

The grant

Following a successful outline proposal in April 2013, and a full proposal in October 2013, this Leverhulme Trust Research Project Grant RPG-2014-010, entitled ‘In the Dancer’s Mind: Creativity, Novelty and the Imagination’ was awarded on 5 March 2014 to Professor Jon May at the University of Plymouth, for a total of £246,061. This award included costs for teams at Coventry University, led by Professor Sarah Whatley, and Trinity-Laban Conservatoire of Music and Dance, London, led by Professor Emma Redding.

The award was to commence on 1 April 2014 and to run for 36 months until 31 March 2017. As this start date was too close to the award to allow appointment of staff and recruitment of PhD students, the Trust agreed to delay the start date to 1 September 2014, and subsequently to extend the end date until 25 January 2018 to allow both the PhD students to complete three years of registration within the project.

The research was conducted at the University of Plymouth, Coventry University and Trinity-Laban Conservatoire of Music and Dance, London.

The staff undertaking the project are detailed in the following table:

Name	Role	Dates	Location	Commitment
Professor Jon May	Principal Investigator	01-09-14 to 25-01-18	University of Plymouth School of Psychology	11.5 hrs/wk (30% FTE)
Prof. Emma Redding	Co-Investigator	01-09-14 to 25-01-18	Trinity-Laban Conservatoire of Music and Dance, London	5 hrs/Week (13% FTE)
Prof. Sarah Whatley	Co-Investigator	01-09-14 to 25-01-18	Coventry University Centre for Dance Research	5 hrs/Week (13% FTE)
John Sikorski	Research Assistant	01-09-14 to 31-03-16	University of Plymouth School of Psychology	37.5 hrs/week (100% FTE)
Marina Khalil	Research Assistant	01-09-16 to 25-01-18	University of Plymouth School of Psychology	37.5 hrs/week (100% FTE)
Lucie Clements	PhD student	01-09-14 to 31-08-17	Trinity-Laban Conservatoire of Music and Dance, London	37.5 hrs/week (100% FTE)
Rebecca Weber	PhD student	09-01-15 to 25-01-18	Coventry University Centre for Dance Research	37.5 hrs/week (100% FTE)

In addition to these staff several other individuals made significant contributions to the project. Dr. Klara Łuczniak, a PhD student in the School of Psychology at the University of Plymouth, who was funded by the EU Marie Skłodowska-Curie Training and Mobility of Researcher’s program, spent six months on secondment at Trinity-Laban and assisted in the development of the data collection materials, as well as conducting some of her PhD research alongside the project. Dr. Sara Reed, Principal Lecturer in Dance in the School of Media & Performing Arts at Coventry University, helped with the data collection at Coventry University and co-supervised Rebecca Weber’s PhD. The choreography staff Katye Coe from Coventry University, and Amanda Gough, Clare Baker, and Dr Naomi Lefebvre Sell from Trinity-Laban, contributed to the design of the imagery training materials and delivered the workshops to students as part of their curriculum. The project team are extremely grateful to all of these people for their help; and advice throughout the project.

Objectives

The objectives listed in our original proposal were:

- i) to develop and evaluate a novel measure of ‘canonical imagery’ measuring the tendency to produce stereotypical images and to assess its relationship to creativity
- ii) to obtain longitudinal data on a recently developed measure of multisensory imagery, the Plymouth Sensory Imagery Questionnaire (Psi-Q)
- iii) to assess changes in the use of mental imagery as students gain experience and progress through their training, using the Experiential Imagery Scales (EIS)
- iv) to assess the effect of different instructional contexts upon imagery strategies
- v) to develop and evaluate training materials that enhance an individual’s insight into their mental imagery strategies, intended to reduce their stereotypical imagery and enhance creativity.

Research Activity

Overview of the activity

In this project, we worked with two cohorts of dance students of Trinity Laban Conservatoire of Music and Dance, Coventry University and Plymouth University, to study the role of mental imagery in creating novel choreographic material. All students joining the BA (Hons) Contemporary Dance program at Trinity-Laban and the BA (Hons) Dance program at Coventry University in 2014 and 2015 were invited to participate in the study, and a total of 240 students consented to take part in our research at some point. All students were invited to take part in three assessment sessions over two years to provide longitudinal data for the project, and the second cohort also received workshops (as part of their timetabled course) designed by the project to enhance their use of mental imagery, and hence creativity.

Alongside the main project plan, two doctoral students (Lucie Clements at Trinity Laban, and Becca Weber at Coventry) conducted independent investigations supervised by the CIs and PI. Both have completed their studies successfully and have been awarded PhDs.

