AHRC “Science in Culture” Large Grant Outline Proposal:
Narrating Complexity

Objectives

"Narrating Complexity" brings together specialists in narrative theory and complexity science in order to address the resistance of complex systemic processes to narrative frameworks; both to examine contemporary cultural manifestations of this impasse in science media and fiction, and to engage with the communicative and conceptual problems it raises.

The project’s starting point is a problem of science communication. The first principle of effective communication is to tell a story, yet complex systems defy narrative explanation, even as they exhibit behaviour that invites it. The tendency to misrepresent complexity in the name of communication affects many of the most important and socially consequential areas of contemporary scientific knowledge, such as climate change, epidemiology and biodiversity. Nor is the problem a superficial one: it stems from the centrality of narrative sense-making to human cognition, and goes to the heart of complexity science itself. "Narrating Complexity" is conceived as a reciprocally informing encounter between narrative studies and complexity science, in which we aim to pursue the ramifications of the problem in breadth and depth.

The project's main objectives are:

1. To generate mutually beneficial dialogue among experts in narrative studies and complexity science on the problematic interface between narrative understanding and complexity, establishing the basis for a sustainable, innovative and rigorously interdisciplinary model of narrative studies which extends beyond the humanities and speaks to scientific research.
2. To consider the role of creative and informative narratives in the cultural mediation of complexity and to use the forms of such mediation in the arts (e.g. in fiction, film and interactive new media) to inform the problem of complexity in science communication (particularly through journalistic media and documentary).
3. To examine, compare and develop representations of complexity in case studies on the environment, human disease and evolution, covering narrative representations in fiction and film, expository narratives in new media, and non-narrative representations; and to evaluate their respective limitations and affordances for communication both in the public sphere and among complexity scientists.
4. To collaborate in the development of models of complex systems informed by narrative theory and, reciprocally, models of narrative informed by complexity science; and to test their value as analytical, interpretative and creative approaches within each discipline.
5. To draw out the implications of the encounter between narrative and complexity for cognitive narratology and for the fundamental concepts of complexity science, clarifying the narrative premises of central concepts in the philosophy of science and the fundamental role of narrative in cognition, and so contributing to current theoretical research in each of these fields.

Within the project we shall examine a range of the cultural manifestations of complex systems: those in which narrative is foregrounded, such as the attempts of contemporary fictions across media to accommodate complexity both formally and thematically; and those focussed upon complexity (in documentary and in science journalism, for example), demonstrating the inadequacies of explanatory narrative to the representation of complex processes, as well as the explanatory limitations, in the absence of narrative, of techniques of complex systems modelling. But we shall pursue the problem beyond its empirical instances to develop analytical accounts of narrative creativity and narrative

cognition informed by complexity science, and of complex systems modelling informed by narrative theory.

The collaboration will also provide the basis for an innovative model of interdisciplinary narrative studies, establishing a research formation that is unique in the UK and potentially world-leading.

Impact Summary

Because "Narrating Complexity" takes a problem of science communication as its starting point, it is intrinsically concerned with the impact of complexity science research upon policy makers, stakeholders and their practices, and the wider public. It is concerned in particular with the effectiveness of the narrative channels through which this research is communicated, in the science media, in education, by third sector interests and through museum and gallery exhibitions. The project is also inherently concerned with the use of complex systems ideas by those involved with producing creative or informative narratives, professionally or recreationally, and in particular with the opportunities to develop this cultural response to complexity in association with users of interactive media. In these respects the project will also have substantial spill-over impacts via the influence of its findings on other researchers in complexity science and in narrative studies; and there will be significant academic impacts from the dialogues the project will foster between otherwise remote disciplines.

In particular, we aim to foster the project's immediate impact upon users of the following types:

1. Users engaging with and understanding complexity science through narrative representations of complex systems, for example the interested public and third sector organizations concerned with particular instances of complexity. The project will develop innovative forms of representation which mediate between narrative and complexity through the use of visual and interactive media, and we shall mount a series of public exhibitions of these presentations, initially in York and Dundee, where we are very well placed to do so in collaboration with our impact partners; subsequent events will be stage around the UK, and we shall establish an online version of the exhibition. Users, whether concerned to communicate or to understand complexity, in theory or in specific systems, will be able to appropriate and adapt the models we devise.
2. Users involved in narrative creativity, as facilitators, writers, performers or new media designers. The project will explore the effect of the phenomenon of emergence as a systemic feature of the generation of narrative itself, in cognitive terms, but also in practical terms, through a series of structured workshop activities facilitating interactive storytelling in several forms. These workshops will enable participants to develop their creativity through constrained writing, dramatic improvisation and interactive media.
3. Users, including science media communicators, policy makers and stakeholders, who are concerned with the production or evaluation of informative narratives in which examples or concepts from complexity science are the subject matter. The project's scrutiny of the narration of complexity in science journalism and documentary, focussing particularly upon accounts of evolution, earth systems and human disease, will provide practitioners in these fields with insights and practical strategies with which to negotiate the tension between narrative and complexity more effectively and responsibly.
4. Uses engaged with problems of complexity and communication among industry, designers and academics. The project will bring the Science in Culture theme into dialogue with the Design in Action project and stage a “Chiasma” innovation event facilitating interaction between science, design and industry in terms of the encounter between narrative and complex systems.

