between the hemispheres? The answer resided in the aetiology. The anatomic proportions and physiological functions are abnormal due to genetic or environmental factors. In this example we see the importance of distinguishing between the causal mechanisms, which are manifested every time a reading error occurs, and the aetiology which describes why these causal mechanisms occur in some people.

The interest in achieving a highly precise and complete description of the symptoms of dyslexia has varied a lot over the history. The Norwegian researcher Hans Jørgen Gjessing was among the pioneers in this area. He asserted in the late 1950s 5 groups of symptoms (Gjessing, 1986). Most known is, however, Elena Boders three groups from the end of the 1960s (Boder, 1973). She claimed that the first group – called 'dyseidetic' – was characterised by symptoms that could be traced back to causal mechanisms in the visual system. The second group consisted of symptoms that could be traced back to causal mechanisms in the auditive system. It is somewhat misleading, however, when she calls the latter symptoms 'dysphonetic', inasmuch as phonological and auditive phenomena are not identical. The third group, which combines these two, was called 'alexic'.

From the 1970s the focus shifted from description and categorization of symptoms. From this time on emphasis was put on the fact that the main problem of dyslexics was to read or write unknown words. The errors dyslexics made when reading and writing nonsense words were extensively used to describe the symptoms of dyslexics. With reference to the issue of language raised in this chapter, a question of definition becomes pertinent: does this

reading involve language? Inasmuch as these words do not have meaning, and given that phonemes are defined as the smallest meaning differentiating unit in language, the sounds elicited from reading a nonsense word cannot be defined as phonemes.

The description and categorization of symptoms in reading and writing behaviour could make use of methods from the behaviouristic tradition. The rising volume of research from the 1970s and onwards was partly also due to an increasing interest in the causal mechanisms underlying overt behaviour. However, cognitive psychology is not based on individual introspection. It is therefore somewhat misleading when the term 'causal mechanisms' is used in this tradition. Rather, it is about structures that stand out for all individuals in a specific domain. Noam Chomsky is the primary representative for this kind of linguistic philosophy. His grammar was never based on a thorough collection of linguistic material with as much variation as possible. His method is not inductive nor empirical, but rather deductive and rationalistic. In this way it is linked to Immanuel Kant's notion of *a priori* analyses, as opposed to *a posteriori* experiences (Kant, 1781). The pure logic is linked to the first term, while all science that is based upon sense experience is associated with the latter. Mathematics, which e.g. is based on counting, has some foundation in the empirical, but is mainly logical. In this way mathematics gains a medium position in terms of *synthetic a priori*. This Kantian expression may be a good characterization of Chomsky's grammar even if the influence from Descartes is usually more emphasized (cf. Chomsky, 1966).Through analyses of a highly abstract concept of language with the abovementioned status, he arrives at definitions and conditions that are claimed to be valid for language. "In its attempt to characterize an innate universal grammar common to all human minds, Chomsky's (1957) transformational grammar shared European structuralism's emphasis on abstract structures (…)"(Leahey, 2001, p.294).

Even though we see similarities, it can be discussed to what extent and how Chomsky has influenced cognitive psychology in general and dyslexia research in particular. Thorne & Henly (2001) claim, however, "(…) if there has been a cognitive revolution, no person is more responsible for it than Noam Chomsky (..) the interaction between psychology and linguistics has strengthened with psychology's new cognitive focus." (Thorne & Henley 2001, p. 538-539)

3. Options and limitations in the cognitive and linguistic approach to dyslexia

When reading research within the cognitive approach arrives at so called 'flow charts', it is not based on inductions that can be falsified. Rather, it is an analysis of what an implicit and abstract definition of 'reading' involves. It shows what ideally has to be present if something is to be characterized as reading. Neither is it a display of causal mechanisms that explain why one comes through the routes of the chart with or without particular errors. A typical flow chart for reading - or more precisely: decoding – is the so called 'dual route model' (c.f. early versions in Thomson, 1990).

When it comes to the transition from one 'box' of the chart to another, emphasis is put on automatization. It is therefore problematic to state what the cognitive consists of in this case. 'Flow charts' may show what the problem consists of and where in the reading – or decoding – process it occurs, but we do not get any explanation of why it happens. It is

therefore not a causal model that shows causal mechanisms. At this point behaviourism and connectionism have advantages over the cognitive approach.

