**Distributed Thinking Symposium V**

**The Time-scales of Language Dynamics in Systemic Thinking**

**30th-31st of January 2013**

**Goldsmiths, University of London**

**New Cross, London, SE14 6NW, U**

**A part of the AISB Workshop series**

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**Program for the individual days[[1]](#footnote-1)**

**Wednesday 30th 9-12: RHB 256, 13-17: RHB 137a**

**09.00-09.15: Welcome**

09.15-09.30: Jens Koed Madsen: Times scales in interactivity

09.30-10.15 Joanna Rączaszek-Leonardi: Language as a System of Replicable Constraints: Multiple systems and multiple time-scales of language dynamics

10.15-11.00: Patrick Healey: Making a Shared Language: Experiments on the Emergence of Co-ordinated Symbol Systems

11.00-11.45: Sune Steffensen: The Multi-scalar Ecology of Human Interactivity

**12.00-13.00: Lunch**

13.00-13.45: Gaelle Villejourbert: The Right Stuff: Unpacking Distributed Thinking through Systematic Observation

13.45-14.30: Frederic Vallée-Tourangeau: Adopting a Systemic Perspective on Reasoning and Problem Solving

**14.30-15.30: Tea and coffee**

15.30-16.15: Enrico Torre: Different Time-Scales, Common Mechanisms: Toward an Eco-Cognitive Account of Language Dynamics

16.15-17.00: Sarah Bro Pedersen: Sense-making in and beyond local time and space

**Program for the individual days**

**Thursday 31st 9-12: BPB LT, 13-17: RHB 137a**

**09.00-09.05: Good morning and welcome**

09.05-09.50: Vera Zabotkina: Language dynamics: conceptual metaphors of time

09.50-10.35: Stephen Cowley: Sustaining the slow process: learning from problem solving

10.35-11.20: Giuseppe Leonardi: Recurrence analysis as a tool to probe the dynamic signatures of language

11.20-12.00: Dongping Zheng: Affordances and Coordination: A Virtual Problem Solving Experience

**12.00-13.00: Lunch**

13.00-13.45: Marilyn Panayi: Understanding the gestural dynamics of distributed systems: Child embodied and enacted interaction
13.35-14.30: Emanuele Bardone: Towards a Model of Chance-Seeking Behaviour

**14.30-15.15:** **Tea and coffee**

15.15-16.00: Paul Thibault: Language Dynamics, Cognition, and Time-extended Multimodal Experience

16.00-16.45: Davide Secchi: A Distributed Cognition Model of Advice Taking

**16.45-17.00: Final remarks and thanks**

**Workshop background**

The workshop represents a meeting of two distinct groups of researchers, namely the The Society for the Study of Artificial Intelligence and Simulation of Behaviour (AISB) and Distributed Language Group (DLG). The latter has hosted four previous workshops on interactivity, dynamic language, and distributed cognition, and the present workshop is the fifth of these workshops. Hence the general title of the workshop: Distributed Thinking Symposium V.

The AISB is sponsoring a series of workshops, which are being held across the United Kingdom, covering a wide range of themes pertinent to the aims of the society. The first workshop, which was held on 26th September 2012 at Goldsmith's College London, explored the theme of Sensory Motor Theory. The events are abstract-only and free for AISB members. If you are interested in more information on the series please contact the workshop organisers at workshops@aisb.org.uk

**Workshop description**

‘The time-scales of language dynamics in systemic thinking’ is the fifth Distributed Thinking Symposium. Like its predecessors it brings together researchers from artificial intelligence, psychology, and the language sciences to discuss themes of general interest. While its general aim is to be an interdisciplinary forum, it focusing on the how people integrate the various time-scales of language and thinking also has discipline specific implications.

