Embracing connectedness and change
A complex dynamic systems perspective
for applied linguistic research

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Complex dynamic systems (CDS) theory offers a powerful metaphorical model of applied linguistic processes, allowing holistic descriptions of situated phenomena, and addressing the connectedness and change that often characterise issues in our field. A recent study of Kenyan conflict transformation illustrates application of a CDS perspective. Key CDS concepts and tools for thinking are described. I argue that the CDS perspective can, and should, include an inherent ethical/moral dimension that applies to every choice made by researcher and participants. Adding the ecological notion of ‘affordances’ allows the CDS metaphor to better address human creativity. Methodological principles for a CDS perspective are described. The author’s Discourse Dynamics model is presented for further development and research.

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World is crazier and more of it than we think,
Incorrigibly plural. I peel and portion
A tangerine and spit the pips and feel
The drunkenness of things being various.
from ‘Snow’ by Louis MacNeice (1935)

Research visit to Maralal, northern Rift Valley, Kenya, March 2012

We were sitting in the café of the guest house in Maralal town, discussing what we’d seen that day, and trying to make sense of the peace-building activity we had observed in this context of inter-tribal conflict. My companion was the director
of a UK NGO, collaborating with me on the ESRC-funded research project.¹ Our
task in the cafe that evening was to draw on our individual backgrounds in applied
linguistics and peace/development studies, and find ways to describe what we’d
seen and heard in terms of empathy dynamics.² Back in the UK, I had constructed
a model of empathy in dialogue and interaction, and we had come to Kenya to
find out whether the model would prove adequate and useful in this very different
context.

Before sharing the model and its theoretical basis, I present two stories we
had heard that day to exemplify the creativity — messy, ad hoc and successful —
with which conflict between pastoralist tribes was being addressed by local peace-
builders.

That morning we had sat on the veranda of the Peace School dormitory at the
top of the Rift Valley and recorded a young man telling how his father had been
killed in a shooting by someone from another tribe. And how he had decided,
not to take revenge, as had been happening with increasing violence over the last
five years, but to go down into the valley to where this other community lived (in
considerable poverty) and to work there as a teacher. When I had asked if he felt
afraid going down there, he had described how his Christian faith gave him the
strength to do it. After a few months working in the village, he had gained the trust
of the community and now brought some of the children up here to be educated
alongside children from the other tribe, sleeping together during the week in the
dormitory that had been paid for by development aid and built as part of the con-

The Peace School was managed by a ‘Peace Committee’ of representatives
from each tribe, set up by Evans Onyiego, who leads the Diocese of Maralal Peace
Building Team, and who acted as our guide and interpreter. Onyiego told us about
the ‘early warning network’ of people with mobile phones in communities across
the vast area of Maralal diocese. If they heard of planned attacks, they would phone
him and the team would take action. Sometimes this involved going out and talk-
ing with armed men gathered in groups as many as 600 strong, trying to persuade
them that they had alternatives to shooting and killing. Once, when Evans had

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and its then Director, Simon Weatherbed. <www.respond.org>

². The outcome can be seen in Cameron, Weatherbed & Onyiego (2013).
been sitting like this with a group late at night in the bush, they heard hyenas howling through the darkness. Hyenas in eastern Africa are both feared and despised as hunters and scavengers that will eat even rotting animals. Evans had directed the young men’s attention to the howling. “The hyenas are hungry. Do you want to be meat for the hyenas?” That night, the peace-building team’s intervention had been successful, and the men with guns had dispersed without attacking.³

These brief examples indicate the multi-faceted nature of the peace-building interventions: working to involve individuals and larger groups; drawing on historical, religious, and cultural resources to frame and re-frame actions in the conflict; long and short term interventions; making creative use of dialogue, story, non-verbal action, and social interaction.

What we had collected as data from the research visit was ‘noisy’ in the extreme. Consisting of interviews in which people were asked to tell their stories relating to the conflict and its transformation, it involved strong emotions and subjectivities, cross-linguistic issues, and cross-cultural sensitivities. Ethically, it was very complicated, raising issues way beyond the (very thorough) research ethics requirements of the university. And yet the peace-building interventions and their impact seemed to us to be ground-breaking and potentially of wider importance. If we could abstract and theorise from the Maralal experience, it might contribute to implementing conflict transformation in other places. The recordings would later be transcribed and analysed with narrative analysis and metaphor analysis, but that night in the café we wanted a more global description that would allow us to bring together the range of different interventions, and explain their outcomes in terms of changing dynamics of empathy. In other words, we needed a theorized description that condensed the data.⁴

Such tasks have come to characterise my applied linguistic research projects over the years. ‘Applied linguistics’ has taken on an expanded sense that I describe as: investigating discourse-related activities of a situation in order to describe and explain its dynamics, with the goal of contributing to human and social well-being. As discussed further below, such projects are an ethical enterprise from the start, with the researcher accepting Bakhtin’s contention that “a moral responsibility pertains to every moment” (Morson & Emerson 1992: 26).