Summary

"Narrating Complexity" confronts the challenge that complex systems - the object of study in complexity science - present to narrative frameworks of understanding. The issue is a vital one in science communication, but the project will show that its roots lie deeper, with significant implications for the practice of complexity science itself and for the nature of narrative cognition. We will elucidate the fundamental conflict between the limitations of narrative sense-making and our dependence upon it, demonstrating its relevance to representations of complexity and to contemporary cultural manifestations of narrative across media. In doing so, we shall also be developing communicative strategies that meet the challenge of narrating complexity.

Complex systems research has numerous applications across the natural and social sciences (e.g. in biology, computer science, artificial intelligence and earth sciences); narrative research is similarly ubiquitous across the arts and humanities (e.g. in literary, film and new media studies, history, philosophy of mind, graphic narrative and performing arts). Both complexity science and narrative theory are fundamentally concerned with the representation of processes; however the basic principles of narrative are sequence, cause and effect, agency, perspectival unity, and teleology, whereas the basic principles of complex systems are concurrency, recursiveness, systemic relations, multiplicity, and emergence. Narrative is an indispensable part of the cognitive legacy of human evolution and defines our understanding of spatio-temporal phenomena; yet representing the behaviour of complex systems in narrative form entirely misunderstands their complexity. It is a crucial problem for public engagement with complexity science and for the policy debates this science informs; but it is also a problem for complexity scientists themselves, and most fundamentally concerns the limits of both complex systems modelling and narrative cognition, and the relation between the two.

This project is a thoroughgoing collaboration between complexity scientists and narrative scholars. It will bring each field to bear upon questions native to the other, drawing upon case studies in evolution, human disease, earth systems and narrative creativity. It will open innovative lines of inquiry by using the principled incompatibility between narrative and complexity to throw each into relief. The scope of the project embraces critical analysis of cultural manifestations of the narrative-complexity encounter in fiction, film, new media, documentary and science journalism; theoretical exploration of the consequences for our understanding of narrative from its cognitive foundations to its most elaborate creative forms, and for our understanding of complex systems modelling, simulation and emergence; and empirical testing of our findings through public events using forms of interactive narrative creativity and innovative representations of complex systems.

The project has the potential to transform the basis of public engagement with complexity science and to facilitate more accountable use of such science to inform policy debate across the vast range of issues to which it applies. It will also demonstrate the capacity for narrative, in its most developed fictional forms, to accommodate our cognitive limitations and refine the resources of narrative meaning. The fields of complexity science and narrative studies themselves both have much to gain from their encounter, which promises reciprocal insights into issues like the ill-understood phenomenon of emergent behaviour, the interpretative problems of complex systems modelling, the processes of narrative creativity and the limits of narrative cognition.

Case for Support

Fit to the Call and Contribution to the Theme

"Narrating Complexity" is based in York's new Interdisciplinary Centre for Narrative Studies, in association with the established York Centre for Complex Systems Analysis. It is intrinsically collaborative, involving experts in narrative studies and complexity science (both broad interdisciplinary fields in themselves); it includes co-investigators in Abertay and a network of participants across the UK and Europe, brought together through a University of York research priming award.

By foregrounding the limits of narrative understanding in the face of complex systems, the project brings both objects of inquiry into sharp focus, and advances an innovative model of narrative studies that transcends the boundaries of the arts and humanities and will inform practice in the sciences. It has the potential to transform the nature of dialogue across the "two cultures" divide and so to establish the long-term future of a vital new research formation.

"Narrating Complexity" will contribute to the Science in Culture theme by using the tools of narrative theory to address the challenge of communicating and interpreting complexity science, and by charting the cultural influences of complex systems ideas in the form and content of contemporary imaginative narratives across media. The project will demonstrate the value of narrative concepts to reflective practice in complex systems research, and apply the principles of complexity science to research on narrative creativity and narrative understanding.

