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Edited by:

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An ecological approach to motor learning

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Free University of Amsterdam, The Netherlands

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Preface

The International Conference on Perception and Action (ICPA) is the official conference of the International Society for Ecological Psychology (ISEP). As such, it provides a forum for scientific discussion for those scholars interested in the ecological approach to perception and action, as well as other topics in ecological psychology, inspired by the work of James and Eleanor Gibson. After last year's conference in Guadalajara, Mexico and switching to even-numbered years, this year the conference is held in Trondheim, Norway.

In accordance with previous ICPA, *Studies in Perception and Action*, Volume XVII, is the Poster Book that represents the posters presented at the meeting. This year, we are again making copies of the actual posters available in electronic format as a PDF file. All presenters were asked to submit the final electronic versions of their posters before the meeting, allowing us to publish the full posters prior to the conference, with the aim of encouraging scientific discussion among attendees. We also hope that the electronic version will make the posters widely available. The Poster Book will be permanently archived on the ISEP website (<http://commons.trincoll.edu/isep/>).

Readers of the book will find research on a wide variety of topics including perception in any modality, motor control and coordination, ecological neuroscience, perceptual control of action, affordances, social interaction, development, learning, cognition, language, human factors, design, sensory substitution, rehabilitation, complex systems, and the dynamics of all the above. This work represents an excellent cross-section of the fascinating and diverse research inspired by the ecological approach today.

We want to thank Kjell Tore Næsgaard for designing the logo of ICPA2024 that was used on the cover of the poster book. Our gratitude extends to members of the Scientific Committee for their timely revisions and comments.

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June 2024

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Julia Blau – Central Connecticut State University, USA

Pablo Covarrubias – University of Guadalajara, Mexico

Laura Cuijpers – University of Groningen, The Netherlands

Chris Pagano – Clemson University, USA

Joanna Rączaszek-Leonardi – University of Warsaw, Poland

Vicente Raja – University of Murcia, Spain

Richard Schmidt – College of the Holy Cross, USA

Paula Silva – University of Cincinnati, USA

Jeffrey Wagman – Illinois State University, USA

Meeting History

1981 – Storrs, CT, USA
1983 – Nashville, TN, USA
1985 – Uppsala, Sweden
1987 – Trieste, Italy
1989 – Miami, OH, USA
1991 – Amsterdam, The Netherlands
1993 – Vancouver, Canada
1995 – Marseille, France
1997 – Toronto, Canada
1999 – Edinburgh, Scotland
2001 – Storrs, CT, USA
2003 – Gold Coast, Australia
2005 – Monterey, CA, USA
2007 – Yokohama City, Japan
2009 – Minneapolis, MN, USA
2011 – Ouro Preto, Brazil
2013 – Estoril, Portugal
2015 – Minneapolis, MN, USA
2017 – Seoul, Republic of Korea
2019 – Groningen, The Netherlands
2023 – Guadalajara, Mexico
2024 – Trondheim, Norway

Perception of affordances for receiving serves in virtual volleyball: Higher order affordances in real time

Introduction

Arruda, Wagman, and Stoffregen (2023) found systematic effects of serve height on participants' selection of either overhead versus underhand techniques in a virtual volleyball task.

Here, we asked whether participants might perceive (and exploit) higher order affordances for "moving the body to optimize a preferred serve reception technique". In a head-mounted virtual environment (Fig. 1), participants viewed approaching serves, and attempted to field it as they would in a physical volleyball game. We separately evaluated the technique used in receiving each serve (overhead vs. underhand) and anticipatory whole-body movements made before ball-hand contact. We compared players in men's and women's volleyball leagues.

In Exp. 1, participants were permitted to move freely in receiving virtual serves. We expected participants would step backward prior to using the underhand technique for higher serves.

In Exp. 2, participants were prohibited from stepping forward or backward. We expected that shorter participants would jump prior to using the overhead technique for higher serves.

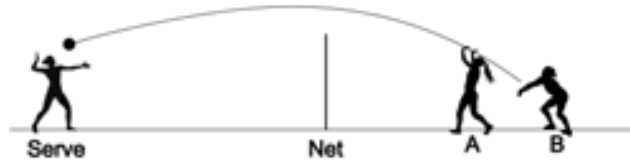


Fig. 2. Anticipatory whole-body movement. A. Overhead technique. B. Stepping back to optimize the underhand serve reception technique. See Exp 1.

Methods

Participants were experienced, competitive volleyball players, mean age 20.75 years. There were 20 players from a men's volleyball league (mean height 1.80 m) and 17 players from a women's volleyball league (mean height 1.64 m); the difference in mean height was statistically significant as was maximum vertical reach. Each participant wore an HMD (VIVE Pro-Eye) and responded to 30 serves (Fig. 3). We manipulated the height (within participants) at which each serve arrived, with 6 values for each participant (see Fig. 4, 5), and 5 trials for each height.

Results

In both experiments serve height influenced the choice of reception techniques, exhibiting the classic "affordance transition" (Fig. 4A, 5A). In Exp 1, the sex difference was significant, but this was not true in Exp. 2. In both experiments serve height influenced anticipatory whole-body movement.

In Exp. 1, no participants jumped. Backward movement (stepping) was scaled to serve height (Fig. 4B), and the sex difference was not significant.

In Exp. 2, 72% of participants jumped on at least one trial. Vertical movement (jumping) was scaled to serve height (Fig. 5B), and the Serve Height × Sex interaction was significant.

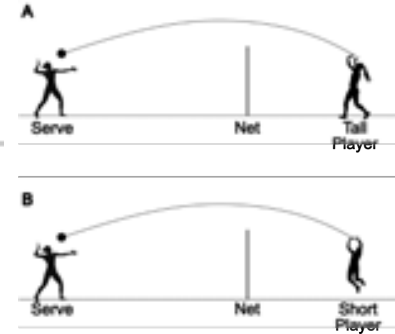


Fig. 3. Anticipatory whole-body movement: Jumping to optimize the overhead serve reception technique. See Exp. 2.



Fig. 1. Representative responses using the HMD and wrist sensors. Left: Overhead. Right: Underhand.

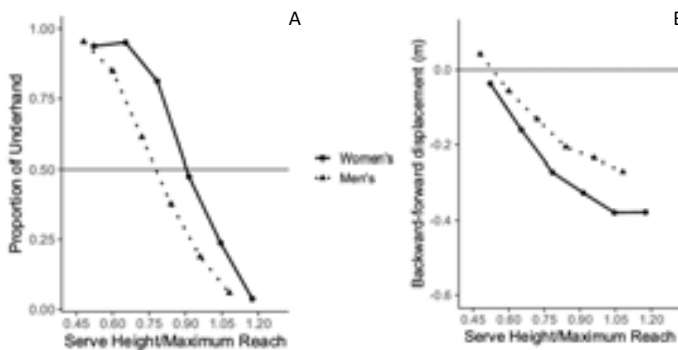


Fig. 4. Experiment 1. A. The proportion of underhand serve receives as a function of serve height and sex. B. Fore-aft headset displacement.

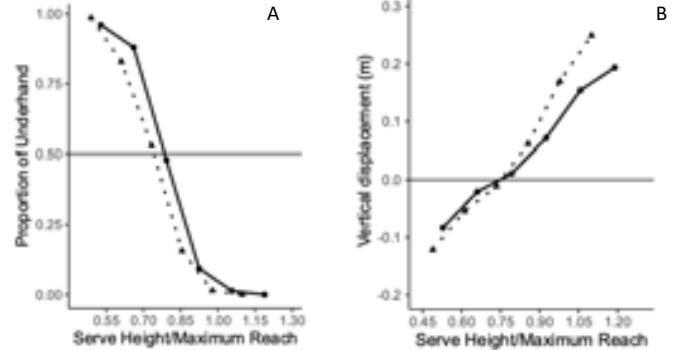
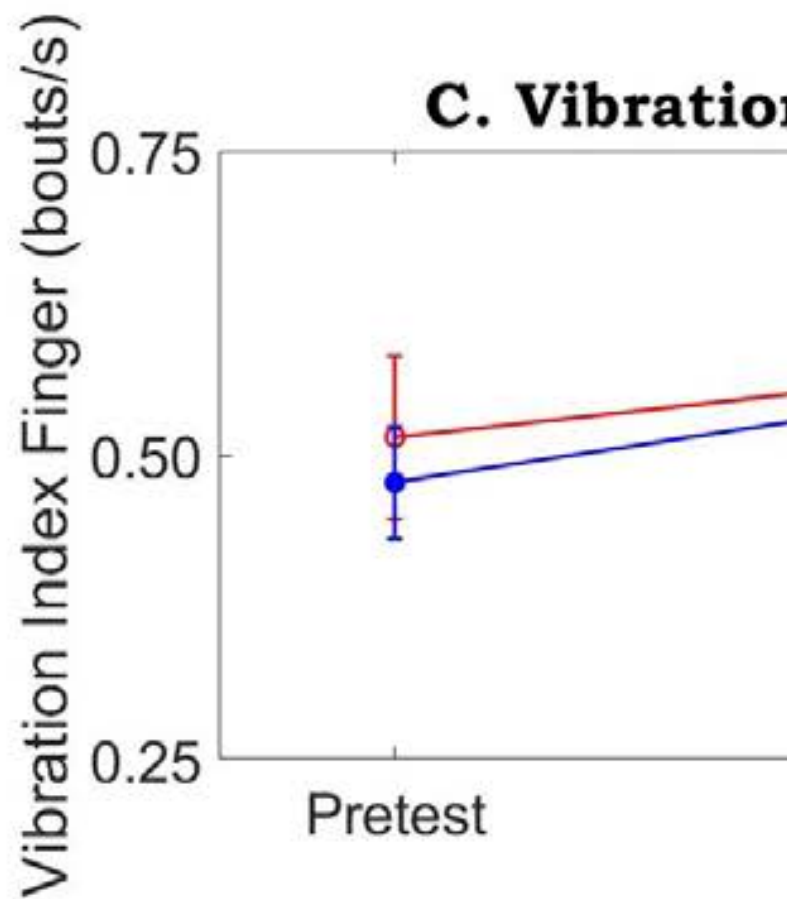
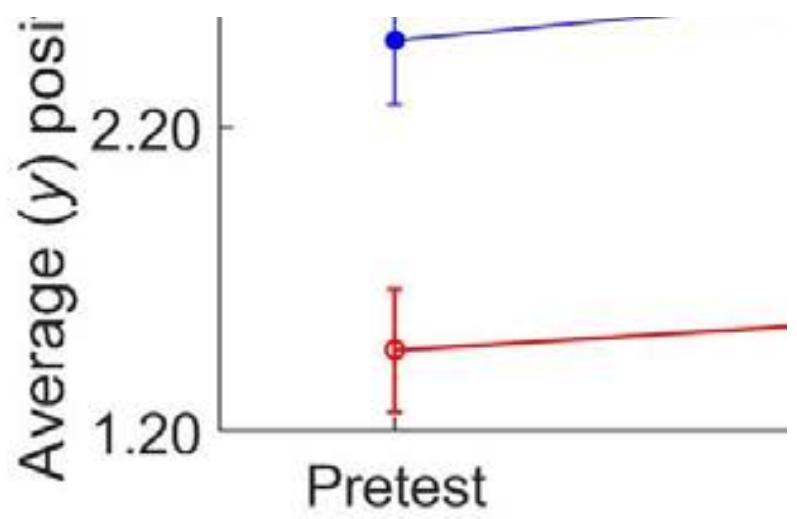


Fig. 5. Experiment 2. A. The proportion of underhand serve receives as a function of serve height and sex. B. Vertical headset displacement.

Discussion

In both experiments, the choice of serve reception techniques reflected the classic "affordance transition", replicating our earlier study (Arruda et al., 2023). In both experiments, anticipatory whole-body movements were related to serve height. In Exp. 1, sex differences were significant for serve reception but not for whole-body anticipatory movement, whereas in Exp. 2 the reverse was true. We conclude that participants perceived (and acted on) functional relations between serve height, serve reception, and anticipatory whole-body movements—that is, higher order affordances, and that those percepts differed by body scale (i.e., sex).

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Predicting repetitive worker behaviour using eye-gaze

Erik Billing, Anna Brolin, Raquel Quesada Díaz, Malin Eklund, Dan Lämkuill



Courtesy of Volvo Cars

Eye-gaze is identified as a very stable queue for predicting *high pitched repetitive* human action!

BACKGROUND

Proactive eye-gaze (PEG) is a behavioural pattern where eye-fixations on the target precede may human actions. Action prediction has a wide range of application areas, including industrial settings where prediction of worker actions could increase safety and improve interaction with automation technology, such as collaborative robots.

Most experimental investigations of PEG involve tasks that are novel to the participants. However, less is known about PEG in repetitive tasks, the latter being much more relevant as a predictive queue in professional settings.

METHOD

With the goal of analysing PEG in repetitive actions, eye-gaze of four industry workers (age 23-43) at Volvo Cars (Torslanda, Sweden) were recorded during manual assembly operations. All participants were experienced workers with two or more years of experience as Volvo employees and nine or more months of experience working at the precise workstation. A total of 57 assemblies were recorded using Pupil Labs Invisible eye-tracking glasses, comprising 1340 high-phased assembly operations such as reach to grasp, placement of components, screwing, and finger press. For each operation, the time of first fixation on the the target and the time of hand contact with the target were manually annotated using ELAN.

RESULTS

A mean PEG of 795 ms (median 707 ms, std 526 ms) reveals a pattern of stable proactive eye-movements towards the target location of each assembly operation. The vast majority (97.4%) of all eye-fixations appeared at least 200 ms before the hand reached the target, supporting the hypothesis that PEG could constitute a reliable queue also in very repetitive situations. While 200 ms is a limited time window, it could for example be used to turn off or break dangerous equipment, drastically increasing safety.

Contrary to our expectations, these results show similar, or possibly even stronger, proactive eye-gaze than what is usually found in traditional experimental investigations, suggesting that PEG is at least as prominent in repetitive actions as in more

Research question:

Is proactive eye-gaze (PEG) present also in highly repetitive behaviour?



Red circle indicate current eye-gaze, blue circles indicate fixations.
Courtesy of Volvo Cars.

Time of target fixation in relation to first hand contact



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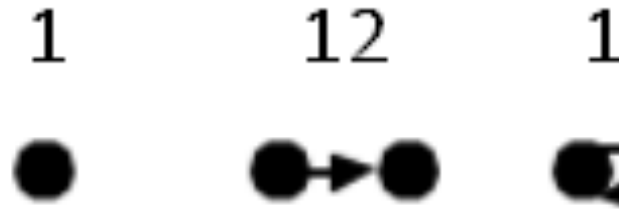
M.Sc. Raquel Quesada Díaz
School of Engineering Science, University of Skövde.

M.Sc. Malin Eklund
School of Engineering Science, University of Skövde.

Assoc. Prof. Dan Lämkuill
Department of Manufacturing Technology, Volvo Cars

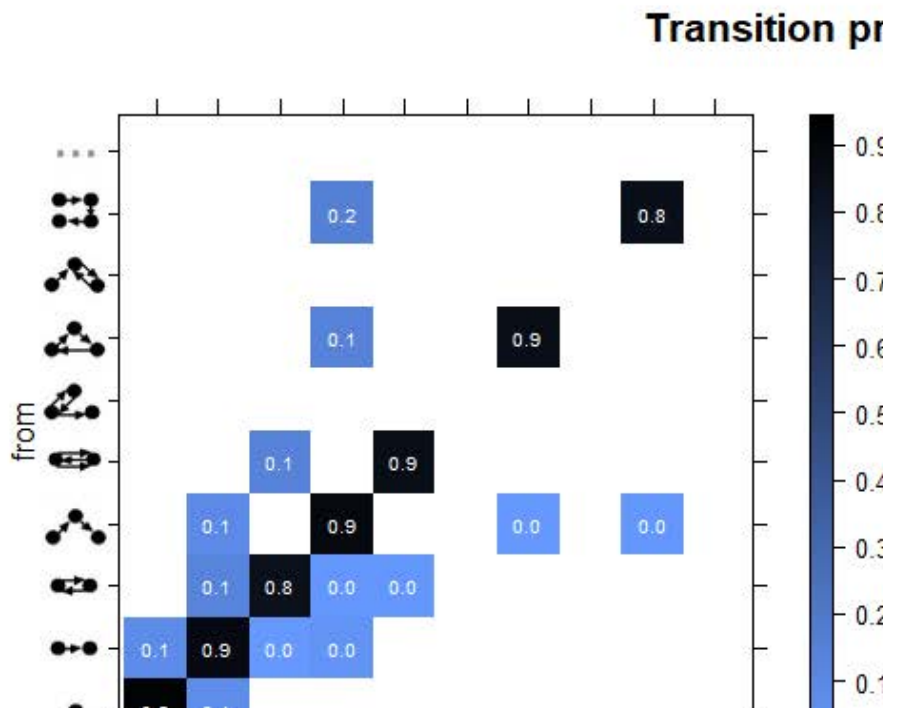
itions excluded)

SE), Transition as follows:



$$RTE = - \sum_{i=1}^N p_i \sum_{j=1, j \neq i}^N p'_{ij} \log_2(p'_{ij})$$

and each of these entropy metrics was tested over



icking algorithm. This process was
or 5 iterations, effectively replicating
McDermott 2017 using our model. Iter
analyzed for statistical significance.

cal analysis, we generated results fro
distribution 1000 times, and compared t
a truly uniform distribution using the
annon Divergence, giving us a 95%
Interval for an expected uniform
. We then compared our experimental
the uniform distribution to get a p-valu

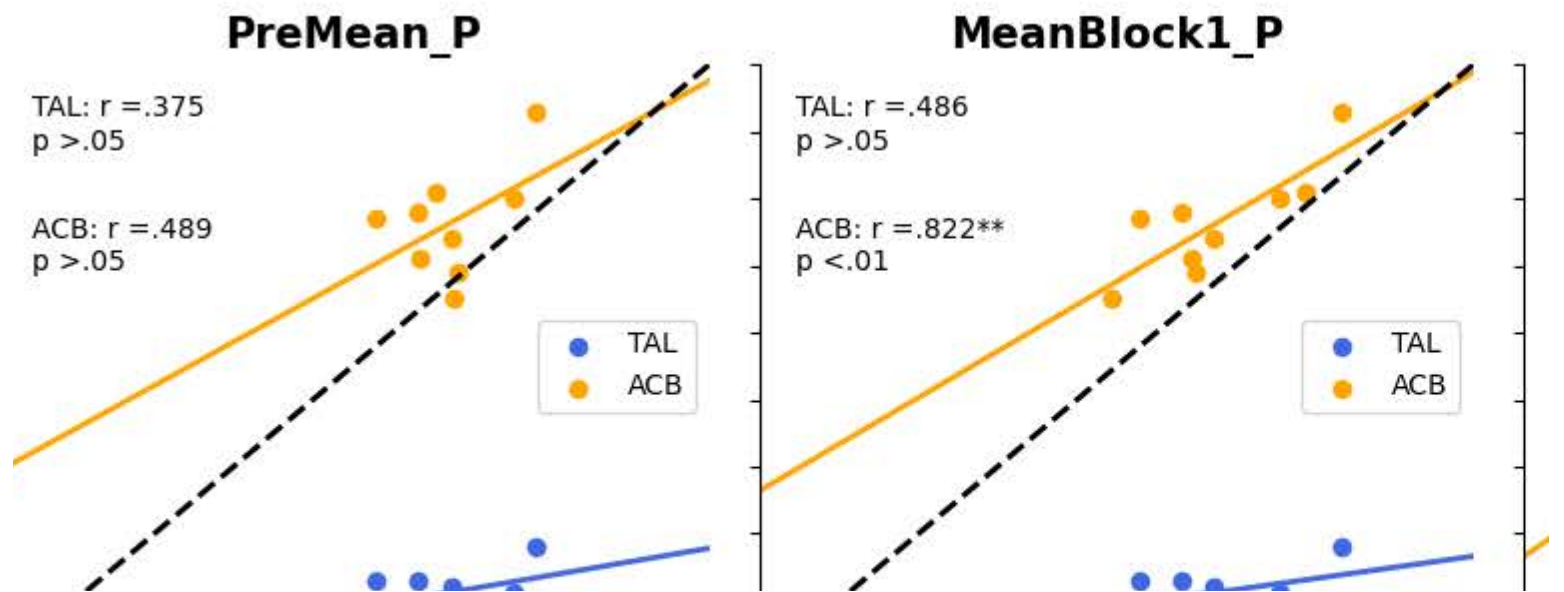
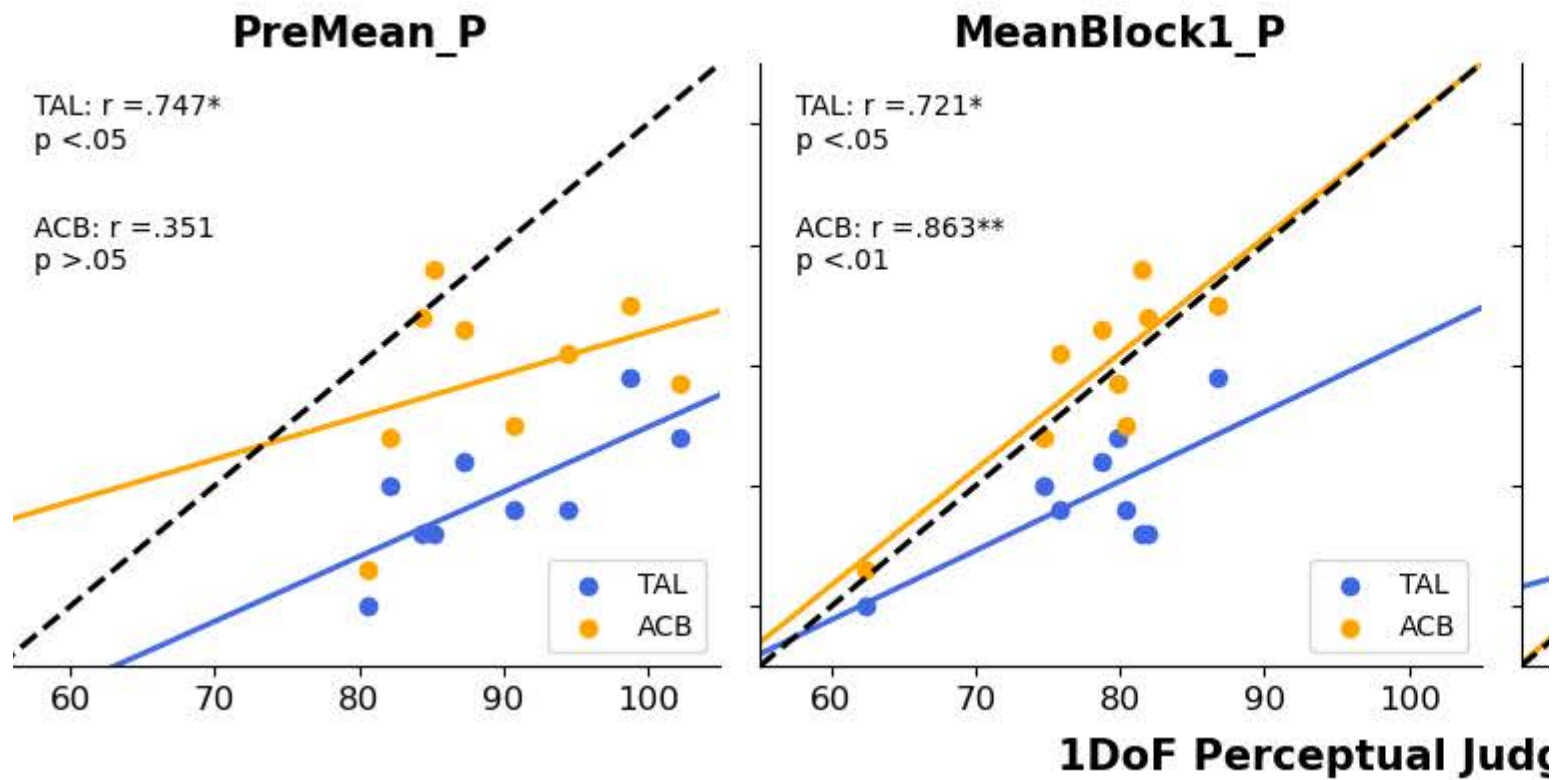
Experiment 1 Results

nal iteration, JSD = 0.351 ($p < .001$)



