European Workshop on Ecological Psychology

EWEP16

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Wednesday 16th July

9am-10.30am: Symposium 1, Grant Opportunities

11am-Noon: Poster Session

Moving larger to (re-)stabilize coordination

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Coordinated movement prevails by virtue of interaction between embedded motor processes. Modelling coordinated body parts as two coupled oscillators, yields coordination patterns that attracts towards 0 deg phase relation (in-phase, synchrony) and/or 180 deg phase relation (antiphase, alternation). In this context, effects of movement frequency are canonical. Formally, however, the coupling forces and, thus, coordinative stability are mainly a function of the amplitudes of the oscillations. As such, enlarged movement amplitudes stabilize coordination and may help to (re-)learn to coordinate movements.

This notion is more so appealing because manipulating movement amplitude would be exceedingly straightforward and utilised for (therapeutic) training purposes. However, surprisingly few interlimb coordination studies have considered amplitude in their analyses. Arguably the most pertinent exception was a study that was specifically designed to tear apart effects of frequency and amplitude (Post et al., 2000). Unfortunately that experiment had 6 participants only, mainly because the most challenging conditions (antiphase at high frequency and large amplitude) could only be performed by few.

With an aim for generalization, we therefore performed a replication experiment with some design simplifications, in which 26 participants oscillated their lower arms around the elbows in 1) in-phase and antiphase mode, 2) at prescribed frequencies of 1, 1.25, 1.5, and 1.75 Hz, and 3) at 0.1, 0.2, and 0.3 rad prescribed amplitudes. Overall, while coordinative measures indicated performace decrement for higher movement frequency, coordination indeed enhanced for larger amplitudes. and these effects were largely additive. Together this generalizes that larger movement amplitudes can stabilize coordination.

Rocking against each other: Dynamics of between-agent interactional opposition

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Between-agent interaction is often of collaborative nature, but can also involve oppositional interaction, such as competitive sports situations (e.g., attacker-defender) and conflicting

social (movement) interactions. In contrast to common attractive (cf. cooperative) coupling, this entails repulsive-attractive coupling (cf. 'attacker-defender'). Modelling two coupled oscillators with such antagonistic interaction yields dynamics that deviate from canonical synergetic dynamics. For example, while cooperative coupling entails attraction towards 0 deg phase relation (in-phase) and/or 180 deg phase relation (antiphase), antagonistic coupling settings yield repulsion from in- and antiphase. For settings close to symmetric antagonistic interaction, this can in fact entail convergence towards phase relations around 90 deg and/or -90 deg.

Here we present empirical results from an experiment in which pairs of participants coordinated in rocking chairs in both cooperative and antagonistic settings. In the latter, one participant was instructed to move in-phase with the partner (reflecting attractive coupling) while the other was instructed to achieve an antiphase pattern (reflecting repulsive coupling). For obvious reasons, the antagonistic trials comprised a variety of behaviours and frequent changes between different coordinative patterns. Still, for antagonistic trials the relative phase values indeed accumulated between either 0-100 deg or -100-0 deg, depending on which dyad-member was instructed to achieve antiphase. Furthermore, interactive opposition appeared to boost amplitude and frequency of the rocking movement altogether. All this shows the unique behaviour when coupled in opposition, highlighting the necessity to study and conceptualize such situations distinctively from cooperative coupling scenarios.

Are Object-Affordance Pairs Bidirectional?

Authors: Jessica M. Dukes, Amelia Morehead, Dr. Mark Huff, and Dr. Alen Hajnal

University of Southern Mississippi

Normed data sets provide a standardized way to study language and provide insights into what makes language meaningful. Dimensions such as concreteness, animacy, body-object interaction (BOI), and object-affordance pairs indicate that sensorimotor experience is important for building associative language networks. A recent investigation (Maxwell et al., 2024) developed the first object-affordance normed data set, presenting participants with object words and requiring participants to provide affordance words (potential actions they could perform) for each object. Results indicated that affordance measures are weakly correlated with existing semantic measures, suggesting that affordance information is unique. The current investigation aims to test if object-affordance pairs are bidirectional (if presenting an affordance instead is equally likely to activate its corresponding objects). The current paradigm is the reverse of Maxwell et al.'s study. Participants are presented with affordances (i.e., action words), and are asked to provide objects they could perform the provided affordance with. The affordances presented for the current study are the responses that were provided in Maxwell et al.'s study. Preliminary results indicate that object-affordance activation is bidirectional, but not equally facilitated in both directions: fewer objects were provided for affordances than affordances were provided for objects. This could be due to objects being more accessible via sensorimotor experience than affordance words themselves. The results of this study will provide more insights into object-affordance relationships in the lexical network. Future studies are planned using normed picture databases of objects and videos of activities to test the bidirectionality and (a)symmetry of object-affordance associations.

