

# Cognitive Dynamics and the Language Sciences: Notes from the conference\*

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## Introduction

In September 2005, the Distributed Language Group (DLG) organized a small conference at Sidney Sussex College, Cambridge. Bringing together scholars who examine human social behavior from a naturalistic perspective, the conference aimed to open up a new perspective on the language sciences. The reasoning of the DLG was that progress in the field has been, hitherto, rather modest. We believe this is because of widely accepted and shared axioms about language and cognition that, overtly or covertly, imply that humans are input-output systems. It is widely and, we think, mistakenly believed that language is 'representational'. In fact, brains neither represent quasi-linguistic forms nor do they enable us to map these onto specifiable entities in the physical world. For this reason, it is equally mistaken to think that written language 'represents' spoken (natural) language or that linguistic interactions are suitably idealized as sequences of written signs. Where such assumptions are made, communication is mistakenly treated as information exchange based in coded linguistic units. Conversely, rejecting these assumptions, those at the conference reject the view that communication is telementation and, building on this logic, any kind of linguistic theory based on what Roy Harris (1981) has termed the 'language myth'.

To move beyond such models we began by asking **whether** there is any sense in which language can be regarded as a 'digital code'. Within distributed cognition, this issue arises because far from 'representing' cognitive processes, language transforms the causal links between brain, body and world (see Clark 1997). Far from being dedicated to processing, language is a heterogeneous set of artifacts and practices that, during ontogenesis, become integral to human activity. In Cambridge, therefore, we asked about the temporal functions of these cognitive dynamics. They were examined in 'real-time', development, cultural history and natural selection. Below, writing as two participants, we present *a shared perspective* on the conference. First, therefore, we introduce distributed cognition. Next, we focus on describing how cognitive and developmental dynamics link language with brains, behavior and biology to suggest that, suitably re-conceptualized, synthetic methods can reinvigorate work in the language sciences. In our closing section, we turn to the ontology of language.

## Distributed cognition

Until recently, most researchers concerned with language *and* thought took an inner 'faculty of language' as their object of study. Often, this was seen as a system of representations that was necessary

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\* The conference web-page can be accessed at: <http://www.psy.herts.ac.uk/dlg/abstracts.html>

to all linguistic activities. While compatible with the ‘computational theory of mind’, such models have fallen out of favor in contemporary cognitive science – or at least with the growing numbers who reject classic views of representations. First, empirical data suggest that, contrary to the belief of first generation cognitive scientists,<sup>\*</sup> brains do not use unchanging quasi-linguistic representations. Second, connectionist models and neuro-imaging show neural activity to be radically distributed: the ‘representational states’ of a brain are time-dependent. Third, animals and robots can often perform flexibly and adaptively without making use of inner representations. Accordingly, many cognitive scientists now focus on situatedness, embodiment and pattern-matching. To the extent that it makes sense to invoke inner representational states at all, these are distributed within the brain, based on a history of body-world coupling, and unlikely to recur in identical form. To explain the importance of verbal patterns in human life, therefore, it is stressed that we also rely on cultural evolution. For this reason a growing number of researchers reject ‘internalism’ by arguing that what we call ‘mind’ relies on causal processes that spread beyond skin and skull (e.g. Vygotsky, Gibson, Maturana and Varela, Clark, Hutchins, Järvillehto).

Cognitive processes are distributed across brains, bodies and, at times, our social and physical worlds. While first mooted in the philosophy of cognitive science, this idea is today widely used in empirical studies of human cognition. The thrust of this work is that, if the fine coupling of dynamical systems influences human behavior, folk views of mind are utterly mistaken. Pursuing consequences of this view, Clark and Chalmers (1998) argue for the ‘extended mind’ on the grounds that, in everyday talk, we mistakenly overlook how external resources – especially artifacts – extend our mental powers. In parallel work, Ed Hutchins (1995) uses ethnographic studies of human activities to show how artifacts, practices and folk-beliefs shape cognitive tasks. For example, how we sail ships and navigate to places depends on instruments, traditions, and collectively organized activity. Computational tasks are distributed, for example, when we fix a ship’s position. In modern Western culture, fixing a ship’s position has come to be organized around micro patterns (e.g. how a sailor reads an alidade display) that serve to enact distributed representational processes. Computing where one is at sea depends – not just on brains – but also on activity by co-operating, artifact using agents. Human networks use events whose causal basis draws on their functional and social history. Paraphrasing Clark (1997), humans often make the world smart so that we can be dumb in peace: cognition is culturally distributed.

