LEARNING STYLES IN AN ELECTRONIC INSTRUCTIONAL READING ENVIRONMENT

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Abstract. A study (Oliveira, 2002) carried out to investigate the reading strategies used by EFL Brazilian students in an instructional hypertextual platform evidenced, among other things, that learning styles considerably influence the way reading material is approached in an electronic environment. The purpose of this paper is to report on these results. In order to inform and contextualize our understanding of the issue, some space is devoted to the following elements: the concept of new literacy; a brief historical overview of hypertext, its characteristics, advantages, disadvantages, and contrasting features in relation to hardcopy; and the concept of learning styles as viewed by some outstanding researchers. Finally, those issues are conflated so as to evidence that learning styles do influence the way electronic reading is approached.

Resumo. Um estudo (Oliveira, 2002) realizado para investigar as estratégias de leitura utilizadas por alunos universitários brasileiros em ambiente eletrônico revelou, entre outras coisas, que os estilos de aprendizagem influenciam consideravelmente o modo como o material instrucional de leitura é abordado. O objetivo deste trabalho é relatar como se dá a escolha de estratégias de leitura dependendo do estilo de aprendizagem de cada sujeito. A fim de melhor contextualizar a questão, alguns conceitos serão aqui discutidos, tais como o conceito de letramento, hipertexto e estilos de aprendizagem.

Key words: reading strategies; hypertext; eletonic reading; learning styles

Palavras-chave: estratégias de leitura; hipertexto; leitura em ambiente eletrônico; estilos de aprendizagem

1. Introduction

Recent research has drawn attention to the importance of customisation of instructional programmes (cf. Jenkins & Keefe, 2001) with immediate consequences to

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teaching practice. Nowadays, the identification of learners´ traits is viewed by materials designers, teachers and possibly policy makers as of utmost importance to the construction of a cognitively richer learning environment. One of those traits is the students´ learning styles. The adjustment of the learning environment to the students´ needs constitutes the focus of a style-based instruction either in conventional or electronic instructional environments. No doubt, a lot has been said and written about conventional learning environments. However, the electronic milieu still deserves very much attention, at least as far as the effects of learning styles on reading strategies are concerned. The purpose of this paper is to report specifically on the learning styles that marked the readers´ choices of strategies in that environment.

As we have been learning in recent years, the electronic text (hypertext) is characterised by a different array of features which go from the different format of representation till the multiplicity of perspectives through which it can be represented (Tergan, 1997; Intraitor, 2000). Today, the electronic text is the amalgamation of resources such as audio, video, animation, graphics and images. This multiplicity of perspectives makes an impact on the way information is displayed and brings in a new concept of text, writer and reader, as well as of the organised contexts they belong to (Landow, 1992; Lanham, 1993). In fact, the whole concept of literacy is experienced in such a different way in an electronic environment as if it were being reinvented.

A study (Oliveira, 2002) carried out to investigate the reading strategies used by EFL Brazilian students in a hypertextual platform evidenced, among other things, that learning styles considerably influence the way reading material is approached in an electronic environment. The purpose of this paper is to report on these results. In order to inform and contextualize our understanding of the issue pursued in this work, some space is devoted to the following elements: the concept of new literacy; a brief historical overview of hypertext, its characteristics, advantages, disadvantages, and contrasting features in relation to hardcopy; and the concept of learning styles as viewed by some outstanding researchers. Finally, those issues are conflated so as to evidence that learning styles do influence the way electronic reading is approached.

2. Literature review

2.1 Literacy

The issue of being literate these days has received considerable attention from researchers and educators concerned with reading and writing. To point out what

the requirements and representations involved in the so called new literacy are implies an analysis of that concept in both traditional and electronic contexts.

It has been difficult to encounter a precise definition of what literacy is or what it should encompass. The term is clouded by relativistic ideological, economic and cultural slants that vary according to the context where it is being discussed, as Johnson-Eilola (1994:218; see also Kaplan, 1995) reminds us:

> [I]n using computer technologies such as hypertext, theorists and educators must remain alert to the pitfall that C.H. Knoblauch warns of in his essay on literacy and politics: definitions of literacy "only tell what some person or group ¾ motivated by political commitments ¾ wants or needs literacy to be". We cannot disable or remove the trap when we define and teach literacy ¾ we must acknowledge and integrate it into our definitions as a way of promoting continual self-criticism.