Not all Solutions are Created Equally: From Possibility to Actuality in Affordance-Based Control

Author: Dees Postma

University of Twente

The continuous control of visually guided action has received wide attention within the ecological community. Over the past decades various models have been proposed to account for the control of braking, catching, intercepting and other visually guided actions. The dominant approach to modelling such actions is 'current-future control' which models behaviour based on the principles of error nulling: e.g. running to null optical acceleration. Such models, however, are limited in one crucial aspect: there is no specification of affordances. Whether catching, braking, or intercepting is possible is dependent on the action capabilities of the performer, which are not explicated in such models. This prompted the development of 'affordance-based control' which naturally integrates action capabilities to specify affordances in the control of action. While affordance-based control solves the problem of action boundaries, it introduces a new problem: affordance-based control strategies only express control in terms of possibility not in terms of actuality. That is, there is no control law that guides behaviour through the space of possibilities. In this contribution, we present recent advancements in affordance-based control that recognize that 'not all solutions are created equal'. That is, there are functional differences between the various solutions in the space of possibilities. In this contribution we explore these functional differences and present modelling and simulation efforts to show how these differences can help to collapse possibility into actuality in affordance-based control.

1.30pm-3pm: Symposium 2, Plurality in Empirical Analyses of Affordances and Effectivities

Despite a shared lineage in embodied and embedded thinking, ecological psychology has developed along diverse trajectories. A common thread through this pluriform development, we argue, is the notion of affordances as possibilities for action. Given that human behavior unfolds along various spatial and temporal scales, these affordances become empirically visible at distinct levels of the agent-environment interaction: from attuning to the information in the perception-action cycle, to perceptual-motor learning into broader social and socio-cultural dynamics. Crucially, these varying scales of analysis give rise to a diverse set of methodologies, which shape the way ecological psychology is practiced inside and outside the lab. Our goal in this symposium is to bring these different levels together by focusing on what they share -affordances- rather than on what distinguishes them. In each talk, we focus on a different scale of behavior and address not only the insights but also the challenges that emerge from its methodologies. In reflecting on how the four levels connect so as to stimulate conversation, we ground our discussion in a shared example. As such, we suggest that the ecological study of behavior is not separated in isolated strands, but in fact united in its goal to understand how human agents come to exploit, perceive and actualize the rich possibilities for action in their environment.

Affordances in context: behavior settings and the social and material organization of possibilities for action

Giulia Di Rienzo

University of Antwerp

Affordances become relevant for a particular organism within the flow of social and material practices. While a water bottle is always graspable for a human capable of doing so, whether we perceive it as an affordance for grasping depends on the broader context. On a train, for instance, if the bottle belongs to someone else, it likely does not invite action in the same way. Socially inspired accounts of ecological psychology, such as those developed by Harry Heft and Alan Costall, have emphasized that affordances are shaped by larger-scale social practices. Yet, while Gibsonian psychology has long studied perception and action as embedded in the environment, it has struggled to extend its methods to the complexities of social life.

To understand how we skillfully navigate everyday situations, we need a way to account for how affordances become relevant within shared social and material settings. Contexts—such as a coffee shop or an academic conference—do not merely provide a collection of discrete affordances; they actively structure how possibilities for action emerge and become salient. Roger Barker's behavior settings theory offers a way forward by showing how affordances are sustained through the organization of people, objects, and activities. My talk explores how behavior settings shape affordance perception and how individuals attune to these dynamics. Empirically, I investigate laboratories as behavior settings where multiple practices and materials intersect, influencing how affordances are perceived and acted upon.

Affordance Perception for Others

Samruddhi Damle

University Medical Centre Groningen

Perceiving the actions afforded to others has been established in several contexts such as jumping-while-reaching, aperture-passing and sitting. However, such experimental studies of actions afforded to others typically present the movement kinematics of one singular actor to a group of observers, who indicate whether the action is afforded to this specific actor (or not). Empirical evidence in this regard seldom pertains to the actions of multiple others. This then begs the question as to what is being perceived; is it an actor-dependent (idiosyncratic) property or an actor-independent (common) informational variable? If indeed a common (i.e., independent of actor idiosyncrasies) informational variable is available, then observers should be able to perceive the affordance for any set of unknown actors, irrespective of how many or who they are. By including multiple actors, with the observers being unable to identify these actors, we will be able to show that the information is defined across all actors, irrespective of which actor the observers are seeing. Thus, in the present study we included 12 actors, whose movement kinematics were presented to 12 observers in an unidentifiable, randomized order. Observers made two alternative-forced-choice judgments on the affordance of interceptability for these actors. We found that observers were successful in perceiving the affordances for the actors on nearly 75 % of trials. This suggests that a common underlying variable guides the affordance perception for others, irrespective of who the specific actor is. These findings are discussed in the context of empirical challenges of researching affordance perception.

