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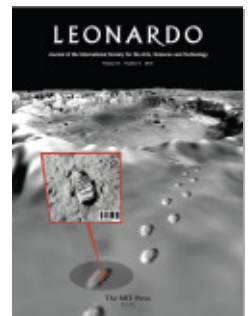
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## **Gesture and Embodied Interaction: Capturing Motion / Data / Value**

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## GESTURE AND EMBODIED INTERACTION: CAPTURING MOTION / DATA / VALUE

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### Abstract

*Gesture and Embodied Interaction* is a five-month practice-led scoping project which explored motion capture development perspectives from artistic, technological and business innovation standpoints. It convened an interdisciplinary community from the arts, sciences and business studies, experienced in practice-driven collaborative research. Effort was focused on two prototyping workshops in Newcastle and Cambridge, bridged by an interim work session to optimize collaboration. A final creative industries seminar in Cambridge allowed debate with a wider stakeholder community. This paper provides an overview of our activities, findings and future directions.

*Keywords:* motion capture; patterns of behavior; value creation, capture and transfer.

### Introduction & Goals

Interest in motion capture for film, video games and live performance challenges and extends technical expertise originally acquired in the bioengineering and orthopedic sectors, testifying to a potentially vibrant development area for the digital economies. Breadth and diversity of the motion capture user base make it a rich locus for interdisciplinary collaboration and novel work models. Through engagement with practice partners diversely involved in ICT development procedures and imperatives, we aimed to glean fresh insights into creative knowledge transfer processes.

The project took as its starting point several distinct strands of research into motion capture: the *AMUC* eScience project led by Sally Jane Norman in Newcastle [1,2], *Will.0.w1sp* and *Swift Traces* media installation projects developed by Kirk Woolford from Sussex [3,4,5], and a range of motion capture experiments by the Cambridge Graphics & Interaction “Rainbow” Group, which

is led by Peter Robinson, together with Alan Blackwell and Neil Dodgson [6]. These partners’ investigations of gesture and embodied interaction represent complementary approaches and a valuable starting point for seeding and scoping practice-led research collaborations.

*Gesture and Embodied Interaction* was a dynamic, innovative and somewhat unorthodox undertaking, typical of the creative industries, whereby numerous actors convene for the duration of a project, then disband to perhaps form new partnerships for the next project. It combined hands-on research and design with a specific focus on motion capture experience and resources, projecting business model frameworks for transferring interdisciplinary creative prototyping work into potentially viable projects and services. An iterative “do-show-discuss” model was implemented, whereby prototyping experiments were subject to regular, steered discussion sessions to identify broader economic implications associated with emerging communities of practice [7]. The latter moderating role was ensured by Lorraine Warren from Southampton’s School of Management, joined for the second workshop and final seminar by Ted Fuller, from the University of Lincoln Business School [8,9].

Central to the project were PhD students in performing arts, computing, and business studies, working alongside research assistants specialized in motion capture and digital sound and imaging. The hierarchical divisions between academics, technicians and students often encountered in traditional teaching institutions inhibit the growth of collaborative models that are relevant in a world of online skill sharing and social networks. Moreover, knowledge transfer at its best is a uniquely inclusive research driver that can weld generations, professional categories and disciplines. By identifying common motivation and stimulating collaboration amongst our group of a dozen individuals, we hoped to gain a sense of the deeper dynamics underlying the shaping and sharing of values in complex technological development processes.

### Methodology

The project was articulated around two week-long workshops held in Newcastle (November 08) and in Cambridge (January 09). Sharing of expertise and language across disciplines was initially favored by the fact that both sites use Vicon optical motion capture systems

and by the earlier experimentation undertaken at Culture Lab by Kirk Woolford, in collaboration with Dave Green, to develop motion capture elements for *Swift Traces*. A two-day interim hands-on session (Cambridge, December 08) refined outputs from the first workshop to prepare for the second.

Given time constraints, we chose to base our collaboration on existing assets (know-how, technical resources) and initiatives. A preliminary show-and-tell session identified research strands apt to mobilize participants over the project’s brief duration, and yield more lastingly useful outputs. This session familiarized us with the wide range of motion capture approaches embedded in the group’s existing research, and with disparities in terms of language, work methods, and notions of value. Platforms for development of these applications were specified in terms of competencies and technical configurations, these requirements being compared with available workshop resources to devise a realistic program.