Before the 'cognitive and linguistic turn' in dyslexia research about 1970, a large emphasis was put on visual factors. This emphasis can be traced back to James Hinshelwood who claimed in 1895 that 'word blindness' was caused by a deficit in visual memory (Hinshelwood, 1895). The different versions of this way of thinking have all been causal models. 'The cognitive and linguistic turn' implied that dyslexia was considered a phonological problem, operationalized as difficulties of identifying, analyzing, and synthesizing speech sounds and to associate these with letters.

However, the statements of this approach, only shows what kind of problem dyslexia is. We neither get to understand the causal mechanisms nor the aetiology. These are statements about what is meant with the term 'dyslexia', and therefore the abovementioned elements or 'boxes' in the flow charts are part of the definition of dyslexia within the cognitive approach.

The International Dyslexia Association adopted in 2002 the definition "Dyslexia is a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language (...)" This quotation gives the impression that the phonological deficit is a cause, but in reality it only describes what kind of problem these individuals face. Investigations 'showing' that phonological difficulties are overrepresented in dyslexics, cannot be described as empirical findings, inasmuch as phonological difficulties is part of the definition of dyslexia and thereby constitute the conditions for inclusion of individuals in the research samples.

Rod Nicolson's (2002) views on the penetration of phonology at different levels of analysis may be illustrative of the point we want to make:

> "…phonological training has often been advocated as the appropriate method of treatment, thereby implicating phonology in all three levels of analysis – cause, symptom and treatment. This penetration of all three levels of analysis explains why many researchers and practitioners consider phonology the 'core' deficit". (Nicolson, 2002:57)

Cognitive psychology has primarily given us insight in what subtasks reading consists of. The diagnosis of dyslexia has through this achievement gained precision. When we know what the problems consist of, we are better positioned to make the treatment more efficient. Still, much remains to be done when it comes to the methods of remediation of dyslexia. In the cognitive tradition, metacognition has been a central keyword. However, there are few definitions of metacognition, but it most often seems to presuppose an introspection. This involves primarily that the dyslexic becomes aware of where and what the problem is, but in order to solve it, more or less behaviouristic elements are applied: repetition and automatization. It is a paradox that cognitive psychology has gained a such dominant position in special education, all the time it devotes so little attention to what learning is and how learning progresses, e.g. questions like: what causal factors promote and obstruct learning?

The lack of precision in the concept of metacognition leaves it with low explanatory power.

In cognitive psychology there is an unclear relationship between the pure intellect on one side, and emotions and feelings on the other. Due to this it also becomes difficult to explain motivation and irrational choices and actions. In this regard we may claim that while behaviourism committed a ‚mechanistic fallacy', cognitivism committed an, intellectualistic fallacy'. From a philosophical point of view we have seen that both these extremes are due to a too strong boundary between body and mind. When cognitivism has attempted to introduce explanational factors by e.g neuroimaging, there is a missing link between the physical and the mental. So called, cognitive neuropsychology' may often give the impression of being an artificial construction. Connectionsim has been more conscient about the philosophical, fundamental questions, and has reasonned in a more consequent way from the premise that body and mind is a unity and a whole. Still, there is a lack of nuances which has the consequence that substantial parts of the human's experienced reality fall outside the boundaries of science. A realistic psychology must discern between, inner' and ‚outer' without drawing a boundary between mind and body. Later on in this chapter we will address the issue that psychology must first decide what reality it intends to study, and then next choose the appropriate methods. An important phenomenon to be studied in this area of science is ‚skill'. As we will see, we may in this term combine important insights from both behaviourism and cognitivism.

In order to make progress in science, we need precise and vulnerable definitions. But we also need more precision when it comes to how the different concepts and disciplines relate to each other:

> "Some researchers and theoreticists have tried to insulate psychology from the other sciences, while others have sought to bring it under the banner of a 'unified science'. In my opinion, both of these extreme positions are problematic. We need to combine diverse approaches, but not jumble them together. Methaphorically speaking, cognitive psychology, behaviourism and neuroscience are each in their own valley, looking up at the same mountain-top from their own perspectives. The truth about the mountain-top will be revealed only when we listen to what each of the disciplines has to say. (Tønnessen, 2000:8)

Once we realize that we do not all see the mountain-top from the same side, we face particular challenges in how to combine our different views so as to understand how they may fit together.

4. Suggestions

4.1 Conditions for definitions

Like all science, dyslexia research is dependent on clear and the possibly most relevant definitions. The latter means that the definitions need to seize as much as possible of the reality to be studied. If we reduce and simplify reality it is easier to obtain clarity, however, we run the risk of losing important aspects of the reality to be studied. Behaviourism achieved a high degree of clarity, but only by excluding significant parts of the human's experienced reality.