Interpersonal coordination to actualize social affordances: lessons from a ball-and-beam paradigm

Marijn Hafkamp

Aix-Marseille University

Joint actions create new, social affordances. In actualizing these social affordances, individuals have to coordinate their movements with one another, creating a collective effectivity. To understand such interpersonal coordination, we introduced the manual ball-and-beam task. In this paradigm, participants roll a ball reciprocally between two targets on a long and hand-held beam, by tilting the beam up and down. The task can be performed individually and dyadically, but the goal is always to hit the targets as often as possible within trial duration. In a first experiment, we found two stable patterns of interpersonal coordination. Dyads performing the task for the first time moved the beam sequentially, while those who had practiced the task individually before moved it simultaneously, thereby scoring more hits. This suggested a transferring role for individual task experience in setting up a collective effectivity. In a follow-up study, we investigated the nature of this transfer. Participants first performed the task individually, before being paired into dyads. The number of hits and ball cycles per dyad was well predicted by the sum of the dyad member's individual performances, while the coordinative stability of dyads seemed to emerge from their interaction rather than being determined in advance. In a final experiment, we aimed to improve this coordinative stability by training participants individually in a constrained setting prior to the dyadic performance. Taken together, we showed that the ball-and-beam paradigm can serve to advance our understanding of joint actions by bringing together the concept of affordances with pattern formation theory.

Influence of Practice Variability on Search for New Effectivities

Anadi Mehta, Student

University Medical Center Groningen, Netherlands

Affordance and Effectivities are complementary dispositional properties of the environment and the agent respectively. Learning a novel task requires formation of new effectivities to actualise the affordances present. In our learning study, effectivity is evaluated as coordinative structures at the level of the joint angles. We examine how variability in practice scheduling influences the search for novel coordinative structure and hypothesize that greater variability in practice would instigate higher search behaviour resulting in coordinative structures with more covariation. To do so, a virtual lateral interception task using a body machine interface was performed with constant, serial and random practice groups. A novel redundant mapping was introduced between the upper limb joint angles and the virtual paddle position to control the paddle for interception. Results showed that successful learning of the mapping required formation of new coordinative structures, and the participants could intercept the ball at the end of learning irrespective of the practice conditions. Search behaviour was significantly higher for random and serial practice groups as compared to blocked practice in the initial phases of learning. Coordinative structures are stabilised towards the end of practice and all practice conditions resulted in comparable levels of covariation within the coordinative structures. We showed that variability in practice influenced the search for new effectivities but not the properties of the effectivities.

3.30-5pm: Talks, Philosophy & Theory

Reclaiming meaning in perception: A biosemiotic account of ecological information

David Sanchez, Joan Camarena

Universidad de Granada/Universitat de València

In ecological psychology, affordances are specific patterns of information that enable goal-directed behavior in an organism. However, within an affordance landscape, why is an organism able to select certain affordances over others? How does the meaningfulness of ecological information emerge? This talk aims to address these questions by proposing a novel understanding of affordances as self-organized informational patterns arising from the organism's informational reorganization. To achieve this, we will proceed as follows:

First, building on Chemero's theory grounded in situational semantics, we argue that while the Turvey-Shaw-Mace framework of ecological laws specifies the relationship between the environment, the energetic array, and the perceiver, it nevertheless fails to explain why such information is meaningful to the organism.

Second, we propose that this limitation can be resolved by interpreting ecological laws as sets of non-holonomic constraints, drawing on Pattee's biosemiotic interpretation and the thermodynamics of dissipative systems. In our view, organisms are fundamentally informational and energetic systems characterized by spontaneous, ontogenetically organized movement. This organization is precisely enabled by non-holonomic constraints that "freeze" the organism's internal informational order parameters.

Our conclusion is that the specificity of affordances results from the organizational dynamics of the organism-environment system. Affordances possess meaning in that they are functionally significant for the organism, which becomes synergistically organized into softly assembled, context-dependent structures.