To start with, it is unquestionable that literacy, as it is viewed currently, leaves far behind in the past the traditional conceptualisation of being literate, i.e. the ability to encode and decode written text. For many years, for example, the mere ability to write and read one's own name was the official criterion used by Brazilian educational policy makers to account for the level of literacy of the country. Nevertheless, if the official figures related to literacy rate increased, so did the statistics of people who were not able to deal with the overflow of information running through the door open with the literacy magic key. A new category of illiteracy comes out: the functional illiteracy. In such a situation, people can read and write but the acts of transferring are impaired. Things like using a map, a bus schedule, or a telling machine, filling in an application form, or giving information about one's social security card represent a real pain and a mystery. As bad as that, is the lack of ability to be selective and critical in relation to the information they get.

With the introduction of information technology, such aspects have exacerbated. If in traditional print era the canons used to dictate what was 'good' and 'bad', 'right' and 'wrong' in most areas of activities, information technologies provide for exactly the opposite. In other words, the centre is impermanent and movable, power tending to follow a centrifugal movement where everybody is, so to speak, a canon. Within such a context, credibility may be a questionable issue.

Literacy, as it is viewed today, should be embedded in a broader context based on tenets that stress cultural transmission as being directly related to human learning, and the crucial role dialogue has in the learning process, as posited by Vygotsky (1962, 1978, as cited in Drapper & Anderson, 1991; Kaplan, 1995) and Wertsch

(1985). Thus, this broader context encompasses the products real reading and writing (electronically or not) should bring about, i.e. the capacity to inquire, to select, to choose, framed by the individual's own values and beliefs, and considering also the social context. It would provide for the creation of Vygotskyian *zones of proximal development*, or *bandwidths of competence* (Brown, 1997), or *zones of learnability* (Kintsch, 1998) both of individuals and of groups. Literacy in our contemporary world has to do with giving / receiving support to/from the joint-work role characteristic of transactional stances. Leu (2000: 746). notes that

> literacy is essential to enable individuals, groups, and societies to access the best information in the shortest time to identify and solve the most important problems and then communicate this information to others. Accessing, evaluating information, solving problems, and communicating solutions are essential to success in this new era.

This view is in line with Pea's (1985). He posits that "[T]o know is no longer to have knowledge in one's own memory, but to be able to effectively search for, find and use the information one needs for particular purposes" (pp.176-177). From this vantage point, literacy should be concerned with developing the following aims, as Pea (ibid:117) outlines:

> 1. A new emphasis on cognitive skills of information management (Hawkins, Mawby, & Ghitman, in press), including problem posing/question definition (S.L. Bown & Walter, 1983), flexible strategies for information retrieval, information schematisation and inference, textual summarisation and intertextual integration.
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> 2. A renewed emphasis on written communication and critical inquiry skills (e.g. evaluation of source of information and claims to knowledge).
>
> 3. Metacognitive and self-regulatory skills (A.L.Brown, 1978) such as planning ahead, comprehension monitoring (Wagoner, 1983), cognitive resource management or control (Scoenfeld, 1985b), and learning how to learn (Dansereau, 1985; Weinstein & Underwood, 1985).
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> 4. Strategies for creative thinking and problem solving (e.g., brainstorming; problem decomposition; and proposing, testing and debugging approaches to a problem) and systematic decision-making methods (e.g. decompositional approaches to comparing utilities of choices, e.g. cost-benefit analysis) that crosscut knowledge domains.
>
> 5. Cooperative group problem solving (Slavin et al., 1985) and negotiation skills.

Negotiation skills that take the learner from 'personal ignorance' to 'public knowledge' (Wilson, 1977, as cited in Burnett & McKinley, 1998) are also included in the aims of the new literacy.

The expanded concept of literacy to different ´literacies´ would be associated, therefore, to the following activities/abilities (as cited in Communication and Critical literacy: Dialogues Group White Paper – 11/28/01 DRAFT)[1]:

> · Print literacy – the ability to understand and interpret written texts.
>
> · Cultural literacy – the ability to understand and interpret cultural, social, and ideological values that shape our "reading" of texts
>
> · Visual literacy – the ability to understand and interpret images, signs, pictures and non-verbal language
>
> · Media literacy – the ability to understand and interpret cultural messages presented by the media, such as from TV and film
>
> · Information technology literacy – the ability to use, access, and evaluate information and ideas via computers
>
> · Numeracy – the ability to understand and interpret mathematical symbols, including reading charts and tables.

Finally, Kaplan (ibid: 15) defines literacy as including visual and non-verbal or gestural or social literacies. In other words, "any set of semiosis that can be recorded outside of a human body and that can be recalled or conjured up for later or for other use."

2.1.1 Computer literacy

Under such an overarching view of literacy there is a narrower one, i.e. *computer literacy*, or Information technology literacy, that is of special interest in this investigation. According to Maddux, Johnson and Willis (1997) the concept of computer literacy also offers ground for intense debate on, among other things, what knowledge or skills it should make up. In other words, "whether literacy should be learning about computers or learning how to use computers" (p.90).