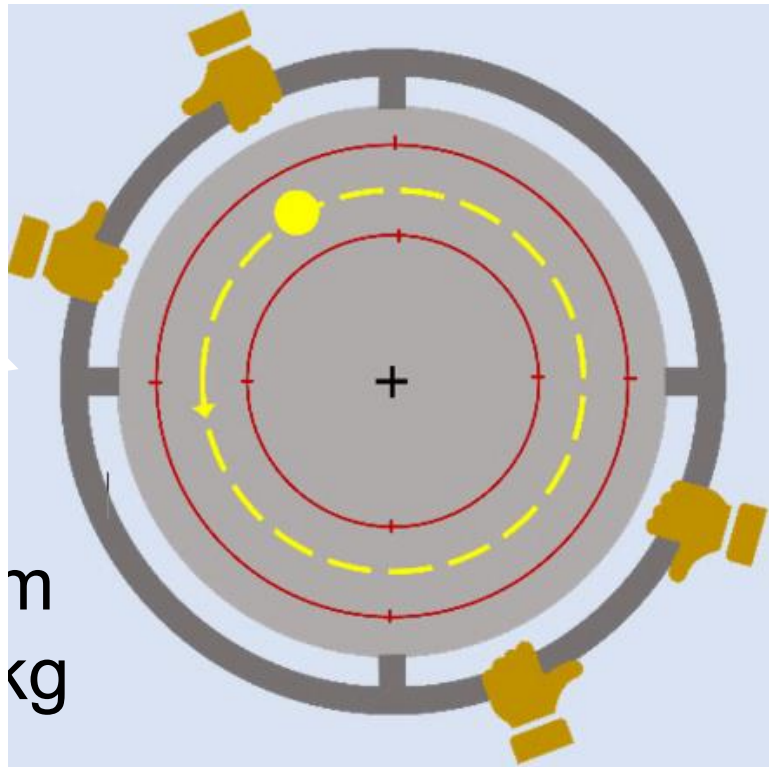
Research Question 2:

plots below show the correlations between the perceptual judgment (1DoF) and Total Arm Length (TAL) and secondary (ACB) and Total Arm Length (TAL).



EC condition, positive effect or sample size

- We found similar trends in sway, but no trends in
- We did not see major differences in different white noise volume was slightly reduced R volume compared to the condition.
- We are not finding major differences between EC and EO in (Figure 2) in opposition research.
- While participants show variability, some seem to show changes in CoD with M

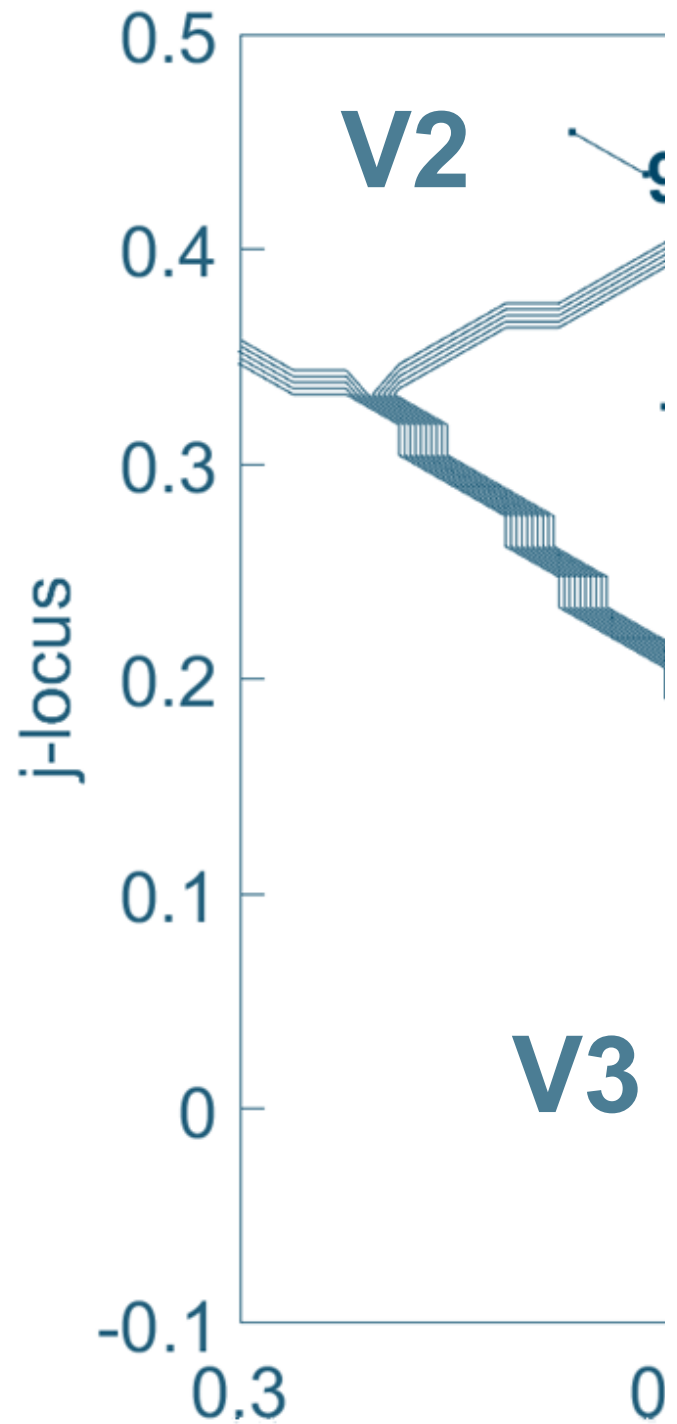


n
kg

board means

n (torqueVP).

RESULT

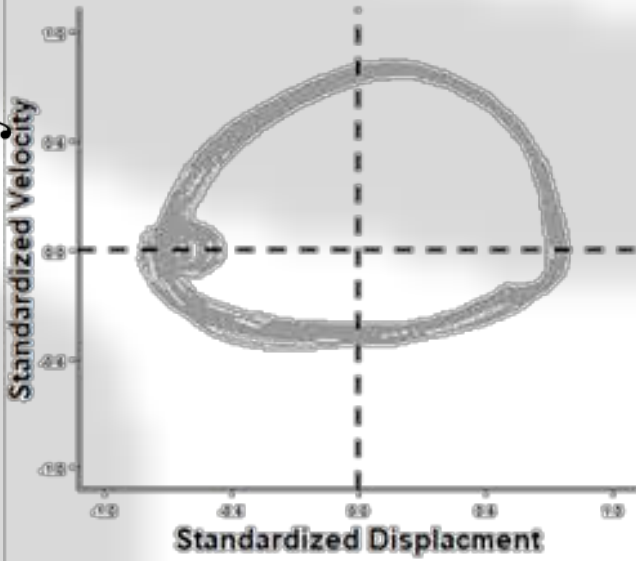


Results

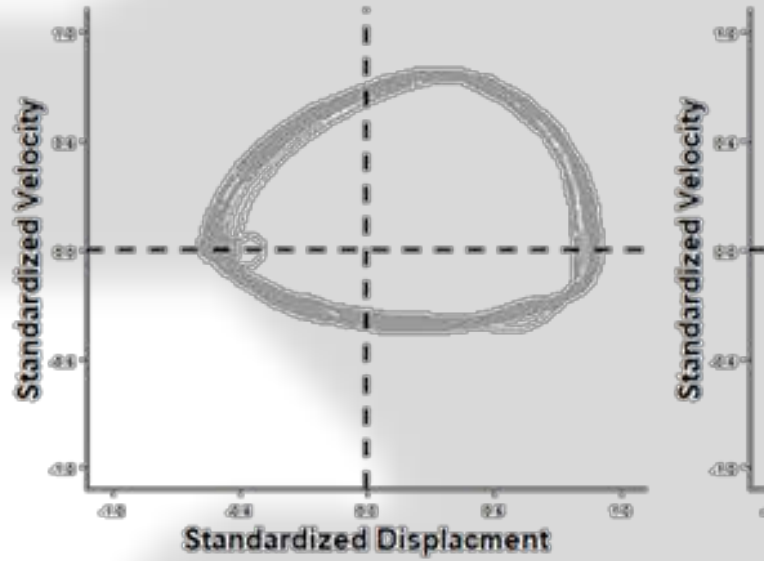
Phase Planes Plots

Jabs only

Preferred

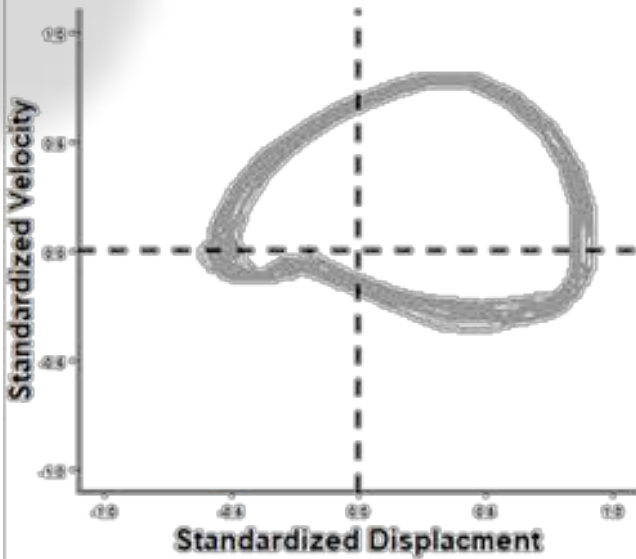


1.5Hz

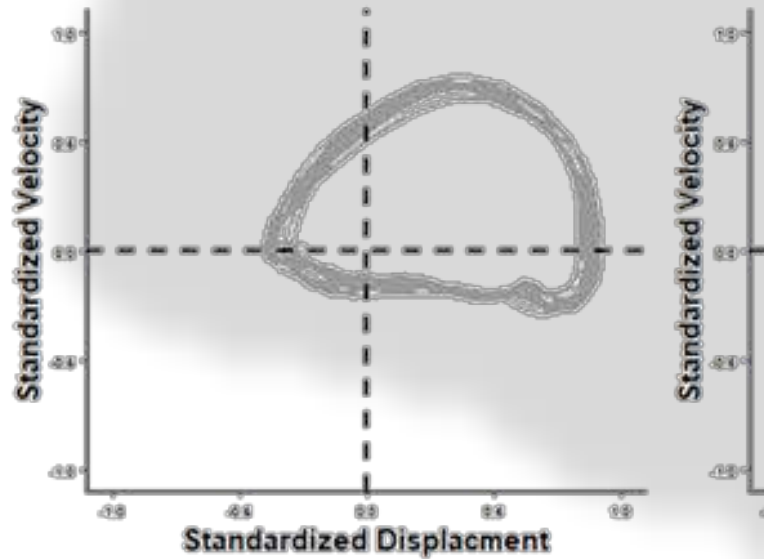


Crosses

Preferred

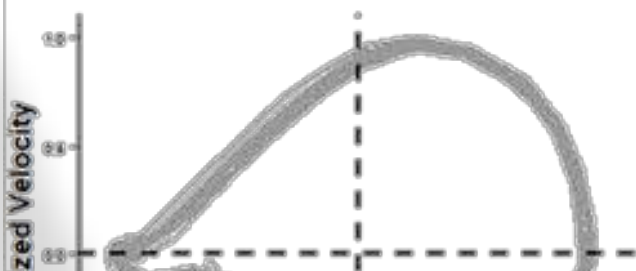


1.5Hz

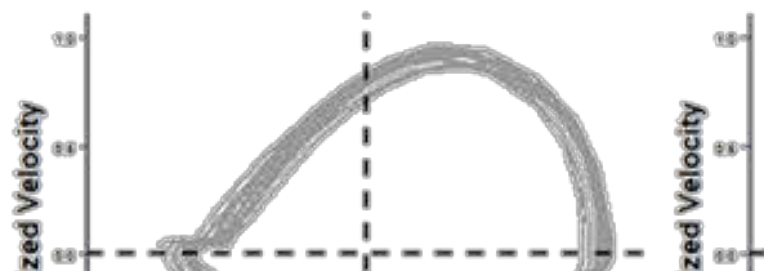


abs

Preferred



1.5Hz

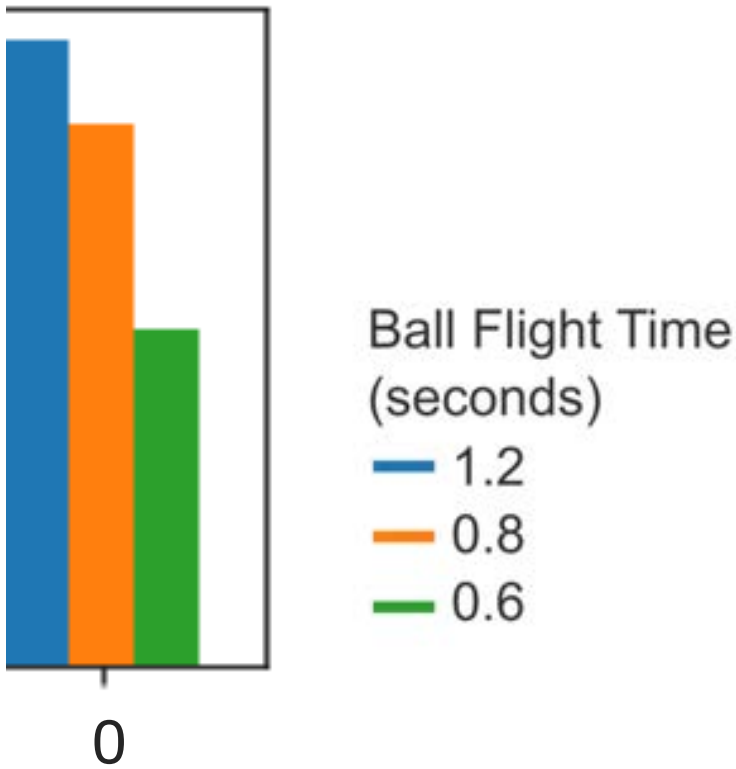


stacles were presented in a view-mounted display (HMD), where the controller through the space. Exploratory behavior was recorded.

affordance landscape changed varied, creating a variable perception of the landscape due to the same size, while both the agent's behavior and the affordance landscape changed. In this case, the aperture changes in the scale of the agent's

Results and Discussion

Results



as a function of ball arrival time. The three ball flight times are shown in green.

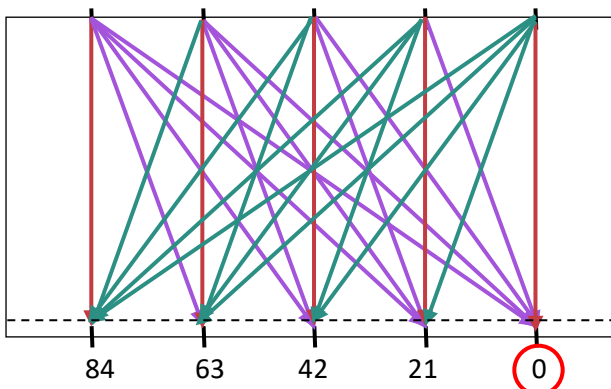


Table 1: Classification table of actual interception performance and frequencies of judgments ("No"s)

Verbal Judg.	Judg. ("No")
	Judg. ("Yes")
Total	

Table 2: Classification table of model predicted interceptability and frequencies of verbal judgments ("No"s)

Verbal Judg.	Judg. ("No")
	Judg. ("Yes")

Procedure.

- The two objects
- No training & no

Results

Total Exploration

	Side		Vc
	1 st	Last	1 st
Time (s)	96.1	★ → 50.9	103.1
Linear D. (m)	5.11	★ → 3.78	7.74
Angular D. (°)	2054	★ → 1314	3224



ew Side View

3: In the motion
n objects rotated
e on a podium



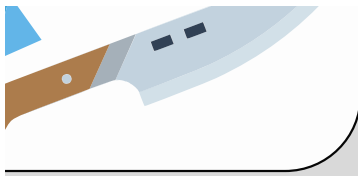
– Learning criterion re
Linear Mixed Model Ana
*dprime ~ View * Movem*
($\beta = .985$, $SE = .3996$, p
ANOVA on blocks-to-crit

Experiment 2

Linear Mixed Model Ana
*dprime ~ View * Movem*

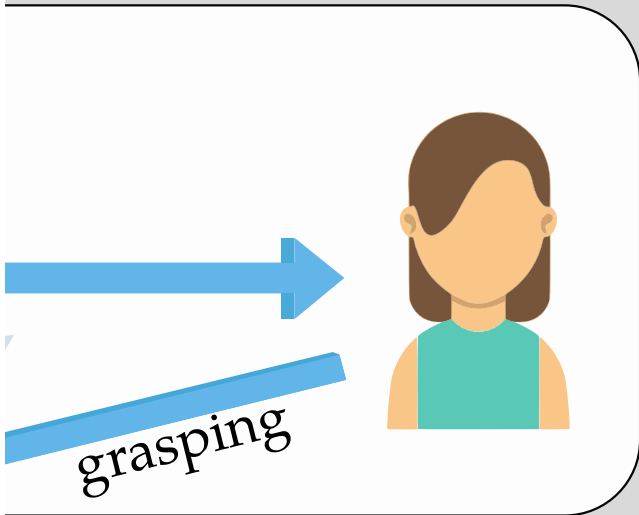
- Significant Motion x V
(see **Figure 5**)
 - Motion provides the
objects are seen fro

Figure 4: Blocks needed to
as a function of View and M



n or

ys of actualizing a



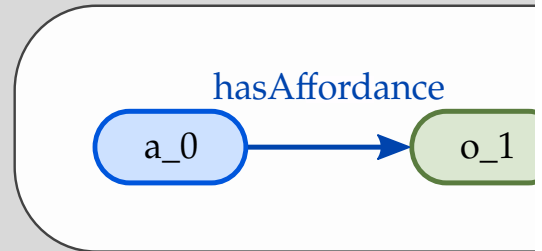
fine concepts,

ndividual fred by the

agent with sufficient

- Cooperative disposition
- reciprocal disposition

Elementary Pattern



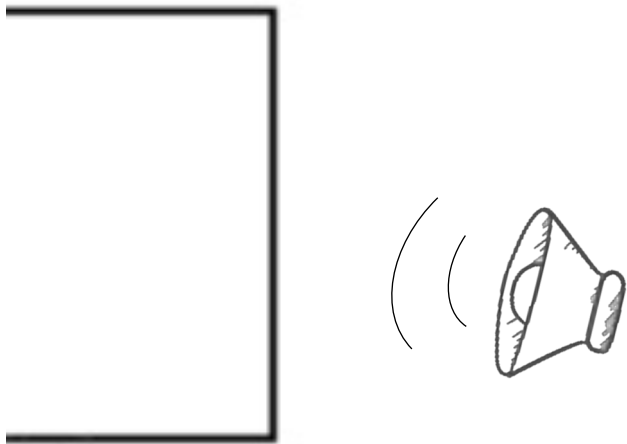
Combined Patterns

Using disposition:



An agent uses its
actualize a DM given

To coordinate



Controls
Mean (SD) or n (%)
17.7 (3.7)
43.4 (4.4)
34.4 (6.1)
3 (30)

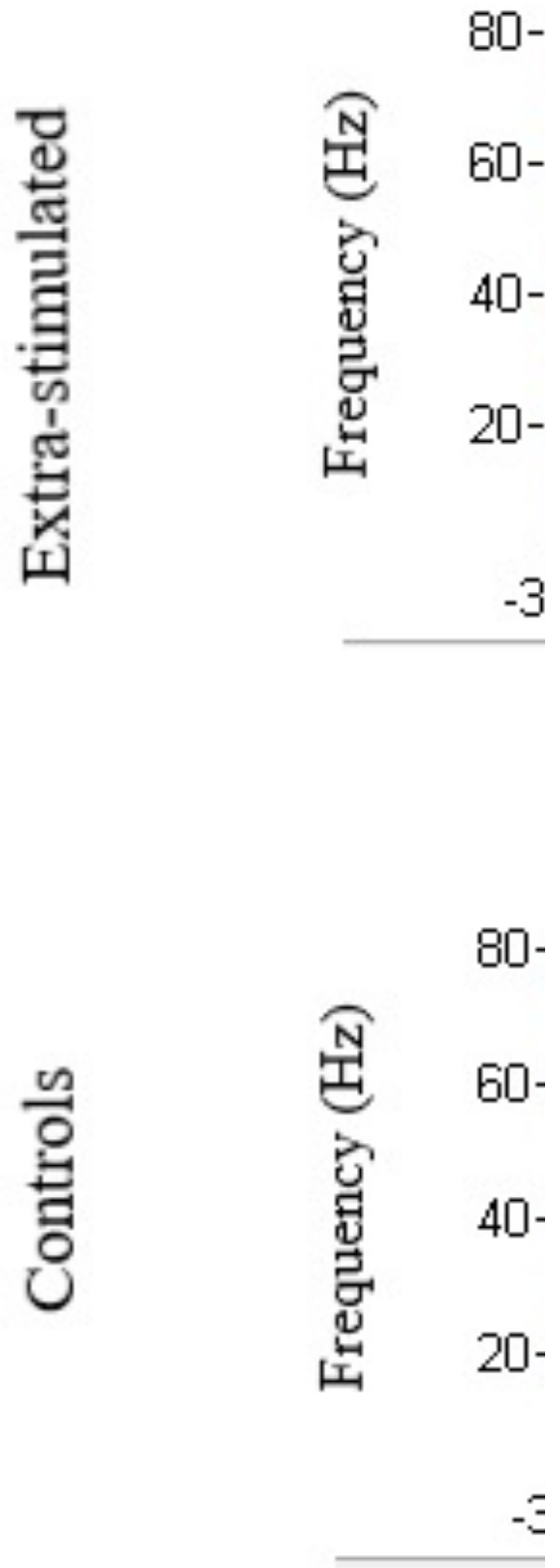
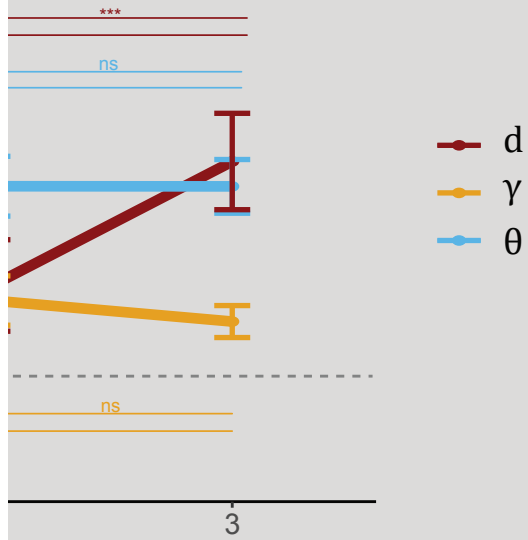


