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Abstract

Our investigation identifies ways in which the transition from traditional social and cultural cognition based on real-world and real-time verbal interactions to digitalized interactions in virtual spaces takes place. We claim that the transition might induce serious concerns for traditional learning theories but promises to open new opportunities for novel and complex learning processes. Our study argues for the usefulness of linguistics for both neighboring fields in the humanities and in educational processes in order to understand how the mind works in learning and in social and cultural cognition. The paper discusses the difference between computationalism and culturalism which represent different assumptions for meaning creation. We also claim that digital culture has evoked worries for traditional learning theories and developmental psychology with reference to attention, memory, motivation, explanation, analytic mode of analysis and reasoning, text processing and information processing in general. We discuss the possible consequences of a radical, almost paradigmatic change for learning processes and knowledge management in digital culture. We present a case study of a linguistics workshop atelier in VR learning space.
Keywords: cultural conceptualization, computationalism, culturalism, explanation, interpretation, causal-explanatory reasoning, interpretative-hermeneutic reasoning, intentional stance, meaning creation, digital culture, learning by doing, VR learning space, literacy

1 Learning and Social Cognition

Our paper is an account of our ongoing research concerning the challenges encountered by some branches of the linguistic sciences in the times of digital culture. Our research focuses on learning with the help of virtual spaces and the processes of social and cultural cognition under the novel circumstances of shared social media and multimodal virtual spaces. Our investigation aims at formulating the ways in which the transition from traditional social and cultural cognition based on real-world and real-time verbal interactions to digitalized interactions happening in virtual spaces takes place. Our research results suggest that the transition, which might induce serious concerns for traditional learning theories, promises to open unprecedented opportunities for complex learning processes due to a plethora of information sources and related new techniques of information processing and novel ways of meaning creation.

We have decided on introducing our arguments by discussing the natural evolution and co-evolution of different frameworks in modern-time linguistics which have been influenced by the need for interdisciplinary approaches to the understanding of the nature of natural

language in intricate interplay with culture, cognition and education. For this reason, we start out by reflecting on the highly elaborate ideas by Jerome Seymour Bruner about culture, cognition, the working of the human mind and education as found in (Bruner 1990 and Bruner 1996.) Bruner made significant contributions to human cognitive psychology and cognitive learning theory in educational psychology.

In *Acts of Meaning* (Bruner 1990) Bruner argues in favor of the renewal of the cognitive revolution inspired by the conviction that the central concept of a human psychology is *meaning* and the processes and transactions involved in the construction of meaning. His unceasing curiosity in relating the human mind to culture and education (including topics about language, meaningful acts, knowledge by doing and learning by doing) resulted in his theory of cultural psychology, spelled out in *The Culture of Education* (Bruner 1996).

Different disciplines will certainly have different starting points and premises for the understanding of how humans obtain knowledge, i.e. how the mind works. It is also questionable how much we know and by what means we hope to obtain knowledge of the workings of the human mind. A related issue is to obtain an idea of how the mind learns anything, how the mind creates attention and how it remembers, reasons, explains and interprets, in other words how the mind executes the task of meaning creation.

In the tradition of the discipline of modern linguistics we have seen two major trends: computationalism and culturalism. Computationalism is closely associated with information processing that is based on the presumption that information be well-formed, systematically coded and disambiguated for identifying transparent meanings. Information processing under such circumstances can be successful and efficient without taking into consideration context-specific pieces of information. It requires no context-sensitivity since meanings are transparent and unambiguous beyond particular context identification. Computationalism as a model for the workings of the mind supports explanation as opposed to interpretation. Explanation requires well-defined premises for system-driven reasoning. For such meaning-creating systems formal (autonomous) syntax and truth-value semantics are prime examples.