That evening in the café, we explored the potential of the complex dynamic systems metaphor for describing the conflict situation and the peace-building


⁴ We were very aware of the neo-colonialist dangers of two English people ‘making sense’ of the activity of Kenyan people. Kenyan colleagues were involved in interpretation of data. ‘Trustworthiness’ rather than ‘reliability’ is the guide.
interventions. Like a complex dynamic system, the Maralal situation had many different people and influences connecting in complicated ways that kept on changing. While intensely local, the situation was affected by multiple influences from outside Maralal, including national and global politics, the availability of weapons from conflicts in Sudan and Somalia, and the forces of international development/aid. We needed both to understand the changing situation as a whole, and to understand how particular dialogues and interactions made a difference to that whole. Seeing the situation from a complex dynamic systems perspective helped to describe how the interventions of the peace-building team were making a difference, while avoiding simplistic cause-effect explanations.

The next section of this paper goes into more detail about complex dynamic systems theory in order to explicate its usefulness, and its limits, when used as the source domain of a metaphorical model. The Kenya data is drawn on to illustrate application. I then discuss the ethical/moral dimension of the CDS perspective. The limitations of the complexity metaphor suggest the addition of ‘affordances’ to more adequately describe human creativity. After some brief considerations about prediction and methodology, the final section presents what I call the ‘discourse dynamics model’, developed through various projects, which is offered as a tool for further work.

**Complex dynamic systems: A metaphorical model for applied linguistic research**

*Connectedness and change at the heart of the metaphorical model*

Complex systems theory, combined with aspects of dynamical systems theory, (hereafter ‘complex dynamic systems’ or CDS) provides a robust supra-theory, i.e. having principles that apply across many different types of systems and situations. As such, it has become the basis for the discourse dynamic approach I have developed in my applied linguistic work. Central to complex dynamic systems are notions of *connectedness* and *change*:

- every aspect of a situation that we investigate and theorise is connected to other aspects of the situation;
- many, if not all, aspects of the situation are in flux, always changing, i.e. dynamic;
- the connections between aspects of the situation are themselves dynamic.

From first reading about chaos, complexity, and dynamic systems back in the early 1990s, when the ideas from maths, physics and biology began to be popularised
in texts for non-specialists (e.g. Cohen & Stewart 1994; Kaufmann 1995), I found resonances with my applied linguistics work, which was at that time concerned with children and their learning in classrooms. What was particularly exciting was the commitment in CDS theories to deal with all that was happening, in contrast to many applications of linguistic theories which too often required dividing and reducing the phenomena under consideration — separating the social from the individual or grammar from meaning, for example. In our 2008 book (Larsen-Freeman & Cameron 2008a), Diane Larsen-Freeman and I developed CDS ideas for applied linguistics, teasing out how they relate to language and discourse, to language learning and teaching, and identifying implications for researching within a CDS paradigm. This article takes forward the thinking about discourse-related phenomena found in that publication.

For me, complex dynamic systems has always offered a metaphorical model for applied linguistics contexts rather than a strict mathematical model. Our concern is with human systems, in contrast to physical and biological systems, and these are only reducible to mathematical equations by simplifications that drastically reduce their validity (Vickers 1983). As what Black calls a “theoretical model”, complex dynamic systems provide a “powerful and irreplaceable metaphor” (Black 1962: 228, 238), a mapping between the target domain of the applied linguistic phenomena and processes under investigation and the source domain of complex dynamic systems that enables us to understand in “powerful and irreplaceable” ways. However, as Black pointed out, to develop a metaphorical model requires a good knowledge of the source domain, i.e. of complex dynamic systems. This is a real limit on its potential since the mathematics involved is very difficult, and most of those working in other disciplines need to rely on simplified explanations and start from popularising texts. It is important that applied linguists who want to employ a complex dynamic systems approach don’t stop there but familiarise themselves to a reasonable level with complexity theory and dynamic systems theory, and/or collaborate with researchers from other disciplines who can bring more technical knowledge.

5. It is possible to build mathematical models of applied linguistic systems, and I have done so for second language vocabulary learning (Knudsen & Cameron 2000). The experience convinced me to take the metaphorical model route.

