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UKRI Neurotech Annual Report 2023-2023

Summary

The Chronic Pain Neurotechnology Network Plus (CPNN+) launched in October 2022, with thanks to funding from UKRI (EPSRC and MRC). Our core mission is to build capacity for the development of novel technologies to treat the spectrum of chronic pain. Our focus is on responsible innovation, supporting a diverse and inclusive community of UK researchers from students upwards, and stimulating discussion and collaboration between people who work in different areas.

The underlying scientific vision is to support the development of integrated technologies, targeting mechanisms central to the pathogenesis of pain. This requires a ‘whole systems’ view on treating chronic pain, and drives understanding of how neurotechnologies fit within the clinical delivery of care in a way that balances pharmacological and behavioural/psychological approaches. The network includes feasibility studies that aim to provide examples of how this can be done.

We look back on a very active and successful first year, in which we have set up a number of activities and initiatives. Below we outline the main achievements so far:



Virtual Reality workshop 12-14th December 2022

Co-sponsored by Versus Arthritis, and IITP (South Korea).

Industry Partners: Verity; Sync VR; Goodboost



One of the main activities we aim to support is a series of high-quality practical workshops. Our first workshop focused on Virtual Reality, and combined talks across a range of topics including the use of VR to basic and clinical pain research, insights from movement science, the design of novel XR therapies, and the integration of VR technologies and art. The workshop followed a hybrid format with the talks taking place in the mornings, alongside a practical workshop on the afternoons of 12th and 13th. The practical workshop was a hands-on workshop designed for 20 competitively selected students and early career researchers aiming to get beginner or early experience with using VR for pain applications.

The workshops provided an overview of hardware and software set-ups, including the basics of coding in Unity, and how to integrate VR within experiments (with pain stimulators or other recording systems such as EEG).

Program:

Christopher Eccleston (Bath): VR and chronic pain: learnings and opportunities

Tamar Makin (Cambridge): Phantom limb pain - thinking outside the mirror box

Neesa Mangalaparathy (NHS Futures): The landscape of XR in the NHS

Joao Minerio (Exeter): Pain in the context of Active Inference

Jordan Tsigarides (East Anglia): Current Uses and Future Directions for Therapeutic VR within the NHS

Ai Koizumi (Tokyo, Sony CSL): Fear in action: Fear conditioning and alleviation through body movements

Helen Dawes (Exeter): Attention and exercise: attending to pain in neurological conditions

Deepa Mann Kler (Neon): A Design For Life

Caitlin Naylor (Bath): Exploring variability in body perception disturbances in CRPS

Anna Firbank (Hatsumi): Painting Pain in Virtual Reality

Ann Meulders (Maastricht): To avoid or not to avoid: the paradox of pain-related avoidance behaviour

Michihiro Osumi (Kio, Japan): VR rehabilitation for phantom limb pain

Betina Ip (Oxford): Using virtual reality training to investigate neuroplasticity in adults with lazy eye

Sang Wan Lee (KAIST): Learning to create synthetic experiences for cognitive behavioural therapy

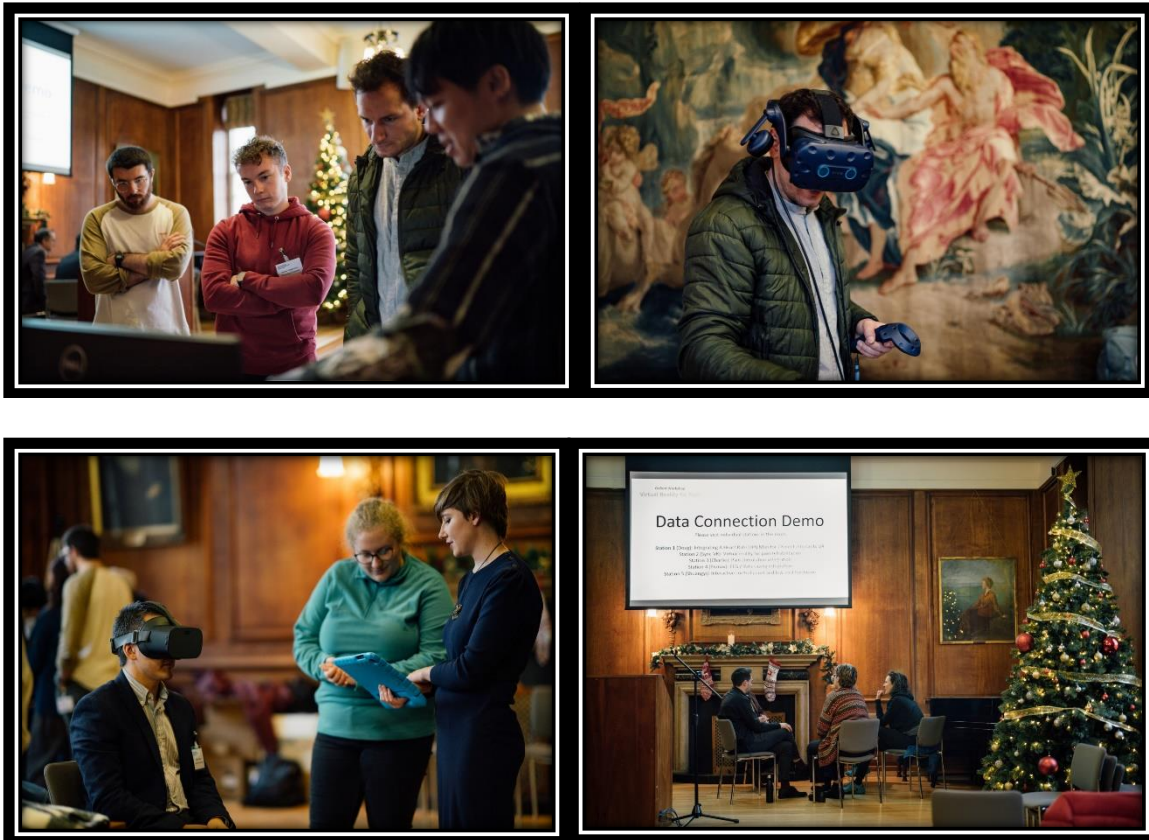
Kyle Pattinson (Oxford): Breathlessness training in a virtual world"