Being literate these days means to have at least some kind of knowledge in dealing with certain new technologies our grandparents or even our parents would never

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[1]Available online.

imagine us to be required to, from the most trivial ¾ choosing items from a supermarket list accessed via a domestic computer, to very sophisticated ones, like participating in real time of meetings and debates without leaving the office. The new literacy pattern also includes the minimum of abilities in dealing with a paraphernalia of electronic devices such as electronic dictionaries, photocopiers, scanners, etc. Even research has become more complex as we need skills in electronic modes and means, such as e-mailing, file transferring, newsgrouping and other forms of electronic interaction. In a narrow sense, this seems to be what computer literacy encompasses.

Bolter's (1991) definition of 'computer literacy' includes either computer operation or technical knowledge of programming and concepts of computer science. On the other hand, Beavis (1998) talks about 'literacies' and acknowledges the fact that "the new literacies need to include the capacity to 'read' and 'write' the new technologies, and to understand what is entailed in the operation, reception and production of their texts" (p.244).

Lemke (as cited in Beavis, 1998: 244), refers to "at least four new literacies that will be required in the age of new information technologies: multimedia authoring skills, multimedia critical analysis, cyberspace strategies and cyberspace navigation skills". All of them will be a fundamental part of the new parameters of professional skills demanded in most occupations. Therefore, as Lanham (1993: 229) advocates, instead of providing for a technological education we should search the "generalised ability to manipulate symbolic reality [that] depends on precisely the rich signal of mixed word, sound, and image. (...) Teaching us how to live within this reality will be the job of a new kind of humanistic education".

2.2 The new literacy and the educational expectations

What are the pledges of this new literacy in the electronic educational scenario? Dryden (1994: 284) emphasises three great expectations:

> · to empower students to become creators of knowledge and constructors of their own meaning;

> · to reintegrate the fragmented departmentalised vision of knowledge that schools currently offer students;

> · and to heal the cleavage Theodore Sizer perceives between the academic literacy of the schools and the broader "public literacy" practised by the rest of society .

To what extent the promises of agency and reflection will be fulfilled in computer mediated learning contexts it is impossible to predict. As I see it, electronic reading is involved in the four literacies pointed out by Lemke (ibid) one way or another. It is involved both in the individual work as well as in the joint-work with peers, teachers, and experts; in evaluative, selective and interpretative activities; in decision-making activities (relevance and adequacy of what to read); and in the architecture of strategies activities to avoid being lost in the cyberspace, for example. To a greater or lesser extent, these four literacies are closely related to the problem posed in the present investigation, i.e. the reader´s learning styles and the electronic environment (hypertext).

By and large, the still growing body of research concerned with learning in electronic environments could be grouped into three categories: those studies related to the assessment of usability of hypertext systems; those referring to the design of media evaluation studies; and those regarding the role and effectiveness of resources to support learning environments. The confluence of technical feasibility and cognitive research apparently envisaged in the last category mentioned above might be encompassed by new literacy approaches whose tenets put learning as a personal process based on one's own peculiarities, and where the building of knowledge and understanding is individual and incremental. This is also the locus where the present study is situated.

Underlying the binomial developmental view of learning / in-general multimedia applications there is the notion of 'cognitively authentic learning experiences'. According to Squires and Preece (1999: 469), a review of the pertinent literature indicates authenticity as leading to the concepts of credibility, complexity, and ownership. Thus, interactive multimedia applications (summarised below) give learners the opportunity to

> · test the credibility of an environment by means of simulations of the system's behaviour and the feedback on the learner's action on the system, environment or artefacts;
>
> · express personal ideas and opinions, with the environment providing a mechanism for the articulation of these ideas;
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> · experiment with new ideas and try out different solutions to problems;
>
> · face complex situations by the use of strategies such as scaffolding, anchoring, and problem based environments;
>
> · get a sense of ownership that is related to learners taking responsibility for their own learning.