6. An interesting dynamic has been noted in the history of science, and in the particular case of complexity used as a theoretical model (Baake 2003). As more people take up complexity ideas to use them in new fields, so the ideas gradually become simplified and terms take on slightly broader meanings.
**Complex dynamic systems: A summary of key-concepts**

**System**
A system is a set of connected elements or components that together form some kind of whole. In applied linguistics we often work with situated practices and processes that we regard as integrated wholes, trying to understand how they come about: language learning processes; professional discourse practices; and, in my project, conflict transformation through dialogue and interaction. Each of these can be seen in terms of systems.7

**Elements and agents in a system**

‘Elements’ is the most general term for the individual components of a system. ‘Agents’ are elements with some agency. All properties of elements and agents are relevant: both inherent and structural. Back in the café in Maralal, we wanted to understand the conflict transformation and peace-building from a systems perspective, and thus needed to understand the actors or agents in the system and the different ways in which they related. In the system of Maralal conflict transformation, human agents included people living in villages, politicians locally and in central government, people from the church. Other elements in the system included the climate/weather, the cattle that are the main source of livelihood, the land, education, religious faiths, historical incidents, stories told about these incidents, and, very importantly, the weapons that had changed traditional cattle raiding practices into vicious cycles of attack and revenge.

Parts of a system may themselves be systems. In Kenya, the peace-building team, the catholic church in the area, and each of the communities/tribes in conflict are elements in the system of conflict transformation and are themselves (sub-) systems.

In the complex dynamic systems literature, groupings of elements with a collective structure and organization are sometimes referred to as ‘levels’ of the larger system. In both my metaphor and empathy models, I use the term ‘levels’ slightly differently (see below).

**Open systems**

‘Closed’ systems are separate from their environment. ‘Open’ systems, on the other hand, connect out into their environment and can be affected by forces coming in. In the Kenya conflict transformation, there are connections that extend back into history (e.g. the placing of political borders across traditional grazing lands),

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7. Linguistic phenomena such as conversations, and their parts such as adjacency pairs, texts, genres, grammars can also be seen as complex dynamic systems.
and out across the world (e.g. the impact of development aid and agencies on local activity). A closed system — like the central heating system in a house — is much easier to model and investigate than much less predictable open systems.

**Dynamic**
A system is said to be ‘dynamic’ when its elements are not fixed and static, but change over time: people get older, have experiences, develop memories; climates go through cycles of warming and cooling.

**Timescales of activity**
Dynamicity brings attention to the timescales on which a system functions. In processes of conflict transformation, a single conversation that lasts only minutes could initiate huge changes in behaviour, as when the tribal elders reached an agreement to ‘stop shooting on sight’. This small but powerful agreement allowed for further, longer scale, conflict transformation interventions. The young men who look after the cattle devised a particular arm movement to use as a peace signal when they met armed men from other communities walking in the bush. The signal showed that they were party to the agreement and that no harm was intended. The formal agreement thus impacted on the automatic responses of individuals meeting each other, and on what became possible once shooting had stopped and people were able to talk together. On a much longer, historical, timescale, stories of tribal rivalries that go back hundreds of years could contribute to new violent incidents.

It is important to note that the timescales that matter in a system are not predetermined but come out of the nature of the interacting agents and elements: the timescale of minutes that fits conversations and other dialogue events are an outcome of how our human bodies, brains and minds work in the world.

**Complexity**
A dynamic system is said to be ‘complex’ if its elements, and the relations between them, are of many different types, and if the relations between elements change over time. To illustrate this, consider just two aspects of the Maralal conflict transformation context: climate/weather and a community of pastoralists who graze cattle for their livelihoods. The ‘relation’ between them is how weather elements such as rainfall and temperature affect living conditions and, in particular, affect the grazing available for cattle. This relation between weather and community changes from one year or season to the next; climate change is noticeable on a longer timescale. In a good year, cattle produce meat and milk, can be sold or exchanged for goods, and add to the wealth and standing of families and community. However, when, as in 2008, there is drought in the region, the opportunities of the
open system allow a community to take its cattle to graze outside of their own area, which can then provoke arguments with other communities and possibly violence.

**Non-linearity**
Changing relations between elements in a system produce non-linearity, i.e. system changes that are not straightforwardly explained as a cause producing a linear effect. When a researcher tries to identify causal patterns within a system, such as tracing the impact of a particular intervention by peace-builders, non-linearity disallows simple explanations and requires examination of all interacting elements.

**Patterns of change in complex dynamic and applied linguistic systems**
Thus far, I have described the basic characteristics of complex dynamic systems. The power of the metaphorical model, however, comes from mapping typical patterns of activity in complex dynamic systems on to applied linguistic processes and practices. These are now described.