Interpretation on the other hand is context-specific and culture-driven with the intrinsic objective of making sense of other minds by attributing mental states to others. Meaning creation is a cultural endeavor the prerequisite of which is the development of the intentional stance in human beings. Culturalism as an alternative model for the workings of the mind supports interpretation in meaning creation. The aptitude for interpretation develops by understanding and learning by doing in socially shaped contextualized practices. For such meaning-creating systems cognitive linguistics, pragmatics, discourse analysis and cultural linguistics are prime examples. In the realm of culturalism language use understood as the expression of linguistic behavior becomes the fundamental object of study. The crucial question to be asked then is "How do we learn what others mean by what they say". This is not a trivial question knowing the long tradition of speech act theory and pragmatics in general. We can claim that the relevance for learning how to create meaning and how to make sense of what people mean by saying what they say is to understand the distinction between the causal-explanatory approach and the interpretative-hermeneutic approach to meaning creation. (This distinction is discussed in detail by Bruner (2006: 100–114)).

In support of the above claim, we may be justified in referring to the ambivalent experience in our own studies of the linguistics discipline. For this purpose, we have chosen to recapitulate briefly the different conceptual frameworks that have deserved equal legitimization in searching for the learnability and acquisition of natural language and for meaningful linguistic behavior in social contexts. We have been intrigued throughout our

professional careers by the challenge of looking at the intricate and complex relationship between culture, language, cognition, learning and education. The different schools of linguistics have not always helped see clearly whether the search for such an intricate relationship makes sense or would be viable and worth pursuing.

In what follows, we intend to acknowledge the rising need for revisiting the relationship between the conceptual foundations of our culture(s), our language(s) and our social discourse(s) in order to better understand cognition, socialization, learning, education and literacy.

We are convinced that interdisciplinary research and inquiry into interrelated issues in the humanities and the social sciences are vital, inevitable and imperative. We are talking about research findings concerning the study of culture and language in linguistics, literary studies, cultural and social anthropology, psychology, educational science, philosophy, formal and informal logics, cognitive science and an over-arching discipline called pragmatics. We consider pragmatics to say important things about social interaction constituting contextualized social discourse in which meaning creation and meaning negotiation are made possible. We see verbal interaction and social discourse as the vehicle for constituting patterns of social behavior. We also believe that the competence of social cognition in human beings gets developed on the basis of participatory engagement. (More detailed discussion on social cognition with participatory engagement in (Komlósi 2016).)

2 The evolution of paradigms in language sciences

Let us start with a trivial claim: paradigms in the language sciences develop in parallel ways and complement each other in non-transparent interdependence, despite the fact that at some points of their development some linguistics models seem to dominate research and scientific interests. This is supported by the insight that natural language lends itself to very different scientific interests: generative grammar (GG) and cognitive grammar (CG), for example, have very different underlying assumptions. So do argumentation theory and critical discourse analysis (CDA). And the same applies, in obvious ways, to the different underlying assumptions in contact linguistics and neurolinguistics. All of the underlying assumptions are justified in identifying their own meaningful research objectives directly related to natural language.

A surprising change in our days, however, concerns a reconceptualization of the ontological foundations of linguistic meaning. After structuralism (with a focus on system-internal structural interdependencies) the mentalist paradigm shifted interest to the individual minds of the language users.

In one version of the mentalist paradigm, special-purpose mental skills are assumed to be at work (with innate autonomous syntax and its interfaces) in the process of language acquisition and language internalization. In this paradigm the Language Faculty functions as a "mental organ", a central component of which is the language acquisition device (LAD).

In another version of the mentalist paradigm, individual language users are assumed to develop an intentional stance which enables them to attribute a great variety of mental states to others (the so-called BDI-states: beliefs, desires, intentions, feelings, etc.) who function as their real speech and discourse partners.

As we can see, there has been a long way in our scientific conceptualizations and scientific narratives about the nature and properties of natural language, that is, in our linguistics

traditions, from assuming an autonomous linguistic component labelled as the Language Faculty to assuming another mentalist architecture for language whose prerequisite is interpersonal sensitivity to mental states and to shared communicative contexts. The existence of the intentional stance in humans seems to be the ontological basis for social cognition (Dennett 1987, Bruner 1996: 104–108).

3 The impact of culture on cultural cognition

Further to our arguments above, we can see that culturalism advocates a further shift from individual conceptualizations to supra-individual cultural conceptualizations characteristic and decisive for culture(s). Cultural conceptualizations are supposed to provide an underlying interpretational base only to facilitate a smooth and seamless interpretation of meaning and form in natural languages (Habermas 1994, Sharifian 2008).