Ben Seymour (Oxford): The UKRI Chronic Pain Neurotechnology Network+

Practical workshop I (Hardware and software basics)

Practical workshop II (System Integration in VR)

Please see link: www.sites.google.com/view/oxford-vr-workshop/



We welcomed over 100 participants, roughly half of which attended online. Feedback was collected after the meeting and is summarised below:

The overall scope of the morning talk topics covered	8.93
The overall quality of the morning talks	8.93
The scope of material covered in the afternoon practical sessions	8.5
The quality of the afternoon practical sessions	8.23
The standard of the accommodation	8.69
The quality of the meeting venue	9.0
The quality of the workshop dinner	9.07
How did you find the overall workshop organisation?	9.53
Do you feel you had a good chance to meet and network with colleagues?	9.47

Example comments:

- Small informal environment; great opportunity to build networks; great organisation; lovely venue.
- Networking and being able to ask specific questions to the experts during workshops
- The opportunity to network and share experiences with colleagues. Very wide range of speakers during the morning presentations. Very high-quality workshop in the afternoon which gave insights into VR technology and the biosensors used throughout research.
- Really friendly and relaxed bunch of people which made it easier to meet people and discuss ideas. Great scope of talks. Super organised, very easy to get to the LMH and find my accommodation as well as getting from accommodation to the conference hall. The structure of the practical workshops was also a clever way to get people to meet and feel part of a team.

Chronic Pain Neurotechnology Lecture Course. Launched Oct 2023

A core objective of the network was development of an online training course. In October, we launched a free, CPD-certificated, and accredited online course that covers topics central to translational neurotechnology, aimed primarily at students and early career researchers. This course provides a comprehensive overview of core pain neuroscience and technologies. It involves 28 lectures of approximately 30 minutes each, using the Canvas course platform at Oxford University. Starting on 17th October 2023, it comprises pre-recorded lectures every week, followed by short quizzes, and runs during 'term time' through to June 2024. From June 2024 it will then become a standalone course once all lectures have been made available, to allow delegates to complete at their own pace. The course is split into 3 modules: basic neuroscience, core technologies, clinical translation.

Brain mechanisms: descending control and pharmacology

What the brain tells the spinal cord

Kirsty Bannister, Associate Professor
Institute of Psychiatry, Psychology and Neuroscience
King's College London, UK
kirsty.bannister@kcl.ac.uk
@bannister_lab
<https://bannisterlab.com>



Course Objectives

- To provide comprehensive scientific and strategic overviews of the current state and future landscape of chronic pain neurotechnology research and development in the UK and globally.
- To support early career researchers with a dedicated pain neurotechnology teaching and mentorship program, and the provision of small grants.
- To engage with the NHS, charities, public and patients, industry, related scientific networks, and other stakeholders to shape an ethical, accessible and inclusive path for future clinical technology translation.
- To implement a series of feasibility studies that explore new directions for integrative technologies.
- To implement a patient and public engagement strategy that highlights the clinical context, the science and the neurotechnological opportunities for the future.