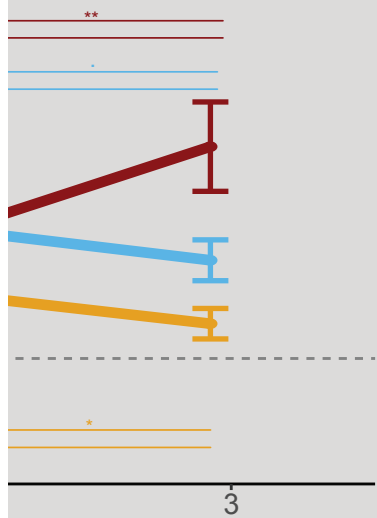
Figure 3. Significant looming motion co

door choice based
 Iso looked at inter-

variable influence across layers



r #



r #

or from beacon disappearance

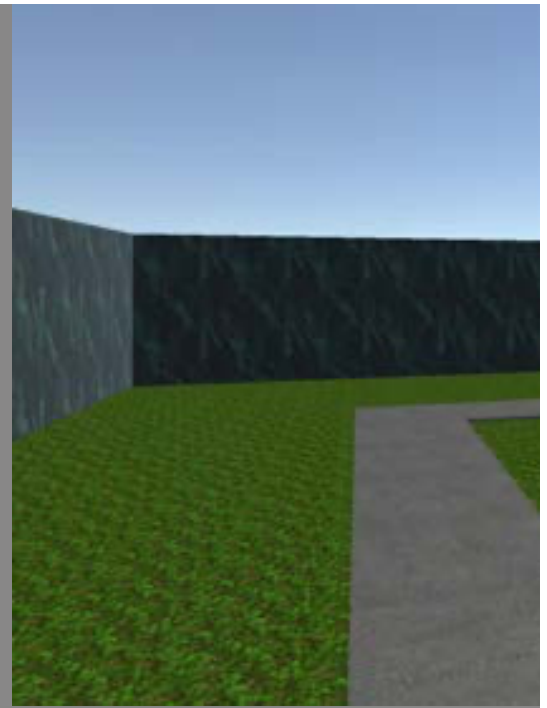
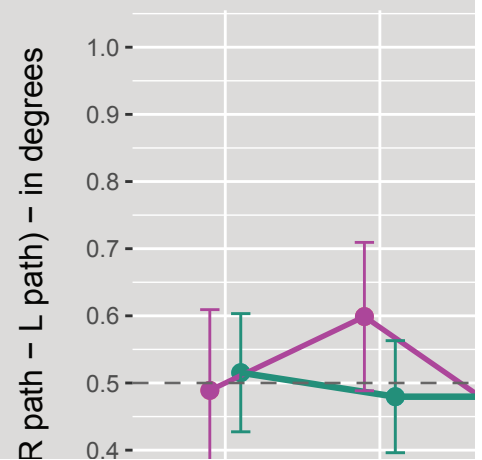


Figure 9

Proportion of trials cons



ated by dividing the
 equency of the right
 and below 1/16 were not

re between the
 \bar{F}_L/F_R was calculated to
 or. The root mean
 was also calculated.

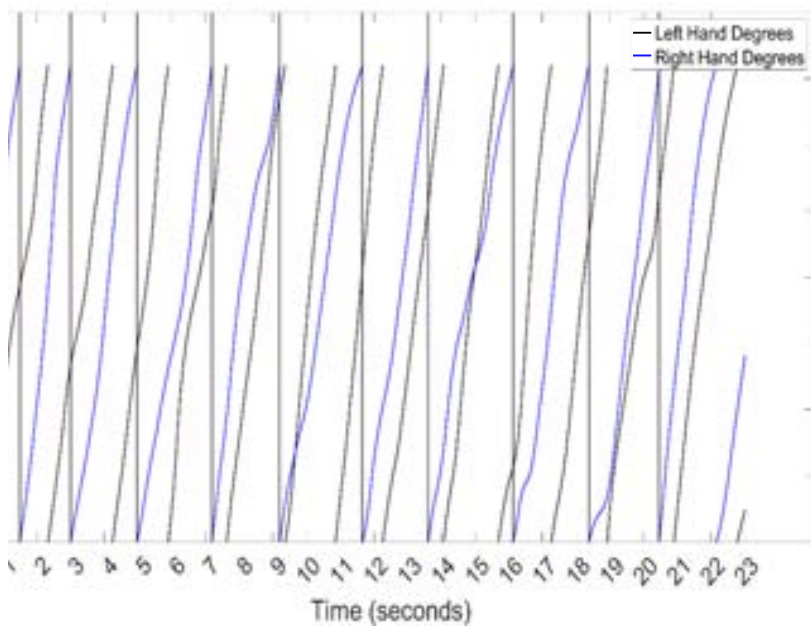


Figure 4. Wrapped
 degrees for a 1:2
 ordination trial
 parated by epoch (black
 vertical lines).

Figure 7. An exampl

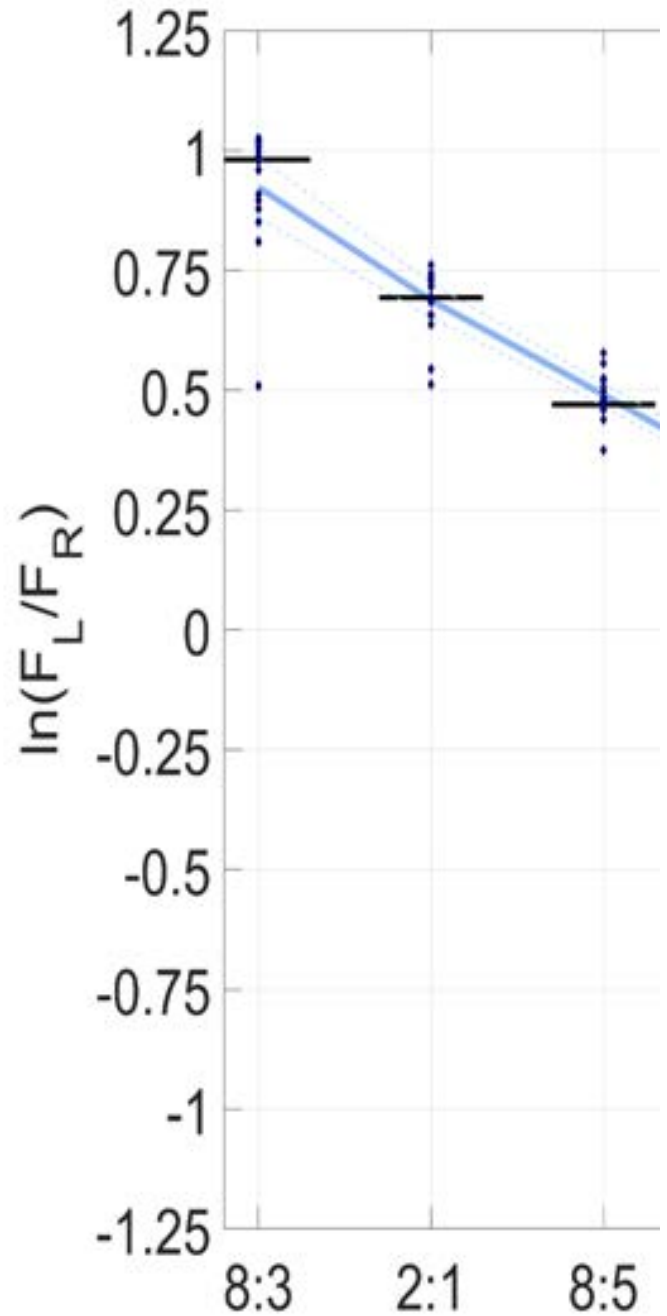


Figure 8. Mean F_L/F_R
 and 6 of the transfe

4

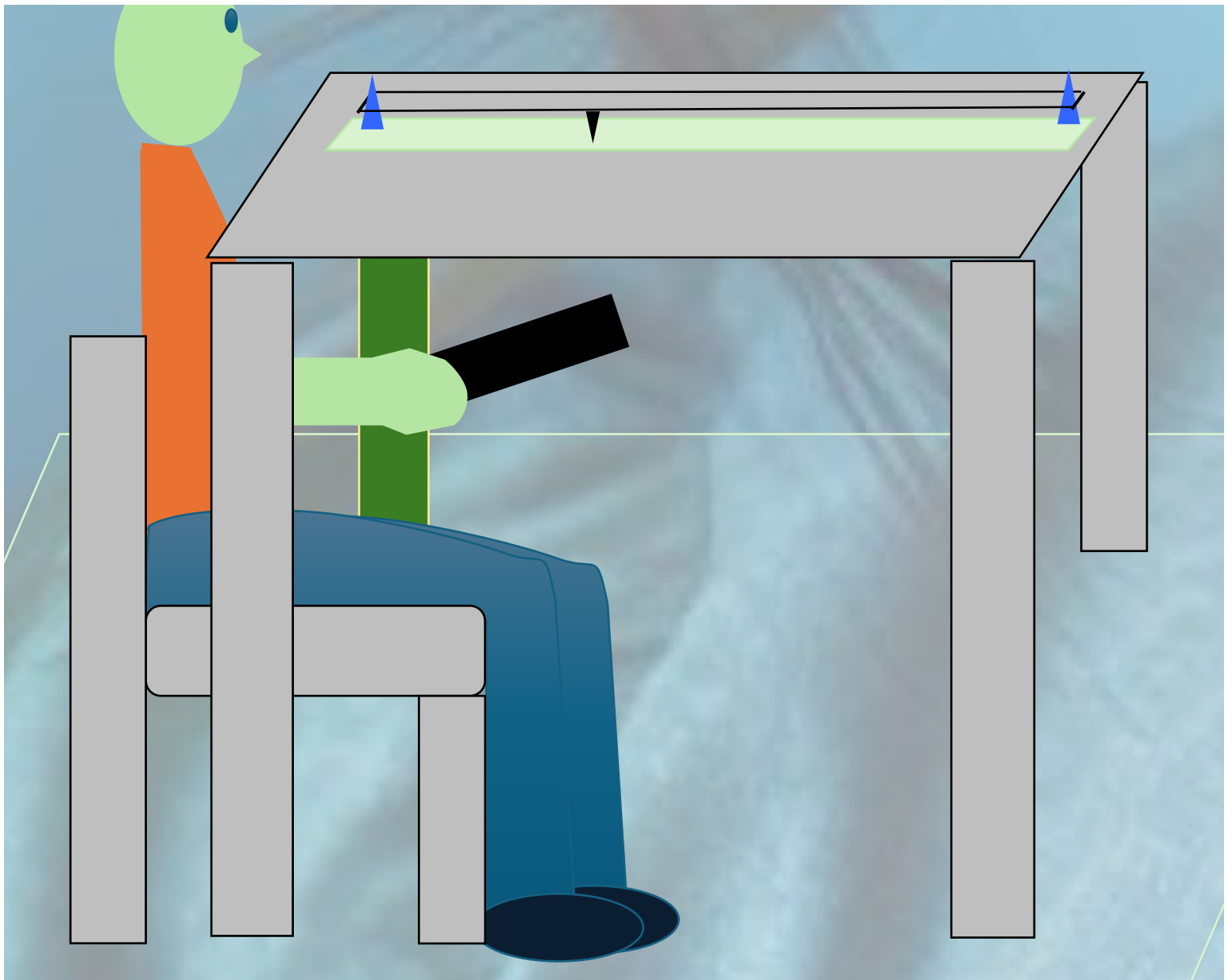


Figure 2: Apparatus and positioning of the children during task 2: Two wooden rods (diameter=0.6 cm) with lengths of 30cm (mass=16.43kg) and 50cm (mass=38.98g) were used. The mass distribution of each rod was manipulated by attaching stainless steel weights (length=1.05cm; mass=22.23g) at positions corresponding to 50%, 70% and 90% of its length from the proximal end (6 principal moments, I^1). The children manipulated the rod under the table and recorded the perceived length using a green marker placed on the table.

Table 1: Descriptive results for age (years), sex, body weight (Kg), height (m), and KBIT2 score.



Results

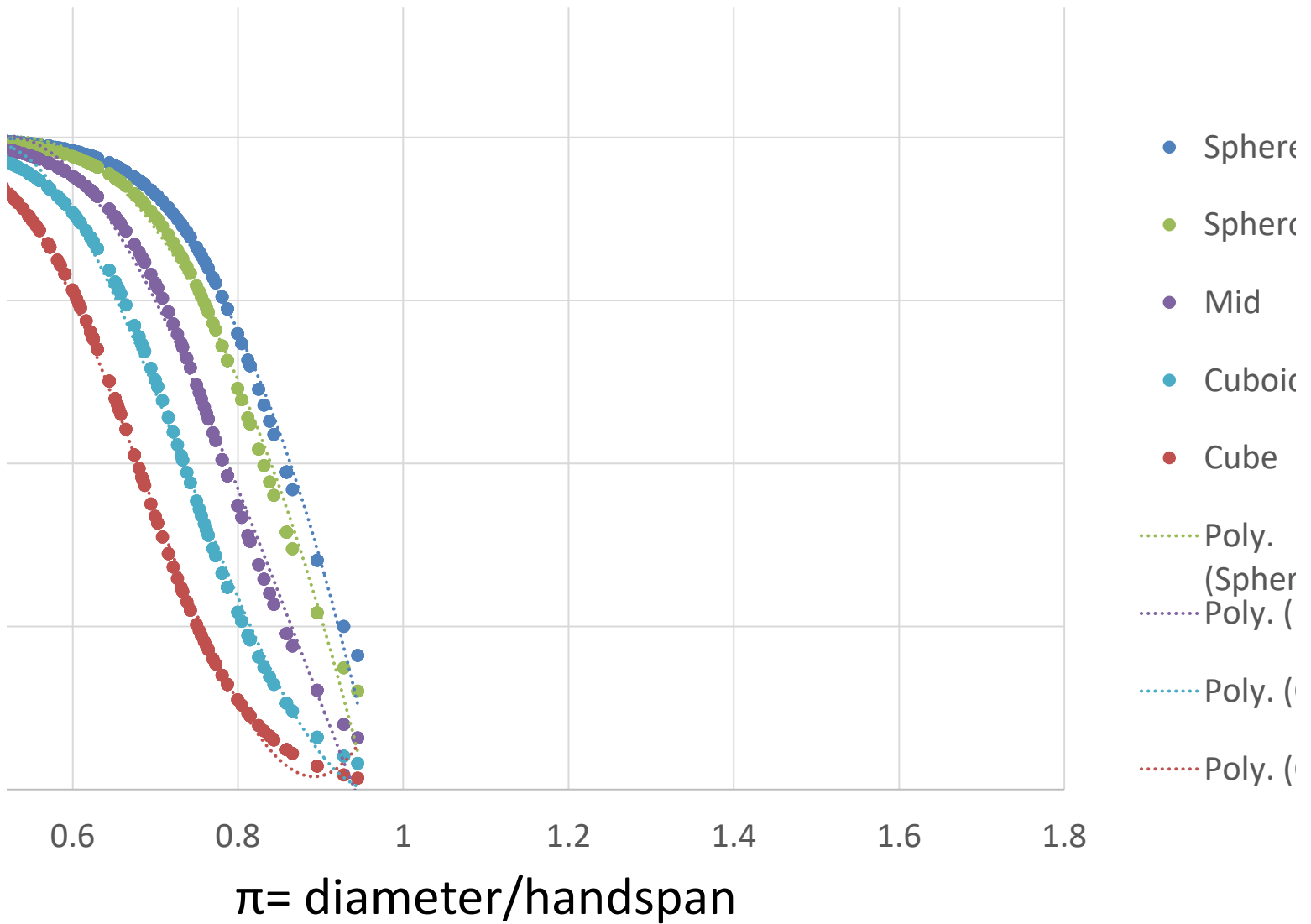
The results showed that the postural control of children with DS improved with the use of TEB. The center of pressure dispersion (RMS) ($p=0.008$), velocity ($p=0.05$), and amplitude of sway ($p=0.008$) decreased with the use of the elastic bands. In addition, removing visual information degraded the postural control of the children only when considering the amplitude of sway ($p < 0.028$), which was minimized by wearing the elastic bands. Wearing the elastic bands during the eyes closed condition did not affect sway velocity.

The findings of this study, while confirming the initial hypothesis, revealed a potential breakthrough. The use of TEB showed a positive



Modes of Action

Logistic regression: Perception= π +Shape



tion

Logistic regression: Action= π +Shape



Psychological and physiological outcomes of interpersonal synchrony during yoga



Caitrín Hall^{1,2} & Alexandra Paxton^{1,2}
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¹University of Connecticut
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Motivation and Hypotheses

Previous work suggests that group behavioral synchrony increases feelings of social connectedness and that the degree of interpersonal heart rate coupling depends on their social closeness. The current study investigates the relationship between group heart rate synchrony, physiological metrics (i.e., heart rate variability [HRV]), and self-reported outcomes (i.e., anxiety and interpersonal connectedness) in the context of yoga. Yoga provides a unique opportunity to study group synchrony because participants are incidentally synchronized, but synchrony is not an explicit goal.

We hypothesized that participants in groups with greater predictability (i.e., determinism) and attractor strength (i.e., maxline) of interpersonal heart rate dynamics will:

- H1.** report a greater reduction in anxiety after yoga.
- H2.** experience a greater increase in HRV after practicing yoga, which can be a sign of greater physiological resilience to stressors.
- H3.** report greater feelings of connectedness to the group.

Method

- **Participants:** 50 undergraduate volunteers with an existing yoga practice participated as 9 groups of 2-7 participants.
- **Procedure:** Each group took a yoga class together. Each participant wore a Polar H10 to record their HRV before, during, and after the class. Before the class, each completed the State Trait Anxiety Inventory (STAI) to assess anxiety. Then they took a 45-60-minute yoga class. After, they repeated the STAI and completed a survey assessing their perceived synchrony and self-other overlap with the group (i.e., interpersonal connectedness).

Data Preparation and Analysis

- HRV was analyzed using **cross-recurrence quantification analysis (CRQA)**. Pairwise calculations of **maxline** and **determinism** were done between all members within each group.
- **Group values** were created by averaging the data from group members, including metrics from pairwise CRQA, anxiety change, and connectedness.
- Separate linear models predicted **change in STAI**, **change in HRV**, and reported **interpersonal connectedness** with determinism and maxline.

HR Time Series of Participant 7



Recurrence
density of recurrent points; inverse of the system's noise

Determinism
proportion of diagonally adjacent lines; system's predictability

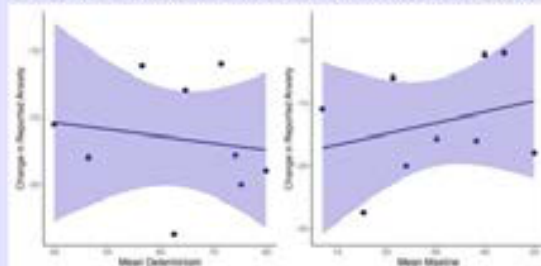
Maxline
longest diagonal line besides line of identity; system's attractor strength

HR Time Series of Participant 6

Discussion and Future Directions

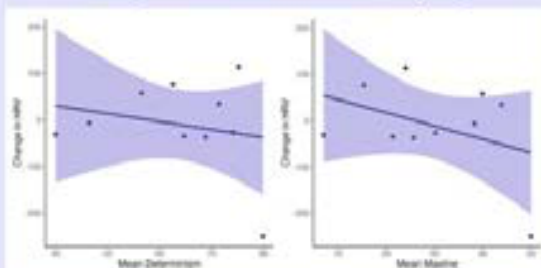
- **H1 was not supported but showed some trends in the expected directions** (Fig. 1A and 1B). No effects reached statistical significance. Consistent with H1, groups with more predictability reported greater anxiety reduction. Contrary to H1, groups with greater attractor strength experienced less anxiety reduction.
- **H2 was not supported and showed trends against the expected direction** (Fig. 2A and 2B). Neither predictor had a significant effect on change in HRV. Contrary to our expectations, groups with less predictability and attractor strength seemed to show an increase in physiological anxiety post-yoga.
- **H3 was not supported and showed trends against the expected direction** (Fig. 3A and 3B). Again, no effects reached significance, but contrary to our hypotheses, groups with less predictability and attractor strength generally reported more interpersonal connectedness among group members.
- **Limitations and future directions**
 - **Additional data collection:** With only 9 groups, the results were underpowered. These results are preliminary, as we are currently collecting data from more groups. Our goal is 15-30 groups.
 - **Additional analyses:** Each group's data was distilled to one metric. We may explore other ways to take advantage of the variability of the data, like by exploring pairwise analyses across group members.