In other words, what we witness today as a result of cognitive and cultural linguistics research is an increased interest in language studies to shift focus from seeing natural language as a special and autonomous cognitive skill to treating the language phenomenon as a bundle of interacting cognitive skills and social competences. Based on the study of human verbal interaction in various social-communicative contexts, it is assumed that language use requires the integration of highly diverse cognitive, affective, social and cultural schemata resulting in contextualized and situated discourse (an extensive discussion to be found in Komlósi 2016).

Thus, cultural cognition is proposed to be used as an umbrella term that integrates the inputs of individual cognitive skills (reasoning, pattern recognition, categorization, memory, attention, mental projection, etc.) and skills determined by social cognition (mentalization, symbol manipulation, theory of mind, intentionality and reading the mental states of others, self-awareness, motivation, imagination, etc.).

Cultural cognition presupposes the ontology of cultural conceptualizations that are supra-individual affordances to facilitate language acquisition and language use. Cultural cognition develops through interactive social activities and participatory meaning creation (Kövecses 2006, Sharifian 2011).

In our view, culture is the collective conceptualization of the human experience involving social order, interpersonal relations, symbolic codes, language and language use. In other words, culture caters for collectively shared interpretation schemes (beliefs, narratives, naïve theories, discourses, etc.). The acquisition of culture is made possible by cognition which may involve cultural cognition, language cognition and social cognition. Literacy, as a consequence, comprises cognitive and affective skills, aptitudes and attitudes with the help of which the individuals build competences for social integration and cooperative-creative behavior in the social space (e.g. the processes of primary and secondary socialization).

4 Culturally conceived conceptual schemata and meaningful experience

It is an intriguing question whether symbolic structures such as metaphoric frames and metaphor variations across and within cultures adhere to frames in the mind or to cultural frames. A profound analysis of this question is offered in (Kövecses 2006). His explorations conclude that it is the meaningful experience that matters which is facilitated by the same

cognitive processes underlying figurative speech and metonymic and metaphoric conceptual structures across linguistic communities. With the help of these – often universal – cognitive processes humans make sense of a wide range of social and cultural phenomena. Kövecses deliberately uses the contradictory phrase *relative universality* to suggest that "Knowledge and meaning are always relative to some context, even if there is a strong universal basis that underlies them" (Kövecses 2006: 332). It is not surprising that advocates of culturalism, such as Bruner or Kövecses, attribute and derive contextualized, situated meanings from cultural cognition.

How can we make sense of the meaningful experience as a kernel element of seamless interpretation of meanings? An illuminating endeavor is the analysis of the concept of "river" as a cultural metaphor as part of the underlying cultural conceptualization in traditional peasant culture in (Baranyiné Kóczy 2018), a monograph on cultural conceptualizations in Hungarian folksongs. The image schema based on the river water is easily understood as a conceptual metaphor involving emotions resembling the water of the river. What is surprising in the use of metaphors in such folk-context is not just the meaning resemblance that is part of the interpretation, but rather its potential to evoke a meaningful experience in a similar way as Kövecses points it out in his analysis.

Having evoked the image of "river" and the associations at hand of stream of emotions and the flow experience, we cannot fail to bring into our discussion a well-known concept from the literature on positive psychology by Mihály Csíkszentmihályi (Csíkszetmihályi 1991). The *flow experience*, as it has been introduced in the literature, offers a philosophical and social-psychological foundation of feeling and enjoying social and individual gratification. Csíkszentmihályi spent decades investigating the relevant conditions for creative activities, innovative attitudes in people, and – in general terms – the pursuit of happiness of the human kind. His investigations also focus on finding out the failure of people to find gratification and happiness in work, in social contact and in life in general. In his seminal work *Flow: The Psychology of Optimal Experience* (Csíkszentmihályi 1991), he describes a special state of mind called *flow* in which individuals experience increased and creative mental activities due to a relaxed and liberated mental state. It is a state in which individuals are actively involved in a certain activity to such an extent that nothing else matters to them. This experience is enjoyable and they are willing and determined to continue to do the activity at great costs, merely for the sheer sake of it. In his theory the experience of *flow* in everyday life is an important component of creativity and well-being, and it is crucial to creating genuine happiness. He offers an amazing formulation of happiness, saying that "happiness takes a committed effort to be manifested."