3. Hypertext

The word 'hypertext' was coined in 1965 by Ted Nelson. However, the concept of networks of information in the form of texts, graphics, video, and sound was known as far back as the mid-1940s when Vannevar Bush, President Roosevelt's Science Adviser, wrote an article where he predicted a machine that could help scholars and decision makers organise and retrieve information by the use of links between texts or parts of texts (Delany & Landow, 1991; Shneiderman, 1998a, Intrator, 2000; Patterson, 2000). Among the innumerable features predicted in Bush's device (called "memex", or memory extender), the following are mentioned in the literature as outstanding:

· storage capacity of a person's information, from books to other textual material, such as pictures, records, letters, and so on;

· speed and flexibility of retrieval by following the way human minds work, i.e. by making associations from one node into another ("associative indexing", "links") (Seyer, 1991; Evans, 1993);

· trails on links;

· capacity for annotation, with the introduction of the concept of customisable text

Despite its relative novelty, the legacy of hypertext is very impressive. Landow (1992, 1994) acknowledges the presence of key concepts of critics and philosophers influencing the architecture of the underlying nature of hypertextual theory and practice, such as Barthes' *ideal textuality*; characterised by reversibility, non-canonical and diverse accessibility; Derrida's *text openness*: *de-centerable / re-centerable system;* Kristeva's *intertextuality*; Bakthin's *multivocality*; McLuhan's ideas on *collaborative practices* of electronic information technology in general (*global village)*; and Foulcault's *conception of networks of power* (also mentioned in Roth, 1992; Gergen, 1994; Burnett & McKinley, 1998). All of them, as Landow (1992:2) comments, "argue that we must abandon conceptual systems founded upon ideas of centre, margin, hyerarchy, and linearity and replace them with one of multilinearity, nodes, links, and networks.".

Finally, LiestÆl (1994) and Burnett and McKinley (1998) find common grounds between hypertext and Wittgenstein's *ambiguity of language,* and *rejection of linear argument*. Wiitgenstein (1953) suggests that the meaning of a concept is not fixed as it depends on issues like individual goals, experience, and context. Therefore, any agreement between two people may be a fallacy. In respect to Wittggenstein's view of language, Drapper and Anderson (1991) attempt a juxtaposition to Vygostky's understanding of the role of social interaction in conceptual development. Their conclusion evidences non-idealisation as a crucial aspect in the process of understanding

the world and consequently foregrounds the role of negotiation among the several elements involved in the construction, transmission and interpretation of language. In other words, as Drapper and Anderson posit, "what is culturally transmitted is not "in" what is said in the sense of a message being decoded by the child" (p. 96) but exactly in the trade offs of meaning.

3.1 The quest for an identity

A problem usually acknowledged by researchers (McKnight, 1996; Ess, 1994; Bolter, 1991) refers to the lack of a consensus on what a hypertext is or should encompass. Thus, the concept of hypertext means different things, and encompasses different problems, to different people. According to McKnight (ibid :233),

> [T]he term hypertext does not refer to a unitary concept. When comparisons are said to be made between hypertext and paper documents they are said to be made between certain implementations of hypertext and standard versions of paper texts. Each implementation consists of one designer's (or group of designers') ideas about how to build the interface between users and information

This 'definitional diversity' is also pointed out by Ess (1994) who asserts that such a lack of definitional clarity is an evidence of the fluidity of the medium caused both by continuing technological progress, and by the atheoretical character of much work on hypertext.

Evans (1993) also attempts to clarify what hypertext consists of. As he puts it, linking units ("nodes") of text represent the basic principle upon which hypertext is built, and connectivity is pointed out as its distinguishing feature. He draws attention to the way the links of a node are connected to different nodes by means of several other links thus composing a file that may be accessed randomly according to the user. The progress on this basic principle and operation is that the nodes can be made up of sound, graphics or film. However, as he adds, "the term *hypermedia* is normally used as a generic reference and *hypertext* continues to be used to allude to specific programs" (p. 214).

Kumbruck's (1998:166) view of hypertext implies decenteredness, empowerment and text flexibility. She observes that the term refers to "a reading approach that is not regarded as determined by the writer". Thus, as she points out, although very vaguely defined, the term suggests no predefined structure, with readers compiling their paths interactively. Reader's control is augmented. A second feature suggested by

the term is that the textual base and its links can be changed, for instance, with the inclusion of annotations, or by electronic cuttings of the text that are then copied into the user's own text or file.

On this flexibility assigned to hypertext, Lanham (1993:6) makes the following comment:

> The interactive reader of the electronic word incarnates the responsive reader of whom we make so much. Electronic readers can do all the things that are claimed for them ¾ or choose not to do them. They can genuflect before the text or spit on its altar, add to a text or subtract from it, rearrange it, revise it, suffuse it with commentary.