Change in Reported Anxiety Before and After Group Yoga



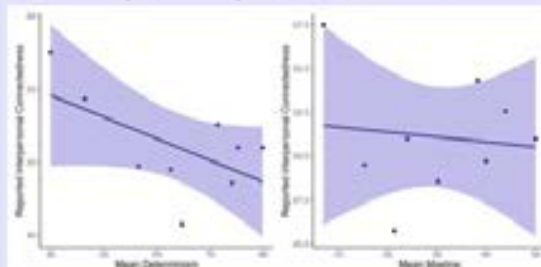
Figures 1A and 1B. Higher values on the y-axis correspond to a lower reduction in self-reported anxiety after group yoga. While not significant, determinism increases with reported anxiety reduction ($b = -0.052 \pm 0.118$, $p = 0.672$; left), and maxline increases as reported anxiety reduction decreases ($b = 0.087 \pm 0.109$, $p = 0.45$; right).

Change in HRV Before and After Group Yoga



Figures 2A and 2B. Higher values on the y-axis values indicate a greater reduction in physiological anxiety after group yoga practice. While not significant, physiological anxiety reduction is negatively associated with determinism ($b = -1.719 \pm 2.661$, $p = 0.536$; left) and maxline ($b = -2.86 \pm 2.411$, $p = 0.27$; right).

Reported Interpersonal Connectedness



Figures 3A and 3B. Higher values on the y-axis indicate greater perceived synchrony with and connectedness to group members during the yoga class. While not significant, both determinism ($b = -0.149 \pm 0.077$, $p = 0.094$; left) and maxline ($b = -0.028 \pm 0.09$, $p = 0.762$; right) increase as reported interpersonal connectedness to the group decreases.

Quantum Mechanics in Perception and Action?

Introduction

Within classical physics, strange phenomena occur at the sub-atomic scale. For example, light sometimes resembles particles (e.g., photons) but at other times resembles waves (e.g., light waves). The theory of quantum mechanics was developed to account for the duality of particles and waves. It has been argued that perception and action at the ecological scale reflect “quantum-like” phenomena. Turvey (2015; cf. Shaw & Kinsella-Shaw, 2015) suggested that phenomena that are accounted for in quantum mechanics, such as local causality and superposition, can be understood to have relevance for our understanding of epistemology (e.g., direct perception) and ontology (e.g., affordances).

For example, Turvey (2015) used quantum mechanical discussions of local causality to interpret what he called “the outness problem” in perception (Fig. 1, 2). The outness problem refers to the fact that perception stimulation occurs in one place (e.g., the retina), but perception is of things in another place (e.g., in the external environment). In quantum physics, the locality principle is understood to prohibit causal simultaneity of distal points. For example, an event at point A (e.g., a falling rock) cannot cause a simultaneous event at point B (e.g., the perception of a falling rock). Shaw and Kinsella-Shaw (2015) focused on quantum entanglement, in which distal systems are characterized by non-linear correlation (Table 1). They argued that animate intentionality (at the scale of perception-action) is equivalent to quantum entanglement (at the sub-atomic scale). We argue that perception and action are not usefully related to quantum mechanics, or to the interpretation of sub-atomic phenomena under quantum mechanics.

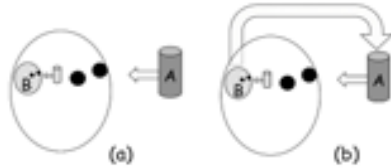


Fig. 1. Turvey's (2015) illustration of the “outness problem”, which he attempted to relate to the Locality Principle from quantum mechanics.

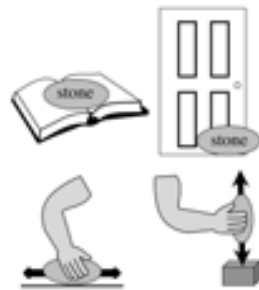


Fig. 3. Turvey's (2015) argument that the existence of multiple simultaneous affordances is equivalent to quantum-level superposition.

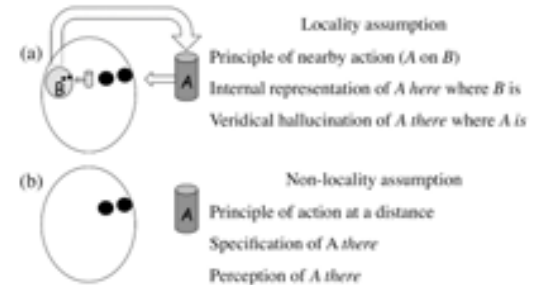


Fig. 2. Turvey's (2015) solution to the “outness problem” lies in the concept of specification. A. The classical view that Turvey rejected. B. The ecological view that Turvey endorsed.

	KIND OF LAW	FORMULATION
I.	Classical mechanics	event ₁ → law → event ₂
II.	Classical psychology	stimulus → law → response
III.	Quantum mechanics	observation ₁ → law → observation ₂
IV.	Ecological psychology	perception ₁ → law → perception ₂

Table 1. Table from Shaw & Kinsella-Shaw (2015) relating the Ecological Approach to explanatory frameworks in classical physics and quantum mechanics.

Is quantum mechanics real?

The utility of quantum mechanics as a route to understanding perception-action depends upon the reality of quantum mechanics, that is, the extent to which quantum mechanics constitutes a factual description of phenomena at the sub-atomic scale. Here, we review two lines of argument that question the physical reality of quantum physics. The first arises within current research in physics. The second, earlier argument is found in the work of Henri Bergson.

3rd millennium physics

Recent evidence has called into question the locality principle (e.g., Wu et al. 2022), and the principle of superposition (e.g., Robens et al., 2015). See presenter for details and discussion.

2nd millennium physics

Both classical physics and quantum mechanics are derived from mathematics in which time is assumed to exist as discrete, sequential units; in effect, a series of temporal particles or quanta. Without this assumption, the equations do not work; are not defined. Bergson (1965) rejected the idea that time exists as discrete temporal units, emphasizing the paradoxes that arise from such a conceptualization (e.g., Zeno's paradoxes). Bergson argued for an alternative conceptualization of time in terms of unbounded duration; in effect, an intrinsic definition of time.

Discussion

Bergson's conceptualization of time in terms of unbounded duration “pulls the rug out” from under the entirety of both classical physics and quantum mechanics. If Bergson is right, then quantum mechanics is a sophisticated mathematical system that is not an accurate description of reality at the sum-atomic scale. Thus, an attempt to use quantum mechanics to understand perception-action within the Ecological Approach is unlikely to yield useful insight and, in fact, runs counter to fundamental overlaps between the theories of Bergson and Gibson.

Bergson, H. (1965). Duration and simultaneity, with reference to Einstein's theory [Trans. L. Jacobson]. New York: Bobbs-Merrill.

Robens, C., Alt, W., Meschede, D., Emary, C., & Alberti, A. (2015). Ideal negative measurements in quantum walks disprove theories based on classical trajectories. *Physical Review X*, 011003.

Shaw, R. E., & Kinsella-Shaw, J. (2015). Intentional quantum dynamics: Entangling choices and goals. In H. Atmanspacher, C. Bergomi, T. Filk and K. Kitto (Eds.), *Quantum interaction* (pp. 255-270). New York: Springer.

Turvey, M. T. (2015). Quantum-like issues at Nature's ecological scale (the scale of organisms and their environments). *Mind & Matter*, 13, 7-44.

Wu, D., et al. (2022). Experimental refutation of real-valued quantum mechanics under strict locality conditions. *Physical Review Letters*, 129, 140401.

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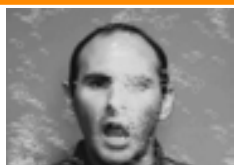
BACKGROUND

When a speaker talks, the consequences are both seen (visible articulation on the speaker's face) and heard (the speech sound). Visible articulatory information on a speaker's face is thought to foster native language acquisition. Children with an autism spectrum disorder (ASD) have been reported to be less sensitive to the visible consequences of speech than their typically developing (TD) peers.

Here we report on:

- 1) Pattern of gaze in children with ASD and TD
- 2) Behavioral responses during perception of AV speech
- 3) ERP findings during perception of AV speech

EYETRACKING



Visual representation of speech trials (N=24) in a child with ASD



Visual representation of speech trials (N=24) in a child with TD

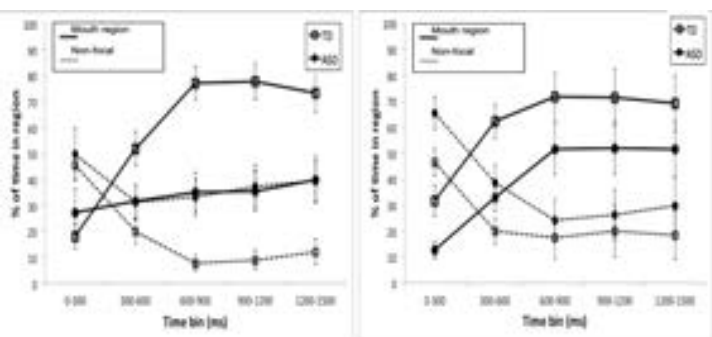
Pattern of gaze to a speaking face was examined in two conditions: speech reading and identification of speech in noise. Participants were 20 children, 10 with ASD (8 boys, mean age 10-2 years) and 10 TD (eight boys, mean age 9.6 years). Data was analyzed in 300 millisecond time bins that correspond with events in the signal.



Stimuli: video of the speaker producing /ma/ and /na/

Visual only Task: Report syllable seen.

Speech in noise Varying S/N ratio: +5dB S/N, 0dB S/N, -5dB S/N, -10dB S/N, -15dB S/N, -20dB S/N Task: Report syllable heard.



- When fixated on face of speaker, the children with ASD were significantly less likely to gaze at the speaker's mouth.
- Group differences were less prominent in the visual-only condition, where visual phonetic information on the mouth is fundamental to the task.

BEHAVIOR (BUTTON PRESS)

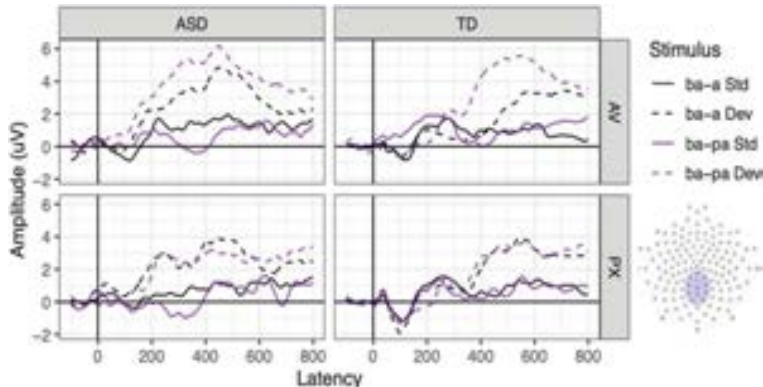
Button press responses to identify what sound was heard was collected in two AV conditions: 1. a fully visible speaking face (AX), 2. a pixelated (PX) condition that included a face, but the mouth and jaw were pixelated with random movement, removing all articulatory information. When articulatory features were present for the /ba-/a/ contrast, it was expected that the influence of the visual articulators would facilitate a phonemic restoration effect in which "a" would be perceived as /ba/.



Stimuli: video of the speaker producing /ba/ paired with audio of /ba/, /a/ or /pa/.
Button press data to the deviant sound (/a/ or /pa/).

TD children were more accurate in discriminating between /ba-/a/ and /ba-/pa/ contrasts in the PX condition relative to the ASD group.

ERP



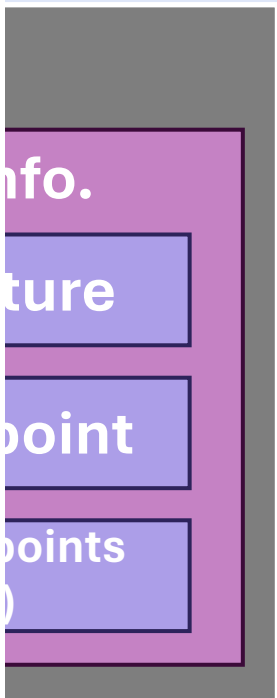
ERPs in response to the /ba-/pa/ contrast within both AV and PX conditions differed between children with ASD and TD children (earlier P300 responses for children with ASD).

SUMMARY AND CONCLUSIONS

- Patterns of gaze in children with ASD appear differ from TD peers in a visual only and AV speech in noise context.
- Children with ASD differ in behavioral response and in the underlying neural mechanisms responsible for speech processing compared with TD peers within an AV context.
- Processing of AV speech varies with task demands.

ACKNOWLEDGMENTS

This work was supported by NIH grants DC-007339, DC-00403 to Haskins Laboratories and DC-013864 to Southern Connecticut State University.



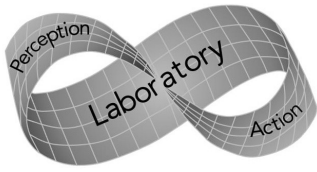
on one session,

- Pre-cursor Sessions without the extended
- Experimental Sessions (2 trials for each)
- a total of 24 trials

Data Analysis

- Dataset: Extracted
- Preprocess: 2nd
- Sample Entropy
 - Lower values: more
 - Higher values: more
 - Parameters: $m =$
- ANOVA

ML and AP sway (2 levels); and (2) v (2 levels) and trials

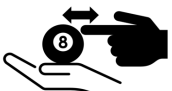


Do probing dynamics differ when perceiving different properties of the probe-surface system?



Arghya Kashyap¹, Kwesi Blankson¹, Alen Hajnal², & Jeffrey B. Wagman¹

People use different exploratory movements to perceive different properties of hand-held objects



Pressure



Enclosure

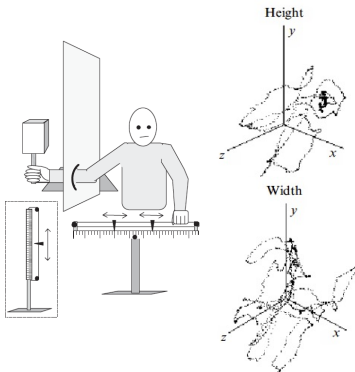


Lateral Motion



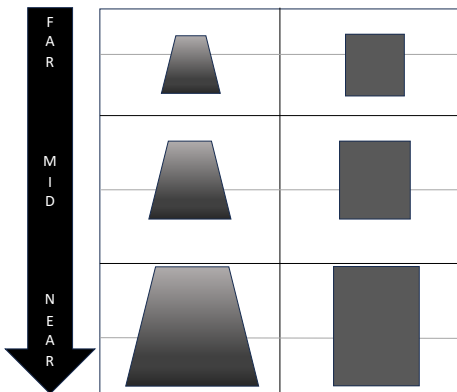
Unsupported Holding

...and use different wielding movements to perceive different properties of wielded objects

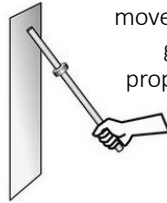


...and people make different postural sway movements to visually perceive geometric or affordance properties of a viewed surface

'Angle' vs. 'Possible to stand on?'



Do people use different probing movements to haptically perceive geometric or affordance properties of a probed surface?



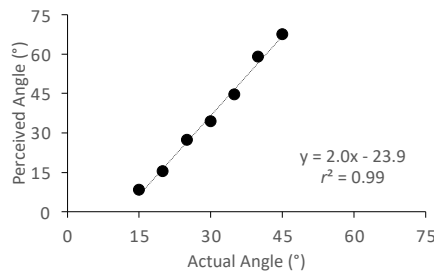
Participants probed an occluded surface and reported the angle of the surface or whether they could stand on the surface



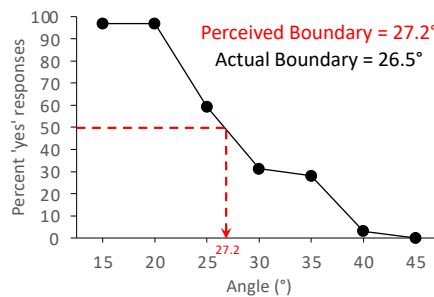
Movement (acceleration) data was collected using an OPAL sensor on the hand (APDM labs)



Perceived angle was nearly perfectly correlated with (but imperfectly scaled to) actual angle



...and participants were aware of which surface inclinations were 'stand-on-able' and which were not...

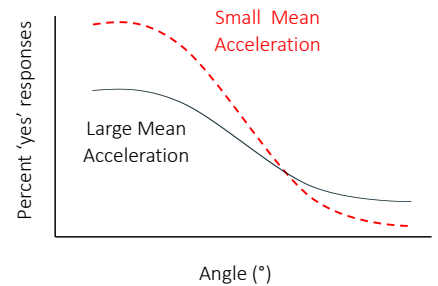


We used mixed effects modeling to investigate whether parameters of probing movements predicted responses in either condition

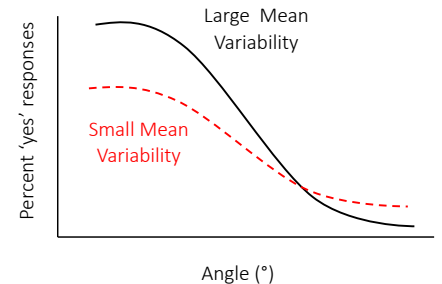
Parameters of probing movements **did not** predict perceived angle...

...but **did** predict perceived affordances

SMALLER MEAN ACCELERATIONS:
More dramatic changes in perceived affordances as surface angle increases



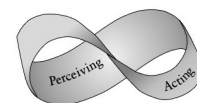
MORE VARIABLE ACCELERATIONS:
More dramatic changes in perceived affordances as surface angle increases



DISCUSSION

Exploratory probing patterns predicted perception of affordances but not perception of geometric properties...

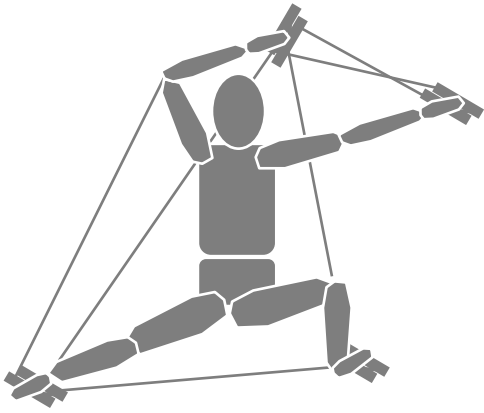
...consistent with the proposal that perceiving is for guiding behavior via active exploration and not for perceiving geometric properties



nciple

rel components

gy



ill for single-leg

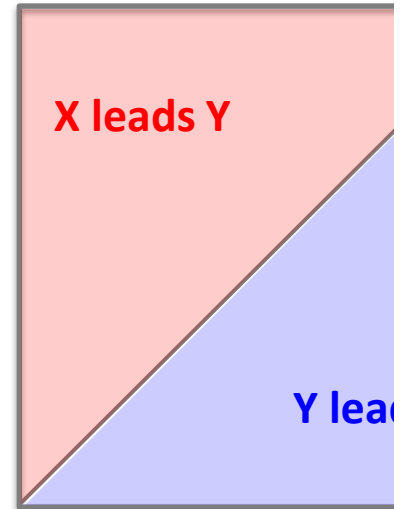
!1)

(/walking) as an
or exploratory

ivariate

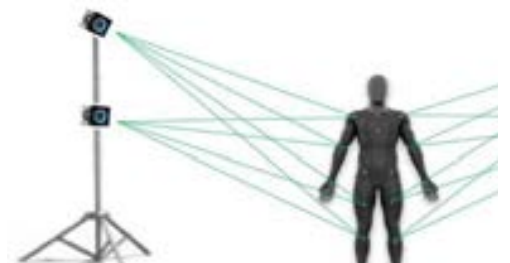
ns (Bashan al.,

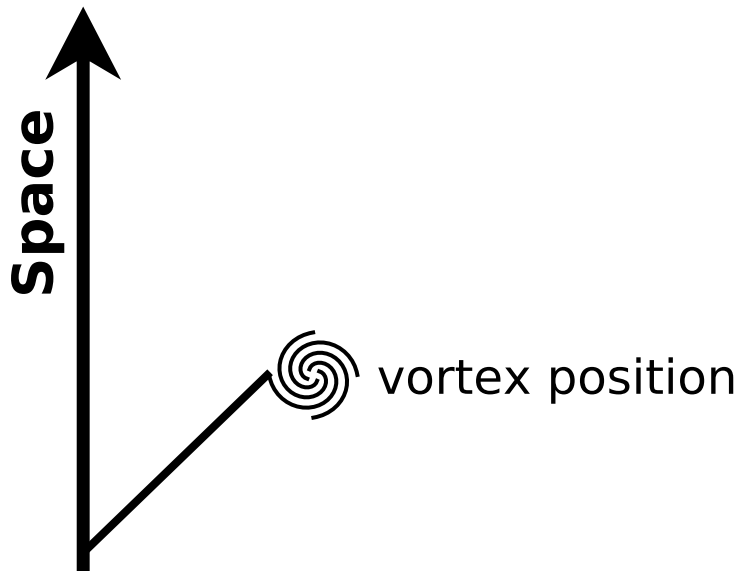
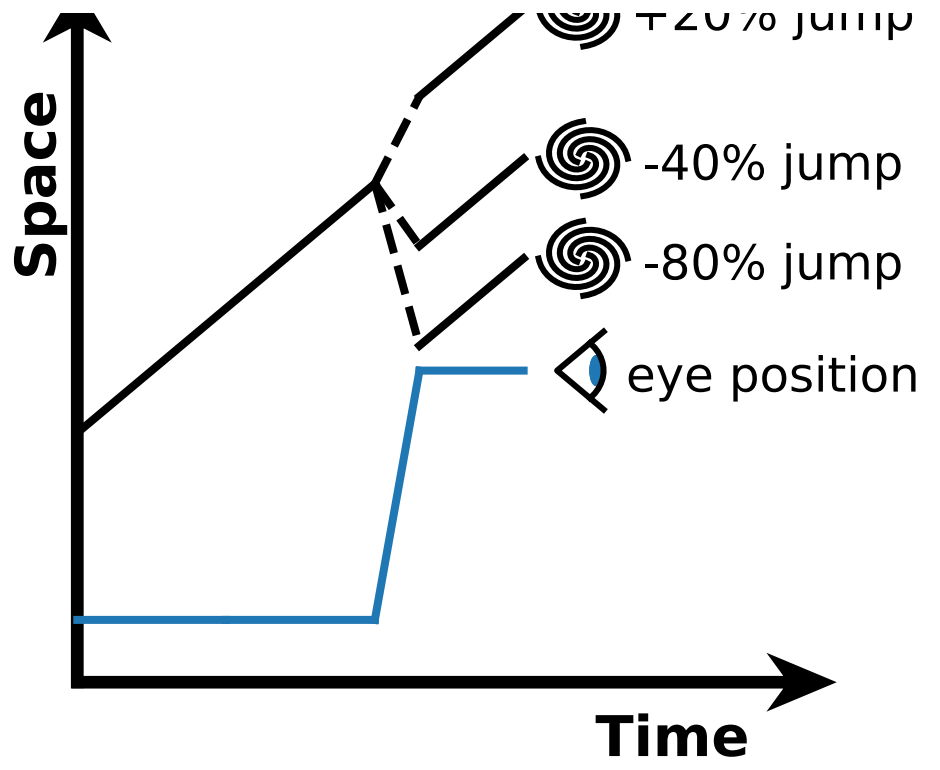
Y is producing a configur
X produced at an earlier p