These reciprocal insights will be developed collaboratively in mutual exchanges between, on the one hand, complexity researchers working in computer science, the life sciences, artificial intelligence, earth sciences and sociology; and on the other hand researchers in literary studies, digital media, history of ideas, film studies, history of art and semiotics. The project embraces questions in which narrative and complexity are each the primary object of inquiry, maximizing the opportunities for bi-directional learning; and the systemic interrelations between these questions ensure that, in one of complexity science's axioms, the whole is more than the sum of the parts.

Research Questions

We frame our questions on two axes: that of narrative-complexity interdisciplinarity (from complex systems dominant to narrative dominant), and that of analytic depth (from the encounter's cultural instances to its conceptual horizons, marked by philosophy of science and cognitive science). Within this space the questions centre upon four nodes, as follows:

1. **Communication: Why does the communication of complexity science present such a problem, and how might this problem be addressed?** We shall evaluate narratives of complexity in relation to high-profile topics such as evolution and environmental science; clarify the double-bind that makes narrative both necessary and unsuitable to the explanation of complex systems; and explore new approaches to combining narrative with visual and interactive media.
2. **Culture: How have the concepts and features of complexity been incorporated thematically and as formal principles, by contemporary fictions in traditional and new media?** We shall examine the capacity of culture's most elaborate narratives to accommodate complexity, and the potential for the systemic qualities of interactive and hypertextual media to redefine the parameters of narrative creativity.
3. **Conceptualization: What can narrative theory contribute to research into the nature of complexity and the problems of complex systems modelling?** We shall make explicit the role of narrative sense-making in design and interpretation of complex system simulations, and in the

conceptualization of emergence; and show the relevance of our cognitive dependence upon narrative for philosophy of science perspectives upon complexity and (e.g.) causation.

4. **Cognition: What does complexity science have to say about the nature of narrative?** We shall explore the extent to which narrative interpretation and narrative creativity can themselves be understood as emergent phenomena produced by implicit or artificially contrived systemic processes; and whether narrative semiotics is itself, in cultural, evolutionary and cognitive terms, grounded in complexity.

Research Context

The project is built around the problematic interface between narrative sense-making and complex systems modelling, considered both as a feature of contemporary cultural mediations of complexity science across several disciplines, and as a theoretical issue informing current research into the cognitive foundations of narrative and the intelligibility of complex systems. It accordingly builds upon research that abuts this interface from several directions.

There has been significant work on the challenges of representing complexity: for example, on the ways in which aspects of narrative form are imposed upon systemic processes such as evolution by natural selection in popular representations and even in scientific discourse. Here the project will draw upon the work of participants from the Interdisciplinary Evolutionary Studies Centre in Aarhus. Narrative studies also provides important research contexts on the ways in which fiction and film have engaged with ideas from complex systems theory in representing the mind, social networks, environmental events, and other systemic subject matter in narrative form. This research has done much to suggest ways in which features of the sophisticated rhetoric of fictional narrative (narrative levels, reflexivity, multiple plot lines and perspectives) have been used to accommodate the sequentiality of narrative to such systemic subjects. These current areas of inquiry have not been informed by a full account of the conflicted relation between narrative understanding and complexity, and this project's engagement with that task will be an important contribution to such research.

Research in visual communication, and in the representational affordances of new media in particular, has opened promising lines of inquiry, for example in work at Abertay representing soil ecosystems and the growth of cancer cells using interactive digital media. The interactivity of new media is the focus of relevant work on the possibilities of emergent narrative, as is the distributed creativity afforded by networked media; we shall build upon this work through both empirical analysis and theoretical elaboration of its significance for the systemic basis of narrative creativity.

The project will also build upon the established dialogue between York's Humanities Research Centre and the York Centre for Complex Systems Analysis, which we have developed through the EPSRC-funded TRANSIT project. "Narrating Complexity" will be informed by previous research within YCCSA on the EPSRC-funded CoSMoS project (York-led, Abertay partner), which raises key problems for narrative understanding in the modelling, simulation and visualization of complex systems.

Artificial intelligence is another important research area for the project, in particular the Artificial Culture project (UWE-led, Abertay partner) and swarm robotics, which provides a context for empirical exploration of the emergence of narrative culture out of the exchange of individual histories (narrative selfhood). The abstract but embodied models available to robosemiotics will be complemented by the project's engagement from the perspective of cognitive narratology with evolutionary semiotics and embodied, extended cognition.