Viewed this way, the reading (and writing) process seems to be referring to a different mode of interaction between reader and text, certainly not the one characterised by Davies (1995) as 'private' and non-observable, and referred to by Leu and Reinking (1996) as internal interactive processes. Reading electronically has as a distinguishing feature the trade off between the reader and the interface, or between the reader and other readers. In other words, there is a permanent externally oriented negotiation aiming at transforming personal ignorance into individual, or public knowledge. The sense of closure and distance imposed by print do not find resonance in the electronic environment

3.2 Hardcopy and Hypertext: some defining features

The literature on hypertext emphasises requisites that contrast with those of the traditional approach to reading and writing. Fowler (as cited in Baron, 1997) puts forward some hardcopy characteristics which I have here contrasted with hypertext features. It is worth noting that what is shown are those outstanding characteristics pointed out by the literature whenever the issue under consideration is the comparison/ contrast between hardcopy and hypertext. It does not mean, whatsoever, that a hardcopy could not be handled in a non-linear way, for example, or that an electronic text could not be read linearly. As Snyder (1998:127) asserts,

> [S]uch features appear to constitute the generic characteristics of hypertext, but it is as difficult to talk of 'generic' hypertext as to talk of generic print. Nor all printed texts appear in books, for instance, nor for that matter as literature.

By *linear* reading I follow Reed et alli's (2000:6) view according to which linear steps have to do with "the next logical, sequentially forward movement" whereas

non-linear steps refer to any other type of random movement (backwards, jumps to the menu, forward but not sequentially, etc.). The issue of hypertext 'defining features' is also discussed by Jonhson-Eilola (ibid: 107) who states:

> A key difference between hypertext and linear text is the degree to which hypertext readers are allowed to choose from multiple paths through a body of text. A text is hypertextual not because it was written in any specific computer program but because it follows this general theory of textual structure: readers do not read top to bottom across a page and front to back from page to page, but according to a path they navigate through a network of text nodes.

Some of the most outstanding features of hypertext found in the literature are summarised and contrasted to traditional printed material in Table 1 below.

Table 1. Hypertext and hardcopy contrasting features

Hypertext	Hardcopy
1. Multiple authorship: blurring distinction between author and reader	uthors can be distinguished from readers
2. Text as a property of authors and co-authors (readers)	A text is a property of its authors
3. Text is changeable: Unstable, non-unified, non-linear texts	A text is (or should be) fixed, unchanged, unified and coherent
4. Text decentredness	The centre of a text, of a group of texts or of anything else, is fixed, stable and single
5. Not one text, but several embedded texts	A text should speak with a single, clear voice
6. Text with a non-sequential body	A text has a beginning and an ending, margins, an inside and an outside
7. Discontinuity: text with a non-hierarchical structure	A text is (or should be) clearly organised in a linear, hierarchical structure
8. Text as an interactive tool	Generally speaking, an author writes by himself and a reader reads by himself

However, it is Patterson (2000:75) that best pinpoints the difference between hypertext and printed material. It is a question of "attitude that readers bring to hypertext and other electronic texts than in any difference in the text itself". Indeed, we have been used to approach texts in a certain way and it may be difficult to change. This is certainly more difficult if we are talking about the 'pre-Nintendo' generation. Selwyn (1997) claims that little research has been undertaken in relation to students' attitudes towards computers, a topic that should interest educators and researchers alike.

3.3 Hypertext and hardcopy: Advantages and disadvantages

The potential of hypertext in education has been celebrated to a great extent by many researchers and developers, since it has become in fashion in the eighties. What has made hypertext so attractive, mainly among educators, seems to have been much more than just the novelty of a technological reading/writing tool. It has been related to the *possibilities* of using this innovation to enhance the way we deal with information ¾ from the capacity to easily access information, accommodate data in just one 'big chunk', assemble these data in different ways, make connections with other correlated bits of information, to the addition of the reader's own contributions and, finally, to the retrieval of what has been stored / changed / juxtaposed. All that in a very tangible and quick manner.

Notwithstanding those advantageous general claims, hypertext does not represent a consensus. Some drawbacks have been pointed out, mainly by scholars, as for reading extensively on the screen. Thus, considerable eye strain and the fatigue of sitting in one position, discomfort and inefficiency with scanning by scrolling through a document on screen have been some of the physical problem complaints. Another drawback refers to disorientation in the hyperspace. Conklin (1987, as cited in Heller, 1990) recognises two kinds of disorientation, a simple one related to finding where you are in the system; and a second one, more difficult to face, has to do with discovering "how to get somewhere else in the system that you know, or think you know, to exist" (p.433). P. Smith (1996) encompasses Conklin's twofold definition in just one. For him, 'being lost' means the user's impossibility "to locate information which they require and which exists in the system" (p. 366).