**Types of change in complex dynamic systems**
Recall that the elements of a complex dynamic system can change, and also the relations between them, i.e. the ways in which they connect, can change. In the systems we are concerned with, this change is mostly continuous rather than discrete. Continuous change can be gradual, as in the growth of a tree or the development of foreign language vocabulary, and it can also be sudden and dramatic, leading a system to shift into new patterns of activity. The agreement in Kenya to ‘stop shooting on sight’ and the shooting of the young man’s father are examples of perturbations that suddenly shifted the conflict transformation system into new patterns of activity. We see below how these patterns can be described in more detail.

**Sensitivity to initial conditions**
The interconnectedness of large numbers of heterogeneous elements in a complex dynamic system means that small changes in individual elements can make a big difference to the system, as changes are amplified through the multiple connections. As a key aspect of the contingency of complex dynamic systems, this sensitivity implies the need for detailed understanding of how the system is at the moment when activity starts, called the ‘initial conditions’ of the system. Any factor, however small at the start, may be enhanced as the system changes, and may produce large effects (commonly illustrated as the flapping of a butterfly’s wings leading to a hurricane on the other side of the world).
We can note that sensitivity to initial conditions problematizes ideas of ‘repetition’, ‘imitation’, and ‘remembering’. No instance of production can ever be repeated because initial conditions have changed as a result of the first instance. This in turn highlights the ‘event-ness’ of the phenomena we are investigating — each discourse event is a one-off.

**Adaptation, self-organisation, emergence**

New patterns of activity produced in the system after such a perturbation are said to have ‘emerged’ or to ‘be emergent’. New lexical items, such as ‘selfie’ to refer to a photo of oneself taken by holding a phone at arm’s length, emerge into the language. Some will be longer lasting than others, becoming common usage and even dictionary entries (Larsen-Freeman & Cameron 2008b). Items are not simply linguistic — in the ‘selfie’ example, technological and economic changes brought about the availability of phones with cameras and social media to post pictures on, while social changes influence what we choose to reveal about ourselves and how widely.

If the system change is not the result of an intervention from outside but rather changes internally until it reaches a critical point, the system is said to ‘self-organise’ into the new patterns or regularities in activity. This idea was popularised by Gladwell as the reaching of a ‘tipping point’ (Gladwell 2000). In a similar vein, conflict transformation theory talks of ‘ripeness’ for peace, as communities reach a critical point when they want to halt on-going conflict.

Change can also come about through adaptation, when one system is affected by another, as happens in ecological systems and in human systems. In classrooms, student behaviour adapts, through interaction, to the expectations and practices of their teacher. Teacher sanctions and encouragement are meanwhile adapting to student behaviour.

**The state of a system**

At any particular point in time, the elements of a system are in a certain relation with each other. This is said to be the ‘state of the system’ at that point in time. (Note that, somewhat paradoxically, the term ‘state’ describes dynamics).

**The state space of a system as a landscape of possibilities**

Because of its complexity, a system at a particular point in time has multiple possible states that it might occupy at subsequent time points. The state space of the system is the collection of all these possible states, its ‘landscape of possibilities’ — a particularly powerful idea to apply metaphorically.
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The evolving system as a trajectory through the system’s state space
The system does not occupy this full landscape but moves from point to point as its state changes, leaving behind it a path or trajectory. The system trajectory is its trace across its state space, its history.

We can understand a system by considering its trajectory and unpacking the dynamics of change.

Attractors in the state space
Attractors are particular self-organised patterns of activity, modes of behavior that are ‘favoured’ or preferred states of the system. Attractors can be more or less difficult for the system to move on from, i.e. they have varying degrees of dynamic stability. For example, a cycle of attack and revenge in Maralal became a dangerous and deep (i.e. stable) attractor for rival communities armed with guns. The peace-building team tried to avoid or replace this attractor by helping people envision alternative developmental attractors in which improvements in health care, education, food security etc. would help peace replace conflict and reduce gun use.

Discussing attractors in a dynamic systems view of child development, Thelen and Smith (1994) make the very important point that highly stable attractors, i.e. patterns of activity that the system is extremely likely to return to, can appear to be inevitable or ‘hard wired’ but may not actually be so. Under different conditions, components of a system may assemble into quite different modes (1994: 60). Self-organisation is not inevitable, but depends on conditions and how components interact with those conditions.

Soft assembly
The CDS opposite to ‘hard-wired’ is ‘soft assembly’. Soft assembly occurs when components in a system interact in flexible ways to move the system into a particular state. System soft-assembly is a powerful idea that can apply metaphorically to various human mental actions, including spontaneous production in dialogue, and perspective-taking in doing empathy.