James J. Gibson's affordance examples

EdwardBaggs

University of Southern Denmark

Affordances are today often glossed as "opportunities for action." This formulation is consistent with a theory of affordances as perceivable structures implicated in the online control of behavior, via prospective control. Gibson himself, however, appears to have favored a more inclusive understanding of the affordance concept. I present an analysis of all of the available examples that Gibson used when explaining his notion of affordances. In texts published in his lifetime, there are over 150 discernible examples of affordances. If we include the Purple Perils (published partly in a posthumous volume and partly online), the number is closer to 200. While many of Gibson's examples can be understood in terms of online control (e.g. obstacles and missiles afford collision), there are also many that cannot. Some of Gibson's examples are boolean (a surface does or does not afford support, or slipping). Others refer to perceptual processes (glass affords seeing through, sounds afford identification), to metabolic processes (air affords breathing, berries afford nutrition), or to ongoing events in the environment (shelters afford protection, fire affords warmth). Gibson also uses affordance language to refer to

cognitive processes (printed script affords reading, other people afford conversation). I discuss some possible implications for the field.

Beyond the Extended Mind: Memory as a Continuum in the Organism-Environment System

Anna Finke, Vicente Raja

MINT Lab, University of Murcia, Spain

Traditional cognitive science treats memory as a property of the brain. The Extended Mind Theory (EMT) challenges this view, positing memory can extend into the environment. Yet, we propose that EMT does not go far enough: memory is not just extended into the environment but distributed on a continuum within the Organism-Environment System without directionality. This relative distribution is determined by the organisms' perception-action modalities. For action, the trade-off between metabolic cost and portability determines how much memory is stored externally vs. internally. Highly mobile organisms, like many animals, require more internal memory for portability. In contrast, rooted organisms like plants, facing a more stable external environment, can rely more on external memory. For perception, the temporal properties of structured energy arrays, partially determined by the medium, shape memory distribution. Light and sound, for instance, are wave-type energy arrays with comparatively short temporality; meaning event information is available within them for shorter time periods. Thus, the temporal span of information these arrays provide is inherently reduced and the organisms dealing with them require a greater reliance on internal memory. In contrast, chemical energy arrays display a longer temporality, so that memory does not need to be stored internally but can be directly perceived in the array itself. Taking all this together, we must understand memory as neither inherently a property of the organism nor the environment, but as an emergent property along a continuum within the O-E system.

Prioritising Relevance: Two Views on Agency and Direct Perception

Miguel Gramage

University of Valencia (Spain)

It is widely accepted within Ecological Psychology that perception is intentional. Intentionality helps to explain the transition from action possibilities—i.e., affordances perceived by the animal—to relevant actions, which the animal typically performs. In this talk, I will present two contrasting approaches to agency: the Selection View and the Coordination View. Each perspective offers a different understanding of what constitutes a relevant action and how it relates to the definition of affordances as possibilities for action.

The Selection View suggests that relevant actions result from a selection process guided by an intentional background. While this is the most common approach, I will critique its conceptual limitations. Specifically, I will argue that it makes difficult to unify the realm of objects of perception—which is inherently non-normative and non-intentional—with the process of using of those objects, where agency appears to be situated.

By contrast, the Coordination View posits that relevance is primary and cannot be understood as the outcome of a subsequent selection among possibilities. Instead, relevant behaviors

emerge through the process of maintaining coordination with the environment. This notion of coordination requires us to accept that is relevance, rather than mere action possibilities, what we directly perceive.

Learning Beyond brains: An ecological-behaviourist framework for plant learning

Aditya Ponkshe and Paco Calvo

Minimal Intelligence Laboratory (MINTLab), University of Murcia, Spain

Plants are often dismissed as non-cognitive organisms, primarily due to the absence of brains and neurons, structures traditionally considered essential for perception, coordination, and purposeful behaviour. However, recent findings in plant behaviour challenge this assumption, suggesting that plants may exhibit forms of learning typically associated with cognitive systems. Conceptualising such capacities in plants and designing empirical approaches to investigate them raises important theoretical and methodological challenges.

To address these, we propose an integrative framework that bridges neo-Gibsonian ecological psychology and neo-Skinnerian behaviourism. Both traditions reject representations and inferential models of cognition, focusing instead on how organisms actively engage with their environments. From the ecological psychology perspective, plants can be seen as embedded agents attuned to affordances within richly structured environments. In parallel, radical behaviourism interprets learning in terms of functional relations between behaviour and environmental contingencies, without invoking inner mental states.