Recent developments in psychology and the language sciences show that language goes beyond the raw linguistic content identified with sentences or discourse (see e.g., Sperber & Wilson, 1995; Love, 2004). This departs from the traditional code-like view of language that traces understanding to decoding determinate forms. Rather, language is viewed as a dynamic process that, while centred on human interaction also exploits historically derived resources (Cowley, 2011). Interaction and problem solving are thus understood, not in relation to normative models, but as sense-saturated, regulatory human activity (Vallée-Tourangeau, Euden, & Hearn, 2011; Steffensen, in press). This results in systemic thinking and action whose dynamics play out in (at least) evolutionary, cultural and developmental time-scales. Cognition and language are thus local or situated and yet dependent on non-local processes or grammatical, cultural, and historical resources that, while not present, are essential for communication and thinking (Thibault, 2011). To conceptualize and operationalize systemic cognition in psychology, the language sciences, and artificial intelligence, there is a need to develop a clear view of how time-scales, dynamics, and local/non-local influences impact on human interactive communication.

Consequently, the workshop explores interdisciplinary research pertaining to time, language dynamics and systemic thinking as influential factors in cognition, languaging, and human-computer interaction.

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**Abstracts**

**Towards a Model of Chance-Seeking Behaviour**

Emanuele Bardone (University of Tallinn) and Davide Secchi

(Bournemouth University)

When individuals have to solve a problem or make a decision, sooner or later they face the very experience of our ignorance. What can people do in a world they don’t quite understand? In this paper our main goal is to sketch a distributed cognitive model of chance-seeking (CS) behaviour (Bardone, 2011). Chance is defined as an event or situation - novel or not - conveying both an opportunity and a risk in the future (Ohsawa & McBurney, 2003). CS is that particular kind of behaviour or cognitive attitude in which a person explores and/or examines his/her proximal environment so as to tentatively make the best out of the opportunities it offers. We are interested in (a) understanding why chance-seeking is widespread, and (b) what makes it successful. As a cognitive behaviour, chance-seeking can be described by five features. Seeking chances is an *adaptive* process in the sense that it involves change, creativity, innovation. It is also *open-ended* because it is not possible to draw a clear distinction between means and ends (Kay, 2011). Problems are solved by successive approximations and incremental modifications projecting the problem-solving process onto subsequent chances and opportunities for action. Also, it is *distributed* because the chance-seeker doesn’t only rely on internal resources, but mostly on external resources (Clark, 2008). CS is *anti-fragile*, meaning that one is not actually harmed by random occurrences, but he or she actually benefits from them (Taleb, 2012). The process is *situated* in the sense that the chance-seeker cannot make an inventory of cognitive skills and knowledge needed, but can only rely on whatever may come in handy. The model intends to provide a solid basis for empirical testing of these characteristics of the successful CS process.

**Sustaining the slow process: learning from problem solving**

Stephen Cowley (University of Hertfordshire)

A systemic view of cognition asks how time-scales, dynamics, and local/non-local influences impact on human communication. In pursuing this question, the paper addresses how people use the world and models of the world in the slow processes that serve in fine-tuning action. It thus builds on Merlin Donald’s challenge to cognitive models which overplay “the study of the sensorimotor foreground” (2007: 214). Without due attention to the non-local it is difficult to see how, in Wittgenstein’s (1958) sense, people would be able to ´go on’. To integrate complex events into long ongoing social (and other) scenarios both neural and world-side mechanisms are needed. Brain-side, Donald hypothesises a neural adaptation, or extended working memory system. Using the assumption that something like serves to comprehend and navigate the social-cognitive domain, the paper addresses how such a mechanism could be managed world-side. Turning to problem-solving, therefore, it presents a pico-scale analysis of how one person draws on various external routines and resources. Finally, the case is generalized through a few tentative remarks on how the slow process could mesh with the linguistically variable and open activity that constitutes the core of human cultural life

**Making a Shared Language: Experiments on the Emergence of Co-ordinated Symbol Systems**

Patrick G. T. Healey (Queen Mary University) and Nik Swoboda (Universidad Politécnica de Madrid)

Studies of the formation of human symbol systems typically employ experimental paradigms in which pairs of people communicate repeatedly about particular concepts, objects or locations.  One of the most salient patterns observed in these studies is that the more often an item repeats the more simplified the representation of the item becomes (verbal, graphical or gestural). Although it can seem natural to explain this process of simplification in terms of increasing familiarity or expertise,  we have previously shown that it also depends on the specific ways in which people can interact. Repeated exchange of representations alone appears to insufficient to drive the process of simplification, it also depends on exactly how people interact.