Downward causation, feedback and feed forward loops
I claimed above that a CDS approach avoids simplistic and linear cause-effect explanations of behavior. Instead it draws attention to emergent behaviours that cannot be explained by considering the elements involved (the whole is greater than the sum of its parts). Furthermore, what emerges or self-organises into more

8. Readers are urged to be on the alert for metaphors and personifications that suggest a system has a will of its own (and thereby making ‘self-organising’ sound threatening). ‘Favoured / preferred’ refers to probability and to forces that can influence what happens in a system.
global patterns can then affect what happens at ‘lower’ levels or timescales in the system. The impact of the agreement to stop shooting on sight discussed above is an example of this downward causation. Applied linguistic examples include the wash-back effect of exams on classroom practice, the impacts of language standardisation and regulation, and the emergence of “conceptual pacts” in dialogue (Brennan & Clark 1996).

**Complex dynamic systems: Summary**

This section has described key ideas that complex dynamic systems offers for metaphorically conceptualising and theorising applied linguistic phenomena or issues. I suggest this CDS perspective offers powerful ways of understanding that are disallowed in more traditional structural or cognitive perspectives. The foregrounding of connectedness and change in a complex dynamic systems approach has the potential to radically alter almost every aspect of thinking and of doing research.

Complex dynamic systems contributes to an integrative theoretical model in which phenomena or issues can be considered in all their complexity, as at once linguistic, social, cognitive, and affective emotions. By not needing to reduce these to separate systems, it offers more valid and more sophisticated approaches to causality. A complex dynamic systems approach also has the benefit of being compatible with important earlier theoretical work that attended to the dynamics of language use, including Bakhtin and Vygotsky (see Cameron 2003 for detailed explanation).

**Ethics, moral responsibilities, and complex dynamic systems**

When I have presented ideas about complex dynamic systems to applied linguists at conferences, I have sometimes encountered negative reactions to some of the constructs and terminology. Some people find the very idea of systems thinking inimical to humanitarian positions, appearing as it does to reduce human activity to something pre-determined and mechanistic. I want to emphasise that this is not the case. Rather, ethical and moral issues should be continuously active, influencing researcher decisions, analysis and interpretation of participants’ activity and language collected as data. In this section I show how Bakhtin’s ideas about moral

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9. The depth metaphor is used to envisage the different timescales or levels of a system as stacked one above the other, with the shortest or smallest at the bottom. Hence, the effect of a social change on individuals becomes ‘downward.’ The backward-forward metaphor describes the same phenomenon, but with time moving horizontally rather than vertically.
choices and Haidt’s more recent work on moral reasoning can provide an ethical or moral dimension\textsuperscript{10} for a complex dynamic systems approach.

Bakhtin declared a strong mistrust of systems, but in doing so was referring to closed, linear systems. Morson and Emerson, who explicate his work, suggest that he would have found chaos and complexity theory very relevant (1992: 33). The systems he opposed included a Kantian code of ethics that would dictate ethical choices for every situation. He objected because such a hierarchical imposition would exclude the particular, the human, the specific and individual instance (ibid). Rather, he insisted, “moral responsibility pertains to every moment of life” (ibid: 26). Every choice, however small, that a person makes has a moral dimension, and it follows that “if ethics is real and located fundamentally in particular situations, then real work is always required” (ibid, p. 26). Such a view, with its focus on the particular and specific, fits well in a complex dynamic systems perspective. Moral and ethical concerns apply to every interaction and relationship within the system, across individuals and groups, including researchers’ interactions with participants, and participants’ interactions with each other (see also Kress this issue).

Bakhtin complemented his view of ethics as individual moral responsibility with his notion of ‘creative understanding’ (Bakhtin 1981; Valentino 2005). By this he meant the act of imagining how it is to be another person, a process that seems to overlap with perspective-taking or ‘controlled empathy’ in current views of empathy (Cameron 2013). Only through standing outside the situation of another person and engaging in creative understanding can we do the ‘real work’ of ethics. Empathy, ethics, and moral responsibility are tightly interconnected.