We illustrate this synthesis through the example of plant-animal coevolutionary interactions, in which plants appear to engage with other organisms in ways that enable context-sensitive, adaptive responses. These interactions can be analysed both as affordance-based couplings and as structured contingencies akin to operant learning. By perceiving affordances and modulating behaviour in relation to environmental feedback, plants may satisfy key criteria for non-neural learning.

This ecological-behaviourist model reframes plant learning as a dynamic, relational phenomenon, challenging neurocentric accounts of cognition and extending the study of learning beyond the animal kingdom. It also opens new avenues for empirical research into non-neural learning.

Thursday 17th July

9am-10.30am: Symposium 3, Ecological Psychology and the Bliss of Motor Abundance

From braking a car to a safe stop to throwing a ball; many tasks in everyday life and sports can be successfully completed in more than one way. This is perfectly illustrated by the seminal work of Nicola Bernstein on motor redundancy. Bernstein studied blacksmiths hitting a chisel with a hammer and noted that the blacksmiths displayed considerable variability in joint angles but comparatively little variability in hitting the chisel. This finding illustrates the abundant mapping of elementary variables (e.g. joint angles) onto performance variables (e.g. end-effector position) in action and is found at every level of analysis throughout the agent-environment system. This symposium brings together examples of recent work on motor abundance within the ecological framework. This includes research on the role of information in the formation of coordinative structures; research connecting the UCM method with the concept of affordance-based control; research on motor learning and skill acquisition through the lens of motor abundance; and research connecting the basic tenets of the Constraints-Led Approach in coaching and training to motor abundance at the task-level. By presenting recent progress in motor abundance research, we hope to ignite discussion around a couple of key questions: Are the characteristics of abundance different at different levels of analysis? Do the various levels of analysis on motor abundance meet, and if so, where? And what is needed to programmatically study motor abundance in an ecological context?

Modelling Motor Equivalence in Sport to Inform the Constraints-Led Approach

Dees Postma

University of Twente

There are many – but not infinite – ways to deal with movement challenges in everyday life and sports. That is to say, 'not everything goes'. When taking a shot in basketball for example, some combinations of release angle and release velocity will lead to successful scoring while others will not. The exact shape and form of the goal-equivalent manifold for successful scoring is determined by the interaction of task constraints, environment constraints, and performer constraints. The constraints-led approach revolves around this notion – proposing interventions that adjust one or multiple constraints such that the learner self-organises to discover more adequate patterns of behavior. However, a successful application of the constraints-led approach in practice tends to remain quite challenging. Because of the dynamic interplay of constraints, it is not always immediately clear how interventions in one constraint impact the other constraints and consequently what the impact on behavior will be. In this presentation, I will explicate the solution manifolds for a number of sport specific actions (i.e. shooting, passing, intercepting) and show how task constraints, environment constraints, and performer constraints relate to form unique solution manifolds. This analysis will show how possibilities for action (i.e. affordances) are distinct for different learners, tasks, and environments. Furthermore, it will show how a thorough analysis of the solution space in redundant tasks can serve as a route to discovery for effective interventions using the constraints-led approach.

Motor abundance concepts for skill acquisition research and applications

Matthew Rodger

School of Psychology, Queen's University Belfast

Perceptual-motor skills are characterised by two qualities: stability and flexibility. Stability, because task-relevant outcomes can be achieved by skilled performers with high likelihood and consistency. Flexibility, because skilled actions can be adapted to internal and external perturbations, contextual constraints, and changing goals. Motor abundance concepts can account for these two qualities and therefore provide principles for skill acquisition research and its applications. This presentation will discuss examples of recent studies which investigate skill acquisition from a motor abundance perspective, in terms of changes in the coordination of movement variables relative to a task solution manifold. One proposal from this discussion will be the need to move beyond central tendency and dispersion measures (e.g. the ratio of two variances aggregated over multiple trials), towards analyses of the structure of changes in measures over multiple timescales (within-trials, within-blocks, across-blocks). The role of perceptual information in guiding learners' trajectories through motor abundant space also requires further investigation. Such theoretical concerns point to promising directions for applying motor abundance concepts to designing and testing skill acquisition interventions. These include the design of augmented feedback, implementation of systematic constraints on movement solutions to promote stability and flexibility, and better accommodation of individual differences between skill learners.

