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# The Body as Starting Point: Applying Inside Body Knowledge for Inbodied Design

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**ABSTRACT**

Inbodied design is an emerging area in HCI that focuses on using knowledge of the body's internal systems and processes to better inform em-bodied and circum-bodied design spaces. The current challenge in developing an inbodied approach to HCI research/design is domain expertise: accessing sufficient and appropriate information about how the body itself works and how the body's different systems interact dynamically. In this workshop, we review and build on last year's introduction to inbodied foundations, focusing on applying inbodied knowledge to design challenges to explore (1) the foundational pillars of the inbodied design approach, and (2) how inbodied knowledge can affect / alter our understanding of em-bodied and circum-bodied design challenges and better inform design decisions. Our aim with this hands-on and cross-domain workshop is for HCI researchers to create innovative designs taking the body as a starting point.

**KEYWORDS:** Inbodied, body centric, circum-bodied, body boundaries, health and wellbeing



Towards informing design in HCI with an inbodied approach to facilitate novel and beneficial experiences for the human body.

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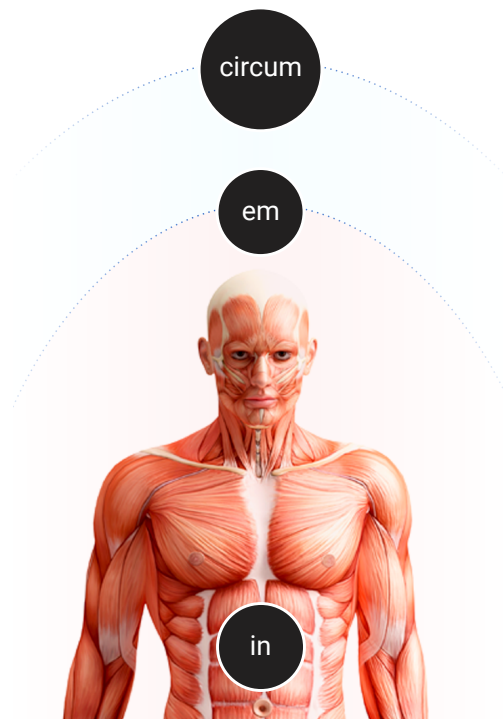
**CCS CONCEPTS:** Human-centered computing → Interaction design → Interaction design theory, concepts and paradigms

### Why Inbodied design?

HCI work in health/wellbeing has often focussed on *em*-bodied design, treating the internal functioning of the body as a 'black box'. Inbodied design aims to open this black box to inform the design space & assist human performance aspirations.

**Core Model:** in5 Move, Eat, Engage, Cogitate, and Sleep – MEECS

**CircumBodied:** What is the In/Em boundary



## 1 INTRODUCTION AND MOTIVATION

A growing area in HCI is the creation of tools to support health and performance. As the field moves in this domain, there is a meta-structural problem emerging; health is a holistic concept that requires an understanding of the many systems involved and their dynamic interactions, but the HCI community, at present, is producing technological artifacts that are largely fragmenting health and lack grounding in basic understanding of human physiology, neurology, etc. This fragmentation is compromising the field's ability to advance in this important domain. Of course, the challenge of holism of health is that it is far too complex for any one person or group to manage at present. How might we advance a new form of design that enables the emergence of more holistic tools and perspectives for advancing proactive and preventive health?

One emerging approach for advancing this problem is inbodied design. Inbodied design is an emerging area in HCI that focuses on using knowledge of the body's internal systems and processes to better inform the design spaces appropriate for HCI. The inbodied design space acknowledges three plausible systems to be aware of including the internal workings of the body within the skin (inbodied), the actions and behaviors made by individuals (em-bodied), and, potentially, the microbiome and other contextual factors outside of the skin that impact health, which we label circum-bodied. When we view the in-, em-, and circum-bodied as a coherent system, we can design from a more holistic, grounded understanding of human performance.

The focus of this workshop is to build on our prior work from last year's Body as a Starting Point Workshop in particular, to explore how best to advance this work further and grow this community. How might we better account for inbodied systems when building tools that target em-bodied actions? How can we, for instance, better understand that which is functioning circum-bodied? Are there mappings between IOT, wearables, and particular aspects of this? How do we build in such a way that technology artifacts can continually be advanced towards a more holistic perspective rather than foster further fragmentation and confusion? These are the questions we seek to explore in this workshop.