4. Learning styles

According to Jonassen and Grabowsk (as cited in Oughton & Reed, 2000:2) "[I]ndividuals vary in their aptitudes for learning, their willingness to learn, and the styles or preferences for how they learn." These traits may be crucial elements in learning outcomes

especially in electronic environments, although, as Reed et al (2000) point out, there is space enough in hypermedia environments to accommodate learners with various learning styles. Stanton & Stammers (1990:115) refers to Schmeck´s (1985) view of learning style as "a predisposition to display a particular kind of behaviour, and suggests that it is probably a translation of personality and cognitive style characteristics." They report on their study about learning styles where they analyse the post hoc justification for subjects' sequences through instructional and practice phases in an electronic environment. According to them, there are three broad band strategies: "top-down *('I looked at the most important things first')*; bottom-up ('*I progressed from the very basic information upwards'*); and sequential ('*I went through the modules in an anticlockwise sequence from the overview screen'*)" (p. 115).

Shneiderman (1998b:207) maintains that "different people have different cognitive styles, and it is quite understandable that individual preferences may vary". According to him, there are 'multiple interface styles' that vary according to user and tasks. The topic has also been focused by Leu (2000) when he reviewed individual differences and cognitive learning styles in hypermedia leaning contexts. He postulates that intuitive and theoretical reasons should be considered to justify why newer technologies of information and communication are expected to be prominently sensitive to individual differences. Intuitive reasons refer to the obvious expectation that in a scenario of path diversity users should take different routes according to their personality diversity. Theoretical reasons about field-independence and field-dependence give support to studies related to individual differences. Thus, field-dependent learners "perform less efficiently", while field-independent learners "tend to be skilled at identifying useful information quickly from a complex context", as claimed by Leu (ibid:.753).

Authors like Williams and Burden (1997), and Ross, Drysdale and Schultz (2001) discuss Dunn and colleagues'(1989) learning styles dimensions that encompass personality traits (affective), inner drive (psychological), the way one perceives, thinks, relates and remembers things (cognitive), and environmental and physical (biological) factors. Reed (2000; Reed et al. 2000) conducted an investigation following Kolb's Learning Style Inventory where learners are categorised according to their preferred methods for perceiving and processing information as well as the way they relate information to the world. Thus, four categories of learning styles are introduced ¾ Accomodators, Assimilators, Convergers, and Divergers ¾ defined as follows:

> · Accomodators valued a lack of structure, a high amount of peer interaction and a lack of authority figures in the classroom. They are more of a risk taker, rely on a intuitive trial and error approaches to problem solving, and are highly adaptive to new situations.

> · Assimilators valued conforming to directions, assigned readings,

theory inputs, and lectures. They are portrayed as a thinker who specialize in inductive reasoning and the formulation of theories.

· Divergers valued self-diagnostic activities, open-ended unstructured homework, lectures, and no-peer information. They are adapted to viewing a situation from multiple perspectives, have broad cultural interests, and excels in areas which require imagination and the generation of ideas through methods such as brainstorming.

· Convergers valued instructor and expert inputs, reading, and discussions (that linked the classroom to the real world). They rely on common sense, are better suited to the practical application of ideas, and is viewed as a pragmatist.

All the researchers mentioned suggest that learning styles are indeed an important aspect to be pondered when information processing is at stake.

Shneiderman's (1998b) theoretical construct on human factors in interactive-systems design includes some vital features involved in the understanding of cognitive and perceptual abilities. He advocates that features like physical, intellectual, and personality differences are essential on the development of interactive systems design in order to accommodate diversity. Among the features he pointed out, I mention here the ones related to cognitive and perceptual abilities and those related to personality differences as they seem to be of utmost importance not only for design but for the purposes of the present study as well. In fact, although with varying levels of intensity and importance, they certainly have influenced the results of the experiment conducted in our main study. Thus the following aspects are mentioned affecting perceptual and motor performance according to Shneiderman (1998b:21): Fatigue; perceptual (mental) load; monotony and boredom; anxiety and fear; personality differences.

In relation to *boredom*, F. Smith (1981) came to the conclusion, while researching learning among young children, that there are two causes of boredom, which can arise from two different sources, namely when there is nothing to learn because they already know, or when they cannot make sense of what they are expected to learn, as no matching has been achieved in the learner's mind that could intertwine given and new information. That the same types of sources of boredom may be encountered in EFL subjects is suggested by the analysis of the data provided.

As far as the item *personality differences* is concerned, Shneiderman (1998b) observes that designers should benefit from paying attention to personality types in order to avoid mismatches. He acknowledges the great variety of taxonomies in the area and points out Carl Jung's theories of personality types which have inspired some measurable criteria like the Myers-Briggs Type Indicator (MBTI). According to Shneiderman, Jung

conceived the existence of four contrasting groups. Table 2 below summarises the dichotomies presented in Shneiderman's work.