Shared enthusiasm for developing unconventional, creative motion capture applications to support novel kinds of embodied interaction led to an emphasis on performance-type, real-time affordances [10]. Objectives were set and subgroups given specific tasks, including writing code to allow live exploitation of Vicon motion capture coordinates.

Daily discussions served to monitor progress and set intense pragmatic effort in the context of reflection on technological innovation and values. Records of this exchange were stored on the project wiki along with other shared media.

At the second workshop, observers invited to demonstrations also attended the final seminar. We presented and discussed our work with a dozen regional and national players from public arts and technology development bodies, regionally-sited industries (games, special effects etc), neighboring Anglia Ruskin University and the associated higher education regional visualization technologies work group, and Cambridge University’s Knowledge Transfer office.

### Findings

As befits a technology-focused, practice-led project offset by prospective thinking on the dynamics of creative innovation, our findings were essentially twofold.

On the one hand, concrete results were achieved in terms of computing breakthroughs, notably in response to the challenge to make motion capture data streams interoperable with other

programs, building libraries to support such developments with a widened user base. More specifically, Java code was authored to connect Vicon streams to Max MSP, and patches, samples and interfaces were devised to open this hybrid platform up to various kinds of gestural control. By subjecting the system to playful experimentation that went way beyond conventional benchmarking, it was possible to generate robust, reproducibly responsive, multimodal interactions, allowing gestural control of visual and sonic outputs. Obvious potential marketable products include interfaces for Wii-type game environments, predictably valuable in therapeutic contexts (e.g. for patients with motor or sensory deprivation disorders) as well as education and leisure applications. In its present form, the software is a multi-purpose toolkit offering good scope for students exploring interactive systems.

On the other hand, by framing ongoing practical experimentation in broader reflection on innovative collaborative work, we became aware of the spectrum of values that can emerge within, then spur, motivated, interdisciplinary developer teams. While it can be awkward to tear people away from urgent tasks on which collaborative problem-solving depends, collectively articulating and contextualizing the value of experimental processes through reflective dialogue can become an integral, enhancing component of technological development effort. In a diverse stakeholder community like ours, constant renewal of dialogue is a socially vital counterpart to the iterative prototyping principle adopted in technical design. Theoretical findings bore on the differentiation of values as a function of the multiple time windows that are simultaneously at work in complex processes, and as a function of the level of resolution applied in a given analysis. For example, knowledge transfer occurred in sometimes ostensibly minor yet decisive ways within the broader project, while apparently dramatic breakthroughs might appear as the foreseeable outcomes of simple earlier stage development work.

## Conclusions & Future Directions

The workshop offered a rich model for reflection through the sheer range of



**Fig. 1. Daniel Bernhardt, Catriona MacInnes, Dave Green and Andrew Duff testing motion capture sound and image control. (© Kirk Woolford)**

technical and creative skill sets involved, and enhanced our understanding of the social processes on which their synergies depend. The eminently cultural questions raised by human-computer interactions demand strongly interdisciplinary response, raising further issues in terms of sector-specific languages and terminologies [11], and in terms of systems and patterns of behavior in the creator/ developer community which are likely to radiate outward to impact the consumer sector. These complex dynamics seem to be inherent to interdisciplinary collaboration and related business models, where the core team structure actively informs and reflects the shape of the final product or service. In the long run, disruptive innovation stemming from small players and projects like this might conceivably impact mainstream business and industry in terms of behavior patterns as much as technical outputs.

This modest scoping exercise has yielded a wealth of material, both technical and conceptual. We plan to consolidate the software toolkit by using and enriching the associated libraries to build an original, customizable interactive gestural control system, working closely with students and graduates, and enlisting interested partners from the performing arts. At the same time, dialogue initiated with industrial and institutional partners will be upheld, to optimize visibility of our research for the wider community, and to monitor development opportunities. Finally, we shall continue to seek out and define novel, salient features of our research processes, to see how these might be accommodated by or adapted to business development tuned to innovative knowledge transfer.

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- Culture Lab, Newcastle: Sally Jane Norman (principal investigator), Dave Green, Catriona MacInnes, Jamie Thompson, Nick Williams.
- Cambridge: Alan Blackwell (co-investigator), Daniel Bernhardt, Ian Davies, Chris Nash, Peter Robinson.
- Southampton: Lorraine Warren (co-investigator).
- Sussex: Kirk Woolford (co-investigator), Andrew Duff.
- Lincoln: Fizza Alamdar, Ted Fuller.

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