It should be emphasized that creativity and gratification involve commitment and focused achievement-orientedness. Nothing comes free, but the reward is worth it. There is a general morale in his findings: the experience of *flow* is a key to obtaining increased intellectual and affective satisfaction and self-realization. Contrary to "hedonia" (pleasure), one strives to achieve "eudaimonia" (self-actualization).

At this point, we can argue that outstanding human activities such as inventions, creations, productive designs, etc. have one important thing in common: a particular level of readiness and the experience of a certain mental state in an easy-going and self-confident anticipation of positive outcomes are necessary to be obtained as the backdrop of gratification and success. It is claimed in relation to the flow experience that the best moments in one's life usually occur if a person's body or mind is stretched to its limits in a voluntary effort in order to accomplish something difficult and worthwhile.

It is not by accident that Daniel Kahnemann devotes serious thoughts and profound discussion to the phenomenon of the flow-experience as elaborated by Csíkszentmihályi. In Kahnemann (2011) *Thinking Fast and Slow*, Kahnemann summarizes the empirical findings of his four-decade-long research concerning judgement, cognitive biases and mistakes in human decision-making. It is important to note that both Csikszentihályi and Kahnemann are psychologists by education who have been able to say a lot about ways of thinking, judgement, decision-making and creativity reflected in human behavior. In a comparable way to Csíkszentmihályi's flow experience, Kahnemann's distinction between two kinds of systems in human thinking processes illuminates the complexities in understanding and evaluating human decisions as right and fruitful as opposed to those which are deemed to be failures. Thinking in the mental state of *cognitive ease* is automatic and effortless, allows for a *free flow mode* of cognitive and affective processes, including first intuitions and emotions to induce *moves*. Thinking in the mental state of *cognitive strain*, on the other hand, takes extra concentration and effort in looking for reasons, evaluating options to achieve the desired outcome (Kahnemann 2012).

5 Collectively constituted cultural narratives

The shift from the individual perspective on cognition to the social and cultural embeddedness of both linguistic cognition and social cognition has stimulated and widened the interest of researchers to a great extent. The idea of socio-cultural situatedness revealed the mechanisms of cultural conceptualization and came to be seen and got adopted as the foundation of socialization and interactive communicative behavior. The socio-cultural frame decisive in the design of interactive communicative patterns of a community can be treated as a mental framework forming a virtual fabric, i.e. a cohesive narrative to accommodate and determine culture-specific interpretation schemes.

It is easy to evoke here the foundational philosophical tradition established by Habermas's consensus-seeking communicative acts (Habermas 1996). On account of the socially situated nature of discourse, communication takes place from within the horizon of shared, unproblematic convictions which automatically constitute consensus-generating interpretative patterns. It entails - at the same time - that communicative actors are always moving within the horizon of their "lifeworlds" since they cannot step outside of it. Lifeworld is the invisible and indispensable background of everything we do and of everything we are.

A culture, in fact a community of "lifeworlds", is the result of fairly homogeneous cultural conceptualizations. In a monolithic culture we witness a culturally transmitted and linguistically organized fund of interpretative patterns. Lifeworld can be seen as a kind of non-thematic knowledge shared within the community that is characterized by an unmediated certainty and a holistic constitution which brings about shared contexts of meaning.

As a brief summary of the tenets of recent theories in cognitive anthropology, we assert that collectively created cultural narratives have had their decisive function in shaping social cognition and social behavior. These narratives – as results of the complex adaptive cognitive systems of the members - have been successful in creating culturally controlled augmented realities by allowing interaction and renegotiation of emergent cultural cognition in real space and time among flesh and blood generations in a linear mode of constitution.

6 Cognitive entities in a digital environment

Our recent research on digital culture suggests, however, that one has to account for a new paradigm in perceiving, conceiving and managing information to be observed by people who have been socialized in a digital era and have internalized the very nature of digital culture. The members of the digital community function in connected networks created by a number of different types of cognitive entities.