Table 2. Shneiderman's (1998b:22) summary of Jung's theories of personality types

Type	Focus
Extroversion versus introversion	external stimuli, with preferences for variety and action **vs.** familiar patterns, with preferences for inner ideas and working alone.
Sensing versus intuition	established routines, with preferences for the application of known skills **vs.** enjoy new problems; dislike taking time for precision.
Perceptive versus judging	learning new situations; problems in making decisions vs. careful planning, that will be carried out even if there is a change in goals.
Feeling versus thinking	other prople's feelings; seek to please others **vs.** unmotivational types; impersonality and logical order.

Different categorisations have also been put forward by some other researchers focusing specifically on the learning style of individuals (Pielstick, 1988. For a review of the literature on the topic see also Busato, Prins, Elshpout & Hamaker, 2000). Indeed, it has been quite common in the hypermedia literature to mention the relationship between such learning styles and information technology. Shaw and Marlow (1999) acknowledge the existence of various studies corroborating this view though they mention some contradictory evidence too.

Honey and Mumford (1986, as cited in Shaw & Marlow, 1999:224) have adapted Kolb's Learning Style Inventory and devised a learning style questionnaire (LSQ) that classifies learners according to their strengths and weaknesses demonstrated in each stage of the learning cycle. The result is a classification system as follows:

· Activists: Individuals who are usually enthusiastic when a concept is novel and exciting but tend to lose patience quickly. These individuals learn best from competitive activities and respond well to challenges.

· Reflectors: Cautious individuals who consider their actions carefully before making a final decision. These individuals learn best when given time to prepare in advance.

· Theorists: Individuals who consider all alternatives and make conclusions from their experiences. These individuals usually attempt to fit their observations into a logical model or theory and learn best when required to understand complex problems.

· Pragmatists: Individuals who get impatient with too much reflection and like to experiment with new plans usually putting them into operation immediately without too much discussion. These individuals learn best when the link between the subject matter and the desired outcome is apparent or there are obvious advantages to learning a given task.

In her research on ESL (hardcopy) reading, Carrell (1988) has acknowledged a relationship between the reader's comprehension and a more general cognitive style of processing incoming information, no matter the type of information or the medium of transmission. She has also reviewed Brown's (1987) work in ESL language "learning" or "acquisition" style; Spiro (1978); and Spiro and Tierre (1979) on the same topic but focusing on native English readers. Taken together with other studies quoted in her work, Carrell points to a general construct where individual cognitive styles have a pervasive influence on reading strategies choices. Heller (1990) also mentions the great number of studies allying cognitive style and the ability to function in unstructured, discovery based learning situations. The opportunity of searching alternatives and results provided by hypermedia makes it a concrete component of those discovery based learning situations.

5. The current study: The subjects' learning style in a hypertextual instructional reading platform

5.1 Methodology

5.1.1 Participants

The participants were twelve EFL Brazilian university students majoring in different areas. However all of them were attending ESP reading courses as an extra curricular activity at Federal University of Santa Catarina, Brazil.

5.1.2 Sample and procedure

The data was gathered in the Oliveira (2002) study. An electronic prototype containing reading tasks was designed and used together with a think aloud protocol. The protocols were analysed so as to establish a pattern on the learning styles that accompanied the reading strategies used by the subjects in a hypertextual environment.

Subjects participated in individual sessions. The length of each session was determined by the own participants. Before the experiment with the hypertextual prototype, subjects filled in a questionnaire inquiring about their frequency of exposure with computers. The results confirmed the expectations that despite the different levels of acquaintance with computers no one was a first-time user as far as interface concepts were concerned. However, some of them were first-time users of hypertextual platforms for learning purposes (Table 3).

Table 3. Subjects' expertise categorisation

SUBJECTS				
DOMAIN	True novice	First time user	Knowledgeable intermittent	Expert frequent user
Interface concepts	A B I		C D E G H J L	F K
Task Concepts	D J	A B C E F G H I K L		

A ten-minute-familiarization session with a similar instructional programme was also provided before the main experiment was conducted.

5.1.3 Results and Discussion: The subjects´ learning styles in a hypertextual instructional reading platform

The results were consistent with the literature in respect to a possible association between the different subjects' perceptions and strategies, and learning styles while dealing with an electronic instructional reading environment.

It was found, as expected, some remarkable individual differences in relation to learning styles in hypertextual instructional platforms. The results obtained have allowed us to categorise the cognitive and metacognitive aspects observed among the subjects as

belonging to three 'mental models'/ 'learning styles' that we have devised for the purpose of this study: a) initiative user, b) compliance user, and c) selective user. They have been devised only to characterise the trends noticed in this specific experiment. Each of them is discussed below.