Reading research – and therefore also dyslexia research - must be based on a definition of reading that correspond to our understanding or experience of the phenomenon. We

thereby cannot e.g. be content with a definition that implies that an optical scanner actually ‚reads'. Nor can we say that the scanner decodes. In case of the scanner, and the underlying definition of reading, the verbal meaning is lacking. It also cuts off the consciousness that is necessary both to understand what reading is and to explain how and why someone can read while others lack this skill. In the same way, ‚Skill' is not a phenomenon that we can ascribe to a scanner. Before we present hypotheses for defining central issues in reading and dyslexia research, we will reflect on some general demands to definitions.

In order to come continually closer to a more adequate theory, we need hypotheses and definitions that are 'vulnerable' (Uppstad & Tønnessen, 2007) in the sense that they are not only possibly falsifiable. In other words, we should first test those hypotheses that are most easily falsifiable. Where the structuralist and generativist definitions turn out to be normative, we should search for descriptive, vulnerable definitions. Given a set of hypotheses, we should first try to falsify those which can be falsified with practical ease. Because of the abstract character of structuralist and generativist definitions of 'language', it can be questioned whether these approaches can be considered vulnerable; some even reject them – and particularly generativist approaches – as being non-falsifiable (Dyvik, 1980; Matthews, 1993; Uppstad & Tønnessen, 2007). This empirical problem, which is most easily identifiable in the generativist approach, is in our view present in all linguistics theories that splits off language use from language system, so-called autonomous linguistics. These build upon philosophical conditions with roots in Platonism, and it is therefore difficult or impossible to undertake empirical testing of the results or the theories. (see Uppstad, 2005, 2006; Uppstad & Tønnessen, 2007, 2010).

The relationship between hypothesis and theory is somewhat controversial, though. A more commonsensical view holds that hypotheses are deduced from theory. Contrary to this view, the philosophy of Karl Popper suggests that the only way to build an adequate theory is to combine an ever-larger number of increasingly tested hypotheses based on observations (i.e. 'bottom-up' instead of 'top-down'; Popper, 1965). When we try to falsify our hypotheses, our precise empirical statements (hypotheses) will crash more or less with 'reality'. On this view, even definitions are considered and treated as hypotheses (Tønnessen, 1997). Definitions should be 'vulnerable' in similar ways as hypotheses. For this reason medical researchers would not base their research on a definition of cancer from the 1960s, because the definition of cancer has changed as empirical data challenged the definition. In research on reading and writing the changes in definitions have been minor and less clear. Tønnessen claims that to treat definitions as hypotheses the scientific enterprise would be more dynamic:

> "The question of how and if we can define 'dyslexia' must, in my opinion, be determined by both empirical findings and theoretical reasoning. In order to attend to both of these, we need to treat definitions as hypotheses". (Tønnessen, 1997:84)

This position is considered to have important consequences for how we conceive of truth in science:

> "Looking back at the contributions made by many researchers in the history of our field, we often have to ask: which findings are merely true **by definition** and which are truly **empirical** findings? Assume, for a moment, that we define 'reading' as mainly decoding, and then define decoding as phonological processing. Should we then be

> surprised when we find a high correlation between 'reading difficulties' and 'phonological difficulties'"? (Tønnessen, 1997:85)

Tønnessen's notion of *truth by definition* involves moderate claims of circularity (the most extreme circularities being tautologies, e.g.: A = A), and his proposal of *treating definitions as hypotheses* is meant to help find a solution to this problem. If we define 'bachelor' as an unmarried man, we do not make an empirical finding if we find that the bachelor 'Pete' is unmarried. If we find, however, that he is greedy, we have an empirical finding.

Modern linguistics and research on reading and writing have claimed that spoken language is primary to written in every important respect (Liberman, 1999; Liberman, Shankweiler & Liberman, 1989; Lyons, 1968), a position that has given the notion of phonology an axiomatic status in mainstream reading research. Goswami and Bryant (1990) arrived at results that in our opinion should have got more influence on reading research in general and dyslexia research in particular:

> "The work that we have reviewed in this chapter makes us think it most unlikely that the progress that children make in reading is determined by their sensivity to phonemes. On the contrary their progress in learning to read (or to read an alphabetic script at any rate) is probably the most important cause of awareness of phonemes." (Goswami & Bryant, 1990, p. 26).