X is producing a configur
Y produced at an earlier p

Fig.4. Leader-follower in re
(Shockley & Riley,)





can

uit

ly between two

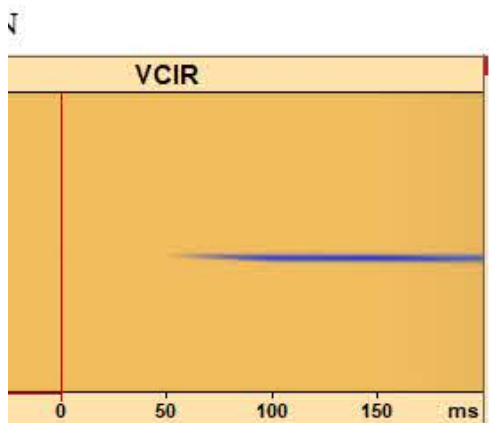
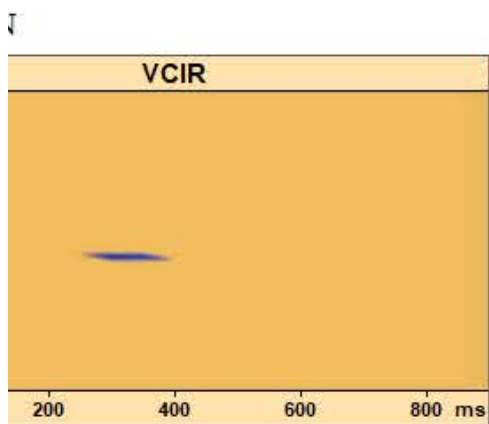
nd connectivity
error



rent speeds

DURING OCCLUSION

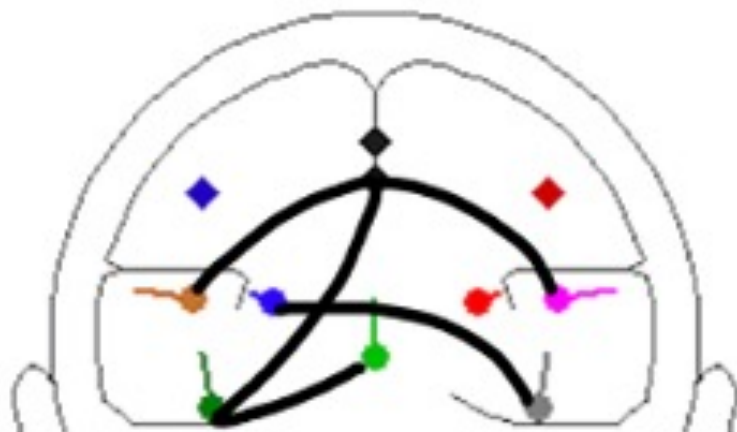
Figure 5. Significant cor
and preterm children be
before and during occlus
indicating a more speciali



VCIR

HITS

FULLTERM



Recorded by DSC-
M4 (120fps)

→ One-sample t-test
Striking outcome

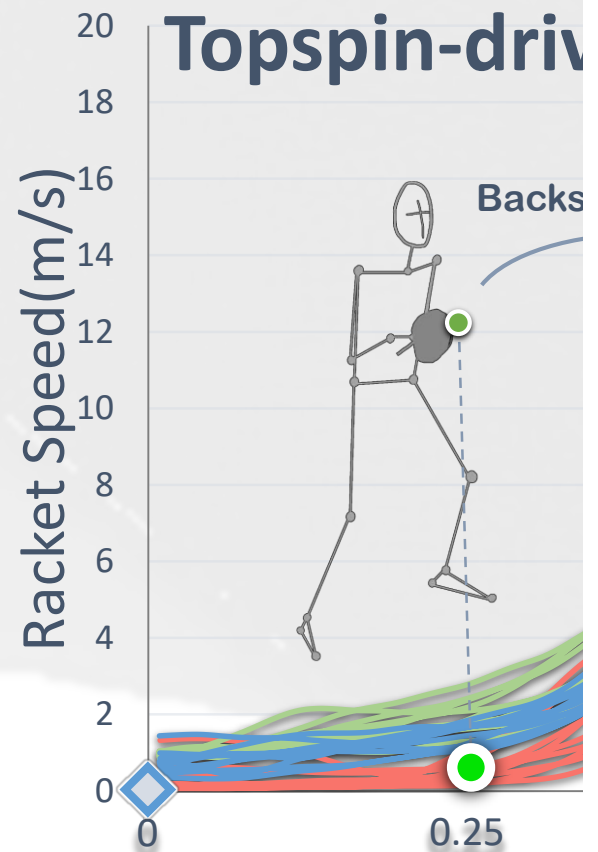
IR (in-bounds rate)

→ Friedman tests

hit (D1) and
hit between

(78.3±11.5%)

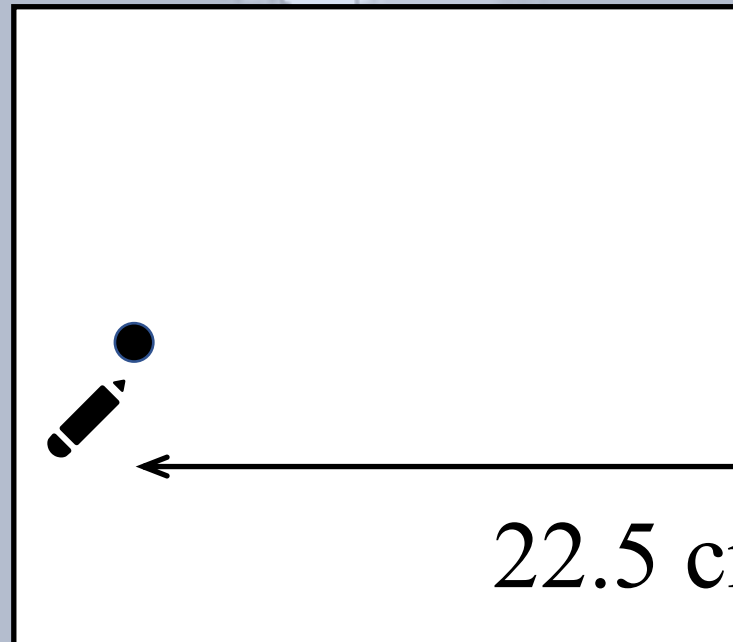
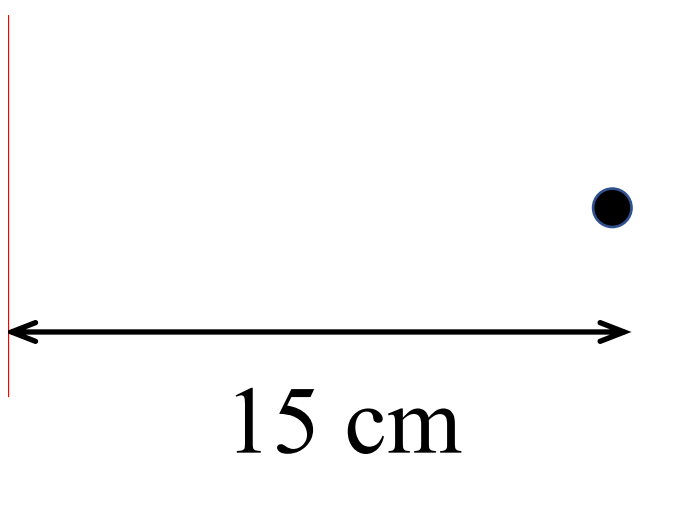
push
topspin-drive



op at end point

at 450 ms and sto

) ms



) occurred on day1 and day4 of each

Results

-0.19, $p = .85$

1.48, $p = .17$

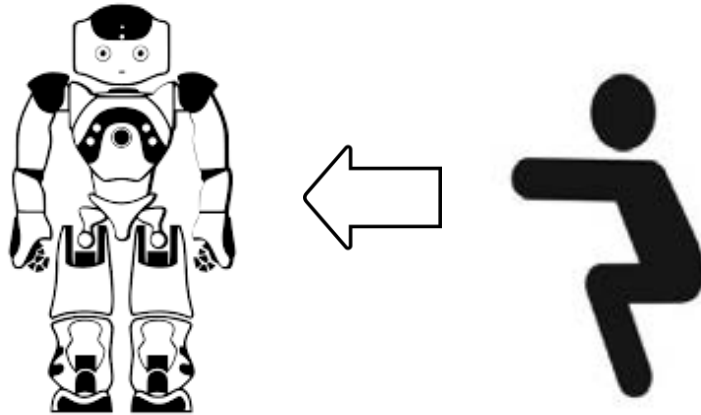
0.80, $p = .44$

Compare the

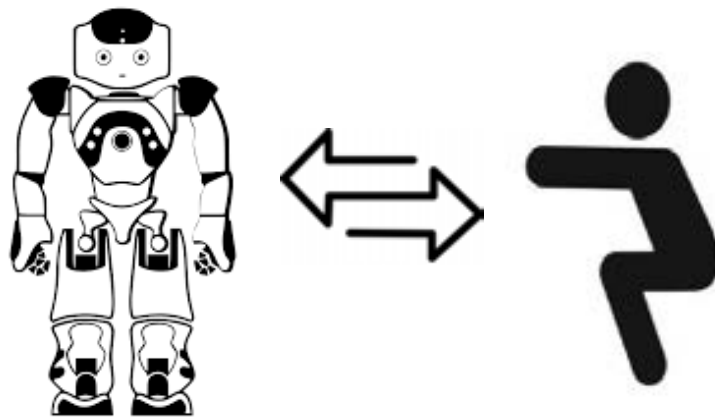
Day

B vs D: $t(22)$

2. Not adaptative



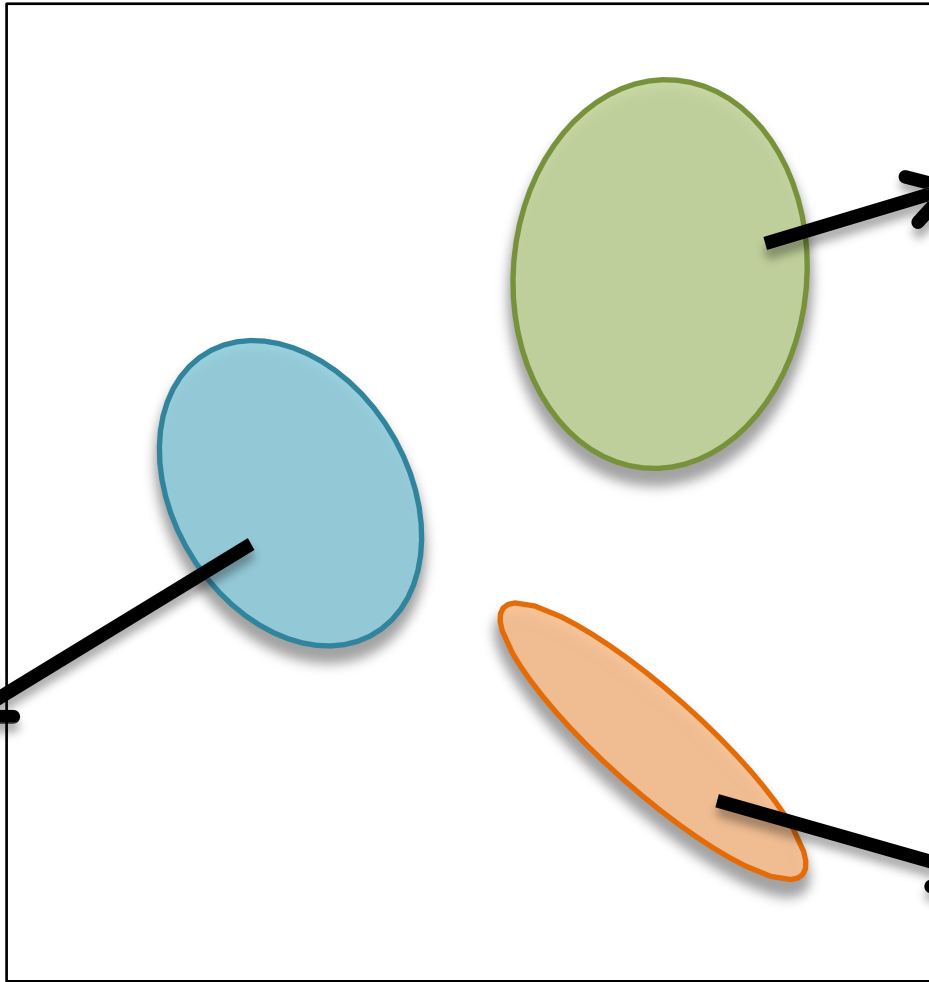
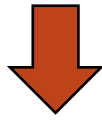
3. Adaptative



ysical activity



-1.15



e change

Joy



er et al., 2017) in

Total Edits	Edit Density
1448	13.92
1176	11.76
1083	9.26
1091	11.36

selected films all fit into the s and 'inter-edit-intervals' is inter-edit-interval time series (& Ramsever 2021) were

Notes: Inter-edit-interval (Blau & Carello, 2020). M used to obtain motion en

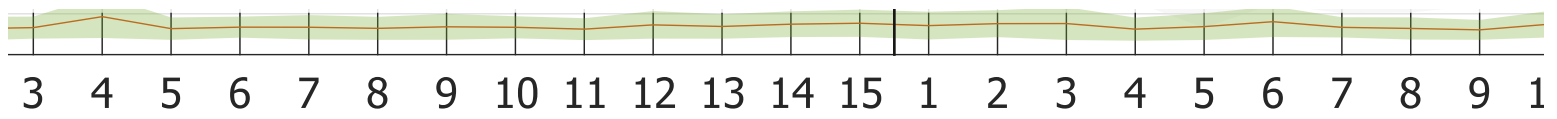
RQ1: Is there a for viewers watch editing structures

Participants' liking an film difference) score. films with different ed

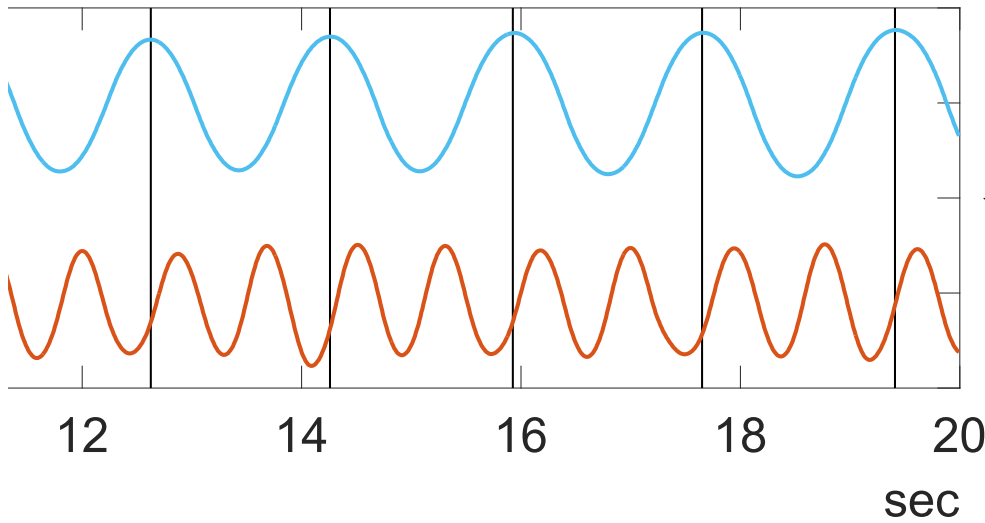
Intensity and frequen **AESTHEMOS** did no different editing struc (p > 0.05), with a few

Watching films with a seemed to elicit **more nostalgia** (Z = 2.355 (Z = 2.135, p = 0.034 'Low' editing structure **negative emotions** s

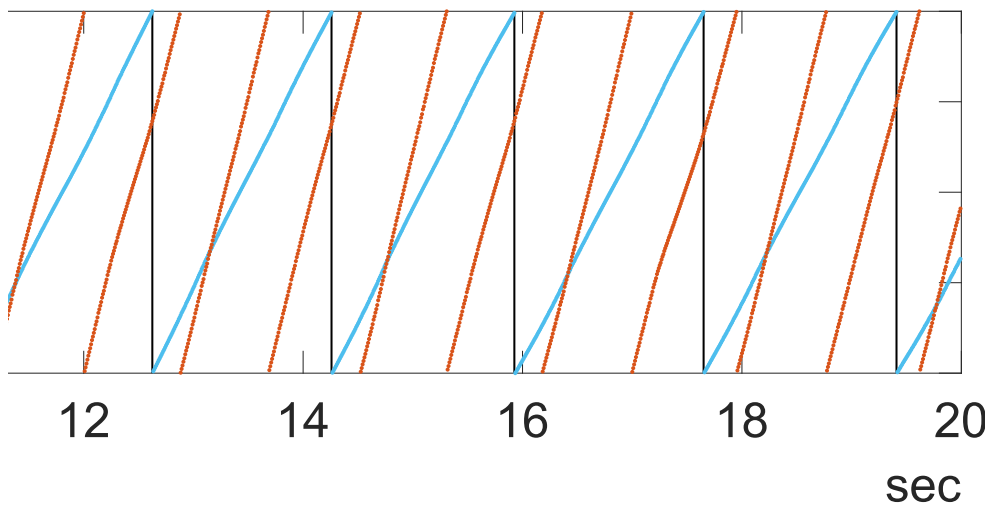
17 0.001



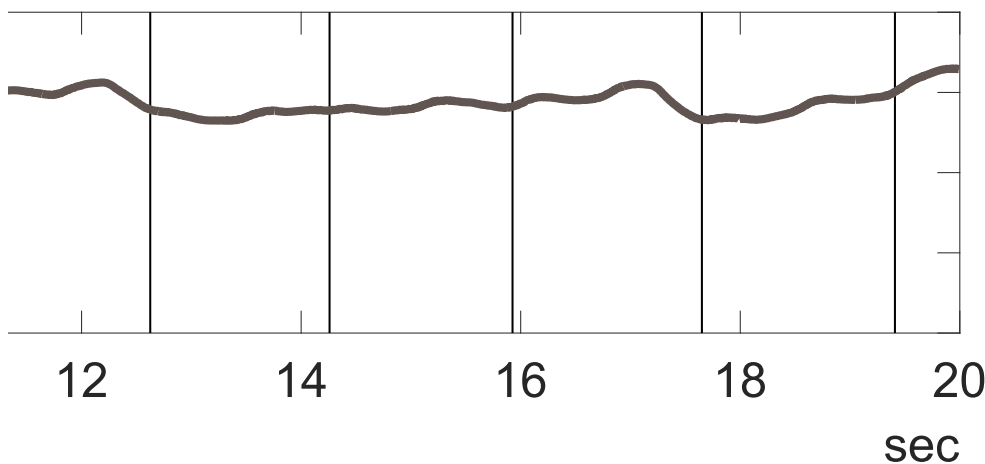
is error on 93.3% of trials in the first four blocks of the (and Absolute Error Calculations Given in Figures 3.



← Example 20 Trial Data R

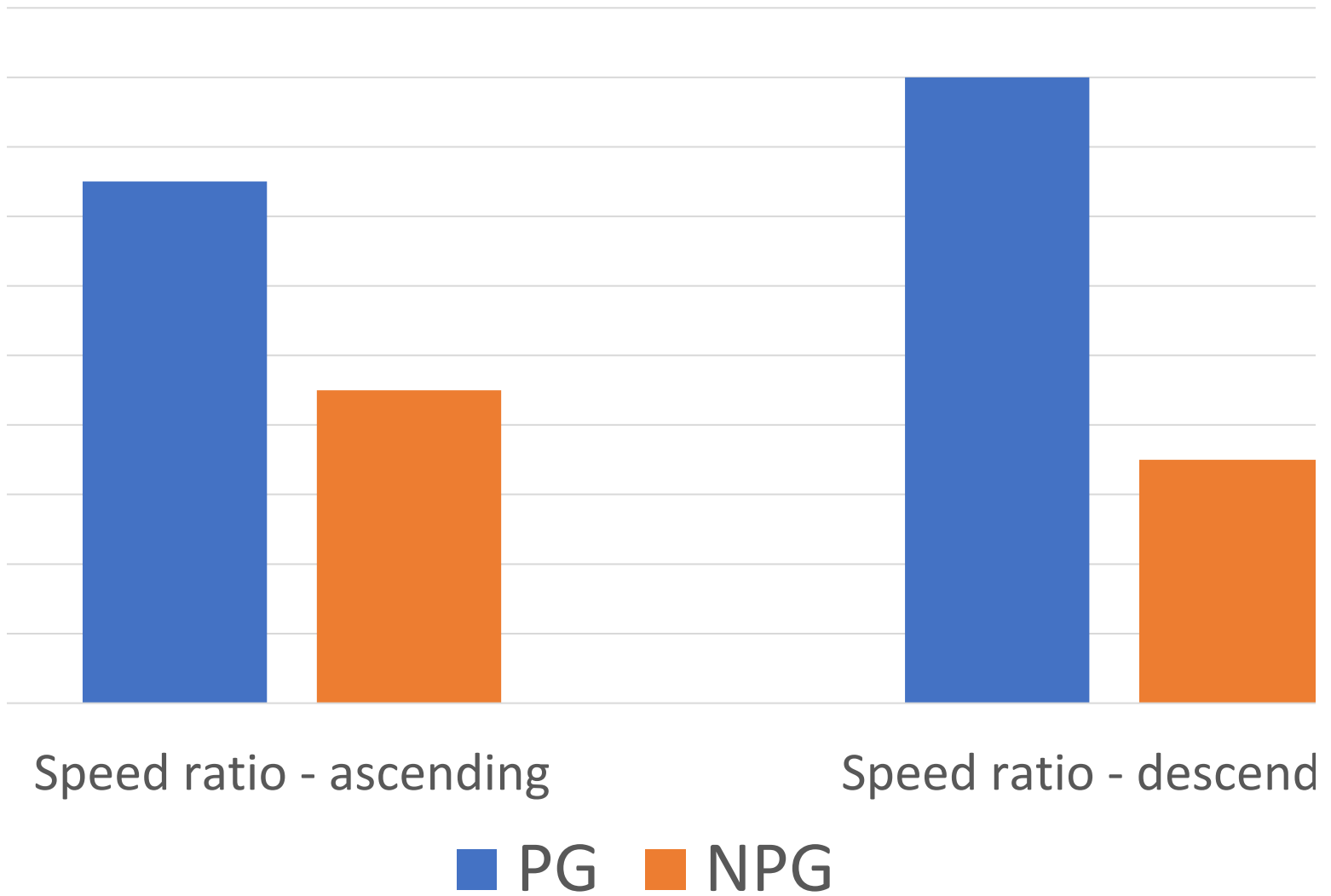


← Estimated I Phase of the Right Hand



← 1:2 Coordination Phase Relat

Path decision by gap presentation order

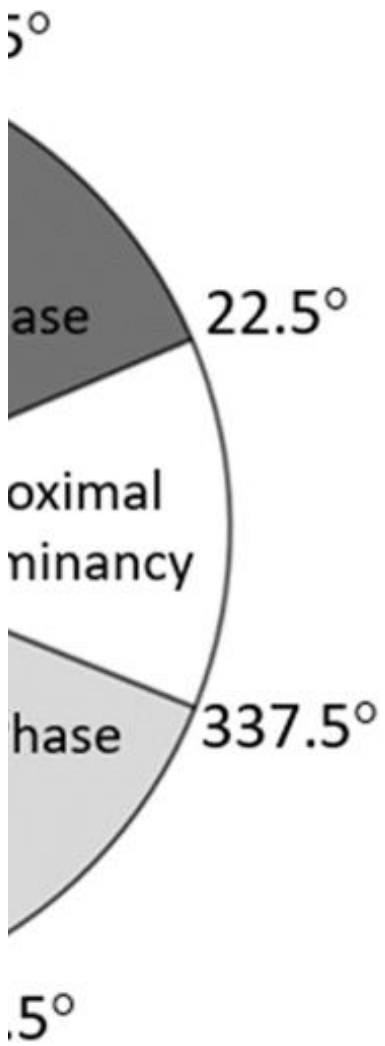


Visual Mo

al motion perception is another prev
. It is an important function of the b
events in a d
ective control is measured via tasks
a moving target and respond with h
impending collusion informatio
s' visual motion perception improve