Research Methods

"Narrating Complexity" will combine theoretical, interpretative and experimental methodologies according to the requirements of each set of research questions. The project's scope demands that

cross-disciplinary collaboration and dialogue are the foundations of its research method, and the principal vehicle for these collaborations will be a structured series of topically-focussed research seminars, workshops and symposia. These will be co-ordinated in order to sustain the bi-directional exchange of "Narrating Complexity" and its address to the four nodes of its research questions throughout the life of the project, whilst establishing the progressive logic of the research programme by highlighting each research question in turn (see timetable).

These events will draw together the work of project participants within their own disciplines and in relation to specific instances of complexity and forms of narrative; the work of each occasion will be both to secure the multi-disciplinary insights of the dialogue and to apply the mutually informing paradigms of narrative studies and complexity science to each other. External perspectives will be fostered by hosting three visiting scholars in York at strategic points over the first three years, allowing international experts in narrative studies to contribute to and benefit from the research agenda of the project.

Two of the project's research assistants will embody the reciprocity of the research programme: Polvinen will work on the significance of complexity for cognitive models of narrative and narratives of cognition, from a background of expertise in cognitive narrative studies; Andrews will work on the implications of narrative theory for problems of visualization, simulation, modelling and emergence in complexity science, from the perspective of a deep and broad experience in complex systems modelling in the natural and social sciences.

The third research assistant will have a background in digital arts and visual communication, and will be appointed with a brief to design and develop interactive digital media solutions inspired by the project's findings, testing the role of interactivity in the reconciliation of narrative and complexity in effective communication. This work will be focussed upon developing an exhibition, in conjunction with the York Festival of Ideas and the resources of the Hannah Maclure Centre gallery at Abertay.

The project's co-investigators in Abertay, Bown and Parker, will bring to the project their own expertise in life sciences and interactive digital media respectively, and their experience in bringing complexity science and the arts together in the interests of science communication. They will also enable the project to collaborate with the AHRC-funded Design in Action project, both by drawing upon the Design in Action team's expertise in devising "Chiasma" innovation events that promote interactions among industry, designers and academics "to build new thinking around complex problems," and by contributing an evaluative analysis of the Chiasma model through the lens of the narrative-complexity interface.

The project's inquiry into the role of complexity and emergence in narrative creativity will be tested through a series of interactive storytelling workshops in association with the Arts Barge, a York community arts project funded by the City Council and the Arts Council. These workshops, based upon constrained writing, dramatic improvisation and interactive media, will enable participants to explore the creative potential of different models and media of narrative interaction, and provide empirical evidence of emergent narrative creativity in action.

Three PhD students are included within the project to help develop the capacity of its innovative research formation in interdisciplinary narrative studies. The PhD topics will be at the narrative-complexity interface and will involve: (1) literary or cognitive narrative theory informed by complexity science; (2) complex systems modelling drawing upon cognitive narrative theory; (3) emergent narrative in visual, interactive and networked media. All three PhDs will be co-supervised and receive appropriate research methods training in both the humanities and sciences.

"Narrating Complexity" will also draw in a larger circle of researchers beyond its immediate participants by hosting two international conferences in years 3 and 5 of the project. These will orient our research questions towards the constituencies of researchers in narrative studies and complexity

science respectively, in order to further the goal of breaking down the barriers between the sciences and humanities.

Management and Co-ordination

The project will be based in York and Abertay. The core team will have the following roles:

PI: Walsh. Overall management. Co-supervises PhDs. Leads Culture and Cognition nodes, dissemination activities and emergent narrative creativity workshops. Co-ordinates other impact activity and pathways to impact.

CI 1: Stepney. Co-supervises PhDs. Leads Communication and Conceptualization nodes.

CI 2: Bown. Co-ordinates Abertay elements of project: collaboration with Design in Action and liaison with Dundee City Council as co-sponsors of impact exhibit.

CI 3: Parker. Leads the interactive digital media elements of project, inc. liaison with the Hannah Maclure Centre exhibition and negotiation of further exhibition with V&A Dundee.

RA 1: Polvinen. Co-organizes research seminars (years 1-3).

RA 2: Andrews. Co-organizes research seminars (years 1-3).

RA 3: tbc. Organizes research seminars (years 4-5). Leads development of the interactive exhibition.

Administrator. Manages arrangements for the workshops, symposia, visiting scholars and conferences.

Project Participants. The following researchers have collaborated on the project from its pilot stage, and will contribute their research to the relevant workshops as well as producing formal papers for the annual symposia and the project conferences: Uprichard, Goriunova, Lury (Warwick: interdisciplinary methodologies); Winfield (UWE: robotics); Dyke (Southampton: earth systems); Nielsen, Grumsen, Clasen (Aarhus: narrative theory, evolutionary studies); Grishakova (Tartu: semiotics); Poulaki (Amsterdam: film studies); Makela (Tampere: narrative theory); Caves, Edwards, Westall (York: biology, history of art, literary studies).