These individuals are at ease with digitalization and virtualization. They live in environments that have all sorts of smart devices such that they can cope with a plethora of information and communicate effectively. Cognitive entities in a digital environment are related to each other not by commonly shared cultural narratives (as stated in the tenets of cognitive cultural anthropology above) but by random and spontaneous interest in networking, information sharing and emergent cognition. We may say that this type of networked information exchange is not teleology-driven, i.e. knowledge accumulation in a linear fashion. What we witness under such conditions is an exponential growth of potential information sources due to the parallel design of connections. What we have seen as the main outcome of our research is that we see digital culture as a novel environment for social cognition that inevitably undermines the permanence of cultural narratives. The consequences for the nature and mechanisms for social cognition based on digital culture cannot be predicted in a reliable way as of today. A new perspective on and an unprecedented practice of information management is, however, part of an irreversible process. It is also very likely that in the digital environment no exclusively determining cultural conceptualizations exist anymore which would function as the ontological basis for shared convictions (The origins of connected cognitive entities (CCE) is discussed by Komlósi & Waldbuesser (2015)).

We are claiming, however, that connected cognitive entities do share a common ground for communication which draws on the emergent properties of digital environment which maintains the permanent thrill of being continually connected to and being engaged in a throbbing digital environment. Creating contexts for interpretation means an innovative challenge for the interactive agents.

Our claim is based on the observation that unprecedented development and innovation in information and communication technologies have exerted unforeseen impact on social cognition, information processing and human learning. We have witnessed the appearance of smart systems of various sorts whose interactive elements include reasoning (i.e., reasonably computing) entities with both human and non-human properties. It is realistic to claim that learning and knowledge management in digital social space are bound to take place (in the near future) and consist in the interaction between intelligent cognizing entities, human and non-human alike. In opposition to the traditional learning conditions, the emerging patterns of digital cognition, digital information management and digital literacy are not only faster involving greater complexities, but they also facilitate coping with virtualization in general, leading to new cultural landscapes involving augmented reality. The new phenomenon is acknowledged by Komlósi & Waldbuesser (2015) by adopting the term *Connected Cognitive Entity Generation* (CCE Generation), by which we refer to the participants of the new information management practices induced by the very nature of the digitalized information environment.

This study is to show that the effect of digitization on the social network of connected cognitive entities holds many implications. Social cognition is to be understood as a permanent learning process, which requires higher-level cognitive skills to process and

integrate emergent properties arising in the digital space through the interaction of connected cognitive entities. We want to emphasize the innovative drive which resides in the interactive informational frameworks, which consist of a multitude of connections of a cognitive personality to other cognitive entities, human and non-human alike.

7 Education and VR learning spaces

The technological developments of the digital age have various impacts on cognition in general which is reflected in both research and learning processes and methods. To exemplify it from the point of view of linguistics, first of all, a large amount of data has become available due to digital technology. This resulted in the rise of corpus linguistics, the investigation of language-related phenomena on natural language, spontaneous speech and different text types (e.g., Hungarian National Corpus). Another advantage is the extended scope on numerous disciplines, which have led to the emergence of multi-disciplinary fields such as cultural linguistics, which has been rapidly developing in the past decade (Sharifian 2011, 2017ab). The aim of cultural linguistics is to unveil the relationship between language, culture and conceptualization. Accordingly, comparative research across cultures is its primary objective, which has only become possible by enabling access to research results worldwide. Another aspect that cultural linguistics benefits from is integrating results and methodologies of several distinct disciplines such as cultural anthropology, cognitive linguistics, corpus linguistics and others, lending themselves to an integrative approach to linguistic phenomena. An example is Baranyiné Kóczy's abovementioned analysis on Hungarian folksongs within a cultural linguistic framework (2018): it incorporates the methodology of cognitive semantics, conceptual metaphor theory, sociolinguistics, cultural anthropology as well as ethnography in order to unveil the specific meaning-making processes in the folksongs. Overall, digital environment enhances complex and integrative research in various disciplines.