Lecture and Lecturers

Please see the list below for all of our course lectures, speakers and dates of when each lecture will be made available:

Basic science - 17.10.2023

- Introduction to the pain system (Ben Seymour)
- Brain mechanisms: descending control and pharmacology – What the brain tells the spinal cord (Kirsty Bannister)
- Brain mechanisms: motivation and learning (Ben Seymour)
- Brain mechanisms: sensory processing (Flavia Mancini)

Core Technologies - 14.11.2023

- Foundations and applications of transcranial direct current stimulation (tDCS) in pain research (Sam Hughes)
- Non-invasive brain stimulation II (Thomas Graven-Nielsen)
- Neurofeedback (Aleksandra Vuckovic and Ben Seymour)
- Brain monitoring: An introduction to EEG technology (Alex Casson)
- EEG biomarkers and applications of machine learning (Aleksandra Vuckovic)
- Virtual Reality: A Novel Immersive Technology in the Study and Management of Chronic Pain (Jordan Tsigarides)
- Deep brain and spinal cord stimulation to treat chronic pain (Scott Lempka)
- Neural interfacing (James Fitzgerald)
- Transcutaneous Electrical Nerve Stimulation for the Relief of Pain (Mark Johnson)
- Embodied Technology: To be (biomimetic) or not to be? (Tamar Makin)
- Non-invasive brain stimulation with ultrasound III (Elsa Fouragnan)
- Developing fMRI-based biomarkers of pain: Promises and challenges (Wani Woo)
- Model Based CBT (Sang Wan Lee)
- Emerging Neuromodulation Modalities (Finlay Walton)
- Collecting pain and other symptoms in daily life- intensive longitudinal methods – (Chris Burton)
- Functional electrical stimulation (FES) & Motor Rehabilitation – (Erika Spaich)

Clinical Translation - 23.04.2024

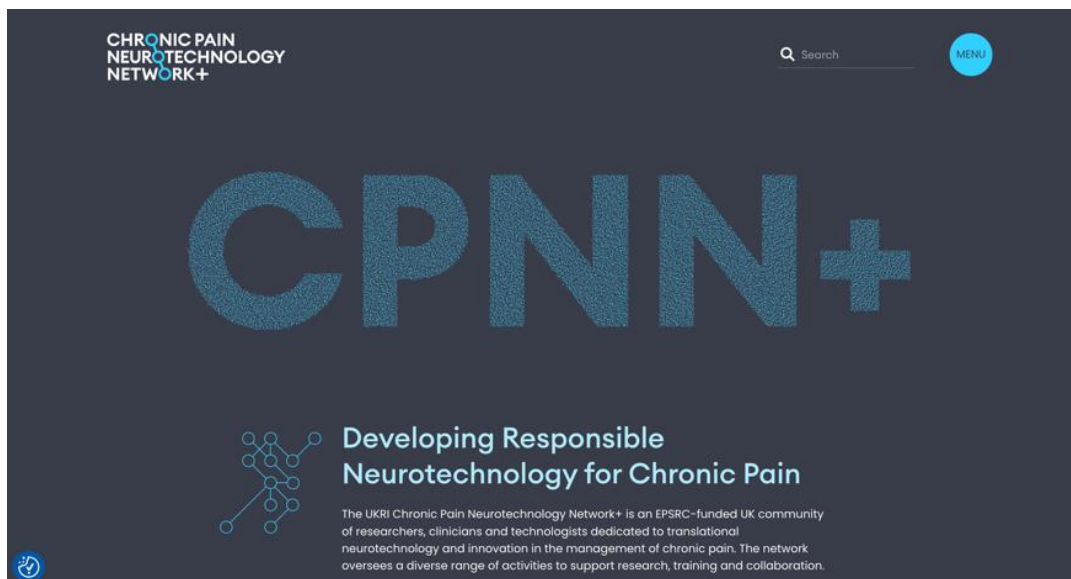
- Chronic pain mechanisms – from models to patients (Ben Seymour)
- Potential of game platforms as a tool for monitoring motor performance, pain and fatigue (Carlos Monteiro)
- Physical rehabilitation and pain (Helen Dawes)
- Physiologic control systems for the treatment of chronic pain (Tim Denison)
- Closed-loop DBS for Movement Disorders (Huiling Tan)
- Patient and clinician opinions regarding the use of technology to support healthcare delivery – can it help technology development? (Val Sparkes)
- Spinal injury (Mariel Purcell, Lauren Cope & Claire Lincoln)
- Clinical Device Trials in Chronic Pain: the EPIONE trial (Alex Green)

As of November, 401 people have signed up for the course, and 233 people have started it.

Our website:

[Homepage - CPNN+](#)

Our website launched in June 2023. The aim of the website is to provide the core platform to support our capacity building activities. Because the network involves educational activities, we were able to acquire an academic domain (ac.uk). This website provides the information about the workshops, the lecture course, other events, funding opportunities; alongside an open job opportunities page. It also includes our networking pages, which aim to provide visibility to researchers, especially students and early career researchers, by outlining their core research and linking to their own pages. Finally, it also provides a platform for gathering information in various public and lived experience contexts.



The website allows people to sign up and officially join the network. Currently we have 110 members. The website now has google analytics added and so we will be able to monitor traffic in due course.