This talk will focus on what happens when the target items do not repeat. In this case people must try to produce not just individual symbols but systems of symbols that can generalise across different items.  Two graphical communication experiments using a shared whiteboard will be described. One 'pictionary' style in which people produce drawings of target concepts and the second a 'music drawing task' in which people must invent novel conventions to communicate about pieces of music.  Two factors are manipulated: 1) whether the target items repeat 2) whether people can interact directly on the whiteboard.

The results confirm the finding that when items repeat, the ability to interact facilitates the simplification of representations.  In addition they show that direct interaction takes on a much more significant role when items do not repeat.  The ability to collaborate directly on the construction of a representation appears to be integral to the use of systematic, proto-compositional symbol systems that can generalise across multiple items.  These findings are used to argue that the structure of human symbol systems is primarily constrained by the processes involved in the joint manipulation of the external representations people use and only secondarily by the internal constraints of cognitive processing.

**Recurrence analysis as a tool to probe the dynamic signatures of language**

Giuseppe Leonardi (Uniwersytet Mikołaja Kopernika)

The dynamical shift we are observing in the cognitive sciences as a whole and in language research as a representative field therein, imposes the use of appropriate methods to analyze data and to interpret empirical evidences. Among the new analytical methods able to uncover some of the dynamic characteristics of language and conversation patterns, Recurrence Analysis (Zbilut & Webber, 1992; Webber & Zbilut, 1994, 2005; Marwan et al. 2007) is emerging as one of the most promising.

Application of Recurrence Analysis (RA) in the language field is still episodic and not well established (Leonardi, in press), but some interesting attempts have been already implemented (Dale & Spivey, 2006; Angus et al., 2012) and we may expect more of them to emerge as a consequence of language behavior being modeled in the dynamical systems perspective.

In this contribution we aim at shortly presenting the basic concepts of RA and showing how different properties of dynamical systems may be captured by the patterns of recurrences as they emerge in recurrence plots and recurrence measures. Examples from known systems (in physical and biological sciences) will be illustrated, with special focus on multiscale phenomena. This discussion will then lead to an attempt of uncovering patterns in orthographic and syntactic structures at different levels of organization of a text (sentences, paragraphs and chapters), comparable to different time scales of the message which the text aims to convey. Further ideas of possible developments in the study of on-going, real world conversations between two actors will be also considered.

**Understanding the gestural dynamics of distributed systems: Child embodied and enacted interaction**

Marilyn Panayi (Ensomatica, UK and City University, UK)

Intentional human action can be considered within a biological dynamic system theory framework. Such movements are considered to enhance our interaction with the self, the social other and the other as artefact and contribute to the development of our socialization and the evolution of our culture. Interactions that place the action-ready-body centre stage can be described as spanning veridical, imaginary and hybrid spaces. The term hybrid is introduced to describe environments that encompass artefacts that extend the nature of these interaction e.g. digital technologies such as those used for education, edutainment, rehabilitation; creative practice and performance. In this research, the process underlying learning, known as the Perception-Cognition-Action cycle is revisited within such a biological systems approach. Arguments are put forward for the use of models as tools to facilitate our exploration of scenarios of emergent cognition that are tightly coupled to systems described as distributed. These distributed systems provide the opportunity to work both at and beyond traditional boundaries. The development of a deeper understanding of human intentionality, specifically children’s corporeal capacity embodied in gesture offer particular insights. A theoretical synthesis of evidence from the domains of cognitive neuroscience and empirical evidence from video analysis of such gestures inform the development of both i) an alternative ontology of gesture (that is not reliant on concept of ‘gesture in the service to language’) and ii) a proposed model of spatial cognition that is contingent on enacted, embodied and participatory sense making. Theoretical and empirical evidence from this research is discussed in terms their significant implications for the design of future pedagogy and technology. This includes those that increasingly incorporate perceptually sensitive technologies. Cases in point are the intimate and bionic technologies that augment interaction for neuro-atypical children e.g. children challenged by severe speech and motor impairment; those who may be twice exceptional, e.g. autism, dyslexia.