To support this exploration, we are requesting papers of a variety of domains, including papers responsive to this introduction, even from authors with no prior engagement in inbodied design. For those who participated in last year's workshop or those who are interested in engaging with prior materials, we also welcome papers proposing innovative solutions to address one of the specific design challenges described below (materials from last year's workshop will be posted on the workshop website).

### *Inbodied Approach In5*

The state of the body (of which the brain is a part) affects all aspects of our performance. By performance we mean cognitive, social, physical and so on. A core model of Inbodied interaction is

in5 (for “Inbodied five”). The in5 lenses are Move, Eat, Engage, Cogitate, Sleep. As presented last year, these five processes are fundamental to our quality of life. They are also processes that each of us engage in daily, and the quality of that engagement affects our wellbeing. For example, we all eat: however, the quality and amount of what we eat, and even how we eat (with others; alone) affects our wellbeing.

These fundamental processes also provide functional ways to view the more formally defined 11 internal systems that keep us alive (endocrine, reproduction, integumentary, immune, skeletal, respiratory, muscular, digestive, urinary, cardiovascular, nervous). Each of the in5 lens engages with each of the 11 internal systems to varying degrees. By leveraging the in5 for interactive designs, we can open the design space to offer multiple paths to a similar objective for anyone interested in improving their quality of life – that is – their human performance.

Building from this focus of how internal systems inform all our embodied (mediated through the body) actions, Inbodied interaction design encourages us to ask how designing to engage these processes deliberately can support our aspirations for performance. For instance, if our aspiration is to improve cognitive performance, in5 gives us a way to achieve this aspiration by considering of any one, or combination, of the in5 lenses (e.g., movement drives processes to support sleep, and in turn, enhanced sleep affects endocrine and nervous responses for taking in and processing information).

Likewise, in5 enables us to “start anywhere” for success. For instance, if one’s goal is to become more active, or “get ripped”, it may be easiest to begin this journey by first adding an hour to one’s sleep several nights a week for a time, and then – being better recovered – one has resource to move more.

The workshop will both review these concepts, and apply them in designs, as described in the submission and workshop plans, below.

### ***Circum-bodied: What are the In/Em Boundaries?***

With the in5 model, an interaction framing within Inbodied interaction is the concept we proposed last year of circumbodied. While embodied frames the body as the key mediator of our interactions with the world, and inbodied focuses on the specifics of the internal processes to enable and effect the state of that embodiment, circumbodied asks us to reflect on the boundary of in and em themselves. More particularly, it asks “what is not inside”?

The concept of circumbodied is exploratory: it is informed by a growing body of research exploring the role of the microbes that live on and in us (our microbiota) that outnumber our human cells by more than 200 to 1 [13]. The related concept of microbiome refers specifically to the genetic makeup of the microbes in and on us and factors such as what we eat, where we live, and for how long we have lived there all have considerable effect on the health of our microbiome [12].

Microbiomic health is reflected by the presence of a diverse set of microbial life, and since our human microbiome appears to be tied to our environment microbiota, In5 practices may be further informed by a circumbodied view. For instance, exploring movement through a circumbodied lens may privilege ways to connect a person to a more diverse microbiomic environment than a gym at least once a week. The workshop will let us explore these kinds of design vectors.

### ***Methods: n-of-1 for Inbodied Tuning***

Last year, we framed our workshop design challenges by asking participants to design tools and applications to “solve” a design challenge. This year, we are particularly interested in exploring in5-oriented designs that, rather than presume a single solution, instead explore possibilities for individuals to dial in their personal in5 to support a particular challenge. Since this dialling in or tuning will be different for each individual, the self-experimentation and associated self-reflection of n-of-1 approaches are particularly well suited for Inbodied interaction designs. While we will not require any participant to use this method in their submissions, we will review the method on the workshop website, point to the literature, offer examples (like [tinyurl.com/in5ogilvy](https://tinyurl.com/in5ogilvy)), and encourage consideration of that approach.

## **WORKSHOP MISSION**

Our mission for this workshop is to have participants gain the practice and confidence to start using and exploring Inbodied interaction approaches in their own research and design practice. We build from the foundation we created in last year’s workshop where we introduced and explored Inbodied interaction concepts as interesting ideas. This year, participants will gain pragmatic experience with the in5 approaches that can be used to inform novel designs and support aspirations for performance. In this year’s workshop, we begin from the participants submissions that demonstrate their engagement with the in5 concepts to solve new problems presented in the design challenges. In these presentations and design jams, we will build and strengthen shared understandings of these ideas so that participants will have confidence in taking these ideas forward and applying them in their own work.