## **Language and Cognitive Dynamics**

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<sup>\*</sup> While many positions are possible, the classic view drew on serial digital computers to regard representations as quasi-linguistic or static entities whose determinate formal properties remain largely unchanging between persons.

While both Clark and Hutchins make observations about what a distributed approach means for language, the perspective has not been systematically developed. Accordingly, Spurrett and Cowley organized a conference on these issues (see, Spurrett, 2004). Emphasizing real-time activity, distributed cognition was linked to 'integrational linguistics' (see e.g. Harris 1996). Instead of positing a form-based system that underpins 'language use', linguistic behavior was regarded as resulting from the real-time integration of activities (including ones that serve as signs). On this view we turn away from exclusive interest in formal patterns to ask how these are integrated with situated, real-time events. We focus on 'first-order language'. This activity is fully embodied but, at the same time, draws on how cultural patterns have come to be organized around the texts and talk that shape social life. In the 2003 conference, all concurred that this broad view of language throws new light on how brains and bodies link with the world. In Cowley's (2004) terms, our contextualizing bodies integrate activity in real-time as we use socially and culturally defined patterns. Language is, on this view, simultaneously enacted and interpreted across the time-scales of biological and cultural events. Extending this view, the Cambridge conference aimed to develop – not a theory – but a clearer model of the necessary cognitive dynamics.

The conference brought together philosophers, psychologists and linguists with many theoretical backgrounds - systemic, generative, cognitive, dialogical, integrational and ecological. All presentations were written partly in response to draft papers by Love and Ross where first-order language was presented as situated, embodied activity that, in evolutionary time, drew on social interactions that use sound (and visible movement). In Cambridge, discussion began with ontological issues about how (if at all) language is 'digital' and, later, turned to neural and behavioral regularities. For ease of exposition, however, we begin with how language is integrated with brain and behavior and, having done so, turn to methodological and ontological matters.

Building on at least 20 years of neural research, S. Bråten in his paper "Beyond egocentric utility: On the origins of protoconversation and (pre)verbal learning by altercentric participation" emphasized that language uses brains that are predisposed for social activity. Human brains exploit altercentric mirroring: babies develop so that brains come to represent both 'self' and, crucially, significant others. Drawing on these resources, infants engage closely with both caregivers and – by extension – cultural patterns in their activity. Much learning arises as we co-author behavior and, as a result, allow language dynamics to alter the social brain. In parallel, P. Linell's presentation "Dialogical language and dialogical minds" stressed our neural capacities for, among other things, monitoring and controlling the events that constitute dialogue. In discussion, Ross confirmed such views by reporting hyper-scanning techniques that show neural activity to differ radically between persons who are and are not alone. In short, while humming with language, the social brain is also connected with its body's world. A. Cangelosi ("The evolution and grounding of language in multi-agent and robotic systems") reports,

for example, research showing verbs and nouns to be associated with neural excitation in sensorimotor and sensory areas respectively. While brains enable us to talk, similar dynamics function beyond the skin. The role of real-time co-ordination is emphasized by P. Thibault ("Language, anticipatory dynamics, and the distributed nature of activity and meaning making") who, turning to micro-events, shows how verbal language is no more than an aspect of integrated multimodal 'utterance-activity' (cf. Cowley, 2004). Using a video of children discussing aliens, he shows how a boy's meaning-making draws on both event-regularities and environmental affordances. Activity is distributed across the different time-scales needed for facial expressions, verbal activity and hair-touching. Specifically, he explored how meaning-making emerges as one boy pulls a friend's ear while saying that an alien 'would look like this'. In Thibault's terms, it depends on 'anticipatory dynamics' and illustrates that talk is 'value laden'. Since meaning-making is intrinsically interindividual, Thibault suggests that many of its functions depend on full-bodied micro-dynamics. They ensure that utterances "implicate perspectives" or, in other terms, prompt us to integrate activity in both the lived present and across eco-social timescales. His micro-investigations prompted consensus: in a distributed approach to language, the multimodal grounding of language transforms bodily resources. Many issues in the language sciences may depend on how activity is simultaneously organized at the brain's pico-scale, that of micro-movements and, of course, those of actions, interindividual events and social practices. Equally, it depends on how, using co-ordination and experience, we seek to produce what we anticipate.