National funding scheme for public and patient involvement and engagement


In August 2023, we announced a Call for Funding to support projects that develop the role of Public and Patient Involvement and Engagement (PPIE) in shaping and advancing the application of neurotechnology in chronic pain research and management. This recognized the transformative potential of neurotechnology in understanding and managing chronic pain, and our aim was to foster collaborative efforts that involve patients and the public in driving innovation, improving treatment outcomes, and enhancing the quality of life for individuals living with chronic pain.



An initial engagement process was first used to identify a series of priority areas, which we believe are important to chronic pain neurotechnology, and this was used to help shape a view of the PPI landscape. The focus areas we identified are:

- **Technology Development:** Projects that involve PPI in the development and refinement of neurotechnological tools, devices, or interventions for chronic pain management. This may include wearable devices, virtual reality, neurostimulation techniques, or neuroimaging approaches, among others.
- **Treatment Optimization:** Projects that explore how PPI can contribute to the optimization of neurotechnology-based interventions for chronic pain. This may involve the inclusion of patient perspectives in treatment protocols, usability assessments, or patient-led modifications to enhance the effectiveness and acceptance of neurotechnological approaches.
- **User Experience and Acceptance:** Projects that investigate the user experience and acceptance of neurotechnology among individuals with chronic pain. This may include studies on usability, accessibility, and factors influencing patient engagement and adherence to neurotechnology-based interventions.
- **Ethical and Societal Implications:** Projects that address the ethical, legal, and societal implications of using neurotechnology in chronic pain management. This may encompass considerations such as privacy, informed consent, equity of access, and the impact of neurotechnology on the individual and society.
- **Policy Engagement:** Projects aimed at influencing the development, implementation, and regulation of policies related to the use of neurotechnological devices, interventions, and applications. This may cover engaging with policymakers, regulatory bodies, advocacy groups, and other stakeholders to inform and shape policies that govern the use and accessibility of neurotechnology in various domains, including healthcare, research, and industry.

We offered funding up to a maximum of £5,000 per project, up to 1 year duration. Applications were judged by our panel and 4 awards were made, which are listed with permission below:

 <p>Dr Janet Bultitude</p>	<p>Patient-informed development of a personalized virtual reality intervention for body representation distortion and chronic pain</p>	<p>Our project will address technology development, treatment optimization, and user experience and acceptance for a personalized virtual reality (VR) rehabilitation tool for chronic upper limb pain. Our tool uses hand-tracking technology to allow patients to embody virtual upper limbs with different appearances. Previous research has demonstrated some success in treating chronic pain by using illusions to change the appearance of the painful hand. We aim to allow a more immersive and personalized experience, and to</p>
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		<p>accommodate a broader range of desired limb appearance. Our objectives are to:</p> <ol style="list-style-type: none"> 1. Develop a VR tool that will enable a person without VR programming expertise to create a virtual limb that has the personalized desired appearance of a patient, and then allow the patient to embody that limb within the same session. 2. Explore patients’ perceptions and attitudes regarding current rehabilitation methods that alter body perception, and their requirements or concerns for personalized and VR-based rehabilitation methods. 3. Gather and implement patient feedback on our VR rehabilitation approach, including preferences about the specific visual limb manipulations and factors influencing the acceptability of the VR tool. 4. Work with patients to understand what information should be conveyed to users of the VR tool, and how that can best be conveyed.
 <p>Dr Jordan Tsigarides</p>	<p>Creation of a National Co-Development Hub for Therapeutic Digital Health Interventions in Chronic Pain</p>	<p>Digital health interventions, including virtual reality, offer new avenues for chronic pain management. However, solutions frequently lack effective co-design with patients, potentially resulting in ineffective or even harmful applications. This gap often arises from limited co-design expertise, poor access to individuals with lived experience and lack of structured collaboration among stakeholders. Currently, no UK-based organisations focus specifically on facilitating such co-development.</p> <p>This application aims to address this problem by establishing a UK Co-Development Hub to support those developing digital therapeutics in chronic pain. The hub’s objectives are three-fold:</p> <ol style="list-style-type: none"> 1. Stakeholder Network Development: Create a cross-sector network of healthcare providers, academics, industry experts, and those with lived experience of chronic pain to foster collaboration and co-design. 2. Digital Platform Creation: Develop a user-friendly website as the hub’s central platform, featuring co-design resources and tools.