### ***Workshop Goals/Outcomes***

- to recap Inbodied design – discussing what it can offer to HCI in the next wave of research.
- to demonstrate the use of the in5 lenses to build novel applications that support aspirations for human performance.
- to chart Inbodied design ideas to further develop and grow this emerging area in HCI.
- to build a community by offering a cross domain online space to connect with others who are interested in this area.

## OUTREACH

Prior the workshop, we will proactively reach out to various communities engaged with the body as a locus of design interest, including MobileHCI, CHI Play, and the rich number of researchers contributing to Health, Aging and Accessibility strands of CHI.

We will also particularly be reaching out to the n-of-1/personal informatics community in CHI.

Likewise, this program is for CSCW, DIS, TEI, Wearables and Pervasive. We all have access to various mailing lists, social media, and direct contacts into these communities, and plan to use these.

## Workshop Structure

Morning 1 9:30 – 10:45	Introductions and recap on Inbodied design In5: Move, Eat, Engage, Cogitate, Sleep.
Break 10:45 – 11:00	
Morning 2 11:00 – 12:20	Concept Position and Design Challenge work Part 1
Lunch 12:20 – 1:30	
Afternoon 1 1:30 – 3:00	Concept Position and Design Challenge work Part 2
Break 3:00 – 3:15	
Afternoon 2 3:15 – 4:30	Pulling it together: FrameWork Workshopping from the day Next steps for community building and research collaborations
Post-Workshop 4:30 – 6:30	Networking and discussion over drinks & dinner

## Pre-Workshop: Position Papers

The first workshop in 2018 introduced participants to in5 and explored design challenges developed at the time. This year, the one-day workshop will build on this foundation. We invite three types of position papers: (A) Open discussions on any aspect of Inbodied-centered design as outlined above, (B) imaginative design responses to design challenge to be posted to the Workshop Website, and (C) Roll Your Own in5 Design to explore one or two MEECS using, for instance, an n-of-1 approach. Examples of types of challenges that might be explored include these inspired from the workshop last year:

1. GPS has made way-finding increasingly passive. Yet studies show that actively practicing navigation, while in that physical environment, results in the involved areas of the brain physically growing. This development may be an aid against cognitive decline. How can MEECS be leveraged in interactive designs to help leverage skill building for more active way finding, – especially for those who may be directionally challenged with or without GPS.
2. Introverts have a hard time making small talk; extroverts have a hard time listening. Oxytocin is a hormone that triggers trust; endorphins create a sense of happiness or even euphoria. How might we use Movement with ENGAGE in an interactive tech design to help us practice better social engagement?
3. Rich engagement with diverse bacteria in the environment, from food to forests to farm animals seem to connect with better physical and mental health. How do we design a movement support app that also helps connect with this bacterial diversity?
4. Meta-challenge – How might any of these scenarios additionally take the circumbodied into consideration for design?

Participants' papers will be posted on the workshop site after the deadline so that participants can read each others' work prior the workshop. At the workshop, similar to a Design Jam, participants will collaboratively iterate their proposals by exploring strengths and opportunities from an Inbodied perspective.

## PLAN FOR THE DAY

Our goal is to build collaboration teams that carry the challenges towards a shared research project and publication. The day will close with a working session towards synthesizing the workshop insights for incorporation into an in5 framework for future publication. The workshop will have four key sections: 1) In5 review, 2) Design Challenges Part 1, 3) Design Challenges Part 2, and 4) FrameWork Workshopping.

**Post-Workshop Plans**

The collaboration will continue over a slack channel and online documents based on the outcomes of the workshop towards targeting future venues.

**Website**

The [bodyasstartingpoint.tumblr.com](https://bodyasstartingpoint.tumblr.com) will be the main communication channel to update participants on the workshop and related features, networking and funding calls stemming from the workshop.

**ORGANIZERS**

Each of the organisers is experienced at developing and leading multi-day events. Each of the organisers also has experience in leading research around topics in embodied design.