No-one who has focused on the real-time coupling of both animal and artificial agents will be surprised that dialogue is grounded in co-ordination. As B. Hodges ("Good prospects: ecological and social perspectives on talking together") stressed, this fits the Gibsonian view that language arises from making "efforts after meaning and value". Language cannot be based on forms or functions precisely because, in his terms, creativity depends on how we strive after values. Insofar as language is like a 'sensory system' our understanding is necessarily coupled with action. One person's response is also a way of anticipating how another may go on. In short, if real-time coupling is part of what makes us human, it is especially striking that this same feature is central to simulations by Cangelosi's adaptive grounded agents. It may well be the case, therefore, that the ontogenetic grounding of language depends on human capacities for fine interindividual co-ordination.

Language cannot be identified with integrated multimodal events. Indeed, while distributed cognition (or 'extended mind') has much to say about the coupling emphasized above, this is only part of the story. Indeed, M. Wheeler ("Continuity in question: linguistic competence and the extended mind") stresses that any theorist faces an even harder challenge. Especially when we 'think to ourselves', language is strangely 'decoupled'. For Wheeler, therefore, it is crucial to establish if there is any sense in which language transforms the brains modes of computation and/or representation (Dennett, 1991; Clark, 1997; Wheeler 2004). In his view, the evidence suggests that language *does* impact on how

brains compute and represent the world. Above and beyond use of first-order language, we also silently rehearse ‘off-line’ performances which, Wheeler suggests, tend to elude biological and ecological models. In L. Vygotsky’s metaphor, language ‘goes underground’. But what does this mean? Are word-forms (or grammar) internalized? Might a person install a virtual system for private thinking? All agree that, in principle, a distributed view of language can be used to ask how brains come to give us these powers. Indeed, a similar conviction informs D. Ross’s challenge to the conference (“*Homo sapiens* as ecologically special: what does language contribute?”). Without language, he suggests, we could never develop the virtual ‘selves’ that both contrast with animal personalities and, strangely, dominate our lives. How, then, did we develop brains that enable us – encultured selves – to partition the world? Somehow, language transforms our original nature. Emphasis also falls on the transformational effects of language in R. Menary’s work (“Why we are special: writing as thinking”). Turning away from first-order events, he considers the role of second-order cultural constructs or written signs. Arguing that using such artifacts changes human agency, he stresses that texts – not just real-time activity – may impact on cultural evolution. While used as tools in unloading cognitive work onto the world, written signs also prompt action that is independent of their physical properties. Given how these confer ‘slow dynamics’ on human cognition, we draw two tentative conclusions. First, it is precisely because of the salience of more ‘static’ aspects of language that so many have been tempted by what P. Linell (2005) calls the ‘written language bias of linguistics’. In distributed terms, however, the relevant phenomena do not justify the internalist’s view of language as a system constituted by (largely determinate) word-based units. Second, these slow phenomena present a problem for the distributed view. While not justifying the reification of a language-system, we need explain how first-order events eventually enable agents to exploit the slow dynamics of reading, writing and silent rehearsal.

While many draw on biological models, the grounding issue is addressed most directly by A. Cangelosi and A. Kravchenko (“Essential properties of language, or why language is not a (digital) code”). Using autopoiesis, Kravchenko stresses that language cannot be code-like. Far from being denotational, it arises from ontogenetic structural coupling which results in the gradual establishment of a consensual domain. On this biological view, therefore, behavior emerges from a structural matching between a dynamic system or organism and its medium or environment. Indeed, it is biology that enables neural systems to draw on language-saturated interactions with the environment.

Logically, therefore, we should not expect specific moments of neuronal activity (‘representations’) co-vary with culturally defined word-based units. In broad terms, this model was acceptable to all. Not only does biology matter but it is correct to see humans as adaptive grounded agents. In discussion, however, its explanatory power was seen insufficient to deal with distinctly human aspects of language. First, it does not clarify how human agency develops, or, in Ross’s terms, how we alone came to use digital signals in partitioning the environment. This, of course, is closely related to

Wheeler's worries about silent thinking. It is precisely when we develop selves that partition the environment that we make use of the silent rehearsal of 'thoughts'. How is this to be resolved? One option is presented by Ph.Carr ("Internalism, externalism and coding"). He suggested combining a distributed view of cognition with 'weak internalism'. While accepting that human signaling is the only possible basis for language (which spreads beyond the body), Carr avoids appeal to embodiment or virtual agents. Instead, while not taking a code-view, he proposes that individual members of a community develop systems that connect speech sounds with concepts. While a minority view (in this setting), the decoupling problem could be solved, in principle, if one could show how physically grounded representations could map onto physically grounded concepts. This, moreover, is consistent with work reported by Cangelosi.