Action and perception co-evolve when learning a novel coordinative structure

Raoul Bongers

Dept of Human Movement Sciences, University Medical Center Groningen, Netherlands

We examined the role of the information-movement coupling in the process of learning a novel coordinative structure, here defined as a temporary functional unit among joint angles. We asked whether first an information-movement coupling is set up before the coordinative structure is learned or the other way around. A virtual lateral interception task using a body machine interface was conducted. A novel redundant mapping was introduced between the upper limb joint angles and the virtual paddle position requiring learning a novel coordinative structure to control the paddle. Coordinative structures are defined by higher co-variation then other variation in the joint angles. Arguably, an information-movement coupling is set up when balls that arrive at the same interception location via different trajectories are intercepted with different kinematic trajectories (i.e., the angle-of-approach effect). We found an angle-of-approach effect at 70% of the ball trajectory in all four phases of learning and for all ball arrival positions, indicating the setup of the information-movement coupling from early on in the learning of the novel coordinative structure. At 70% of the ball trajectory co-variation in joint angles was not different from other variation in any of the phases, whereas at interception, co-variation was larger than other variation from phase 2 onward. This showed that the coordinative structure was formed late in the movement and emerged after the initial phases of learning. The results suggest that first an information-movement coupling is set up to guide the action before the coordinative structure is formed.

How Task Dynamical Affordances Constrain Motor Abundance

Andrew D Wilson

Leeds Beckett University, UK

Motor abundance analysis methods such as the Uncontrolled Manifold and Tolerance/Noise/Covariation analyses decompose movement variability with respect to a task goal. A synergy assembled to achieve that task goal is said to be present when more of the variability does not interfere with achieving that task goal. But what is a task goal?

In current motor abundance research, the task goal is a researcher degree-of-freedom. UCM research typically focuses on a biomechanical variable (e.g. the trajectory of the hand), while TNC uses a dynamical description of the task to generate a solution manifold. But from the first-person perspective of a mover, the task goal is *effecting an affordance*. In this talk I will describe how a task-dynamical approach to affordances can be used to characterise the task goal in a way that can be used to constrain motor abundance analysis methods. This approach formally defines affordances using the dynamics of the task at hand; for example, in throwing, the affordances of the target is described using the variables of projectile motion, expressed in an action space defined by the release parameters that parameterise such a motion.

This talk will describe this hypothesis about how to formalise affordances, and the research program it entails.

11am-12pm: Talks, Social Cooridination

The Ecological Self and its Development

Catherine Read, Agnes Szokolszky

Rutgers University, Szeged University, Hungary

J. J. Gibson (1979) defined the self ecologically, as the constant co-perceiving of self-in-surround. Neisser (1988) drew on Gibson and defined the ecological self as the sense infants develop of their own physical body in relation to other physical objects and differentiated it from the "interpersonal self". Marjorie Grene (1993) described the ecological self but, in opposition to Neisser, she argued that these aspects of the self cannot be separated. There are no different selves, "instead, I have access to myself under different aspects ... that both locate and define me and that, reciprocally, I have helped to shape through my own activity" (Grene, 1993, 112.). Thus, Grene understood the ecological self as an overarching concept that incorporates the "interpersonal self" which is fundamentally social.

We propose that the ecological self is a key to understanding and studying living animal and human organisms. Attending, perceiving, and the value of affordances are the foci of ecological research, but questions regarding who is attending and who is valuing are often left unaddressed. The organicist developmental ecological approach to the self presented here takes the whole life cycle (or rather, the developmental life spiral) into consideration. Animal and human organisms (agents) move and act and the dynamic self is a consequent experience over their lifetimes. What forms do the changes in the ecological self take in this process? What is the basis of the unity and continuity of self-awareness? These are the main issues we address.

Modulation of Multimodal Effort in Communicative Breakdowns during a Gestural-Vocal Game

Sarka Kadava

Leibniz Centre General Linguistics, Berlin

Humans, like other living systems, follow the principle of least effort, optimizing cost-to-benefit ratios in daily activities, including communication. However, they also deviate from low-cost tendencies when adapting to environmental constraints. While effort is extensively examined in spoken language, less is known about how bodily effort is recruited across modalities and during interactive challenges.

This study investigates how people modulate physical effort when repairing communicative misunderstandings. Dyads played a referential game, conveying concepts without a shared language, using only sound, only movement, or both. When a guesser misinterpreted an expression, the performer attempted up to two attempts to repair through corrections. We assessed effort using acoustic, biomechanical measures, including vocal intensity, joint torque, and center of pressure shifts.

We hypothesize that repair involves increased effort, with articulatory adjustments scaling to the common ground—measured as similarity between the guesser's answer and the target. Specifically, we expect that greater similarity affords lower effort. However, preliminary results

suggest a non-linear pattern across the two corrections, with effort increasing when the guesser's previous answer was more similar to the target.