**Josh Andres - IBM Research & RMIT University:** Josh Andres leads user experience and design at IBM Research Australia; his research in HCI focuses on supporting the physically active human body during exertion through systems that can act on, react to and are aware of the environment to participate during the experience [1]. Josh has explored facilitating users creating their own playful experiences towards reflecting on their physical activity [2]. Last, he was one of the coordinators of a Dagstuhl on Body Centric Computing [8].

**m.c. schraefel - University of Southampton:** m.c. is a professor of computer science and human performance, and leads the WellthLab at the University of Southampton. The Lab focuses on human-systems interaction with the mission to #makeNormalBetter [9]. In 2014 mc lead the first Dagstuhl workshop on HCI and proactive Health [5], and has lead to a variety of workshops like [3] and articles like [4] to design from both a better understanding of how the body actually functions; to think about performance as well as prevention, and to focus on intervention design at scale rather than individual alone. mc's research beyond health also focuses on human personhood, and how design of automated systems can ensure individual and social consent is respected at internet scale and speed of its data-sharing communications. m.c. is also an NSCA certified strength and conditioning coach, nutritionist and functional neurology coach – m.c.'s work can be found at <http://www.ecs.soton.ac.uk/~mc> and she can be found on twitter @mcphoo and Instagram @m.c.phoo.

**Aaron Tabor – University of New Brunswick**

Aaron Tabor is a PhD student at the University of New Brunswick, where he works with both the HCI Lab and the Institute of Biomedical Engineering. Aaron's previous research has focused on the design of myoelectric training games – games that help people who have lost use of one or both of their arms learn to use a prosthesis more effectively [10]. His training game was awarded “best game” at the 2016 CHIPlay Student Game Design Competition [11]. Since beginning his PhD, Aaron's research has focused on using embodied knowledge to rethink the current office workplace, with the ultimate goal of designing healthy breathing practices directly into the work environment.

**Eric Hekler** is the Director of the Center for Wireless and Population Health Systems and a member of the Design Lab at the Qualcomm Institute and an Associate Professor in the Department of Family Medicine & Public Health at UC San Diego. He conducts research with the aim of facilitating equitable participation, contribution, and benefit from the applied sciences, particularly as mediated via digital technologies and in the domain of public health.

His research focuses on how to advance precision health interventions developed by scientists and scientific citizens. For example, he has been funded by the National Science Foundation to develop a personalized and perpetually adapting physical activity intervention that uses control systems engineering methods, which are a highly advanced n-of-1 methodology used in the auto-pilot of planes to support individual behavior change [7]. He has been funded by Google in the development of strategies to support individuals in finding their own solutions for living healthier lives via self-experimentation. He was funded by the Robert Wood Johnson Foundation to advance a process for advancing solutions to complex societal problems via melding insights from human-centered design and agile development with advanced applied science methods, including n-of-1 methods like control systems engineering, and the use of triangulation of insights across disparate methods and iteration to increase confidence in assertions [6].

### CALL FOR PARTICIPATION

How can we use movement to help us improve spatial navigation? How can we use sleep and eating to be more creative? How can we use movement to help introverts & extraverts get along right away? What would interactive systems that foster these approaches look like? To answer these questions, we need to know something about how we work internally as physio-neuro-electro-chemical social systems. The challenge is that accessing knowledge of how the body itself works and how its different systems interact dynamically has often been out of reach in HCI. In this cross-domain & hands on workshop we explore why designing with an embodied view is the next wave of research in HCI.

In this one-day workshop in its second year at CHI, returning & new participants will have the opportunity to practice the Embodied interaction model of in5 and test its lenses of Move Eat Engage Sleep Cogitate – to specific design challenges. In doing so, gaining practice on how to take an embodied approach to HCI and inform em- and circum- embodied design decisions.

Embodied design is an emerging area in HCI which contributes to the fast-growing focus on proactive and preventative health at CHI over the past years, but also asks, how else can we leverage the body to support our aspirations for social, physical and cognitive performance?. Participants will take away embodied knowledge and practice to design with an embodied view, as well as resources and contacts that will help them extend their knowledge so that they can approach embodied design with more confidence. Participants are invited to put together a 2-4 page position paper or pictorial that addresses one of the design challenges mentioned on this article and also on the BodyAsStartingPoint. These papers will form the basis of the day's activities. Visit our website, [bodyasstartingpoint.tumblr.com](http://bodyasstartingpoint.tumblr.com) for more information about how to join in this emerging area in HCI and how to prepare for the workshop activities.

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