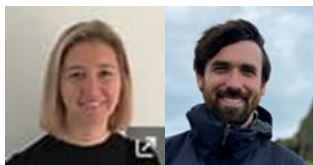
		<p>3. Co-design Framework: Create evidence-based guidelines and helpful toolkits to support co-development of digital therapeutics in chronic pain.</p> <p>By offering a structured approach to co-development, the hub aims to catalyse the creation of effective, tailored digital interventions for chronic pain utilising human-centered design</p>
 <p>Dr George Tackley</p>	<p>Exploring the Use of Immersive Virtual Reality (IVR) for the Treatment of Chronic Back Pain (CBP) – Patient perspectives and expectations.</p>	<p>The value of patient and public involvement and engagement (PPIE) in developing meaningful outcome measures is increasingly recognised within chronic pain research. Our proposal is to explore the perceptions and expectations in participants arising from the use of immersive virtual reality (IVR) to manipulate pain in people suffering from moderate to severe chronic low back pain (CBP). An IVR/CBP study is currently running which will investigate the mechanisms by which pain improvement occurs with IVR. In our PPIE sub-study we will focus on participant perceptions and experiences of this novel intervention, which are important to any future developments of IVR and its role in managing CBP. We will utilise both standard and novel questionnaires to gauge pre and post IVR intervention responses from 40 participants, documenting their current understanding and expectations from the IVR technology and its impact on their CBP. We also intend to examine whether certain patient characteristics, such as anxiety, fear avoidance, or catastrophizing impact upon the response to IVR as a therapy. The main objective of our project is to ensure that due importance is given to the voice of the end - user in this novel intervention.</p>
 <p>Alexander Smith</p>	<p>Nature-based Analgesia and Chronic Low-Back Pain: A Role for Immersive Virtual Reality?</p>	<p>Exposure to nature has a myriad of health benefits from mental health and wellbeing to pain amelioration. The benefits to pain, specifically chronic, have yet to be explored in real depth. Understanding the mechanisms through which nature can be leveraged for chronic pain may improve therapeutic options in the future. This project aims to develop a nature based virtual reality intervention for chronic low back pain patients using a mixed methods co-design approach. Specifically, we aim to: 1) To understand and quantify the unmet clinical needs of the chronic low-back pain community, and to work with members of that community in exploring potential treatments, programmes or interventions using immersive nature-based VR technologies [phase 1]. 2) To co-design a VR intervention with members of the chronic low-back</p>

		<p>pain community using existing environmental psychology theory and anticipated impact on symptom profiles [phase 2]. 3) To develop a working nature-based VR intervention using real world 360 degree immersive videos based on extensive patient co-design [phase 3]. Through developing this patient informed working prototype of a novel VR intervention, we will then be able to start testing the therapeutic effects in follow on studies beyond the scope of this funding period.</p>
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Feasibility Studies:

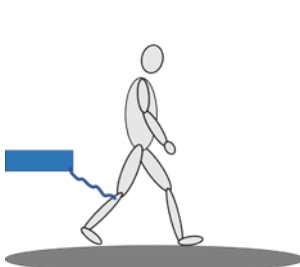
A key part of the network is initiating a series of feasibility studies. These aim to be new studies, testing proof of concept experiments and acquiring pilot studies, and intended to support new collaborations between network members. They also are generally aimed at exploring integrated technologies and interdisciplinary interactions, which involve The feasibility studies are funded by the network, and are outlined in brief below.

Investigating the modulation of the nociceptive withdrawal reflex during the gait cycle: a role for tonic pain?

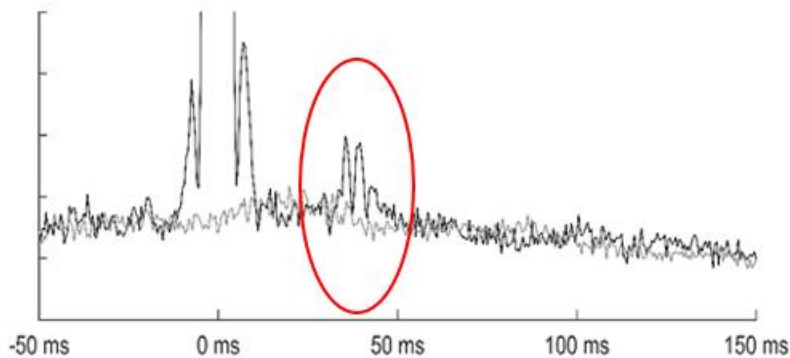


This will be a collaborative project between Cardiff and Exeter Universities. Led by Dr Jen Davies, Senior Lecturer, School of Healthcare Sciences, Cardiff University and Dr Sam Hughes, Senior Lecturer in Pain Neuroscience, Exeter University.

The aim of the project will be to establish a protocol to (a) evaluate the nociceptive withdrawal reflex (NWR) throughout the gait cycle and (b) evaluate the effect of tonic pain on the NWR throughout the gait cycle in healthy individuals.



We will measure muscle response such as indicated in the red circle.



We will then use this as data on which to build a funding application to study NWR throughout the gait cycle in chronic pain, and what implications any dysregulation in NWR modulation would have on gait and balance control and falls risk and also functional mobility. Start Summer / early Autumn (Sept) 2024.