Our findings suggest that effort is not purely internally optimized, but dynamically calibrated by co-acting with other linguistic bodies. While often framed as a cost to be minimized, our study links effort to values (Reed, 1996), reflecting mutual commitment, as shown by a positive relationship between effort and guesser accuracy. This aligns with a view of communication as an active 'languaging' in which individuals jointly regulate the gradient between sensorimotor and interactive norms.

Move and Play Like You Never Did Before: Social Coordination and Creativity During Musical Improvisation

Lisette De Jonge-Hoekstra

Psychology, Faculty of Behavioral and Social Sciences, University of Groningen

Traditional music education often focuses on playing music as instructed, either through teacher guidance or by following musical notation. This approach limits the possibilities for fostering creativity and improvisation. In fact, research suggests that prolonged formal music training may actually decrease these creative skills. One way to encourage musicians to explore new, creative ways of improvising is through disrupting established musical patterns. Based on the KineMusicalPerformance (KiMuPe) approach by Nijs (2019), we can distrubt these patterns by means of making musicians move like they have never moved before.

In this study, we implemented the KiMuPe approach with dyads of one guitarist and one bass player, who had no prior experience playing together, over a 6-week workshop series. A control group, consisting of similar dyads, participated in weekly jam sessions over the same period. After each session, both the KiMuPe and control dyads engaged in a 15-minute improvisation, which we video and audio recorded for analysis.

We investigated the interpersonal coordination of body movements as well as musical sounds in the KiMuPe dyads by means of cross wavelet analysis. We employed consensual assessment to evaluate the creativity of the dyads' improvisations, with ratings provided by 10 (semi-) professional musicians. Furthermore, we investigated how the interpersonal coordination of body movements and musical sounds were related to creativity. Our findings will contribute to understanding of the relation between interpersonal coordination of body movements, making music and creative improvisation.

1.30pm-2.30pm: Talks, Coordination

Perception of Coordination

Harjo J de Poel

Dept. of Human Movement Sciences, University Medical Center Groningen (UMCG), University of Groningen

Stable coordinative performance crucially requires proper perception, hence some patterns are easier to perceive - and thereby perform - than others. In that context, in-phase coordination (perfect synchrony) is indeed judged as better and/or less variably coordinated than antiphase coordination (perfect alternation), and that patterns of other phase relations are judged as worse and/or most variable (Bingham et al., 1999, 2001; Wilson et al, 2003; Zaal et al., 2000). This may suggest that the dynamics of interlimb (or more general: inter-process) coordination are more so constrained by perception rather than performance (Bingham, 2004).

Continuing in this line of reasoning, we asked whether the well-known tempo-induced transitions of antiphase to the more stable in-phase pattern (Kelso, 1984; Haken et al. 1985) may due to limits in the perception at higher tempos. This could not be tested in the visual judgement studies of 20-25 years ago, because refresh rates of computer monitors at the time were bounded to around 60-70 Hz.

In a series of recent experiments, the above contention was tackled, using contemporary technology including visual stimuli on a gaming monitor with a refresh rate of 360Hz. Overall, the outcomes suggested that at increasing movement frequencies (to as high as 8 Hz) in-phase coordination is still judged as 'good', while for antiphase judgements drop to the level of other, unstable patterns. Hence, antiphase may not be properly perceivable anymore at higher tempos.

Multimodal Characteristics of Phase Transitions in Collaborative Conversation

James Trujillo, Travis J. Wiltshire

University of Amsterdam, Tilburg University

During conversation, multimodal communicative behaviors of interacting individuals, such as speech and gestures, become coupled as individuals take turns exchanging information. Temporally, speaker turn transitions tend to follow a rhythmic pattern, and the patterning of speaker transitions seem to be informative about the goals and subjective quality of interactions. For example, smoother turn-taking timing is associated with collaboration rather than competition, and may reflect the stability of an interaction. Recent research aiming to better understand the dynamics of effective collaborative interaction suggests that moments of “critical instability”, or phase transitions, may be important for capturing the dynamics of collaborative conversation. We build on this work using an open dataset of group problem-solving to assess how points of critical instability in turn-taking entropy relate to group task performance, and the characteristics of multimodal communication around these instability peaks. We assess 1) whether the number or magnitude of critical instability peaks is associated with task performance, 2) whether critical instability peaks co-occur with semantic divergence between speaker utterances, and 3) whether use of visual communicative signals (which have a regulatory function in conversation) is associated with the rate of reorganization after a point of

critical instability. For question 1, we observed that the magnitude of instability peaks was not associated with performance; however, groups with fewer instability peaks performed better on the task.. Analyses for the remaining questions are ongoing. Findings will be discussed in relation to monitoring or assessing group performance, and more broadly, the dynamics of multimodal human interaction.