In line with academic developments, education has also radically changed over the past years. It must be emphasized that education is a cover term for various processes including gaining information, transmitting information, having an overview of a range of subjects, memorizing data, focusing on different details of learning material, searching for new information etc. Human cognition and cognitive processes themselves have changed radically due to available information, which call for novel methods in teaching. It seems that while big data is available for everyone nowadays, managing data turned to be much more in the focus of education. The term "competence" is related to such "management." Managing data involves the ability of both handling individually large amount of information, and also enhancing collaboration among pupils in order to make them able to cooperate. This also entails a sufficient change in the role of the teachers: instead of the role of "instructor," they should rather function as one who supports and enhances (assists) learning processes. Furthermore, managing data involves identifying various perspectives on certain issues and viewing them in their complexity, in a project-like manner. Thus, self-education and collaborative learning are key points in digital age education.

As a response to such claims, VR learning has been introduced in order to fulfil the current needs of education. Representing knowledge and enabling learning in VR spaces is inevitably a shift of paradigm in the realm of teaching and learning, not to speak of its ground-breaking step in the evolution of informatics. It is estimated that VR spaces in learning will come into

effect at the beginning of the 2020's. The spread of 3D digital environment can be viewed like the evolutionary shift in computer technology from DOS character-based computer interface to Microsoft Windows interface in the 1990's. At the time the desktop metaphor was popularized by Microsoft many claimed that this interface was either trivial like a computer game, or much too complex to be usable. However, it turned out to be wildly popular. Similar to that shift, it is expected that 2D windows will be substituted by 3D spaces in the near future. The reason for the change is explained in various studies on working and learning in 3D environment: according to them, working and learning, memorizing data and having an overview of the users' tasks in 3D spaces is 30 to 50% more effective on average (Lampert et al. 2018, Horváth & Sudár 2018, Berki 2018, Budai & Kuczmann 2018, Kövecses-Gősi 2018). These advantages were first studied and applied to education (Horváth 2016, 2018, Csapó et al. 2018), but later it was also investigated in industrial environments, namely, in solving management tasks (Bőczén-Rumbach 2018). Improved task-management is explained by biological processes: while the advantage of Microsoft Windows interface was to involve the visual center of the brain in its working processes (as compared to character-based DOS interface), 3D spaces also activate the parietal eminence of the brain, which is faster, and which has much more capacity. The parietal eminence, on the one hand, is directly connected to the eye by the optic nerve, and on the other hand, it is related to the visual center. Due to this, even positioning information in the form of numerous windows in 3D space effects a significantly faster processing and greater effectivity. Spatially arranged digital contents, regardless their form or type of content, become more accessible, manageable, clear and understandable for the viewer, which is an essential element of working processes.

8 Advantages of learning in 3D spaces

Several studies have investigated the effectiveness of learning in 3D spaces, as compared to learning processes in Windows interface. These empirical researches have outlined basically three fields where work in VR spaces proved more effective: memory, comprehension and collaboration.

8.1 Memory

Berki (2018) showed that memory works 50% more effectively in 3D than in Windows. The experiment involving 22 participants proved that 2D advertising in VR is more effective than in the classic banner ad format, namely more participants remembered the advertisement displayed in VR than the web-based ad. In 3D space there are various carriers (e.g., boards on walls, projectors, desktops), which themselves suggest the type of learning content they display. We have real-life experience about desks where we usually put documents, notes, or telephones next to which one may find a telephone directory. We generally put photos, pictures and diaries on the walls, and similarly, videos can be found on projector screens. All this knowledge is based on our learning processes in non-virtual spaces. Furthermore, the placement of various materials and their size relative to each other also provide information about their relative importance and how the different contents are interconnected as parts of the learning process. These observations become incorporated into our memory, enhancing learning and memory processes to a large extent. These correlations formulate a network and a hierarchical structure, which in 2D space cannot be represented.

8.2 Comprehension

Likewise, comprehension and understanding learning materials is proven to be 50% more effective in 3D space. Lampert et al. (2018) undertook an experiment in three groups where workflow description and materials were presented in three ways: via e-mail attachment, web interface (moodle) and VR space. It was found that the last group completed the given task 50% faster than the participants in the first two groups. The basis of comprehension also relies on the spatial arrangement of digital materials. In fact, understanding and having a clear overview of learning contents means considering and assessing the elements of a project, including their correspondences, swiftly and correctly. In traditional 2D user interface, documents and other contents are stored in alphabetical order and they are opened in a linear order. Understandably, transition between different documents and establishing linkage between their contents is very limited. Keeping files in folders is a matter of storage, which is an appropriate method to have access to a large number of documents and to find them easily.