Spinal neurophysiological measure of pain modulation by a virtual reality intervention (University of Exeter)

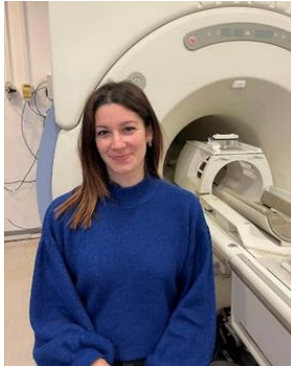


This study utilises the nociceptive withdrawal reflex (NWR) in healthy human participants as a measure of spinal cord activity to investigate the effects of nature-based virtual reality on spinal pain processing. Having completed pilot testing and study set-up, data collection for this study is currently ongoing with 19 participants completed so far. Dr Sophie Clarke (CPNN Post doctoral research associate) pictured is working on both projects at Exeter.

Modulation of pain using transcranial ultrasound (TUS) (University of Exeter and University of Plymouth)

This study aims to investigate the effects of neuromodulation by transcranial ultrasound (TUS) on pain processing. TUS (or sham stimulation) will be applied to the anterior cingulate cortex (ACC) during a tonic cold pain stimulus, followed by fMRI during the same cold pain stimulus to investigate the effects of the stimulation on pain responses. Study set-up is currently ongoing, with pilot testing planned in December and the start of data collection planned for December/January.

Investigate neural correlates of prediction error in chronic low back pain patients



This BRC translational fellowship will seek to identify novel brain-based correlates of prediction error (PE) using a simultaneous virtual reality and functional near-infrared spectroscopy (fNIRS) protocol, which is already established within the University of Exeter V Simulators platform. We will use this cutting-edge technique in a group of chronic low back pain patients with co-morbid anxiety to help identify key mechanisms of PE. It is highly likely that the results from this research will lead to commercial partnership with clinical VR companies interested in developing approved VR treatments (e.g. Verity). Pictured, Dr Sonia Medina (University of Exeter BRC research fellow).

Integrated systems for intracranial recordings, neurofeedback and virtual reality (University of Oxford, University of Glasgow).



The study address technical challenges in building integrated systems that allow real-time signal processing from various sensors, including potentially deep brain stimulation electrodes, within the context of closed loop control (for instance for neurofeedback, or virtual reality based interventions).

Neurofeedback for Nociceptive Pain in Rheumatoid Arthritis: A Pilot Study (University of Glasgow)

Rheumatoid arthritis is caused by an autoimmune condition, causing inflammation and pain. Yet pain may persist even when inflammation has been treated. This residual pain, called nociceptive pain, has symptoms of chronic pain condition called fibromyalgia. There are few effective therapies to address this residual pain. Published literature shows that fibromyalgia can be treated by neurofeedback, a non-invasive method that is based on the voluntary modulation of cortical activity. In this pilot study, we want to test the effect of 10 sessions of neurofeedback, on the fibromyalgia component of pain in rheumatoid arthritis in 16 patients, and also to investigate its effects on related symptoms such as fatigue and sleep disturbance. This is a collaboration between Co Investigator Aleksandra Vuckovic and Dr Neil Bassu, Professor of Musculoskeletal Medicine and Vasculitis from the School of Medicine at the University of Glasgow. Status of the project: REC meeting on 6th December

Mentorship network:

In November 2023 we launched our mentorship scheme. This is designed to match mentors and mentees in the field of pain technology, to provide mentorship or coaching for early or mid-career researchers as they navigate their careers and make plans. This is a formalised scheme in which mentor and mentee make an agreement – typically for 2-3 meetings in an year, which can extended if mutually agreed. The scheme was advertised to network members and previous workshop attendees. Currently we have matched 8 mentees with 8

mentors, with a further 3 mentees pending the matching process. We will gather anonymous feedback from the scheme in one year.

Responsible innovation

A central theme for the neurotechnology networks is responsible innovation. This involves developing and deploying advancements in neuroscience and technology while prioritizing ethical, social, and safety considerations. It encompasses designing and implementing neurotechnologies for chronic pain in a way that actively considers potential risks, user privacy, consent, and equitable access, and actively engaging stakeholders (including scientists, ethicists, policymakers, and the public) in the innovation process. This approach aims to balance technological progress with ethical principles to foster beneficial and sustainable outcomes in neurotechnology.

Practically speaking, the network drives a responsible innovation in several ways. First, we identified two areas where we felt special consideration is needed: neurotechnology for autism, and for the elderly. In the initial stage we have been scoping out possible areas of engagement. In particular, we have begun an engagement process in collaboration with the Respect for Neurodevelopment (R4N) network+ with an information acquisition stage (mediated through our website).

Second, we have considered whether or not current engagement process adequately access individuals from lower socio-economic backgrounds, who are at increased risk of pain. To develop a novel approach to this, we have begun a discussion with an artist with experience of working with under-privileged groups to explore the possibility of a residential project employing photographic and textual material in a reciprocal engagement process. We expect this project to start formally in year 2.

Third, an issue raised in our consultations is whether or not the research facilities we use in our laboratories and clinical research settings is as inclusive as it could be. With this in mind, we have initiated an Inclusive Labs project to consider all aspect of inclusivity, which we aim to deliver in year 2-3, and would support a contribution to a broader series of outputs involving other network+s, where there is a focus on PPIE and ethical issues.