\textit{Ethics, moral responsibility and the system being researched}

We can add a moral/ethical dimension to the complex dynamic systems model, assisted by Haidt’s work on the timescales of moral reasoning (2007). In this model, moral/ethical choices are assumed to be dynamic, everywhere active and relevant, even if agents are unaware of them. When describing and analysing a complex dynamic system, we can examine how patterns of behavior suggest or are underpinned by moral/ethical activity. Actions may be influenced by established (and, in CDS terms, emergent) ethical codes, such as those accepted as part of a religious or other affiliation. We may find evidence of “moral intuitions” (Haidt 2007), which are instant moral judgments made by people in the moment, and of more thoughtful and controlled “moral reasoning” (ibid), which happens on a slightly

\textsuperscript{10} The terms ‘moral’ and ‘ethical’ often overlap but ‘moral’ is more often applied at the individual level and ‘ethical’ to some codified formulation of principles at a social level.
longer timescale (as per Bakhtin’s creative understanding). Moral/ethical activity is an open, rather than closed, sub-system, and influenced by external forces, of which the media would be an obvious example (Pelosi et al. 2014).

In the conflict transformation system we were researching in Kenya, a range of moral justifications for conflict could be heard — tribal loyalty, adhering to expected behavior, revenging a death. The peace-builders were motivated by their (catholic) Christian ethical code which places others as fellow children of God and therefore renders killing as abhorrent and forgiveness as necessary. Individual peace-builders had other moral drivers for their involvement in conflict transformation work, including repaying the community who had supported them as a child or memorialising a family member killed in conflict.

An important role for peace-builders, as in the story of the hyenas related earlier, was to temporarily ‘hold’ moral responsibility for people caught up in the immediate emotions and adrenalin of shooting and killing. By stalling automatic responses to violence, they enabled more controlled processes to happen and helped people to recall their intentions to peace and to find alternative responses. In Vygotskyan terms, the peace-builders scaffolded an interpersonal process until it could become intrapersonal.

Ethics, moral responsibility and the researcher

As researchers, we work within established institutional codes of ethics, but we also have to do the work of ethics on a moment-by-moment basis, taking moral responsibility for our choices. In addition to the responsibilities underpinned by university codes of ethics (such as considering implications of participation in research), the extreme complexity of the systems we research imposes choices in where to focus our attention, making important default moral choices in the process. In applied linguistics we are often dealing with very complex systems in continuous change with very many, and different, types of elements. Simplification, omission of some elements and relations, and restriction of our focus of concern become inevitable. The researcher has a moral responsibility, in deciding on the part of the system that will be intensively researched, to be very aware of what is cut or left out in case it later turns out to be relevant. In making claims from a study, the reduction of complexity must again be taken account of to avoid false generalisations or other errors.
Creativity in complex dynamic systems: Adding affordances

It has long been recognized that, while a good metaphor offers illumination, it remains a metaphor and can also ‘hide’ aspects of its topic as well as highlighting them (Lakoff & Johnson 1980: 10). One aspect of human systems that I have found at risk of being hidden by the complex dynamic systems metaphor is creativity. While creativity may be described as emergent or self-organising, I have found the idea of ‘affordances’ a rich addition to the theoretical apparatus.

For example, it was important in theorising the conflict transformation system to emphasise the skills with which the peace-building team took advantage of any opportunity they could, however small or apparently distant from the present situation, to shift people out of conflict, to engage with a former enemy, and enable re-humanising and empathy development. For this purpose, we drew on the ecological notion of ‘affordances’. Affordances emerge when aspects of the environment are in interaction with an agent (Gibson 1979). Affordances are a dynamic and adaptive version of the more static notions of ‘resources’ or ‘opportunities’. A particular aspect of the environment offers different affordances to different agents: for example, a tree affords timber, shelter or shade to people, whereas it affords a perch or nesting support to birds.

We identified many examples of affordances that were noticed and exploited creatively by the peace-building team for conflict transformation. For someone with different moral values or intentions, many of the affordances could have been used for escalating violence rather than peace-building.

- Development and aid money for well-digging or animal breeding was used to bring together men from the different tribes to work, eat and sleep together, re-establishing human bonds and reversing the de-humanisation of ‘the other’.
- When a local politician was hospitalised after a shooting, the team gathered children from each of the communities to visit him and plead for revenge to be avoided.
- To get buy-in to building a connecting road between opposing communities, the team worked out the different advantages to each side to use in persuading them. For one community, the road provided an opportunity to sell surplus goats; for the other, it offered a means for health care and education provision.
- The road-building provided the opportunity for a joint planning committee of elders, and for young men to work on the road, eat and sleep together.
- The oral history of the tribes provided stories of earlier conflicts resolved through an historical peace agreement, which were re-told as reminders of the possibility of peace.
This historical agreement was commemorated with a new memorial and ceremony to remind people of how bad things had been, and yet how they managed to move to peace.

Both people’s allegiance to the Catholic church and their memories of historical (non-Christian) curses on those who killed after the peace agreement were invoked to persuade people not to resort to violence.