In our view this empirical finding stands in stark contrast to the widespread opinion that among others Liberman et al. (1989) defend:

> "What follows, then, is that phonology governs all words, whether dead, living or waiting to be born. So whatever else a word is, and regardless of whether it is spoken or printed, it is always a phonological structure." (Liberman, Shankweiler & Liberman, 1989:8)

The role of phonology seems to be a truth by definition in Liberman et al.'s way of thinking, where a word is defined as a collection of phonemes. The concept of 'phoneme' is in our view an abstraction which was developed after the introduction of written language (Uppstad & Tønnessen, 2010). In our view 'meaning' is both psychologically and historically primary. The concept of 'word' must therefore primarily be defined by meaning. Words are entities in language that have a potential for meaning. And this meaning potential can be realized in different forms of language, like speech, tactile reading, sign language, and reading and writing. The proposed definition of language as 'a set of codes with potential for meaning' is claimed to have a fruitful level of generalization, and to contain no *a priori* assumptions about the relationship between spoken and written language.

Definitions always involve some kind of generalization. The question is how far such generalization should be taken, and what justifies the generalization in a given case. Our intention here is to say something about generalizations in definitions of 'language', but let us take a different example first: If we want to generalize from the set of all circles to the concept of 'circle', we have to set some features of specific circles aside. If we investigate circles of different diameters, we will discover that, independently of the length of the diameter, the circumference will be about 3.14 times longer ($\pi \approx 3.14$). The more general concept of 'circle' does not have a fixed circumference or diameter, and we

therefore disregard these features, keeping only the constant quotient. This notion of 'circle' is thus more abstract than the notion of 'a circle whose circumference is 10 cm'. The first notion is also very precise by the fact that it encompasses all circles and excludes other shapes, like for instance squares. However, if we generalize further to the notion of 'figure', we obtain a notion which is less useful in science. This is because, in the notion of 'figure', we have set aside so many features that it becomes difficult to define. As a result, the notion of 'figure' lacks precision as compared with that of 'circle', by the fact that all different shapes are included. Definitions of 'language' may be evaluated in a similar way. What seems clear is that we need some level of generalization when we define 'language'. The distinction between langue/parole and competence/performance is a distinction of levels of abstraction. While there clearly is general agreement that the definition of 'language' should be more general than a description of the features of single utterances, modern linguistics chose, at the very beginning, to define 'language' in a highly abstract way, where the features of the definition rely on theoretical constructions which are imposed on the phenomenon to be defined. At its most abstract, 'language' is defined as "a set (finite or infinite) of sentences, each finite in length and constructed out of a finite set of elements" (Chomsky, 1957:13). In our view this is one of several examples of reductionist definitions in Chomsky's linguistics. If meaning is not included in the fundamental definitions, the most important aspects of language are placed outside linguistics.

4.2 Language and skill

In this chapter, we propose that language is best understood as a skill and not primarily as a more or less static system. In doing so, we give a statement of what kind of phenomenon language is. Still, language is different from many other human skills, so we need a definition of language in order to say what is specific to this kind of skill compared to other skills. In this chapter we propose that 'language' is to be best defined as 'a set of codes with potential for meaning'. Some will probably object that the notion of 'potential' is not empirical. It is, however, more problematic to claim that meaning exist independently of humans and speech acts. A such platonic inspired theory of meaning is in our view more or less explicitly present in most of linguistics. Potentiality is far more grounded in empiricism and can be found in physics and chemistry when we say that 'salt is soluble in water', 'petrol is flammable' and 'glass is breakable'. Aristotle claims that change makes it necessary to use the term 'potential'. The existence of a potential can be shown by if-then statements. If salt is put into water and dissolves, this shows that salt was soluble (had the potentiality) before it was put into water. It is only through behaviour that we can determine whether a code *has* meaning, and possibly *what* meaning it has. The proposed definition is claimed to be at a level of generalization which counteracts the disadvantages associated with the highest levels of generalization. The new definition does not presuppose a strict symbolic conception of 'language', as it focuses on the potential for meaning instead of static mental representations. A skill is a potential. We only know the potentialities through the realization of them. We know what breakability is when we have seen glass been broken, and we know how breakability can be realized when we have seen something been broken. When we say that a skill is a potential it means that there is a possibility to perform different actions. We can only

study a musical skill through music performance. However, we cannot know for sure that the performance gives us a complete picture of the skill in question.