Fourth, we also aim to support and promote diversity across network members in all of our activities, and adopting an inclusive approach therein. This is a persistent priority issue for us, and we have been able to maintain a good balance in terms of gender and ethnicity across all areas. Inclusivity is also reflected in various policies, for example all of our events include free childcare.



Events and meetings:

In addition to our VR workshop, we have been involved in various other meetings around the UK in our first year, including

November 2022: OA Tech Network+: End of Network Event

The OA Tech Network was a previous UKRI network, based from Cardiff University, and focusing on multidisciplinary approaches to osteoarthritis with a focus on technology. We gave a platform presentation to introduce CPNN+ to the audience, as a way of linking those interested in OA pain to our new program of activities.

April 2023 BNA annual meeting: symposium

Aversive cognition and pain: from theory to neuroengineering



We jointly organised this meeting developed core concepts of computation and information processing in the pain system, towards an understanding of how this can be used to shape technological therapies. The BNA is an excellent forum to reach a large audience of UK neuroscientists, and the event was well attended (>>100 delegates).

Deborah Talmi, University of Cambridge, UK: non-speaking co-chair

Dounia Mulders, Universite' Catholique de Louvain, Belgium: Inference and control of aversive states in the human brain

Ariane Delgado-Sanchez, University of Manchester, UK: Pain phenotyping using Bayesian modelling (co-chair)

Christopher Brown, University of Liverpool, UK: Joint modelling of priming, perceptual and aversive learning within a Bayesian framework

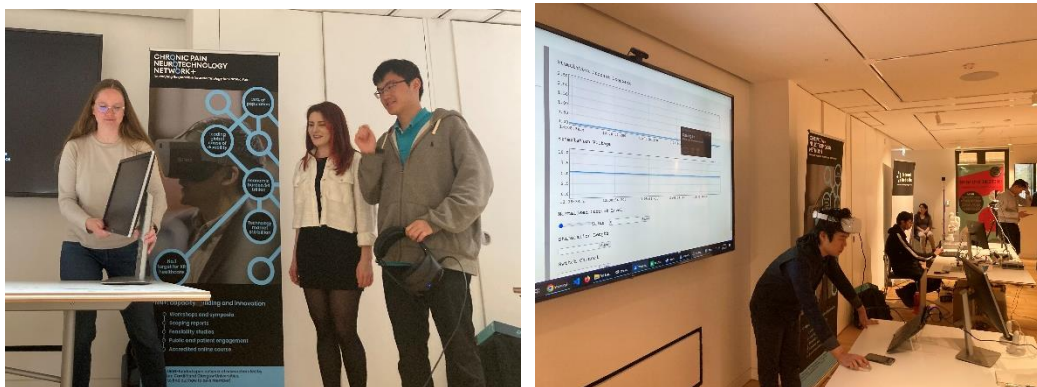
Ben Seymour, University of Oxford, UK: Neuroengineering for chronic pain

May 2023 - British Pain Society

We also gave a talk on virtual reality approaches to pain to an audience of clinicians and scientists in Glasgow.

May 2023 Immers-eXpo (Oxford)

We co-sponsored the Oxford X-Reality Hub, in collaboration with the Jesus College Cheng Kar Shun Digital Hub, for a mixed reality expo at the University of Oxford, introducing the newest developments in mixed reality technology and its potential in research, teaching and outreach. We gave a platform presentation and ran a stand demonstrating our research. This was a key opportunity to reach an academic and industry audience beyond that usually interested in chronic pain.



June 2023: Dubai meeting World Physiotherapy Congress, Platform presentation

We presented the following at the World Physiotherapy Congress held on 2-4th June 2023.

For further information about the event, please visit [WP2023 \(world.physio\)](https://world.physio/)

**CHRONIC PAIN
NEUROTECHNOLOGY
NETWORK+**

**CARDIFF
UNIVERSITY**
**PRIFYSGOL
CAERDYDD**

Acceptance of technology in remote rehabilitation management for neuro musculoskeletal conditions-clinician's perspective

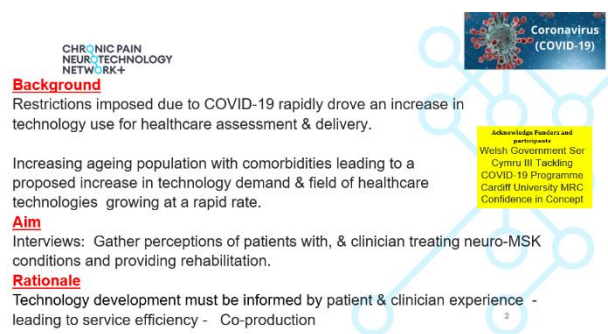
Valerie Sparkes¹, K. Job², J. Williams², C. Gibson³, C. Holt²

¹ School of Healthcare Sciences, Cardiff University, UK
² School of Engineering, Cardiff University,, UK , ³Cardiff and Vale University Health Board, Rehabilitation Engineering, Cardiff, UK

UKRI Network+
Responsible innovation and capacity building for UK Neurotechnology

June 2023: EPSRC meeting on digital technologies (Cardiff)

On 6th June 2023, we also presented on the 'Barriers and Facilitators for the use of technology for rehabilitation'



July 2023: First ADPD annual conference (Nottingham)

We presented a series of posters and a platform presentation about the network at the first annual APDP conference in Nottingham. The APDP is a key partner for CPNN+, as it provides a national infrastructure for chronic pain research, especially translational research. Network members also received prizes for their poster:



Measuring the effect of immersive virtual reality (VR) in people with persistent low back pain—what can quantitative sensory testing tell us?