Patterns of variability in young children's coordinative processes across different cognitive tasks

Marije ten Den, L. de Jonge-Hoekstra, M. van Dijk, J.T. Burman, & R.F.A. Cox

University of Groningen

Cognitive variability is present from moment to moment, in every task, for every child. Cognition is an embodied and dynamic process which encompasses interactions between the brain, body, and environment. Cognitive systems are soft-assembled, such that they configure themselves into functional structures depending on the task and context. Patterns of variability in the activity of a system are indicative of the underlying coordinative processes. In the current study we explore potential changes over time in this coordination during three different cognitive tasks (of different levels of complexity) by characterising the patterns of variability. In the first wave of a longitudinal study, 36 children aged 4,5-6,5 performed a rapid automatized naming (RAN) task, a rhythmical tapping task, and a Fitts task. Data series of time intervals (i.e. between words, inter-tap, movement) are analysed using fractal analyses and are also related to IQ test results. Findings of this study add to our understanding of cognitive variability and coordinative processes in young children.

Friday, 18th July

9am-10am: Neuroscience & Robotics

A Brain for the Ecological Mind

Vicente Raja

MINT Lab, University of Murcia, Spain

In this talk, I'll address the state of what can be called "ecological neuroscience"; that is, an approach to neuroscience compatible with the main tenets of ecological psychology. After a brief sociological remark, I will address the core ideas that can potentially guide such endeavour: both the negative ones (i.e., the rejection of encoding, the skepticism regarding algorithmic explanations) and the positive ones (i.e., the notion of rich/complex stimulation, the primacy of organic behaviour). After that, I will show some recent data that provide a proof of concept of ecological neuroscience as at least some ecological psychologists see it.

Neural Aspects of Prospective Control through Resonating Taus

Ruud Van der Weel, Audrey van der Meer

Norwegian University of Science & Technology (NTNU)

The ecological notion of resonance, as operationalized by Gibson (1966), provides a characterization of the mechanism that allows perceptual systems to detect ecological information and reflect this information into the nervous system. According to ecological psychologists, organisms' pick-up information from the ambient global array. We investigated developmental aspects of this process and found that sensory integration is underway soon after birth. Resonating tau-coupling results from visual and auditory cortices in young babies showed equivalent electricity-flow dynamics with correspondence between informational and neural flow: events in the informational flow mimicked events in the neural flow.

Thus, the global ambient array information features in a dynamical model of the organism–environment interactions and serves as a constraint for interactions with that environment. Ecological resonance occurs when the same variable of ecological information that features in the dynamical models of these interactions also constrains brain dynamics. In other words, when the dynamics of brain activity are constrained by the same variable of ecological information that constrains the organism-environment dynamics, the situation is an instance of ecological resonance. For instance, in a situation in which the variable of ecological information τ constrains a given organism–environment interaction, ecological resonance occurs when that very variable τ is also found to constrain the organism's brain dynamics in the situation. This is also an instance of what we would call τ-coupling at two different scales, the organism–environment one and the neural one. In this presentation various examples of such couplings will be discussed.

Beyond Morphological Computation: An Ecological Approach to Control in Soft Robotics

Matteo Antonelli

University of Urbino (Italy)

This presentation addresses a major challenge in soft robotics: designing effective control strategies for adaptive behavior. Soft robots – flexible systems made of deformable materials (e.g., soft grippers) – pose difficulties for traditional control methods due to their high degrees of freedom and nonlinear dynamics. To simplify control, the principle of morphological computation proposes to offload computation from the brain (controller) to the body, leveraging the physical properties of the agent.

However, describing this process as computation is misleading. While morphology reduces control complexity, it does not take over any computation. Calling it computation suggests that what is done by body-environment interactions could be done by a conventional computer, contradicting the morphological stance, which underscored the indispensability of embodiment.

I propose ecological psychology as a more accurate framework to explain how morphology contributes to control. Control emerges through continuous interplay between body and environment, rather than computational processes. In the case of a soft gripper, conforming to the shape of an object is done by the reciprocal interaction of a soft material with the object's surface, instead of a computation of the required grip strength. Thus, effective soft robotics design should emphasize affordance exploitation to enhance adaptability in dynamic environments.

This talk first introduces soft robotics and its control challenges, critiques morphological computation, and advances ecological psychology as an alternative. Finally, it outlines new ecological design principles that can guide the development of more efficient soft robotic systems.