It is important, both in research and in educational contexts, to distinguish between potentialities on the one hand and their actualisations or realisations on the other. For example, a person may have excellent musical skills but also suffer from performance anxiety or be easily distracted by noise or other sensory impressions. Then a performance in a concert hall is likely to fall short of the promise inherent in his or her skills. In such a case it is important to take measures that may enhance performance, such as shielding the person from impressions and/or giving him or her training in how to ignore factors that may disturb or deteriorate performance. By contrast, a person with poor musical skills will need different and more fundamental measures. In other words, distinguishing between skills as such and their performance is important in both regular and special education.

Through development and learning a skill becomes constantly more stable. However, it will never become unchangeable. The skill – which is a potential – therefore has a potential of change. We need to discern between 1) the skill, 2) the acquisition (or reduction) of the skill and 3) the realization of the skill. Chomsky defines ‚competence' in a way that it comprises the innate grammatical structures, while ‚performance' concerns the use of competence that is dependent on person and situation (Chomsky, 1980). In our understanding of Chomsky, ‚competence' is universal and unchangeable. Contrary to his point of view, we claim that potentials can be developed and that individual differences exist. Chomsky also claims that it is wrong to assert that „…evidence about Jone's competence can only be drawn from Jone's behavior …" (Chomsky, 2002, p.57). As stated above – and in opposition to Chomsky – we suggest that we can only know a skill through empirical studies of ‚performances'. Still, we will never know whether we have got a complete picture of the skill.

The concept of 'skill' allows us to unite two of the most important concepts of behaviourism and cognitive psychology, respectively: 'automaticity' and 'awareness'. This concept can be compared to the third corner of a triangle where the other two corners are dominated by behaviourism and cognitive psychology Uppstad & Tønnessen, submitted. Good performance of a skill implies a good combination of 'automaticity' and 'awareness'. The term 'awareness' is more appropriate than, for example, 'metacognition'. 'Awareness' encompasses two main functions: 'monitoring' and 'steering'. Whenever automatised actions fail or encounter problems, the person will interfere actively. Humans are not rational in a way that they first choose clear and well grounded goals and then choose the right tools to reach the goals. Our actions emerge from either spontaneity or automatization. If we discover that our actions generate problems, we intervene and change the way of acting. In this way our actions become like mutations in nature or hypotheses in science: They are adjusted when faced with reality. But because we do not know the long term consequences, we have to concentrate on what is immediate and easy to test.

When we study written language skills, it is an important starting point to consider these skills in relation to other human skills. The proposed definition of language therefore fills

the function of discerning language skills from other human skills, but without giving priority to one form of language. Language takes different forms in different parts of the world, in different individuals, in different situations and in different sub-cultures. Most humans master different forms of language, e.g. both written and spoken language, or signed and written language. A definition of language that serves the purpose of understanding individual differences and changes, must encompass these different forms of language, understood as skills.

5. Conclusion

The cognitive and linguistic approach to reading and dyslexia has focussed too much on structures, e.g. as expressed in different versions of the 'dual route model' and the general strong focus on phonemes. The dynamics in development and the causal mechanisms has only got a subordinate importance. We need a more radical and consequent empiricism with emphasis on hypotheses and falsification. This demands more and clearer thinking about conditions and definitions on which the hypotheses are based. Research on language, reading and dyslexia should therefore put more emphasis on elaboration and clarification of the word and concept of 'skill'.

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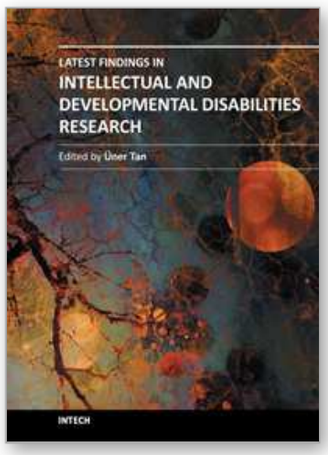

Latest Findings in Intellectual and Developmental Disabilities Research

Edited by Prof. Uner Tan

ISBN 978-953-307-865-6
Hard cover, 404 pages
Publisher InTech
Published online 15, February, 2012
Published in print edition February, 2012

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How to reference

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Per Henning Uppstad and Finn Egil Tønnessen (2012). Definitions and Explanations in Language, Reading and Dyslexia Research, Latest Findings in Intellectual and Developmental Disabilities Research, Prof. Uner Tan (Ed.), ISBN: 978-953-307-865-6, InTech, Available from: http://www.intechopen.com/books/latest-findings-in-intellectual-and-developmental-disabilities-research/definitions-and-explanations-in-language-reading-and-dyslexia-research

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