Mr Mohammed Algamdi (PhD Student)
Cardiff University, Wales, UK. Email: Alghamdin4@cardiff.ac.uk

- Immersive virtual reality is increasingly used to help reduce pain in people with low back pain and people wear headset that allows them to be engaged in virtual environment. Although we are seeing good results in term of pain reduction, we do not fully understand how exactly immersive virtual reality works.
- Immersive virtual reality often combines distraction (looking at a relaxing scene) & embodiment (moving with the virtual environment). We do not know which of these environments is better than another at reducing pain. Also, outcome measures used in research studies are commonly patients reported outcome measures, whilst these are valuable, they do not tell us how immersive virtual reality works on the body's pain processing system that is responsible for pain.
- We think that using tests called quantitative sensory testing (such as hot & cold testing, & pin prick testing), in addition to patients reported outcome measures will give us valuable information about how the pain processing systems in our body are affected by these two different virtual reality approaches and which one may be best at reducing pain.

September 2023 - Exeter Brain Network

We presented CPNN+ on September 27th 2023: Introducing the CPNN+ to the Exeter Brain Network at Sandy Park in Exeter.

September 2023: Living with Persistent Pain (Cardiff)



Val Sparkes and CPNN+ partner (Sharmila Khot) attended the 'Living with Persistent Pain in Wales' conference on 18.09.2023. The event was held by the Welsh Government in Cardiff, with the afternoon session being opened by the Minister for Health and Social Services and addressed by the Deputy Chief Medical Officer. The aim of this event was to raise awareness and education around persistent pain conditions and the support that is available within pain management and service development.

October 2023: World Arthritis Day (Cardiff)



We promoted CPNN+ at the inaugural Musculoskeletal (MSK) Innovations in Wales Conference on 12.10.23 on World Arthritis Day. In response to the significant number of people affected by MSK, the Welsh Government has co-produced the Quality Statement for MSK Health. The Quality Statement for MSK Health sets out the Welsh Government's vision for the development of better MSK care throughout the life-course and across the whole of Wales. The aim of the conference was to gather key stakeholders, professionals, and organisations from the health and social care sector to address the challenges and opportunities in the field of MSK healthcare. The event

welcomed keynote speeches from the Minister for Health and Social Services, the Chief Medical Officer for Wales and many others who showcased good practices and innovations in MSK healthcare across Wales.

November 2023 Pan-network neurotechnology meeting with EPSRC / Alan Turing Institute (London)

With the EPSRC, we organised this one-day event to strengthen links with the other neurotechnology networks (CloseNIT – which focused on closed-loop neurotechnology, Neuromod+ - which focused on neuromodulation, Respect for Neurodevelopment (R4N) - which focuses on neurotechnology for people with neurodevelopmental disorders, and N-CODE – which develops digital technology). We linked up with our network partner the Alan Turing Institute, in particular the Clinical AI research network, who kindly acted as hosts at the Turing facilities at the British Library. The meeting focused on responsible innovation, in particular to synergise approaches to PPIE, ethics and inclusivity. What emerged was a clear joint strategy to develop outputs on these core themes, as well as a broader consensus on future priorities and challenges for the UK neurotechnology field as a whole.



Follow on-funding

- Sonia Medina-Hernandez has been awarded a 2 year NIHR BRC fellowship to develop work done as part of one of the feasibility studies.
- Sam Hughes & Elsa Fouragnan have also been awarded an EPSRC grant for approx. £1.1 million.

Publications:

Seymour, B., Crook, R. J., & Chen, Z. S. (2023). Post-injury pain and behaviour: a control theory perspective. *Nature Reviews Neuroscience*, 1-15.

Bannister, K., & Hughes, S. (2022). One size does not fit all: towards optimising the therapeutic potential of endogenous pain modulatory systems. *Pain*, 10-1097.

Looking ahead:

Finally we are looking forward to year 2. Anticipated highlights include our next practical workshop, focusing on neurostimulation, to be held in July at Exeter University. We also have a conference planned in collaboration with Oxford University and national NIHR BRCs who are working in the field of chronic pain (March 2024). The NIHR BRCs are a key strategic partner for the network, and we are actively thinking ahead to how we can develop this partnership into the future.