**Sense-making in and beyond local time and space**

Sarah Bro Pedersen (University of Southern Denmark)

“Wherever anything lives, there is, open somewhere,

a register in which time is being inscribed.”

(Bergson, 1911: 16).

The main idea in this talk is that sense-making is a dialogical and multi-scalar activity that links bodies together around common projects in interactivity. Sense-making is dialogical since it emerges in local activity that draws on multiple timescales spanning from here-and-now dynamics between living beings to lived experience over time and space. I present an analysis that uses real-life video-recordings from an emergency ward at a Danish hospital to test this hypothesis. It emphasises sense-making as bio-cognitive and dialogical activity that is sometimes explained as social normativity; sometimes as thoughtless (but not accidental) embodied automaticity that we have learned over time. The overall aim of the analysis is to show through such real-life examples what a dialogical, naturalised and non-reductionist perspective on human sense-making interactivity gains. It argues that an observer-perspective is able to go counter on the natural bent of human perception and explanation. Pursuing that road, I introduce two analytical concepts: first-order sense-making and second-order sense-making. Second-order sense-making is investigated as micro-sociological phenomena related to norms and rules, and to what we are aware of in language. But if these are treated as the only analysable features of sense-making, we maintain the dichotomy between the skilled body with sensorimotor knowledge and the mind confined to an intracranial realm of thoughts ready for representation through a language code. By turning the focus towards first-order sense-making I investigate interbodily dynamics that enable us to explain what happens in time beyond language representation and natural perception.

**Language as a System of Replicable Constraints: Multiple systems and multiple time-scales of language dynamics**

Joanna Rączaszek-Leonardi (University of Warsaw & Polish Academy of Sciences)

At the times of birth of modern cognitive sciences (in the 50s and 60s of the last century), the computer metaphor was just one of the ways to think about cognitive processes. Besides this (most popular) view, there was the ecological psychology program, which did not see any significant role for symbolic computation in the mind/brain and – a much less known for various reasons – “conciliatory” proposal stating that *both* the symbolic *and* the dynamical modes of description are necessary to develop a meaningful theory of cognition (Polanyi, 1968, Pattee, 1969, 1972; Pattee & Rączaszek-Leonardi, in press).

According to the latter view, framing cognition in terms of symbol processing does not make sense without the specification of the dynamics that give rise to ‘symbols’ and that are, in turn, controlled by these ‘symbols’. This approach brings about a shift in the understanding of the term ‘symbol’. Symbolic structures are seen as physical structures that due to their history within a system gained the controlling power over the system’s dynamics. The control is understood in terms of functional coordination, i.e., binding the system’s degrees of freedom to make a behavior or a structure functional (Rączaszek-Leonardi & Kelso, 2008). Symbols are thus inseparable from the dynamics, their coordinative role comes to the fore together with their potential for being replicable.

Applying this view to natural language seems particularly fruitful, since it allows for identifying relevant systems and relevant time-scales on which the (relatively easily distinguished) symbolic forms may act as constraints. The talk will be devoted to the presentation of the above theoretical background in more detail (Rączaszek-Leonardi & Kelso, 2008; Rączaszek-Leonardi & Cowley, 2012) and illustrating the concept of linguistic forms working on many time-scales with psycholinguistic data on grammatical gender (Rączaszek-Leonardi, 2010).

A reflection on the form of the theory of language that can deal with such complexity will follow, emphasizing the potential of computer simulations. This time, however, in contrast with the early rule-based, algorithmic simulations of cognitive processes, the virtue of the computational approach would be in re-creating the dynamics: the multi-element, non-linear, iterative, time-dependent processes (Smith, Brighton & Kirby, 2005; Steels, 2011, Steels and Belpaeme, 2005). The author hopes that the presence of the computer scientists in the audience will allow furthering the discussion on the form of linguistic theory and cognitive theory in general, and, perhaps, relate these issues to the ones present in computer science since the works of Turing (1952).