The lack of an effective police and justice system was exploited to help establish a new local system for trying and punishing those caught stealing cattle from other communities. Important here was the discursive re-framing of the traditional view of cattle-raiding as communal to an individual act of theft.

The notion of affordances, as interactions connecting agents and context, serves as a useful addition to the complex dynamic system perspective for many of the phenomena and situations we are concerned with as applied linguists.

Prediction in a complex dynamic systems approach

Traditionally, a good theory or model not only describes and explains, but also has power to predict future behaviours. This is not the case for complex dynamic systems because of the complexity and non-linearity of the systems we deal with, because of self-organisation and emergence, and because of sensitivity to, often unknowable, initial conditions. Retro-diction, however, is possible and useful, showing how certain outcomes came to occur (Larsen-Freeman & Cameron 2008b), as is comparing trajectories across previous system activity.

Lack of predictive power is a corollary of the increased validity of a complex dynamic systems approach, to be accepted in exchange for the more subtle and detailed understanding of what kinds of evolution and change are possible.

Notes on methodology and method

The complex dynamic systems perspective or approach is described as a supra-theory. As such, it produces methodological principles, rather than ‘a method’. Both ‘perspective’ and ‘approach’ are metaphorical terms that suggest a way of seeing or coming close to the research or teaching concern, rather than the more hands-on idea of ‘method’. A supra-theory is more about deciding what constitutes that concern, and how to describe and explain it, than about how precisely to analyse data.

For applied linguistic research and teaching concerns, a complex dynamic systems perspective inevitably points our attention to interaction, to ‘language-ing’
rather than to ‘language’. That interaction leads us to identify the complex dynamic systems that are of relevance to our particular research or teaching concerns. Those systems can then be unpacked, explored, investigated, understood. The unpacking of systems may take us out into social or political issues or more deeply into cognitive or neurological issues. We enter the realm of method when appropriate tools are employed to investigate timescales of a system in detail. Such tools might encompass, for example, actor network analysis, conversation analysis, narrative analysis, psychological testing, or MRI scans.

In summary, methodological principles underlying a complex dynamic systems approach can be stated as follows:

– Start from interaction: e.g. face-to-face talk, use of text, situated discourse.
– Interpret an instance of the interaction — a literacy event, a conversation, a task — as a trajectory of a complex dynamic system.
– Unpack the elements, connections, and dynamics of the system.
– Investigate the detail with appropriate tools.
– Make every decision with moral/ethical responsibility.

A discourse dynamics model for applied linguistics phenomena

This final section presents the multi-level model of discourse dynamics that did indeed turn out to be applicable to conflict transformation in Kenya, as well as to empathy dynamics after terrorism in the UK (Cameron 2013; Cameron & Weatherbed 2014) and to metaphor in discourse and interaction (Cameron & Deignan 2006; Cameron et al. 2009; Cameron & Maslen 2010). I suggest that the model can be adapted for other applied linguistic phenomena that might benefit from being understood as dynamic, connected, context-sensitive, and contingent.

The shape of the model

We saw above that a complex dynamic system may function on several different timescales and may also include different types of social groupings as sub-systems. Social groupings and timescales are not independent in the human systems we research and, in the discourse dynamic model, the term ‘level’ incorporates both, referring to activity on a particular timescale of a particular grouping. Five levels of dialogue and interaction emerged as particularly salient.11

11. A focus on dialogue alone does not provide sufficient understanding of an applied linguistic system; interaction in a broader sense may need to be considered. For example, to under-
A decision was made to place instances of dialogue and interaction between individuals at the core of the model. This may be, but need not be, face-to-face. Out of repeated such interactions emerge patterns of behavior, including language-using behavior. This decision privileges performance as the site of change; in other words, system emerges from repeated soft-assembly, and there is no need to assume it to be hard-wired (Cameron & Deignan 2006, show how this works for metaphor).

At each level, the concern is with the dynamics of systems and sub-systems in continual flux: the flow of talk with its shifting meanings and emotions; shifts in feelings and understandings in relation to the other person; changing cultural narratives and social attitudes. Levels are connected by feedback and feed-forward loops, as the system changes, adapts, or self-organises, and as new stabilities emerge. External inputs to the system provide disruptions that spread unpredictably through the multiple, connected sub-systems, and may tip the system into a period of perturbation that eventually produce new stabilisations.

Figure 1 shows the five interacting levels (0–4) of discourse dynamics.

Figure 1. The discourse dynamics model for applied linguistic phenomena

stand how people use metaphor, it is necessary to investigate not just the metaphorically-used language but also its interactional function in context.