on

be a unique predictor of mathemat
on mathematics performed worse c
imaging studies demonstrated that



projected on
derived from

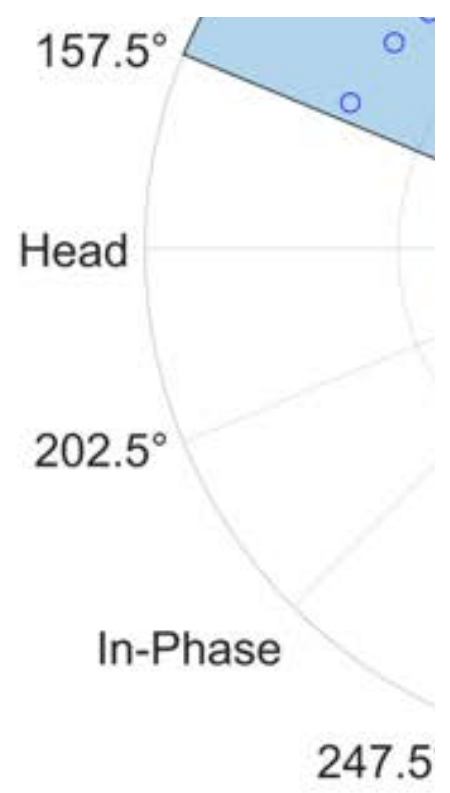


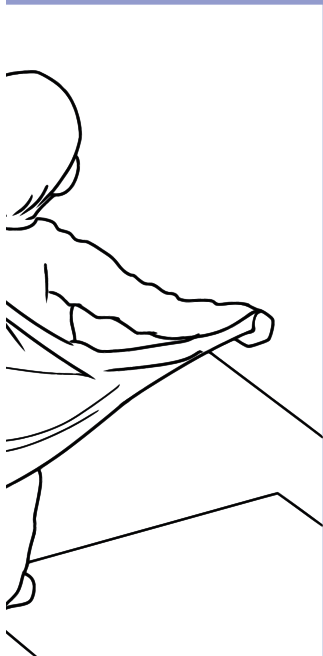
Fig. 4. Scatter phase (center) Also included

- Over the last the dominant
- This coordination adaptation
- In contrast condition to

re and

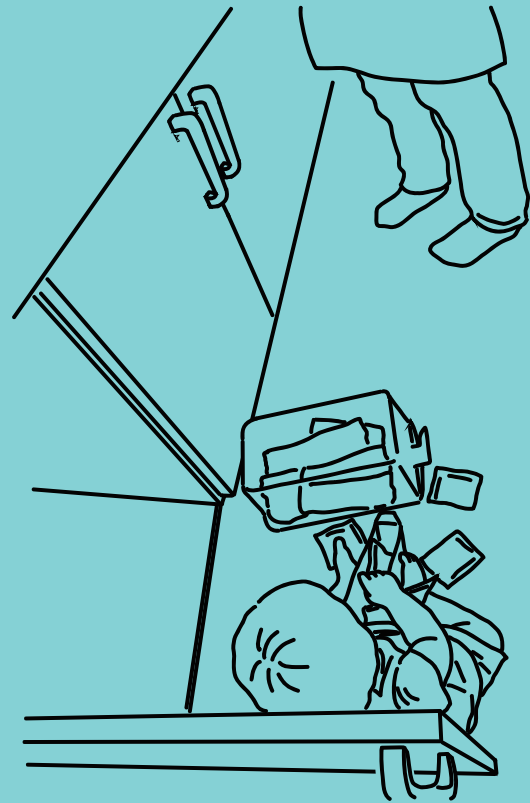
1 year to
the onset

thin
onset.



walking onset

9m9d



10m25d

7 to 12-month-old

Pulling out as many
possible.

19 to 32-month-old

- Pulling out as many
possible, which was
the first period, be
frequent and beca
context specific

HT

comfort
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, trans
ccess to
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t every
theless,
on the
oore &
ius not

ct



Light Intensity on Affordance Perception

Tyler Overstreet, Myah Kelly,
Ron Dickson, Alen Hajnal
School of Psychology



INTRODUCTION:

Standing in front of a flat surface at a steep angle stabilizes posture and increases movement complexity (Hajnal et al., 2014)

- Does ambient light affect perceived standonableness?

Present Study

- Manipulated ambient lighting (Scotopic, Mesopic, Photopic)
- Manipulated slope angle (0° - 90°)
- Affordance task: "Could you stand on this ramp?"

HYPOTHESES:

- H1:** The action boundary in the scotopic condition should be < 30 degrees
- H2:** The action boundary in the scotopic condition will be lower than in the mesopic and photopic conditions
- H3:** Response time should be longer in the scotopic condition compared to the photopic and mesopic conditions
- H4:** Body movements should be **more complex** in the scotopic condition compared to the photopic and mesopic conditions
- H5:** Light intensity and body movements should interact and **predict** affordance judgments

METHODS (n = 31):

13 angles repeated 3x in each lighting condition

Dependent variables:

Yes/No responses

Response time

Head movements: Mean,

Coefficient of Variation (CV),

Effort to Compress (ETC)

Center of Pressure (COP): Mean, CV, multifractal spectrum width (MFW), ETC

Design:

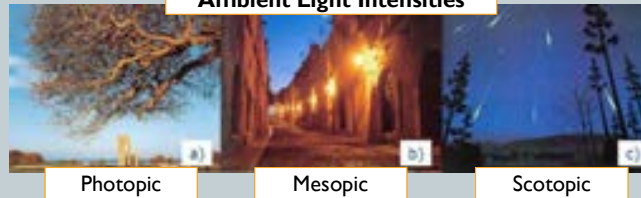
Lighting conditions x 13 Slope

- Virtual environment in Oculus Quest
- Stand on forceplate (AMTI)
- Respond (yes/no) with hand-held controllers
- Head movements recorded at 60Hz from Oculus headset
- Postural sway recorded by forceplate at 1000Hz



30° at 1m

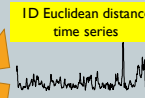
Ambient Light Intensities



Photopic

Mesopic

Scotopic

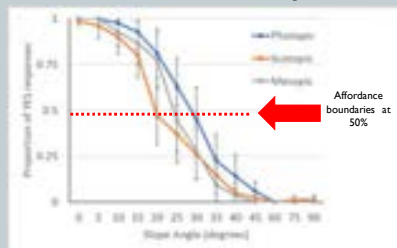


Mean Magnitude
CV
Complexity

RESULTS:

- Perceptual judgements transition from Yes to No with increase in slope angle
- Responses were more conservative under scotopic and mesopic light (**H1 & H2 confirmed**)

Affordance Response



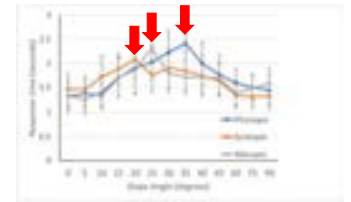
Affordance boundaries: $F(2,52)=12.65, p<.001, \eta_p^2=.33$
 Photopic: $M=28.45^\circ$ (95%CI=3.41°)
 Mesopic: $M=22.5^\circ$ (95%CI=3.5°)
 Scotopic: $M=23.93^\circ$ (95%CI=2.9°)

References:

Hajnal, A., Rumble, D., Shelley-Tremblay, J. F., & Liu, W. (2014). Optical push by geographical slant affects postural sway. *Ecological Psychology*, 26(4), 283–300. <https://doi.org/10.1080/10407413.2014.957999>
 Hajnal, A., Surber, T., Overstreet, T., Masoner, H., Dowell, C., Funkhouser, A., Shelley-Tremblay, J., & Samu, K. (2022). Complex Postural Sway is Related to Perception of Stand-on-Ability. *Ecological Psychology*, 34(1-2), 1-18, <https://doi.org/10.1080/10407413.2022.2035225>

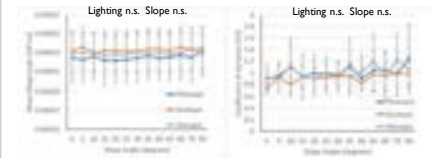
- Response time is longest at corresponding affordance boundaries of each lighting condition (**H3 not confirmed**)

Response Time

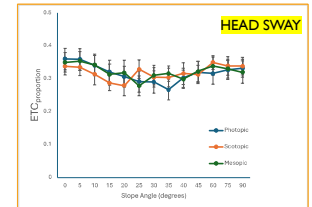


Slope: $F(12,312)=8.6, p<.001, \eta_p^2=.25$
 Slope x Lighting: $F(24,624)=2.4, p<.001, \eta_p^2=.08$

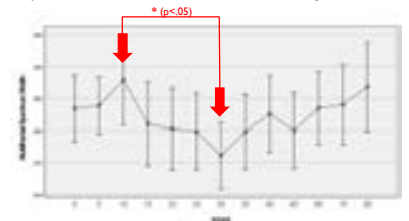
Mean COP & CV



- Effort to Compress** is lowest at action boundaries as a function of ambient light (**H4 not confirmed; H5 confirmed**)



- MFW is lowest at action boundary and not influenced by ambient light (**H4&H5 not confirmed**)



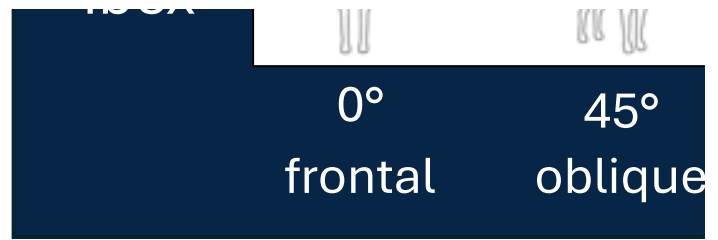
Slope: $F(12,276)=2.74, p<.002, \eta_p^2=.11$
 Lighting: n.s.

- Mixed-effects logistic regression:
Perception~ComplexityXAngleXLighting
ETC(head)xLightingxAngle* ($\beta=-0.056, SE=0.018, p=.002, OR=0.946$)
ETC(COP)xLightingxAngle* ($\beta=-0.068, SE=0.034, p=.045, OR=0.934$)
MFW(COP)xLightingxAngle* ($\beta=0.085, SE=0.033, p=.011, OR=1.089$)
H5 confirmed (complexity ** predictor)

DISCUSSION:

- Perceived affordance boundary is more conservative under low ambient light
- Latency is maximal at affordance boundaries (→critical fluctuations??)
- Magnitude and variability of postural sway is not affected by ambient lighting conditions! (H4 not confirmed)
- Complexity is lowest at affordance boundary (30°) for all lighting condition. (contrary to H5)

Fig 2. The stimulus set.



Taxonomic recognition

er a practice block to learn the key-animal association
icipants were shown the outlines one-by-one in random order
e times in total) and instructed to identify the depicted animal
uickly and accurately as possible.

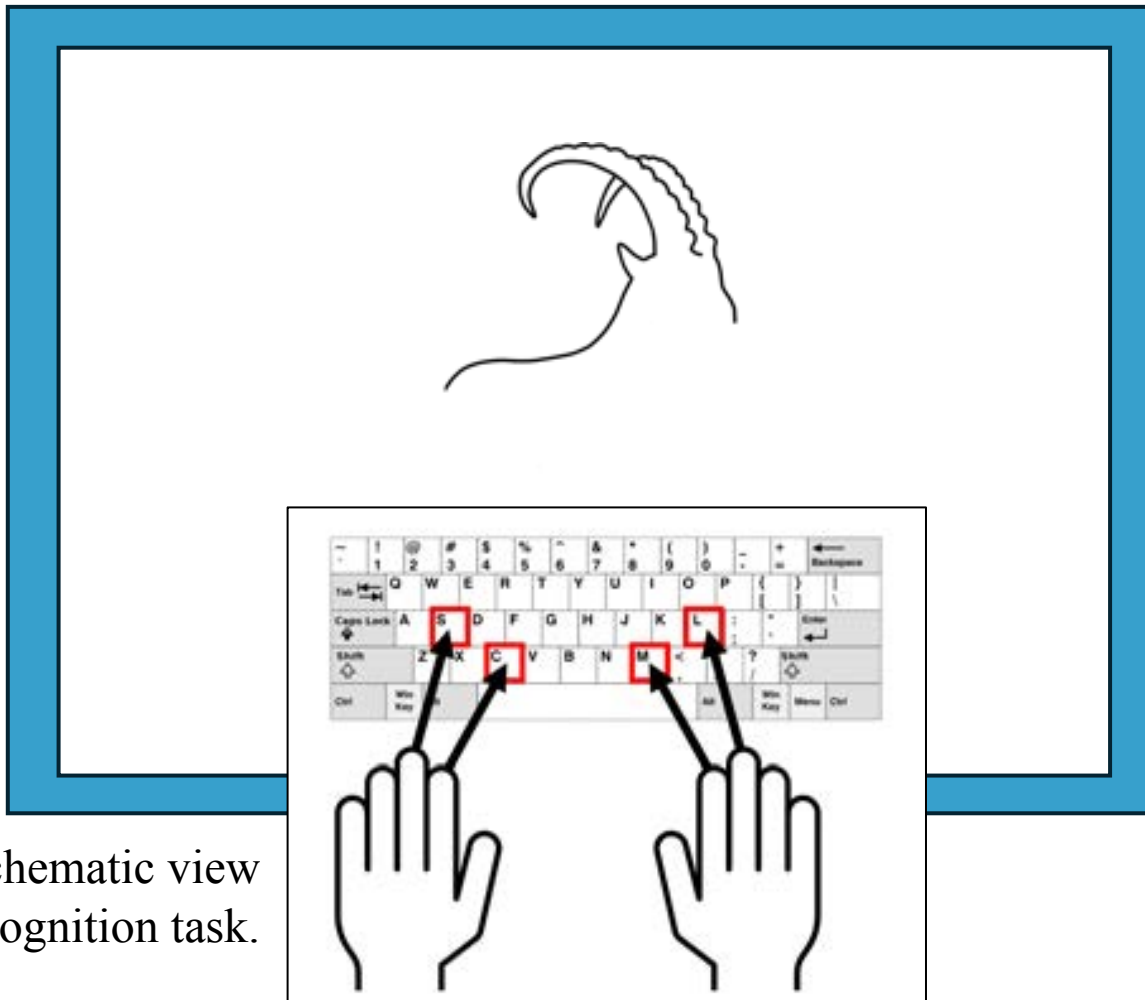
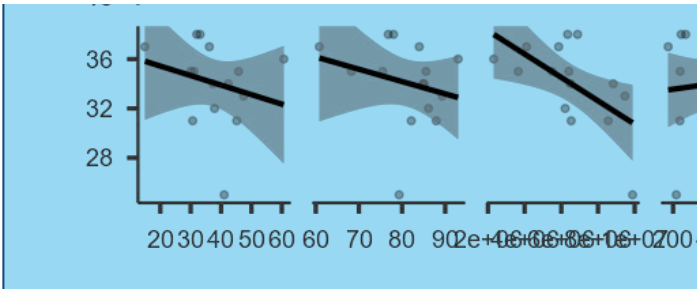


Fig 3. Schematic view
of the recognition task.



Object_2



Object_2

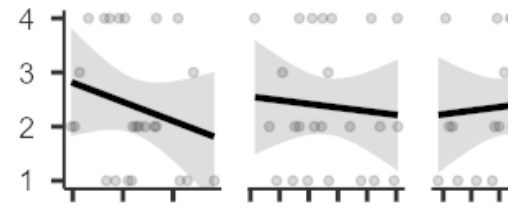


Object_2

The degree of coo
but not in the way we
stronger synchrony w
show a negative corre

As opposed to pre
conversation. The em
regulation might be th
for patients. When w
counterbalance our n

In negative emotio
negative correlation v



By the end of the first minu

Overall performan
 related to reverse u
 changes in MFSW
 movements, espec
 complex tasks.

Our pilot suggests
 measurement may
 development of le
 education systems



macro-dynamics of sp
 combination of maxima
 accurately by the followi

tal running speed of the
 is successfully nulled:

$$\frac{v_b \ddot{y}_b + 2x_c y_b \ddot{y}_b}{\left(\right)^{\frac{1}{2}}}$$

t acceleration, or ideal
 re to make a catch:

$$\frac{v_b \ddot{y}_b + 2x_c y_b \ddot{y}_b}{\left(\right)^{\frac{1}{2}}}$$

EQ.4 $\ddot{x} = a(\dot{x} + c$

Equation 4, models ma
 running speed, and maxi

AFFORDANCE

$$\frac{a_{ideal}}{a_{max}} < 1 \rightarrow catchable$$

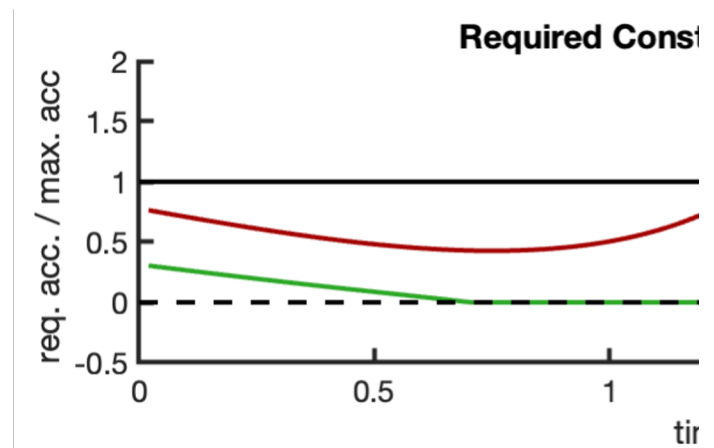


Fig 1: Required constant

FUTURE AFFORDA

6• 7• 8•

target points on the poster.

oints printed on it was

e center of black

m 1 through 8 (figure

to point six times

ne.