**A Distributed Cognition Model of Advice Taking**

Davide Secchi (Bournemouth University) and Raffaello Seri (University of Insubria)

This research integrates part of the emerging and growing literature on advice taking (Bonaccio & Dalal, 2006) to define a framework that predicts advice discounting. The model follows a simple judge-advisor system (JAS) (e.g., Sniezek and Van Swol, 2001) where decision maker attitudes are defined via (a) *relational* factors such as judge-advisor closeness, authority/position, expertise, and (b) *individual* factors, such as cognitive mechanisms available and self-confidence. The advisor’s input is also considered in its intensity. The model sets advice taking as a measure of ‘docility’ (Simon, 1993; Secchi, 2011), that is the attitude of the judge to discount the advice, given their original point of view. This is modelled as a behavioural aspect of distributed cognition. The model assumes that the judge faces a dichotomic decision in two times and use a so-called latent regression approach. This allows us to define a probabilistic model of advice taking, where discount is a function of ‘docility’, measured as the probability that the judge’s decision at time 1 is *α* given her own opinion at time 0 being *ß*, the advisor’s suggestion being *α*. The model also takes into consideration individual and relational factors (*x*), as well as measures of the judge’s *stickiness* to her opinion, *λ*. The paper constitutes an attempt to provide a mathematical account of how attitudes towards distributing one’s cognition affect the probability of taking advice.

**The Multi-scalar Ecology of Human Interactivity**

Sune Steffensen (University of Southern Denmark)

This paper presents a naturalised approach to ecological, situated *interactivity*, defined as sense-saturated coordination that contributes to human action. The paper explores the cognitive ecology of human problem-solving: How do humans, as biodynamic agents, do things together and make things happen drawing on structures on multiple timescales, ranging from real-time interbodily coordination in a lived ecology, over semiotic and material artefacts, and to social normativity and cultural values? In order to give some answers to such questions, the method of Cognitive Event Analysis (CEA) is introduced. CEA is a method for conducting detailed analyses of how problems are solved in real-life contexts, here exemplified by an analysis of the cognitive dynamics of two persons engaged in a problem-solving event in a workplace setting. The problem-solving, it is demonstrated, pivots on the spatial organisation of the workplace, the interbodily dynamics between the two participants (especially in relation to gaze and the manual handling of papers), and verbal patterns that prompts them to simulate how the problem appears to a third party. The analysis shows that human problem-solving is far less linear and planned than assumed in much work on the topic. Problem-solving, really, appears to be solution-probing, and the cognitive trajectory from insurmountable problem to viable solution is demonstrably self-organised, unplanned, and on the edge of chaos.

**Language Dynamics, Cognition, and Time-extended Multimodal Experience**

Paul J. Thibault (University of Agder)

The high order invariances of linguistic structure compress information deriving from the collective experience of an entire population of languaging agents on far larger time scales than that in which the utterance occurs. Other relevant time-scales include the individual agent’s ontogenesis and the possibilities of subjective awareness that this ontogenesis enables. The individual agent is, of course, embedded in this larger field. Utterances have the functional capacity to modulate awareness of previously experienced invariance structures and their transformation in multimodal 4-D experience. It is not the case that the utterance ‘encodes’ this experience in the homogeneous medium of abstract lexicogrammatical form. Current accounts of language qua encoding/decoding system view language as consisting of levels of abstract structure (e.g., phonology/graphology, lexicogrammar or morphosyntax, and semantics). This ‘levels’ conception of language is unable to say anything about the perception and evocation of time-extended multi-modal experience that is defined over Bergson’s qualitative melodic time (Bergson, 1896/1911: 111, 125-127; Robbins, 2002: 312). Utterances are cueing events: their high-order invariants have the capacity to prompt agents to reconstruct from their past experience the whole qualitative experience that is integrated and synthesised with the pattern evoked by the linguistic utterance in the present. The present moment is not, then, a discrete instant or point in time, but a **qualitative** synthesis (Bergson, 1896/1911: 111) of preceding experience that is reactivated and synthesised with the present. Such a qualitative synthesis is like the motion of a continuous melody, rather that a succession of discrete points or instants of time. The agent-environment interaction system is grounded in the I-here-now orientational frame or “deictic field” (Bühler, 1934/1990) that is centred on the agent’s embodiment. On this view, languaging behaviour is intrinsically temporal and interpretative. This paper will consider some of the implications of these observations for a distributed and systemic explanation of time-extended linguistic cognition.