Impact Partners. Impact activities within the life of the project and pathways to further impact will be developed in consultation and collaboration with the following, who will be fully involved as participants in relevant workshops and symposia: Brennan (curator, Hannah Maclure Centre); Heaven (journalist, *New Scientist*); Zeevenhooven, Sisam (documentary researcher, director, BBC); Topman, Riley (director, writer, Arts Barge Project).

Timetable

Year One: Symposium 1 (Communication); Workshops 1.1-3 (Culture, Conceptualization, Cognition); Research seminar series 1.1-6; Visiting Scholar 1: tbc.
Milestone: enrolment of PhD 1 & 2.

Year Two: Symposium 2 (Culture); Workshops 2.1-3 (Communication, Conceptualization, Cognition); Research seminar series 2.1-6; Visiting Scholar 2: tbc.
Milestones: Chiasma creative event; narrative creativity workshop 1; submission of co-authored science journalism feature article; enrolment of PhD 3.

Year Three: Symposium 3 (Conceptualization); Workshops 3.1-3 (Communication, Culture, Cognition); Research seminar series 3.1-6; Visiting Scholar 3: tbc.
Milestones: conference 1 ("Complex Systems: The Role of Narrative"); narrative creativity workshop 2; compilation of edited book 1; recruitment of RA 3.

Year Four: Symposium 4 (Cognition); Workshops: 4.1-3 (Communication, Culture, Conceptualization); Research seminar series 4.1-6.
Milestones: exhibition 1, "Complex Stories" (York Festival of Ideas); submission of authored book 2 (Polvinen); narrative creativity workshop 3; completion of PhD 1 and 2.

Year Five: Symposium 5 (Conclusions, legacy, prospects); Workshops 5.1-3 (Impact, Cultural Contexts, Theoretical Horizons); Research seminar series 5.1-6.
Milestones: conference 2 ("Narrative Studies: Encounters with Complexity"); exhibition 2, "Complex Stories" (Hannah Maclure Centre); compilation of edited book 2; submission of authored book 1 (Walsh); completion of PhD 3.

Outcomes, Impact and Dissemination

- Authored book 1: Walsh, *The Sense of Stories* (exploring the limits and value of narrative from its fundamental cognitive function to its most elaborate fictional manifestations).
- Authored book 2: Polvinen, narrative and complexity in relation to cognitive narrative studies
- Edited book 1: Stepney and Walsh, *Complex Systems: The Role of Narrative* (derived from contributions to the first project conference).
- Edited book 2: Walsh and Stepney, *Narrative Studies: Encounters with Complexity* (derived from contributions to the second project conference).
- Journal articles: refereed publications deriving from symposium papers by all participants, in field-specific humanities journals publishing on narrative studies, science journals publishing on complex systems, and journals specific to science communication.
- Interactive media exhibition: developed and co-curated by RA 3 at the York Festival of Ideas and the Hannah Maclure Centre gallery; further dissemination will be sought via the V&A, Dundee's local exhibitors' channel, and a co-sponsored UK-wide exhibit with Dundee City Council; subsequently an online version will remain as legacy of this work.
- Chiasma creative event on Science in Culture, with the theme of narrative and complexity, in collaboration with the AHRC Design in Action project.
- Conference papers: dissemination of ongoing project research at annual international conferences in narrative studies and complexity science, by PI, CI 1, RAs, PhDs.
- Co-authored *New Scientist* feature article on narrating complexity: Walsh and Stepney.
- PhDs: it is expected that all three PhDs will be published as monographs.
- Three public workshops on interactive narrative creativity, held in York in association with the Arts Barge project. They will be reciprocally valuable impact activities, developing relationships between the university and community arts users in York, and contributing empirically to the project's inquiry into the mechanisms of emergence in relation to narrative.
- Legacy: the project's cross-disciplinary dialogue and exceptionally broad range of relevance across the humanities, sciences and social sciences will establish an innovative research paradigm for interdisciplinary narrative studies. Its research output and development of research capability will give an international profile to York's ICNS and enable its research programme to become a beacon for similar narrative research innovation across the UK.
- Pathways to Impact: in collaboration with our team of impact partners, we shall seek both to build upon the impact activities programmed into the project, and cultivate further take-up of the project's science communication theme in particular – for example via consultation on narrative strategies within science documentary making.
- We have identified common interests with two Science in Culture Exploratory Award holders: Metcalfe, "Representing and Communicating Uncertainty"; and Boon, "Initial Intermedia study of Science on Television and in Museums." We shall pursue possible interactions with both.