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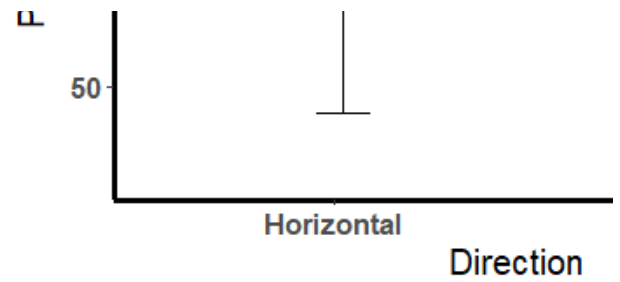


Figure 9. Interaction between and direction

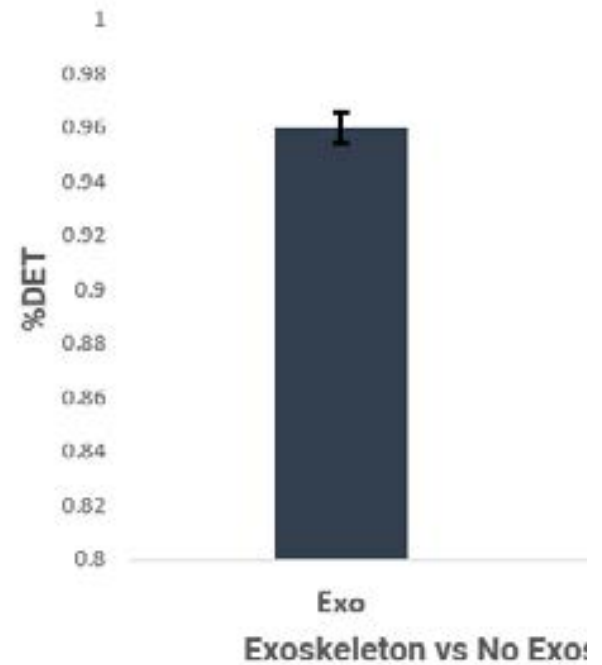


Figure 11. Effect of exoske



figure 8 as the visual focus point. I was able to now dissolution. As one cannot form an afterimage

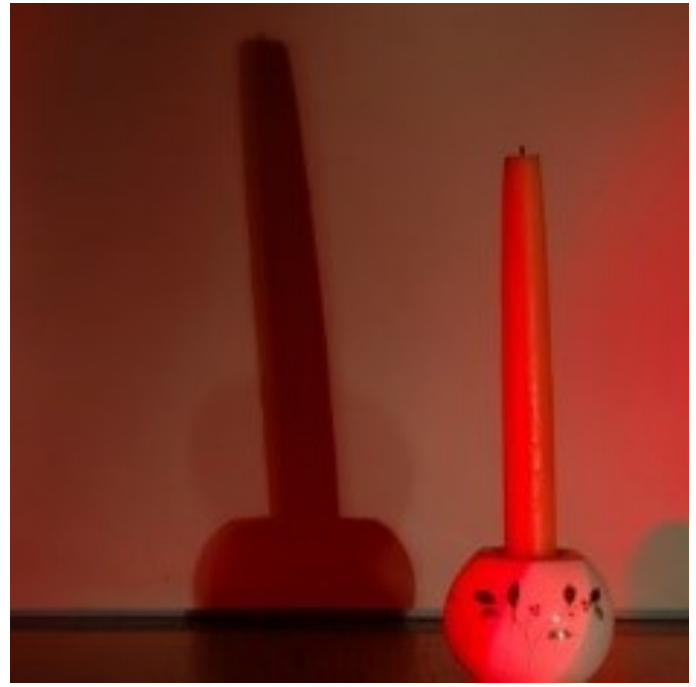
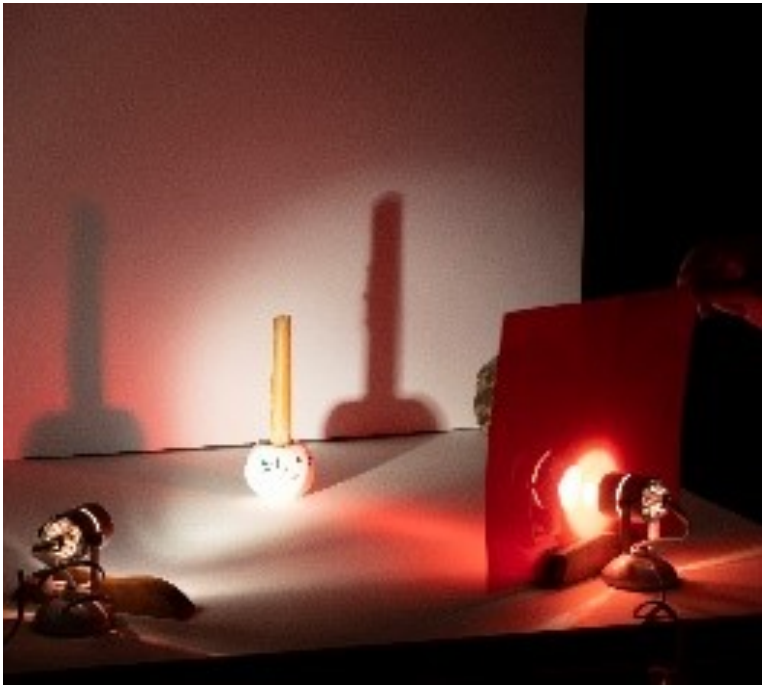


Figure 8. Colored light and colored shadows

the prism. A sample colored shadow is given in color fringe or color separation in relation to the

shadows in that the prism does not at all change the color. Perhaps the complementary colors balance each other

nts who most
fer face-to-face



Participants who l
Zoom calls are very
for social intera

Conditions



Participant 2 Video



Participant 1 Video

nts ($n = 48$) watched one of three videos and were
ory (see above for procedure summary). Participants
transcribed for analysis and qualitatively analyzed
correctly explained the intended meaning of the

Tools in the Box

Audio Quality

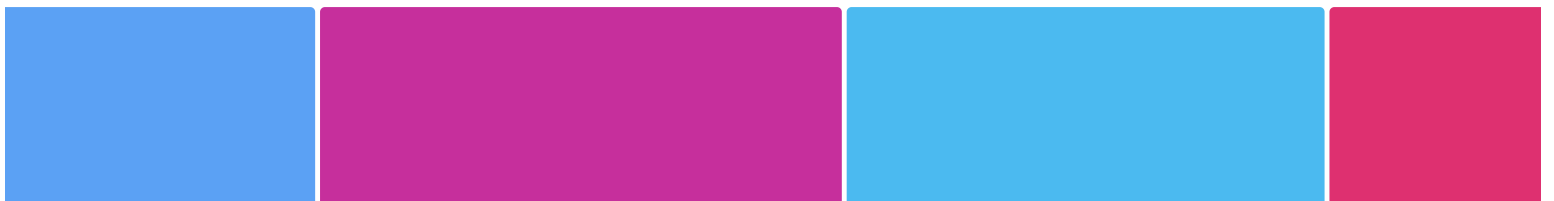
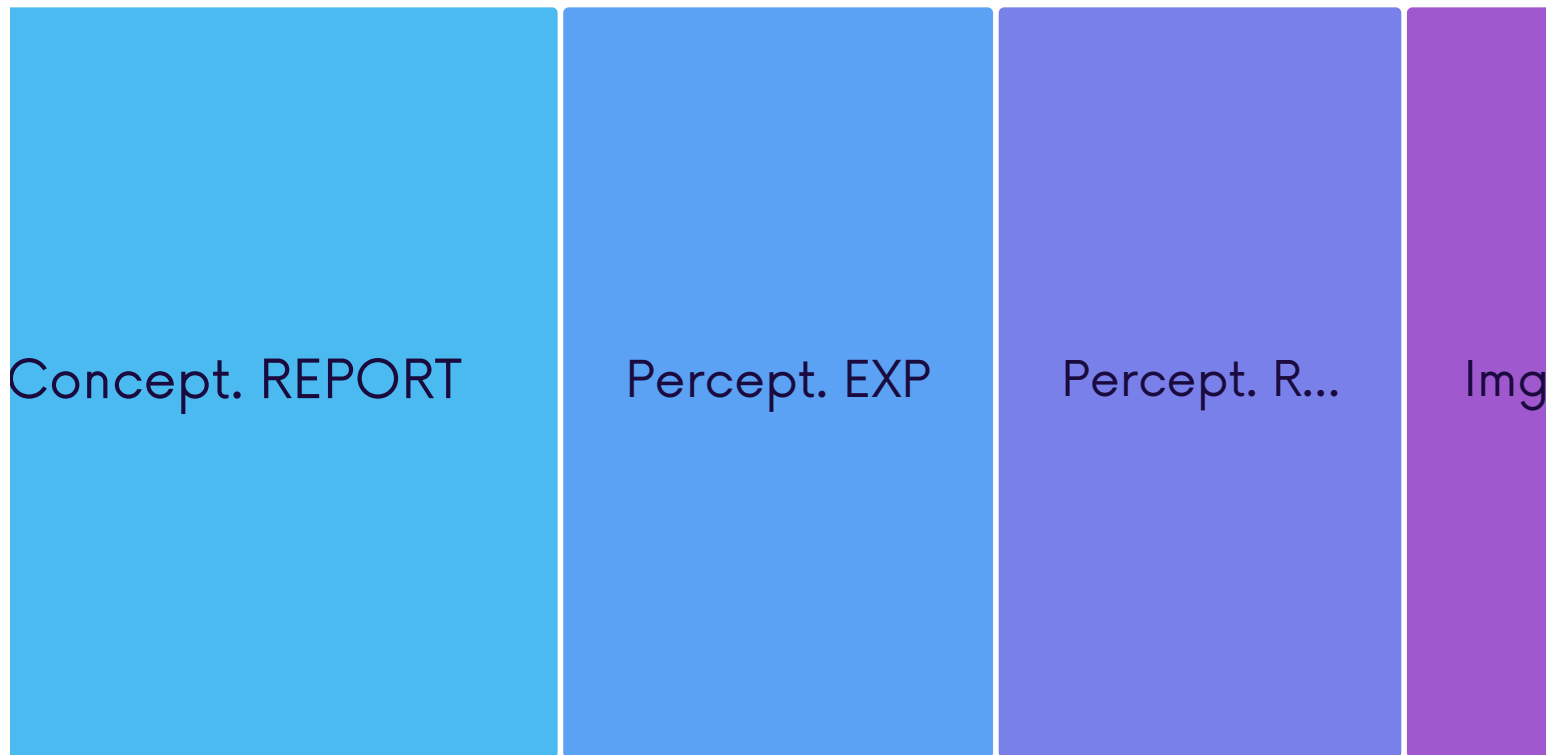
OpenSMILE algorithm

Speech-related features

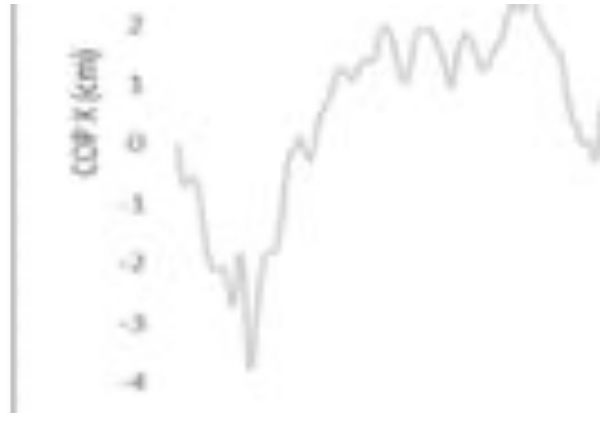
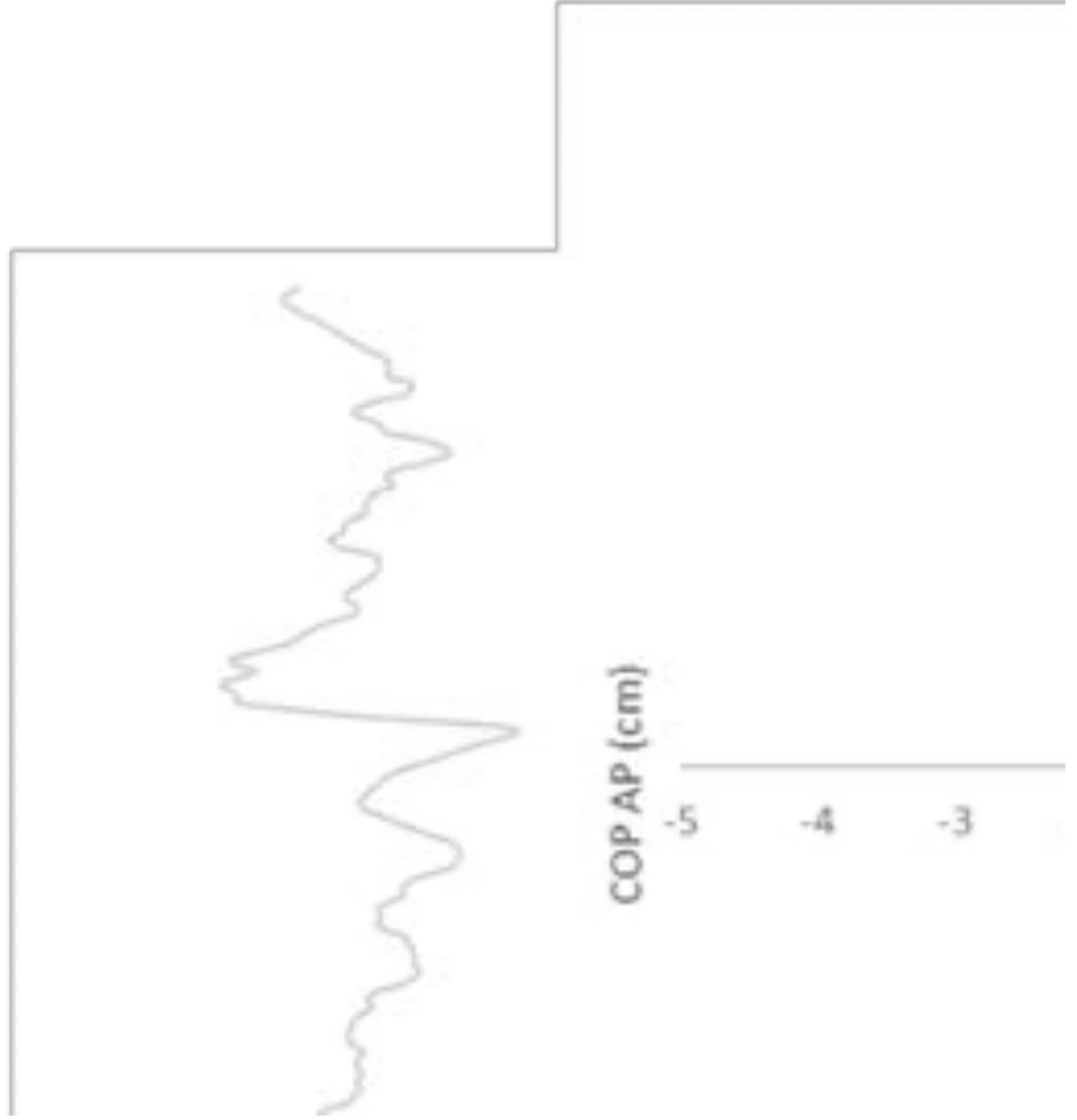
- Signal energy
- Loudness
- Pitch
- Voice quality
- Formants

data in terms of four semiotic strategies (e.g. Eusden, 2009) and two dimensions (i.e.: participant brought to the experiment weaps (BSMs, Nummenmaa et al., 2014).

DYADIC INTERACTION



the
up
ral
ring



)

player corresponds to the
of flow degree on the 6



25m

15m

1m



25

25

harbour porpoises -

porpoises *Phocoena phocoena*
at Otaru Aquarium, Japan

(fluke width, body height)

test phase

experimental equipment

pass through a gap with food rewards
randomly using the Latin square design

five trials in each session

trials were alternated

total time taken to pass through

Data analysis

1

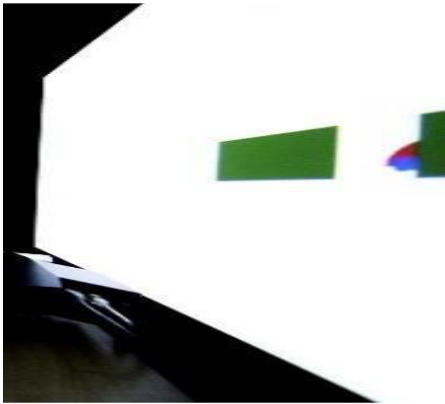
2

3

oscillatory activities in the human
 induced moving objects.

Coherence analysis was used to investigate
 connectivity during, and after occlusion of a small
 screen.

4], we predict that 8- to 12-month-
 old activation in response to our
 connectivity analysis, we expected to find
 sources of interest.



analysis

distributed with enough artefact-free

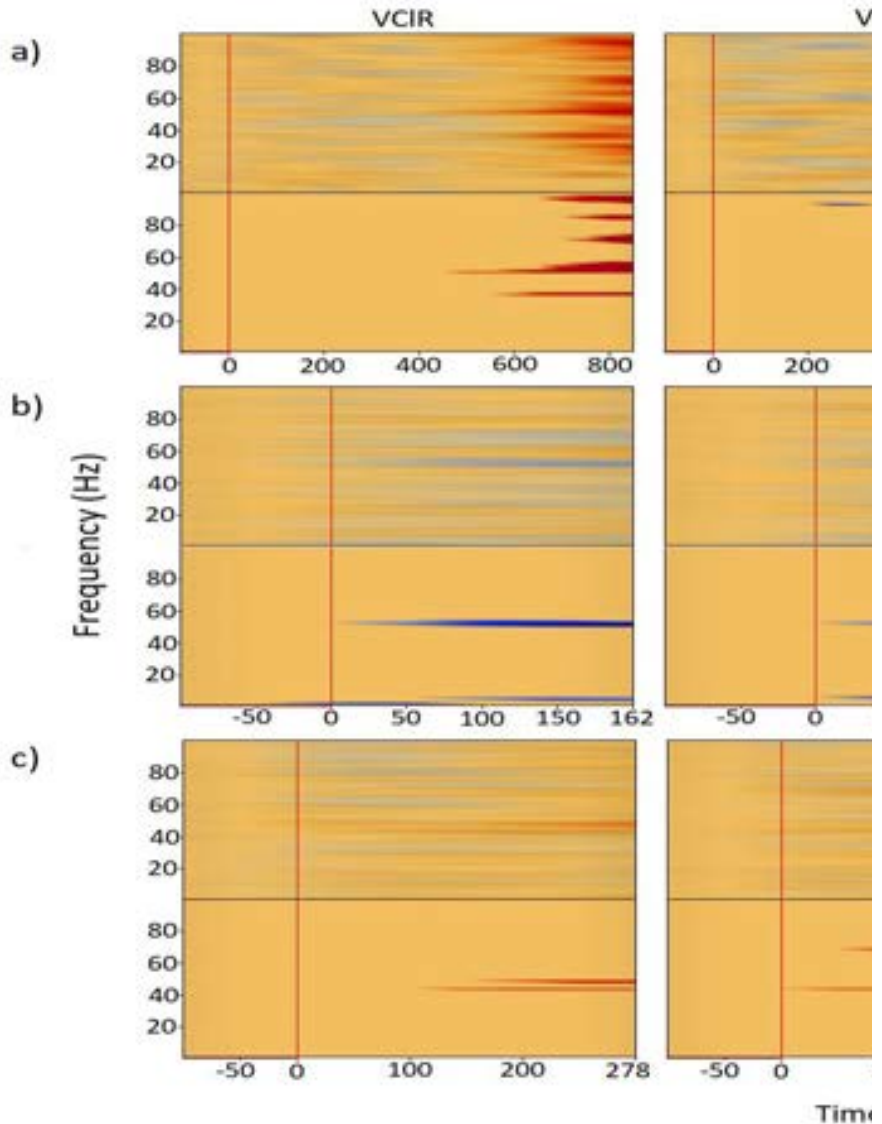
the EEG data. An array of 128 Ag/AgCl
 electrodes covers the head surface.

rectangular path during which it

is during slow, 228 ms during



TSEs before (a) and after (c) occlusion, and a
 significant difference in amplitudes ($p < 0.05$) in the TSEs during occlus
 Epoch is shown from -100-824 ms before occ
 occlusion (b), and from -100-278 ms after occ
 to 0 ms. Frequency (Hz) cut-off is 2-100. Occlu
 onset.



Coherence connectivity &

Brain maps of coherence connectivity when c
 speed before, during, and after occlusion. A c
 demodulation with time and frequency samp
 applied. The significant connectivity differenc
 and theta (orange lines) frequency ranges are
 sources of interest: **CM, PM, CL, CR, VCIL, VCI**

Extrinsic Time, Intrinsic Time

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¹Affordance Perception-Action Laboratory, University of Minnesota

²Winona, MN



Introduction

The Ecological Approach to Perception and Action motivates a focus on intrinsic measures of perceiving and acting in animal-environment systems. Within the Ecological Approach, many scholars are familiar with intrinsic measures of space, both in terms of ontology (e.g., leg length) and in terms of epistemology (e.g., scaling of patterns in ambient arrays). In daily life, most widely used measures of space are extrinsic (e.g., the Metric system). For many scholars, less attention has been paid to intrinsic measures of time. We review a variety of measures of time that are in common usage in daily life. In daily life we commonly use (and casually combine) both extrinsic and intrinsic measures of time, including years, days, hours, and seconds. The casual mixed use of extrinsic and intrinsic units of time can lead to confusion among scientists about the nature of time in psychological phenomena (e.g., perceiving and acting) but also in our general understanding of the natural world.



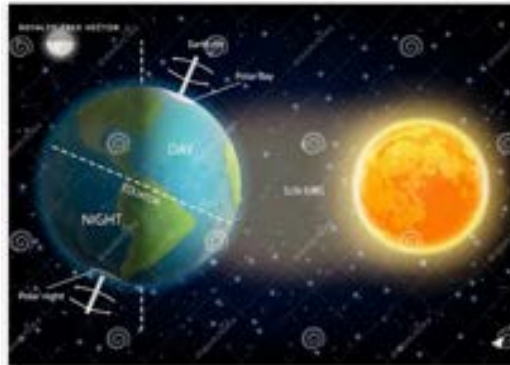
Intrinsic time: The day. Under terrestrial conditions, the rotation of the Earth cannot be perceived, but day/night cycles are perceived by all species.

Extrinsic time

Hypothetical
 Cannot be perceived (by animals)
 Does not structure ambient arrays
 Cannot be detected (by scientists)
 Inferred from detected events
 Abstract, Platonic
 Distinct from events
 Millennium, century, week, hours, minutes, seconds

Intrinsic time

Part of physical reality
 Perceived by animals
 Structures ambient arrays
 Detected by scientists
 Structures ambient arrays
 Concrete, physical
 Time *IS* events
 Seasons, months, days, T_c , time need / time remaining



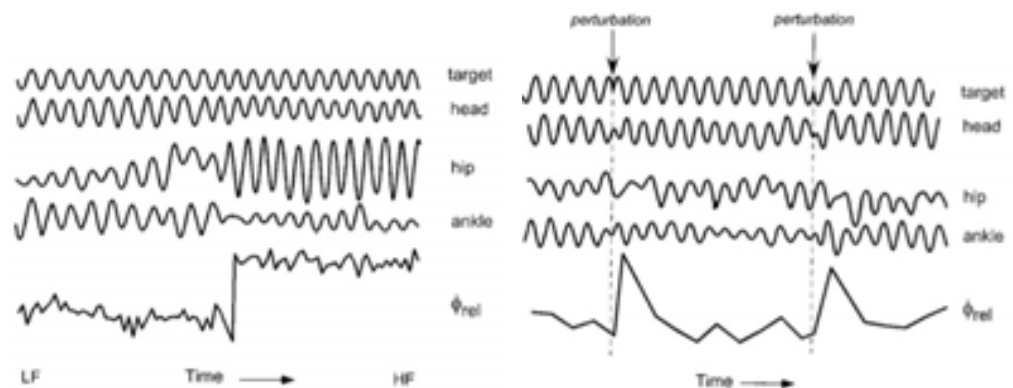
Intrinsic time. The tilt of the Earth's axis generates seasons which, in turn, generate the year. Specified. Perceived.



Intrinsic time. The phases of the moon define the month. Specified. Perceived.



Intrinsic time for locomotion: A day's journey as a function of locomotor technologies.



Intrinsic time: Cyclical phenomena, such as relative phase, exist exclusively as relational entities. These graphs do not have, or need, metric (extrinsic) time.