**Different Time-Scales, Common Mechanisms: Toward an Eco-Cognitive Account of Language Dynamics**

Enrico Torre (University of Lancaster)

No scholar of any theoretical persuasion would ever deny that language develops and evolves over time. Nevertheless, there is no consensus on the nature of language dynamics; in particular, there is a striking contrast between advocates of formal vs functional approaches to the study of language change (e.g. Lightfoot 1991; Fischer et al. 2000; Bybee 2003; Hopper and Traugott 2003). The present paper will tackle the issue of how language changes at two different levels of inquiry: ontogenesis and phylogenesis. I will propose that, while these two dimensions may not completely overlap in regard to the evolution paths they follow, it seems sensible to posit that the mechanisms which underpin these patterns are basically the same. Adopting an empiricist approach which is firmly grounded in the Cognitive Linguistics tradition (Langacker 1987; Goldberg 1995; Croft 2001; Tomasello 2003) and driven by the principles of Dynamic Systems Theory (e.g. Thelen and Smith 1994; Kelso 1995; Spivey 2007; Rączaszek-Leonardi and Kelso 2008), I will argue for an integrated, unified account of both ontogenetic development and phylogenetic evolution of the linguistic system. Accordingly, I will draw the conclusion that the dynamics of language can be seen as the same at both time-scales, thus arguing that the linguistic system may be seen as showing a fractal architecture, with each dimension resembling each other and the structure of the entire system. As language is seen, in an ecological perspective, as constantly interacting with other cognitive systems, this conclusion may be extended to the nature of cognition as whole.

**Adopting a Systemic Perspective on Reasoning and Problem Solving**

Frédéric Vallée-Tourangeau and Gaëlle Villejoubert

(Kingston University)

From a traditional cognitive science perspective on problem solving, perception shapes a mental representation of the world upon which certain computational processes operate to identify a move in a problem space, which is then translated into a behavioural output. The distinct and largely unconnected treatment of perception, computation and action, may well have served the information processing paradigm, but problem solving behaviour outside the cognitive psychologist’s laboratory suggests this approach fails to capture the fundamentally distributed, dynamic, and emergent nature of thinking—something long appreciated by ethnographers. We show that it is possible to ask and answer lab-based experimental research questions predicated on the notion that thinking is the product of the coupling of a participant’s internal resources and external resources. This is accomplished by developing a problem presentation that affords the manipulation of its constituent physical features. The ensuing fluid problem presentation offers a shifting array of affordances and opportunities that guide problem solving behaviour in ways that are simply impossible to observe on the basis of the static task description that traditionally serves as the problem givens. It is not simply the participant’s representation of the problem that is distributed across a meshwork of resources, some in the head, some in the world, but also working memory and so-called executive functions. We review recent work on insight and transformation problem solving, mental arithmetic and Bayesian reasoning that showcases the fruitful nature of casting thinking in systemic terms and engineering thinking tasks that encourages interactivity.

**The Right Stuff: Unpacking** **Distributed Thinking through Systematic Observation**

Gaëlle Villejoubert and Frédéric Vallée-Tourangeau

(Kingston University)