The ItDM imagery training materials

We developed a suite of training workshops and materials intended to enhance undergraduate students’ understanding and awareness of their mental imagery, and to provide them with the metacognitive skills to use their imagery to support novel and innovative idea generation. This is thought to be the foundation of creativity. The training materials were inspired by the Mind and Movement workshops developed by Wayne McGregor’s Random Dance company for use with A-Level and BTEC students, and based on the Interacting Cognitive Subsystems (ICS; Barnard, 1985) model of human cognition. We worked with the choreography staff at Trinity-Laban and Coventry to produce a modular set of 37 exercises that could be adapted and re-ordered to fit different timetabling requirements. These workshops were then delivered to the second cohort of first year students in the 2015-16 session. The training materials are all available for download on the project web site, <http://www.dancersmind.org.uk>, and include a Teacher’s Guide, Lesson Plans, a Coursepack for distribution to students, six videos introducing key concepts, along with posters, and ‘The Imagery Game’.

The Experiential Imagery Scale

At each assessment session, students took part in a choreography task during which they completed the Experiential Imagery Scale (EIS) scale several times to record their subjective experience of the extent to which they were aware of using different forms of mental imagery. We are completing an analysis of the pattern of changes on this scale over time to show the effect of increasing experience and our imagery interventions.

Flexible Thinking Tasks

We developed a short pencil and paper test of creativity, the Flexible Thinking Tasks (FTT), and validated five alternate forms of the test against an established ‘gold standard’ test of creativity (the Abbreviated Torrance Test for Adults, or ATTA). We used these five forms to assess longitudinal changes in dance students’ creativity over the two years of their undergraduate dance education, and to assess the effectiveness of our imagery based creativity intervention. Our analyses show that there was a statistically significant interaction between the cohorts and the assessment point $F(1,115) = 4.49, p = .036$, and that students who received the imagery training workshops increased in creativity scores on this test over time $t(59) = 4.76, p < .001$, while those who did not receive them did not increase statistically $t(56) = 1.79, p = .079$ (Figure 1)

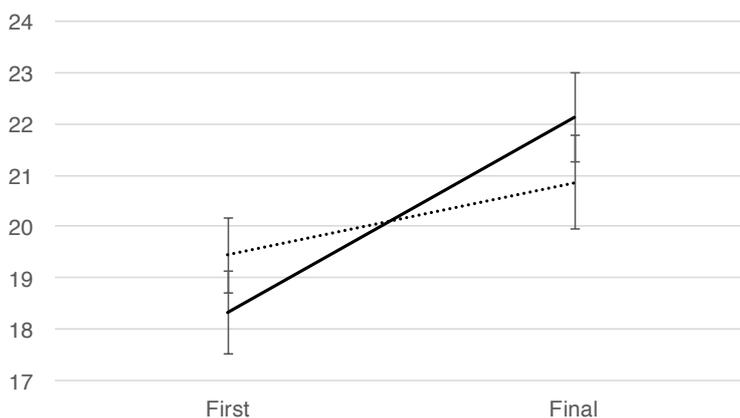


Figure 1: The improvement in Flexible Thinking Test scores over time was statistically significant for the imagery cohort (solid line) but not for the control cohort (dotted line). Bars show one standard error.

Choreographic assessment measures

We obtained the transcripts and feedback from all students’ first year choreography modules, and conducted a content analysis for positive and negative mentions by the markers of the student’s creativity and use of imaginative ideas. At the assessment point immediately after the workshops, the students who had received the training scored lower on imaginative ideas, and the same on creativity as the untrained students, but at the final assessment the trained students scored higher on both measures: imagination $p=.007$; creativity $p=.003$.

Individual Differences in Imagery

We collected data on the use of routine and novel imagery by dance students by developing the Scale of Canonical Imagery (SCI), and on the vividness of imagery in seven different modalities (using the Plymouth Sensory Imagery Questionnaire, Psi-Q). We compared scores on these measures and the FTT creativity scores to test hypotheses about individual differences in the nature of creative imagery, but found little association between any of these measures. The SCI was used

to identify imagery cues which lead most people to generate similar mental images, such as ‘imagine a staircase’, which most people visualise as if they are standing at the bottom, looking up. These canonical images formed the basis of ‘The Imagery Game’, used during the imagery training workshops to highlight the routine and predictable nature of ‘the first thing that comes into your head’.

Lucie Clements:

Lucie Clements’ doctoral research presents an examination of the psychology of creativity in contemporary dance, and through a literature review, five studies, and discussion, focusses on investigating methodologies suitable for assessing dancers’ creativity by exploring the nature of contemporary dance creativity. Emphasis is placed on the need for, and possibilities of, understanding dance specific creativity, using methodologies that recognise the unique nature of dance while remaining within the psychology research framework.