12. The number and specification of levels is guided by the specific research goals, and fewer or more levels could be used if appropriate.
Time is portrayed as moving from left to right in Figure 1 (black arrow), and different levels of the system operate at different scales. Sensitivity to initial conditions is emphasised by inserting a level 0 in the model, as the state of the system immediately before the event being modelled or investigated, called Point Zero. All that participants are at Point Zero and that they bring to the dialogue and interaction may impact on what develops in the dialogue. The state of the system at Point Zero potentially affects all the other levels, while other levels can feed back into the Point Zero of future events.

The local discourse dynamics take place along the timeline at the base of the diagram, as people engage in moments of dialogue and interaction (levels 1 and 2). As people interact, cognitive, affective, linguistic and moral processes are activated or inhibited. Level 1 represents activity on a timescale of milliseconds, such as automatic responses to another person or experience in, for example, returning fire or experiencing immediate emotional responses to a story.

Level 2 represents the level of minute-by-minute engagement and more controlled responses, for example, in conversation or language learning activity.

Level 3 is the level of a single discourse event. Governed by our human attention spans and physical needs, the timescale of a discourse event can be between several minutes and several hours: e.g. a task or lesson; a meeting of community elders. At level 3, we see emerging discourse patterns that arise from self-organisation or adaptation during interaction, and that feed back into the on-going dialogue. These might, for example, be systematic metaphors that become shared currency or new creative understandings of another person.

Level 4 encompasses accumulated level 3 patterns that stabilise as attractors in the system, for example as learnt vocabulary items, empathic understandings, idioms, discourse genres, or ethical codes. These operate on a longer timescale beyond an immediate event, and may, as social change, spread across communities, groups or nations, as with the signing of a peace agreement.

Emergent phenomena at level 4 are stabilised but, like everything else in the system, not permanently fixed. In a complex dynamic system, a stabilised pattern occurs with degrees of variability that contain the potential for further change. Level 4 phenomena can also feed back into level 0 of new events, influencing the initial conditions of new dialogue or interaction.

The spiraling background to Figure 1 represents connections between individuals in dialogue and larger socio-cultural systems/groups, and is a reminder that the individual is almost always a social being, even when operating individually. Socio-cultural systems, which are also complex and dynamic, operate on timescales that encompass and surpass lifetimes. Individuals participate in and identify with multiple social groups; groups are constructed through participation and the emergence of organization and structure (Sealey & Carter 2004): families,
schools, hobby and interest groups, neighborhoods, ethnic communities, faith groups, nations. The spiralling ‘cloud’ across the top of the diagram represents on-going socio-cultural life, from which downward spirals represent individuals engaging with others, bringing influences into the interaction and taking influences back out into the wider socio-cultural world.

One of the greatest challenges of adopting a complex dynamic systems perspective is avoiding the static thinking imposed by our language, learning and habits. The model should be represented dynamically rather than by a static diagram — a video version of the discourse dynamics model of empathy is available here: <https://www.youtube.com/watch?v=lXUAC_p6y9k>. We have to remember that, inside the modelled system, everything is in constant flux. Activity is taking place on all levels, and across levels, all the time.

**Using the model**

Having been successfully applied to metaphor and empathy, the multi-level discourse dynamics model is offered here for wider use and development. It is not designed as a mathematical model to produce equations and numerical outcomes but as a theoretical model that affords a complex dynamic systems perspective on particular applied linguistic phenomena. Using the model in researching an applied linguistic phenomenon involves unpacking data about the phenomenon and re-formulating in terms of the trajectory of a complex dynamic system, i.e. as a process that has already taken place. Individuals in dialogue and interaction are placed at the core of the complex dynamic system, and other elements and relations traced, so that the system as a whole is described, including connections out into the wider environment. For any particular event, initial conditions are any factors affecting performance.

If the system description is valid, we can ‘replay’ the evolution of the system from its Point Zero, producing its trajectory in its state space. The outcomes should replicate our starting point. If not, then some aspect of the system needs to be more accurately described. The end result of this recursive retro-fitting of the phenomenon to a system description will be an enhanced understanding of process, in itself a research outcome.

**Conclusion**

This article began in rural Kenya as we tried to ‘make sense’ of the details of an extremely complicated situation of conflict and peace-building in terms of empathy dynamics. I have shown how a complex dynamic systems perspective helped
in this research endeavour, how the CDS perspective was bolstered with the addition of the notion of affordances, and how it can work as an inherently ethical and moral approach. Using complex dynamic systems to help identify patterns of activity and behaviour affords a powerful way of focussing the researcher’s attention, a way of seeing. The discourse dynamics model developed through this and other research projects is offered as a tool for further research in the belief that we should not try to escape connectedness and change in the phenomena we investigate but should, rather, embrace them.

References