Research in our laboratory shows that reasoning and problem solving are substantially transformed when participants are given the opportunity to manipulate and reconfigure the physical features of a problem presentation. Interactivity fosters the emergence of thinking and reasoning that is both more insightful and normative. Beyond these performance indicators, tracing the emergence of a distributed problem representation on the basis of the participants’ actions is the focus of our recent research efforts. As in a more naturalistic environments, our participants engage in a wide range of actions, some appear deliberate and reflexive, others less purposive. Kirsh has often stressed the importance of methodically tracing and coding “all that stuff”; this repertoire of actions—epistemic, complementary—and verbalisations that drive and accompany thinking and yet do not figure in traditional computational accounts. To complicate matters, the emergent thinking trajectories can be idiosyncratic, reflecting the unique and original coupling of a participant’s internal resources with the resources in the outside world. Yet the distributed cognition research agenda must move beyond what Barsalou calls “demonstration experiments” and develop methodological tools to make sense of “all that stuff”. In this presentation, we share and discuss recent video data, generated from our experiments on distributed Bayesian reasoning, using Observer XT. The development of a coding scheme and the identification of recurrent action categories help us understand how, through interactivity, participants develop a problem representation that is better aligned with a Bayesian normative benchmark.

**Language dynamics: conceptual metaphors of time**

Vera Zabotkina (Russian State University for the Humanities)

The paper focuses on the interrelation of language use with linguistic structure and underlying conceptual structure. Language is viewed as a dynamic process that, while centered on human interaction, also exploits historically derived resources (Cowley, 2011). We proceed from the assumption that new meaning development involves both cognitive and communicative issues. In fact when any new meaning is formed we deal with three types of deviation: semantic (“sign - referent” relation), pragmatic (“sign - user” relation) and cognitive (relations between conceptual structures of original and new meanings). The new meaning of a word appears as a result of instantaneous deviation in individual use in the new linguistic environment. The speaker as if invites the hearer to infer the new nuances of meaning. The individual pragmatic inference in the course of time becomes salient in the speaking community, it is shared and adapted by more that one speaker and becomes conventionalized (generalized) invited inference with strengthened pragmatic impact (Traugott, 2002). And at a later stage pragmatic inference becomes reference (Bolinger, 1975).

The paper will shed some light on the dynamics of the conceptual metaphors of time in English. We build on historically derived resources which demonstrate the changes in macroconcept of time beginning with the introduction of Christianity to the present post-industrial conceptualization of time as a virtual entity.

Conceptual metaphors are viewed as frame-to-frame mappings with the roles of the source frame mapping to the corresponding role of the target frame. They can be decomposed into combinations of primary metaphors which are motivated by embodied experience coming together regularly (Lakoff, 2012)

**Affordances and Coordination: A Virtual Problem Solving Experience**

Dongping Zheng (University of Hawaii), Ying Hu (University of Vermont) and Min Liu (University of Hawaii)

This study situates interaction among language learners of Chinese and English in a 3D virtual environment. It looks at how learners’ deployment of different ways of coordination varies depending on affordances. The data stemmed from a large video corpus collected in a participatory design and research project where adolescent Chinese language learners in the American West and English Language Learners in Mainland China collaborated on co-creating a game mission in Atlantis Remixed and Quest Atlantis (ARX). Applying an ecological and dialogical framework, we examine the ways in which language learners coordinate with linguistic resources, emotional engagements, and cultural artifacts (materialized 3D objects) on different time scales to solve emerging problems. Interaction between the language learners is characterized as translanguaging, that is switching linguistic actions from L1 to L2 and L2 to L1. The process of coordination is functionalized as common ground alignment, prospective coordination, way-finding, and joint action.

The Chi-square test results revealed that the association between the number of objects, common ground alignment, prospective coordination, and joint action, and L1 to L2 translanguaging, is statistically significant (see Figure 1). Inspecting contingency tables (1-5), the more objects presented, the more often learners are engaged in these coordination processes and L1to L2 translanguaging. However, L2 to L1 translanguaging reveals a different pattern, in that such occurrence has significant negative association with the number of objects manipulated. This indicates language learners tend to translanguage more from L2 to L1 when there were fewer objects manipulated. Additionally, multimodal analysis provides a concrete account for shedding light on why manipulation of multiple objects affords language learners to align common ground to achieve mutual understanding, coordinate for future actions and support joint action. The findings have implications for designing game-based learning environments where ecological affordances and dialogical resources can play a significant role for L2 development.

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1. Please note that, for the sake of brevity, only first authors are listed in the program. For a detailed list of authors, please refer to the abstracts. [↑](#footnote-ref-1)