5.1.3.1 The initiative user

The initiative user worshiped the possibilities provided by the machine. This learning style was associated with the use of strategies that attempted to execute commands that could enhance the subject´s control over the machine/application even in detriment of reading task performance. Included here were those subjects who tried to use of commands that could minimise efforts, and those who experienced the 'execution gulf'. Norman (1988) refers to these gulfs as the distance between the mental representations of the person (what we want to do) and the physical components and states of the environment (what can be done). Analogous to Norman's gulfs, there are Kintsch´s (1998) expressions 'want-to' _ referring to 'potential actions'; and 'can-do' referring to 'possible actions' nodes. The subjects included in this category reported frustration of unsuccessfully attempting to increase control over the application by, for example, trying to add functions to which the system had not been prepared. Forty one percent of the subjects were included in this category.

In relation to the learning style dichotomies established previously, the subjects of the initiative type could roughly speaking be also categorised as *intuition type* (following Shneiderman's on Jung categorisation; *field-independent* (i.e. those ones who rely more on internal references and focus on individual parts of the object. Cf. Reed et al, 2000; Leu, 2000, or Honey and Mumford's *activist,* (as cited in Shaw & Marlow, 1999).

5.1.3.2 The compliance user

The c*ompliance category,* on the other hand*,* included those users who spent more time in their experiment, thoroughly followed the reading tasks, used a very conservative navigational pattern, and maintained an intense dialogical basis with the researcher aiming at getting suggestions, tips, advice, feedback, and encouragement (the researcher was demanded as an almost full participant of the experiment) along the instructional electronic reading material. They only rarely attempted to violate the rules either because they knew they had to conform to a context (not very familiar) /situation (experiment, non real), or because they did not know how to do it. In short, the compliance group needed more coherent

structures, and created more affective bonds with the interface and researcher. Forty one percent of the subjects were included in this category.

If we consider the *extroversion / sensing type* dichotomy of Shneiderman (1998b) based on Jung's*,* we might classify those subjects as *field-dependent* (i.e. subjects who rely more on external references and perceive objects as whole) (cf. Reed et al. 2000). The subjects of this group

5.1.3.3 The selective type

Finally, the *selective type* comprised those who just explored the instructional reading application, but got minimally involved with it. Perhaps the familiarity with both format and content have triggered a sub-conscious valence[2] analysis of the effort necessary to accomplish the task versus the value they give to the outcomes. It might be that users in this category did not see the situation as really purposeful and were there just for some kind of collaboration. Seventeen percent of the subjects were included in this category.

Seen from a cognitive perspective, total (or almost) exploratory behaviour might denote overlapping. Thus, some subjects have been allocated in the *Selective* category. If other categorisations were to be taken into account, these subjects could be placed in the *introvert, thinking, field-independent* categories where knowledge is hierarchically organised. The selective users were also the ones assigned as ´expert frequent users´ of computers.

6. Conclusion

It is widely known that the medium defines the way one approaches text. In other words, the presentation format may encourage different text approaches, for instance, with emphasis on diverse learning styles. In general, the findings of this study evidenced the importance of considering the students´ learning traits while reading in an electronic environment. It evidenced different levels of engagement confirming some studies about differences in learning styles. At the same time, they indirectly confirmed that learning styles also depends on physical, intellectual and personality features (Shneiderman, 1998b) factors such as goals established, overlapping of the zones of learnability, task domain, familiarity with the interface, the navigational devices provided, how information has been organised,

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[2]   Valence: positive or negative value that a person places on a reward (cf. Hancock, 1994:103)

and the credibility the experimental situation has raised, among others.

Thus, in times of electronic literacy it is important that a through mapping of such learning styles be available in order to help materials designers and educators to trace more effective actions that could enhance teaching and learning. In fact, network literacy could lead teachers to create customised instructional materials to attend individual needs and individual learning styles. These issues deserve further attention and investigation in our national scenario.

7. A final word

Computer-education paucity is still a fact in Brazil. While in developed countries a majority of schools are equipped with computers, using them for educational purposes or as educational instruments, in our country the use of computers is still relatively low, mainly in public schools. Despite the recent efforts of the government to provide public schools with technological resources we can say for sure that from a technological access perspective our educational system has a long way ahead.

In order to meet the celebrated possibilities of hypertextual instruction, at least three issues should be tackled. The first has to do with the setting up of educational policies that could enhance material access to technological resources. The second refers to cognitive issues, i.e. we have to be taught how to deal with those resources; and the third must consider the affective perspective, i.e. hypertextual instruction has to be approached in such a way so as to create positive learning contexts that could help enhance the learners' confidence in the new medium. Thus, activities hypertextually formatted need to provide for purposeful activities on social, intellectual, academic and professional levels. Thus, an understanding of how users interact with a hypertextual application is necessary so that materials designers, teachers and policy makers could make more informed decisions on the issue.

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