Becca Weber:

Becca Weber’s doctoral research comprises an in-depth, multidisciplinary and mixed-methods research project into creativity in Somatics-based choreographic practices. The project draws on methodologies from phenomenology, ethnography, grounded theory, feminist philosophies, and thematic analysis. It involved data collected from three well-known Somatics practitioners who embody a professional hybridity as artists, authors, and Somatic Movement Educators—Sandra Reeve, Andrea Olsen, and Miranda Tufnell—and who each use their Somatic practice as instrumental in their choreography. Each practitioner utilises different Somatics modalities (Move into Life, Authentic Movement, Embodied Anatomy, Alexander Technique, among others) in various settings (higher education, community arts, professional practice, etc.), which provides an international (US and UK) and cross-modality scope to examine shared ideologies within Somatics. Data was collected in an open-ended qualitative interview process, participant observation of workshops and intensives delivered by the artists, and in close reading of their published texts and was analysed for emergent shared themes. Becca argues that these themes identify connections between the identification, definition, and facilitation of creativity within Somatics-based choreographic practice and cognitive psychological theories of creativity. She identifies elements of the pedagogical environment and argue that they facilitate the development of a refined perceptual ability. This perceptual expertise is presented as a change-agent in facilitating both novelty in movement generation and the generation of meaning, allowing for a discerning, selective retention of this movement material in giving form to that meaning choreographically. Situating it within the Interacting Cognitive Subsystems model and theories of embodied cognition, Becca proposes a philosophical audit-trace of the ways in which this meaning and expertise is developed cognitively, and how that expertise allows for greater novelty and creativity in choreography. These are presented as pathways strengthened in somatic practices which facilitate more creative choreography for performance settings; the research closes with a discussion of how understanding these pathways might be instrumental in shaping dance pedagogy to increase dancers’ creativity, and what directions this theory produces for future research.

Conclusions and Achievements

The most important finding of this project is that it is indeed possible to improve the creativity of dance students through giving them training in the use of their mental imagery. Our workshops improved their scores on a pencil-and-paper test of creativity unrelated to dance or movement, as

well as improving markers' evaluations of their imaginative ideas and creativity in their end of year choreography modules. This is important as previous research had concluded that while creativity could be improved through some training methods, imagery interventions were not found to be successful. We believe that this is because previous imagery interventions had focussed on mental rehearsal of being successful or creative, whereas our intervention was theoretically-based and trained students in moving between different forms of imagery, helping them to reject conventional ideas and to generate novel and unusual ideas.

The training materials are themselves an achievement. Produced in a modular format with the contribution of the choreography staff at Coventry and Trinity-Laban, and based upon the theoretical principles outlined by Barnard, they can be freely downloaded and used by other dance educators. The website is now hosted on the University of Plymouth website and so will remain accessible for the foreseeable future.

A third major achievement is the development of a brief and easily scored creativity test suitable for longitudinal use, the FTT. Other creativity measures are only suitable for use once, as they either preclude the possibility of change (biographical surveys) or evaluate creative production using fixed and unrepeatable materials (e.g., the Torrance tests). They can also be time-consuming to score, requiring subjective judgements about novelty or humour. The FTT will be valuable for any researcher investigating changes in creativity over time.

Our analysis of the EIS is not yet complete, but we hope that it will help us to understand changes in dancers' use of imagery as they develop their choreographic skills and increase in confidence and expertise. We are comparing different models of the latent structure of the EIS to determine the relationships between the items, before assessing these changes.

The two PhD students funded by the trust can also major achievements of the project – Dr Clements and Dr Weber are now independent early career researchers who have the potential to make significant contributions to the development of teaching methods that can support dance students understanding the nature of creativity and routes to enhancing their creativity. The research will also inform choreographic practice, supporting the development of expertise that allows for greater novelty and creativity in choreography.

Principal Investigator's personal evaluation

It is of course pleasing to be able to say at the end of a project that 'It worked!' and to show that we have succeeded in enhancing creativity, both on psychological tests and in actual performance. The most successful aspects of the project have been the development of the training materials and the creativity test (FTT); the least successful the canonical imagery (SCI) and use of the imagery vividness (Psi-Q) measures; the momentary ecological assessments of imagery use (EIS) is currently intermediate but when analysis is complete may also prove valuable. Publication of the final outcomes of the project are still in progress.