In this tradition, agents are designed in ways intended to resolve the 'symbol-grounding' problem (Harnad, 1991). In short, using weak internalist models, artificial agents are designed to build up representational states by linking features of the world to an agent's sensorimotor system. Where, then, is the catch? Technical issues aside, we once again face the same problems. There is no evidence that this approach can either produce agents who use signals that are separate from their own world-based perception or ones that serve to condense their own cognitive categories. As yet, artificial agents cannot, in Ross's terms, create their own meaning spaces.

### **New directions in the language sciences**

It might be objected we have merely shown that a broad model of mind – one where mental powers are extended by exploiting external resources – maps onto a broad view of language. How, then, can we develop a scientific programme to investigate both the nature of first-order language and its transformatory powers? While currently schematic, Ross proposed research based on a simple claim – *there are no such things as pure linguistic data*. If this is taken as axiomatic, our primary descriptive goal is to examine how first-order dynamics are organized, as a first approximation, in evolutionary, historical, developmental, real-time, and pico (or high-level neural) timescales. This, it is to be hoped, can open up the way for explanatory modeling. Interactions between adjacent timescales can be simulated, results tested and, once analyzed, used to develop new hypotheses concerning invariant patterns – gauge regularities – that may (or may not) occur across time domains.

The synthetic methods described by Cangelosi might thus be used to test hypotheses based on a range of issues. Instead of focusing exclusively on questions based on the slow dynamics of culture, we might also model events in faster time scales. The question of 'symbol grounding' would thus come to concern how first-order language can gradually nudge agents towards using what *others* identify as symbols. At the moment, however, we stress that we know neither what kinds of artificial agents would be most appropriate nor whether the program is possible at all. While this has parallels with

cognitive developmental robotics, the emphasis would fall – not on how we manipulate second order cultural constructs –but on how we come to *believe* in words and related patterns. Not only does this parallel work on how babies learn to talk (see, Thibault, 2000; Cowley & Spurrett, 2003; Spurrett & Cowley, 2004; Cowley, 2004) but, with variations, bonobos and parrots make progress in communicating with us when motivated to act in line with such beliefs. To succeed, therefore, the programme must be based in descriptions and simulations of how social events arise from integrated multimodal activity that uses multiple time-scales. Finally, given the importance of cognitive dynamics, the distributed view of language needs a well-defined contact space with the humanities. Dynamical models require detailed descriptions of how acting subjects are constrained by the social and historical context. In short, while language is complex social behavior, we need descriptions of why subjects come to differ from other human (and non-human) signaling agents as they partition the world, develop complex institutions, virtual selves, and weird beliefs. We need to grasp why experience gradually convinces us that the most readily repeated aspects of our signaling – syllabic patterns – constitute the core of a language-system.

### **Ontological issues**

Many linguists assume that we have a language faculty: somehow, brains represent word-forms ‘in the head’. Indeed, many refuse to question the folk view that talk and texts depend on verbal systems and their use. Traditionally, therefore, ontological issues have been subordinated to epistemological ones. From the distributed perspective, of course, it is stressed that the brain is very unlikely to exploit ‘quasi-linguistic’ representations. While the positive argument needs development, all concur with Love (“Language and the digital code”) that it is mistaken to identify language with *any* kind of code. On the contrary, if word-forms are second order cultural constructs (based in a history of writing), first-order language is enacted in the multi-scale dynamics of human activity. Our main concerns are with biocultural events. While *Schwerpunkter* remain concerning how to conceptualize language and representations, theory begins with first order linguistic experience. Code models, therefore, derive not from how language is integrated with brains and behavior, but from a cultural tradition that privileges monologue and uses written texts to define linguistic units. Strikingly, even those with ‘weak internalist’ views concur that, as signaling, language is physically grounded. In linguistics, this marks a break: we reject Saussure’s view that ‘phonic substance’ has no part in the language sciences.

Language is based in physical events whereby social brains prompt real-time co-ordination: this, however, does not result from the use of words, phonological units or meanings. While all were willing to accept some version of this view, not all follow Love in regarding language as a physically grounded process. Some hear this as coming close to a nominalist view that, perversely, seems to deny

that even experience gives rise to functioning representations. Second, all accepted the need to meet Ross' challenge. Not only does language, somehow, constrain the cognitive processes that enable us to 'partition the world' but, somehow, the distributed approach must explain how such abilities derive from embodied action. It is all very well to reject dualism, eliminativism and supervenience but, to show the power of the distributed view, we need to explain how language enables us to condense and separate what it is that we experience through our embodiment. We need to explain, as Hodges put it, how we 'use language as a perceptual mode that invites the world to respond.' While we have sketches of how infants become agents that exploit digital signals (in Ross's sense), we cannot yet account for how this capacity emerged in pre-history. Somehow, humans broke with the causal closure of biological systems by developing strategic uses of cultural and linguistic patterns. Even if language is based in physical events that allow social brains to co-ordinate our activities in real-time, we need to explain both how our selves decouple from activity and, in so doing, become capable of silent rehearsal.