On the other hand, a learning process needs different arrangements of the documents where we apply certain organizing principles. These principles map onto the learning process at hand, which means that the relative spatial position of the knowledge elements should represent the learning process itself. While comprehension, a key factor in learning means building up to and evaluating a network of related contents, it is more efficient when it is supported by the representation of materials in 3D space, which enables multiple connection among them as opposed to linearly ordered knowledge elements. A further advantage of learning in 3D space is that we do not need to open files when we start learning and, similarly, there is no need to close them when we finish it – they are constantly there laid out in the virtual room as we arranged them earlier.

8.3 Collaboration

In 2D digital environment collaborative learning means sending numerous documents to each other, which is time consuming. A better solution is sharing documents, for example, via google drive. It is inevitably faster and enables the participant to make changes on the same document, however, it also has constraints while we can work on one document at a time. Empirical research proves that collaborative learning in 3D environment is 30% faster than via e-mail or web interface (Lampert et al. 2018). The process of collaborative work in virtual spaces is very different from those in 2D interface. Here the access to documents is very simple – the collaborative partners just enter the virtual room where they find the necessary documents in their actual state, arranged by principle applicable to the work process they are involved in. The documents can be viewed, and one can make alterations to them, if necessary.

On top of that, documents are not represented as single ones but according to their function in the complex learning process, which is their natural context. This characteristic leads to another critical issue of collaborative work, namely, describing and sharing the dynamic aspect of the learning process at hand. In 2D interface it can only be accomplished by providing a list of instructions for the other participants. Contrary to that, the location of contents in virtual rooms represent their functions in the process and thusly the process itself, enhances easy comprehension, and there is no need to share additional information on the process. As an overall outcome, research has also shown that in virtual spaces, projects are carried out 30% faster than via e-mail-based communication or web interface (Lampert et al.

2018, Horváth & Sudár 2018, Bőczén-Rumbach 2018). This is mainly based on improved comprehension and collaboration characteristics. In addition, learners spare a lot of time by no longer requiring using elemental machine-based user functions such as clicking, opening and closing windows, enlarging documents etc.

9 Case study: representing the process of linguistic research

To exemplify the benefits of learning in 3D space, this section describes how students gain practical experience and insight into the process of academic research. In this case, the field of the research is linguistics, namely, a multidisciplinary approach to the conceptualization of the Hungarian word *szem* 'eye' within the framework of Cultural Linguistics. The aim of this case study is to allow students access to the various tools, documents, sources, webpages, academic social networks which help a linguist's work. In fact, while students consult numerous research papers during their education, they know little about the process of research itself. The general opinion about linguistic research is that it covers a solitary and isolated activity, study of documents in libraries, however, nothing could be further from truth. Linguistic research is a highly complex creative work, which is often collaborative at the same time.

In the followings, the linguistic study is introduced in 3D/VR MaxWhere programme, in Smart Office Quick space. This space has been designed to serve everyday administrative tasks (e-mails, notes, diaries) as well as storing documents, teaching, keeping contact with other researchers and students, or giving presentations in the same space.

Figure 1. Linguistic workshop in Smart Office Quick space

The Smart Office Quick space is divided into two levels and 4 *rooms*: the bottom-left room on Figure 1 is the *office*, dedicated to surfaces that are necessary for everyday task management, communication with colleagues and students, and actual events.

Figure 2. The "office" in Smart Office Quick space

On the desk (Figure 2), the researcher's mailboxes are open to help her deal with everyday tasks. E-mails are important as means to keep contact with other researchers and certain academic events, such as workshops, conferences and seminars. Another surface includes a notebook where reminders are made note of, in order to provide access to up to date information. On the wall of the office, various webtables are found. A large webtable displays a diary, which contains important task and deadlines. Behind the desk, two boards are dedicated to the two most popular academic social networks, *Researchgate* and *Academia.edu*. These networks have various functions that are helpful in the research process: one may a) announce their academic projects; b) upload the preprints of their publications; c) ask questions about research methods etc.; d) learn about other researchers' academic projects (follow other researchers); e) have access to others' publications; f) establish and maintain contact with others; g) ask about others' reflections on our research etc. It must be emphasized that such networks both play an important role in the free access to research achievements and reflect the collaborative nature of scientific work. Another three webtables on the wall display documents related to current events, such as a conference: the abstract submitted, the conference program, and a sketch of the presentation to be given.