Personally, one of the key challenges of this interdisciplinary research project has been the translation of theoretical concepts and paradigms from psychology into an artistic and practice based culture that has a very different perspective on analysis and interpretation. I have learnt a great deal about the way that dance science and practice is increasingly using somatic and kinaesthetic awareness as a key method in creative work, and realise that this is of value for psychological research into embodied cognition. This will influence my own future research and

understanding. I also hope that the exposure to psychological research methods and concepts will similarly influence the research, teaching and perhaps even the choreographic practice, of other participants in the project.

Publications and other outputs

- Brown, D & Clements, L. (2016) How can poetics in dance be measured? At *The Potentials and Challenges of Research in Dance Medicine & Science: building innovative collaborations between United Kingdom and Brazil*, August 27 - 31st, 2016. Goiânia, Goias, Brazil.
- Clements, L (2016) Can we measure a dancer's creativity? *Cognition Institute Conference*, 7th -8th July, University of Plymouth, UK.
- Clements, L. (2015) Creativity: In the Dancer's Mind. *DANScienCE Festival*, 21st -23rd August, QUT, Brisbane, Australia.
- Clements, L. (2016) Investigating creativity, novelty and the imagination in dance science, *MOVIMENTA Special Edition, Analysis of the International Workshop of the Brazil-United Kingdom Network in Dance Medicine and Science 9(4)*. (Dual publication in English and Portuguese).
- Clements, L. (2016) Researching Imagery & Creativity in Dance Science. At *The Potentials and Challenges of Research in Dance Medicine & Science: building innovative collaborations between United Kingdom and Brazil*, August 27 - 31st, 2016. Goiânia, Goias, Brazil,
- Clements, L. (2016) Researching, Creativity, Novelty and the Imagination in Dance Science. *Dance Medicine and Science Research Workshop*. 13th – 14th June. Wolverhampton University.
- Clements, L. & Wilkinson, A. (2016) Big 5 Personality traits of male and female contemporary dance students, *IADMS 16th Annual Conference*, 20-23rd October, Wan Chai, Hong Kong.
- Clements, L., & Weber, B. (2015). In the Dancer's Mind: An Introduction and Movement Exploration. *TCCE 10th Annual Conference: Culture, Creativity and the Academy: Exploring the New Normal*. Guildhall School of Music & Drama. 14th July. London, UK
- Clements, L., Quested, E., & Turner, J. (2015). Autonomy, relatedness, competence and the immune response in a ballet and contemporary dance school. *IADMS 25th Annual Meeting*. 9th-11th October. Pittsburgh, USA.
- Łuczniak, K. (2015). Between Minds and Bodies – Shared flow experience in dance practice. *ZIF Dance Engaging Science*. 23–25th April 2015, Bielefeld, DE
- Łuczniak, K. (2015). Between minds and bodies: Some insights about creativity from dance improvisation. *The Undivided Mind. Planetary Collegium symposium*. Plymouth University, 16-18th July 2015, Plymouth, UK
- Łuczniak, K. (2016) Creative Flow – Dance Improvisation Perspective. *Cognition Institute Conference*, 7-8 July 2016, Plymouth, UK
- Łuczniak, K. (2016). Between minds and bodies: Some insights about creativity from dance improvisation *Symposium on Embodied Cognition, Acting and Performance, AISB*, 4-5th April, 2016, Sheffield, UK
- Łuczniak, K. Jackson, A. (2017) How do we do what we do? – Embodied studies on cognitive theories. *IADMS 27th Annual Meeting*, 12-15th October, Houston, Texas, US.
- Łuczniak, K., Jackson, A., Sakuta, A., Siarava, E. (2017) Let's Improv It – strategies for sharing embodied knowledge. *Dance Fields: Staking a Claim for Dance Studies in the 21st Century*, University of Roehampton, 19-22.04.2017, London, UK
- Łuczniak, K., Loesche, F., Reading, E., May, J. (2016) Physiology of Flow Experience in Dance Improvisation, *IADMS 26th Annual Meeting*, 20-23rd October, Hong Kong