It is striking that the parallel challenges recur. While Cangelosi appeals for more realistic approaches to how language enables us to separate and condense categories, Carr emphasises decoupled phonetic categories and Wheeler stresses silent rehearsal. Although providing no solutions, this seems to suggest that we need to explore the transformational power of language. First, for Menary, as collective practices develop around our use of written marks, they become more 'theoretical' (Donald, 1991). Second, Linell noted, since practices involving written signs impact deeply on neural processing, the same logic probably applies to first-order language activity. Rather than ask whether language transforms the computational and/or representational powers of the brain, we might consider how neural systems draw on interactions in giving rise to human agency. On such a view, silent rehearsal would be – not internalized language – but a consequence of integrating first-order activity with embodied aspects of self. In Hodges' terms, the mutually regulating functions of co-ordination might serve to ensure that individuals gained from using silent rehearsal to evaluate 'thoughts'. Not only does this fit with viewing language as extending primate powers but it fits with species specific aspects of development. Indeed, it may be by striving to fit the perceived standards of a community that first-order language retools individuals who come to create their own affordances. Rather than needing *shared* phonetic and conceptual structures, *pace* Carr, it may be sufficient to adopt this belief. Be that as it may, there are main two outcomes: participants rejected use of the code metaphor in relation to language and, equally, highlighted the power of linguistic signals to partition the world. Work can thus proceed on the basis of the Ross premise: 'There are no pure linguistic data'. Rather, language is part of first-order activity and experience and, to pursue this view, we are able to use the methodological resources developed in modeling causal processes. With this in mind, the next DLG conference will be used in developing axioms that give shape to the models that we believe are needed to reinvigorate the language sciences.

## Glossary

1. *Internalism*: The view that cognitive processes, by definition, occur within the skin. On a weak internalist view, a focus on (exclusively) inner cognitive processes is mitigated by claiming that these depend – not only on natural selection (and inherent physical constraints) – but some kind of internalization.
2. *Externalism*: The view that aspects of the environment determine, at least, the content of cognitive processes.
3. *Distributed cognition*: The view that knowing and coming to know do not depend exclusively on events within the skin. Rather these activities are inseparable from acting in relation to perceived aspects of an environment.
4. *Distributed language*: Far from being a homogeneous inner code, language describes a heterogeneous set of artifacts (e.g. road signs, books, computer programs) and practices (e.g. talking to dogs, children and parliamentary debates). These enable us to exploit behavioural modalities in ways allowing the attribution of semiotic values.
5. *Extended mind*: The view that mind is not contained in the body, and mental states are not solely determined by states of the brain. External factors play a significant role in determining mental states as a result of the coupling between the environment and the organism; this coupled system is one in which brain, body, and world move in and out of reciprocal causal relations.
6. *Integrational linguistics*: An approach to language that takes it as axiomatic that the semiotic value of a sign is not given in advance but emerges as a function of integrating activities (and in experiential time).
7. *Language dynamics*: Processes of using and interpreting language as a person engages with the environment. These depend on the causal processes that constitute cognitive dynamics which occur in and across several time domains (e.g. evolution, history, development, relationships, experiential time, various micro-domains).
8. *Anticipatory dynamics*: Processes of constructing anticipative models of the organism-environment interactions which provide a basis for flexible goal-directed behavior.
9. *First-order linguistic activity*. Doing what you talk about when you talk about language (i.e. engage in second order activity). Thus, by extension, first order activity is ‘doing what you talk about when you talk about action and perception’ (having both a neural and behavioural aspect).
10. *Second-order cultural constructs*: Entities that result from talk about activity. Centrally, these include the second order linguistic constructs that are invoked in discussion of first-order linguistic activity (words, phrases, sentences, meanings, phonological units and so on).

11. *External symbol grounding*: the problem of understanding (or modeling) how agents become able to exploit what other people treat as second order linguistic constructs. (Note that, to become human-like, the agent must also come to treat its own behaviour as depending on these constructs).

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