Discussion

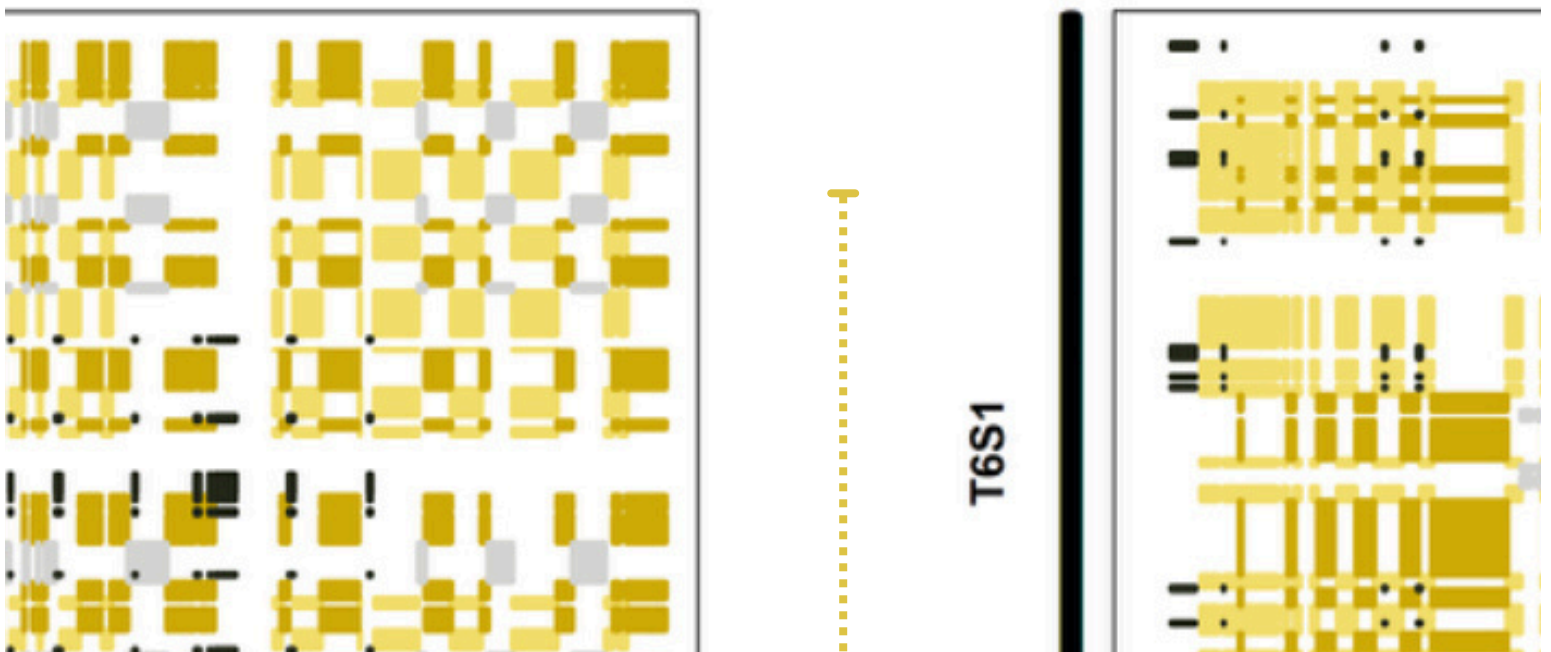
Time and units of time are of central importance to all living things. The existence of diurnal and nocturnal species (for example) is dependent upon units of time (e.g., day, night) that are specified, and are perceived directly by most (if not all) species, including plants. In daily life (and in scientific discourse) humans (but not other species) typically exhibit an uncritical mixing of extrinsic and intrinsic units of time. Scientists—in particular, students of the Ecological Approach—can benefit from carefully attending to the distinction between intrinsic time and extrinsic time, using only the former in discourse, writing, experimental design, data analysis, and so on.

- behaviour
- innovations
- competences
- ...

visualized the
 dynamics be
 or Wilcoxon
 between dy
 correct answ

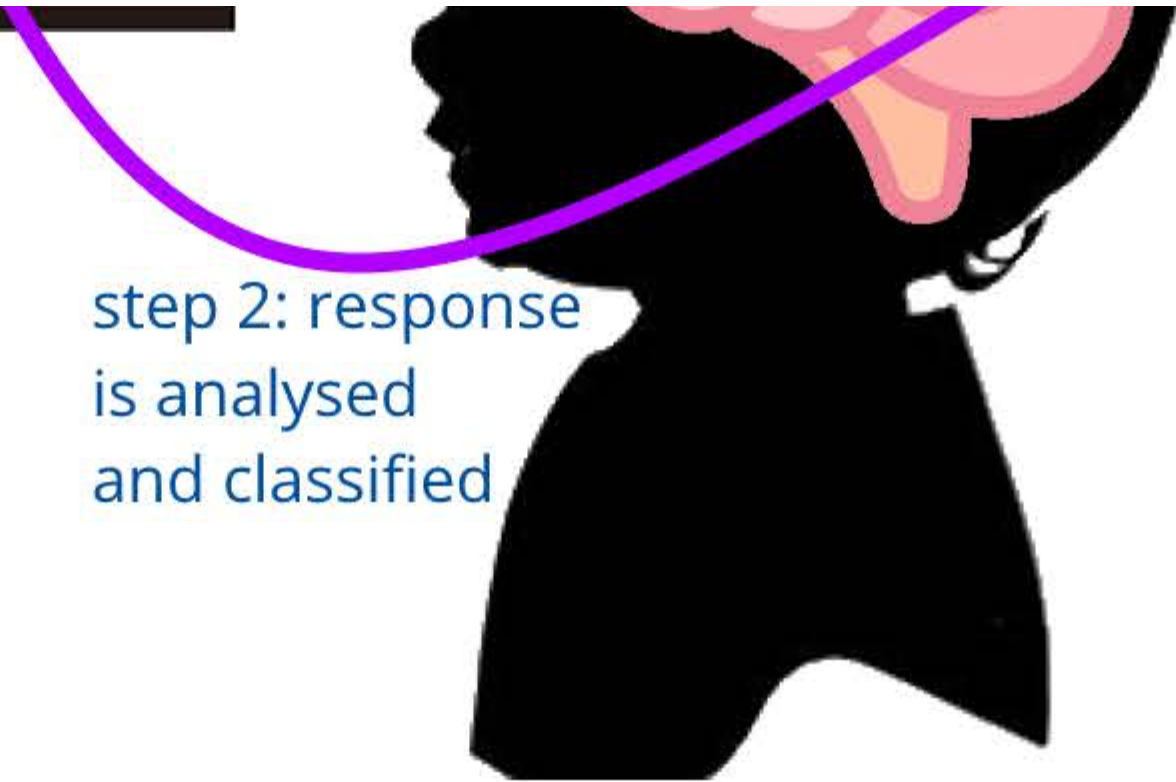
the **team learning dynamics** of

the plots of team learning for four teams





sed
on



step 2: response
is analysed
and classified

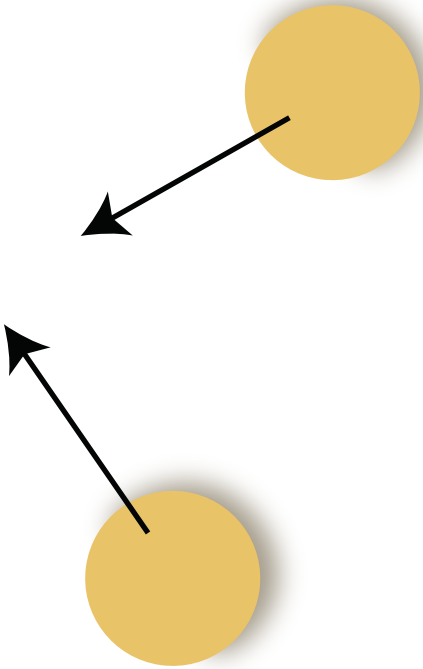
: A simple illustration of the BCI pipeline

Discussion

The RF model produced has a more than satisfactory performance, keeping in mind both the classification metrics and the computational cost of this type of classifier, meaning it is suitable for real-time applications. In combination with [4], this work lays the foundation of constructing a Baby BCI for early autism spectrum deficit detection and intervention. Improvement of the project is at a stage where step 1 and step 2 for

in a 2D environment,
in 3D, the

$$\dot{\theta} \mid \dot{\psi}$$



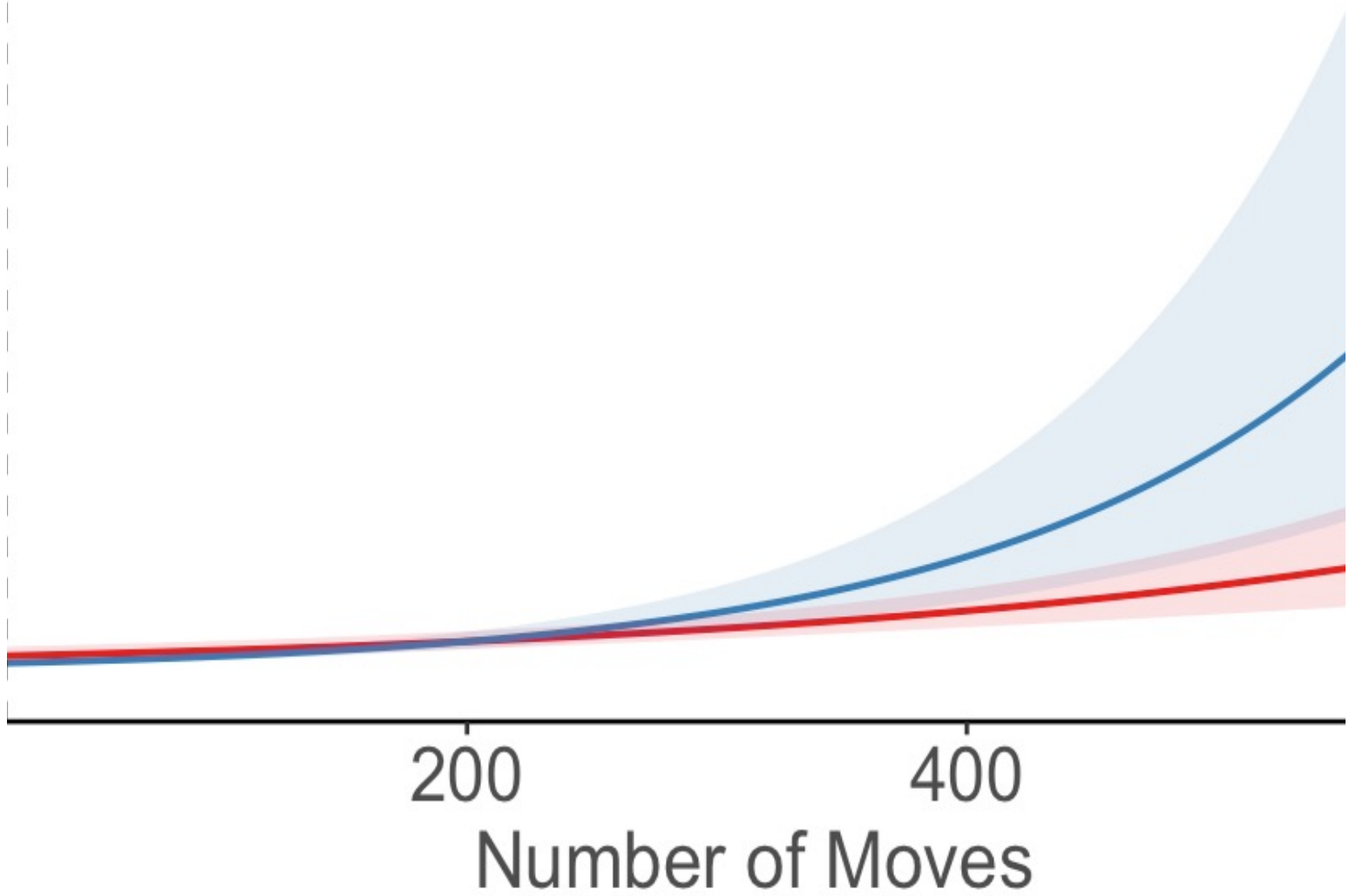
Participants walked with
shown displays in a Sc



Experiment A

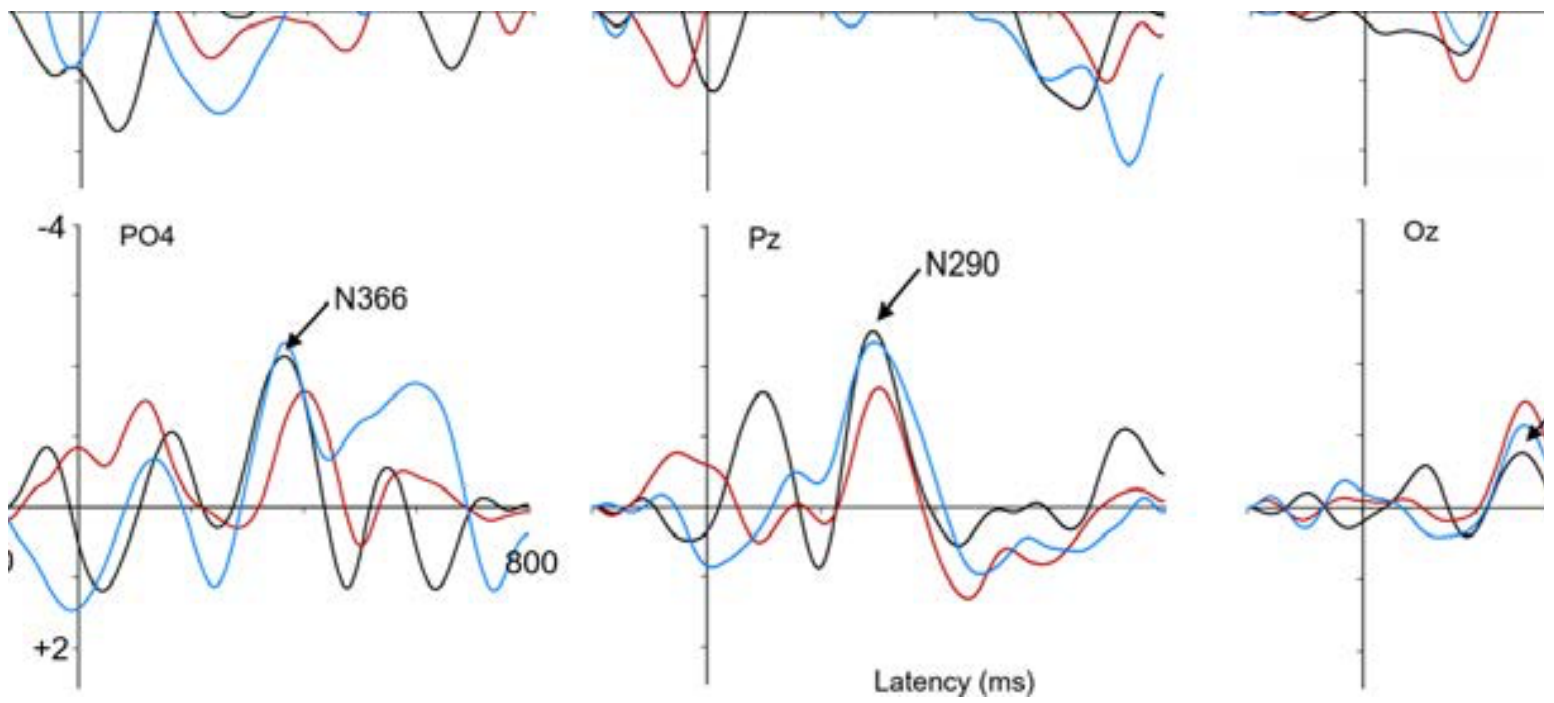
re
lking to

M



l areas represent 95% confidence intervals.

submitted to linear mixed effects models to
ervals (IMI), Total Task Time, and Number of
cant differences in the Number of Moves be
3.

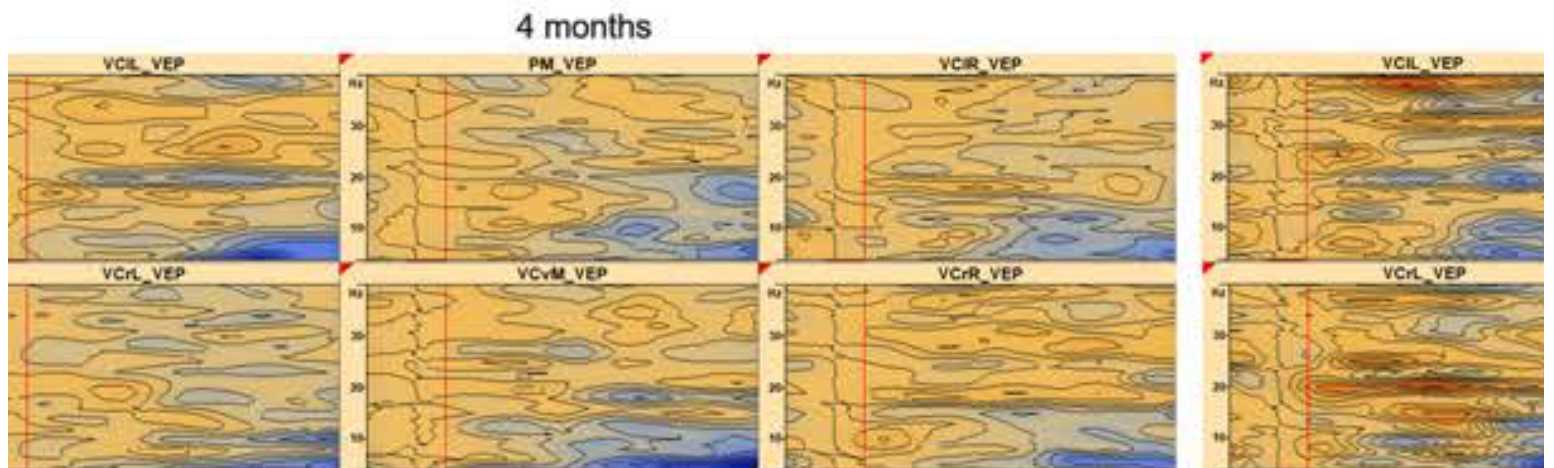


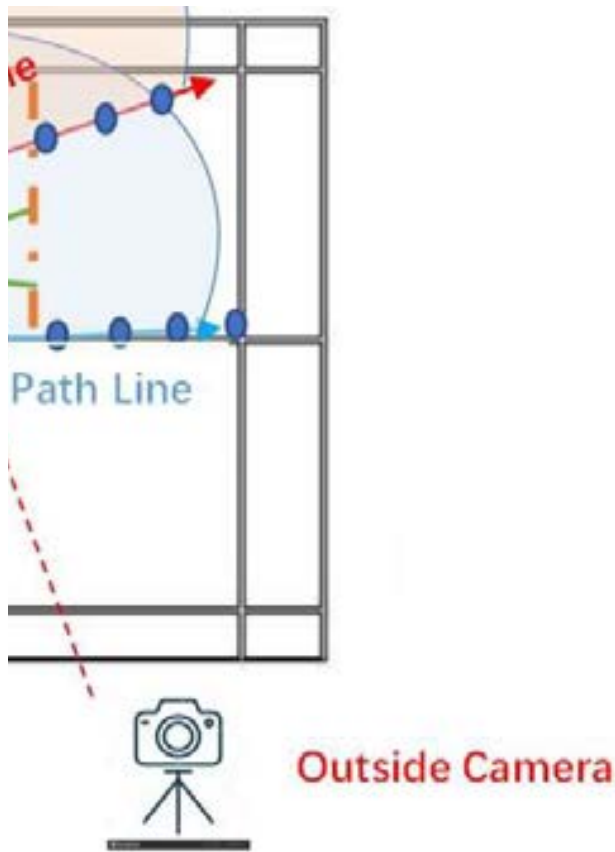
2: Grand average motion VEPs. The actual N2 peak latencies for forvlicated at PO4 at 4 months, at Pz at 12 months, and at Oz at 6 years

SE analysis

the desynchronization transitioned from the sloweencies with age during radial motion processingeta-band desynchronizations were more prevalentities were observed in full-term participants.

significant differences in induced activities were





er and Receiver on court; ii) Both
The two cameras set perpendicular
paths; iv) The two floor-taped lines
the service box in orange.

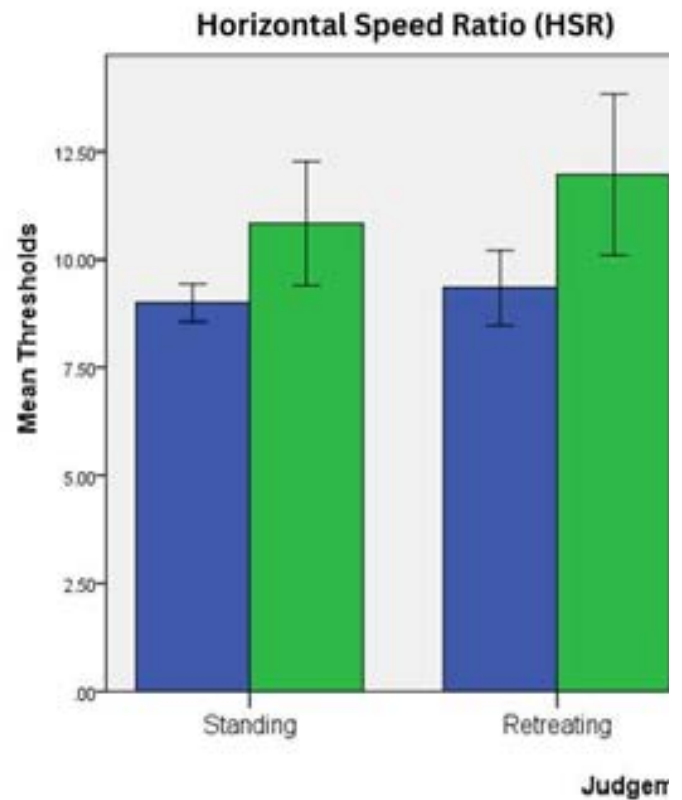


Figure 5 Mean Threshold
Judgment Co



with different
divided into
1 year) and
year).

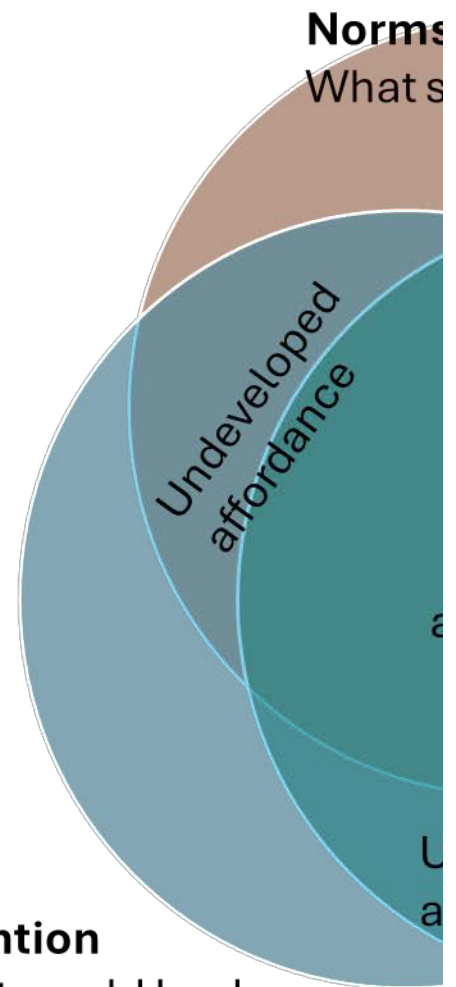


- Visuomotor
- the player t
- Change of c
- players bet

Creating new affordances

nu (2012)

Intention
What would be done



Guided affordances

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