- Łuczniak, K., May J., (2015). Between Minds And Bodies: A study into group flow experience in dance improvisation. *Situating Cognition: Agency, Affect, And Extension*. 15-18th October 2015, Warsaw, PL
- Łuczniak, K., May, J., F., Redding, E. (2017) Group Flow And Creativity In Dance Improvisation – A Viewer Perspective. *UK Creativity Psychology of Creativity Conference*, 17th May, Edinburgh, UK
- Łuczniak, K., May, J., F., Redding, E. (2017) Sync To The Others Not To The Movement - The Investigation Into Shared Physiological Dynamics In Dance Improvisation. *3rd Avant Conference, Trends in Interdisciplinary Studies: Social cognition*. 20-22nd October, Lublin, Poland.
- Łuczniak, K., May, J., Matthias, J., Redding, E. (2017) Dancing in a Zone: multi-method research on the role of flow experience in shared creative practice. *IADMS 27th Annual Conference*, 12-15th October, Houston, Texas, US.
- May, J. (2016) Psychology and the Creative Arts. *Cognition Institute Conference*, 7th -8th July, University of Plymouth, UK.
- Redding E, Lefebvre Sell N, Gough A, Clements L & Baker C (2017) Collaborative research in science and creative practice, *The Labanarium: Thinking in terms of Movement: Teaching and Researching Movement and Dance in University and Conservatoire Settings*, 6th Jan. Institute of Performance at the University of Surrey, Guildford School of Acting.
- Weber, R. (2009) Integrating Semi-Structured Somatic Practices and Contemporary Dance Technique Training. *Journal of Dance and Somatic Practices* 1 (2), 237-254
- Weber, R. (2016) Interacting Cognitive Subsystems and Dance: Choreographic Creativity. In M. Grazia, J. Sindoni, J. Wildfeuer, & K. O'Halloran, (Eds.), *Multimodal Perspectives in Performing Arts: Routledge Studies in Multimodality*. London: Routledge. pp. 106-126
- Weber, R. (2018) Somatic Movement Dance Education: Making Meaning through Dance. In K. Bond, & S. Gardner (Eds.), *Dance and the Quality of Life: Springer Social Index Series*. Dordrecht: Springer
- Whatley, S. (2017). Somatic Practices: How Motion Analysis and Mind Images Work Hand in Hand in Dance. In B. Müller & S.I. Wolf (Eds.), *Handbook of Human Motion*. Springer, Switzerland, pp. (in press). DOI: 10.1007/978-3-319-30808-1_113-1
- Whatley, S. (2015) Motion Capture and The Dancer: Visuality, Temporality and the Dancing Image. In S. Whatley, N. Garrett Brown and K. Alexander (Eds.), *Attending to Movement: Somatic Perspectives on Living in this World*. Triarchy
- Whatley, S. and Lefebvre Sell, N. (2014) Dancing and Flourishing: Mindful Meditation in Dance-Making and Performing. In A. Williamson, G. Batson, S. Whatley, & R. Weber (Eds.), *Dance, Somatics and Spiritualities: Contemporary Sacred Narratives*. Bristol: Intellect, pp. 437-458

Future Research Plans

As this project has successfully enhanced dance students' creativity, the obvious next step is to adapt the training materials for use with other populations. This idea formed the core of a proposal submitted by Professors Jon May and Emma Redding to the ESRC in April 2017 'Enhancing musical creativity through strategic use of mental imagery'. In this project a generic version of the training materials would have been developed and evaluated on music students at Trinity-Laban, using a similar cohort design to this project. The proposal was well rated by reviewers and was ranked 35th out of 118 proposals at the November 2017 finding panel, being rated as fundable

(scoring >7) but there were only sufficient funds to finance the top 24 projects. We are now considering other funding routes for this work.

Part of this ESRC proposal built upon Dr. Łuczniak work on flow, and we planned to conduct experimental studies with musicians and non-musicians in Plymouth to test hypotheses about the specific effects of aspects of the training materials upon mental imagery use and vividness, the role of body state awareness, the tendency to rely on canonical imagery, and upon the subjective experience of flow states where people are creating or improvising freely and effortlessly. Along with further development of a novel tablet-based video-cued immediate recall tool for collecting subjectively self-evaluations performance aspects (such as flow and creativity), Dr. Łuczniak is seeking ESRC funding to pursue this work.

During the project, Professor Sarah Whatley obtained funding from the AHRC with Professor Sita Popat to establish the Error Network (<http://errornetwork.com>). This group of practitioners and researchers, including Professor Jon May, explored the generative potential of error, ambiguity and the body in dance and human-computer interaction. Its activities included workshop-laboratories relating to the role that movement and ambiguity could play in the creative design of human-technology interfaces, and culminated in a symposium at University of Leeds on 13th December 2016. A collaborative proposal combining the work of *In the Dancer's Mind* with the insights of the Error network is in preparation for submission to AHRC, ESRC or EPSRC, depending upon the focus of the final workplan upon humanities, social or technological questions.

This 'In the Dancer's Mind' project focussed mainly upon individual creativity. Professor Sarah Whatley's group are now exploring how the collaborative nature of dance practice might offer new insights to creativity, focusing on distributed cognition. This research will extend into other embodied practices, to test out these methods in other related contexts and also to develop the protocols for other contexts (e.g. the professional dance rehearsal setting).