Figure 3. Research room in Smart Office Quick space

Next to the office, at the back of the building the *research room* is located (Figure 3). It contains documents in pdf format and ones stored on google-drive as well as online surfaces connected to the given project. The various types of documents and sources represent the complexity of academic work. The present research aims at unfolding the conceptualizations of 'eye' (*szem*) in Hungarian, based on observing its representation in linguistic data. The fact that the various types of sources are displayed in one room, ascertain the observer that they belong to the same topic. In the middle of the room, there is a large desk on top of which there are numerous surfaces. Some of them contain articles on the conceptualization of the eye in other languages, which make up reference works related to the topic at hand. Next to them, other sources such as the *The Hungarian Encyclopaedia of Ethnography*, the *Hungarian Orthographical Dictionary*, *The Historical-Etymological Encyclopedia of the Hungarian language* and the searching surface of the *Hungarian National corpus* are found. On the other side of the desk there are various further sources to be used in linguistic research. One important tool is a Hungarian-English dictionary, which is useful when writing an article in English. Other webtables include a stylesheet for the article, a google searcher to look up quickly any kinds of missing information and a list of references from which the researcher can extract the references needed (including the precise data of any reference works). On the wall of the *research room* (Figure 3), the publication in process is placed along with its abstract and relevant list of references. Below the paper, a figure is displayed to provide a quick summary/overview of the topic under development. The figure itself depicts the various conceptualizations of the eye (*szem*) in Hungarian, representing also the connection between the domains.

Although the room contains only the most important sources the researcher uses during her work, it can be observed that Cultural Linguistic study is a complex and many-fold work involving several types of documents and webpages. The way the different documents and websites are positioned in the *research room* not only highlight the strong interconnectedness of the sources, but also the fact that they are utilized in parallel rather than linearly during research work. Likewise, the 3D location of the items supports the cognitive process of establishing connections among the pieces of information/knowledge that the documents

contain. The google search function demonstrates that this framework is an open one, to which a researcher may add new data any time she needs.

On the top floor of Smart Office Quick space a presentation hall/space is located where a power point presentation is laid out. The presentation is one that the researcher prepared for a conference in Warsaw, 2017, on body part terms. The benefit of viewing the presentation in 3D space is not less than we can freely move among the slides, which is not possible in power point program. Again, the linear view of the information on the slides is replaced by the possibility to arrange multiple linkage among the slides. Furthermore, some of the slides can also be presented in groups, indicating their stronger coherence.

Figure 4. Presentation in Smart Office Quick space

10 Concluding remarks concerning the VR learning spaces

The objective of teaching students about the process and development of a linguistic publication is manifold: by representing the various tools and sources a researcher uses in her work, the students become aware of the complexity of academic study, and also the fact that doing research is not a solitary kind of activity but often a collaborative one. This is well represented in a virtual building in MaxWhere VR space where the rooms are given distinct functions: the office, the research room and the presentation space each have their own roles. In the rooms, the numerous webtables are placed on different carriers, suggesting which stage of the workflow they belong to. By means of webtables the students also benefit from viewing the various types of sources (social networks, documents, online forums) in a laid-out form, among which they can freely move, they can view them closely or from a distance. They can further experience that this space is not static and timeless: it is dynamic, and it has the potential to make any changes to the documents (except pdf documents, naturally) in the process of the research. In this way, academic research work is presented and observed as an enjoyable and exciting activity.

Among the challenges of the digital age, the need of paradigm shift in education is one of the most crucial ones. The new framework introduced in this paper has been developed as a response to the new needs that have recently arisen in education. Learning in 3D space is

more efficient due to representing and managing information in a non-linear way, providing access to data in a laid-out form, enhancing memory, allowing collaborative work and overall, representing knowledge much more similar to real-life learning processes.

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