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# Emotional valence and arousal in remote, hybrid, and face-to-face work interaction situations

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# Background

- Emotions have been increasingly studied in connection to work well-being (Diener et al., 2020) and workplace learning (Hökkä et al., 2020).
- Emotions are relevant in individual work tasks, but also in interaction and collaboration in work.
- Research has focused on trait emotions or moods, even though emotions in work often manifest at state-level, having significant situational and temporal variability (Eaton & Funder, 2001).
- Increase in remote and multilocational working has raised new challenges in work interaction and collaboration.

# Aims

- To examine how task-related
  - autonomy and relatedness satisfaction,
  - perceived competence development,
  - physiological arousal (EDA), and
  - perceived goal fulfilment

predict post-event activity- and outcome-related *emotional valence* (positive/negative) and *emotional arousal* (activating/deactivating).

# Setting

- Setting of the interaction situation



*Face-to-face*

All persons in the same place during the situation



*Hybrid*

Some persons in the same location face-to-face, but some participating online



*Online*

All persons participating online

## *Work interaction situation:*

Work situations, where you are not working alone (e.g., conversation with a manager, client meeting, working together)

# Emotions

- Achievement emotions
  - From Control-Value Theory (Pekrun & Perry, 2014).
  - Emotions can be categorized by emotional **valence** (positive/negative), and emotional **arousal** (activating/deactivating).
    - For example: joy (positive, activating), anxiety (negative, activating), contentment (positive, deactivating), sadness (negative, deactivating)

# Autonomy and relatedness satisfaction

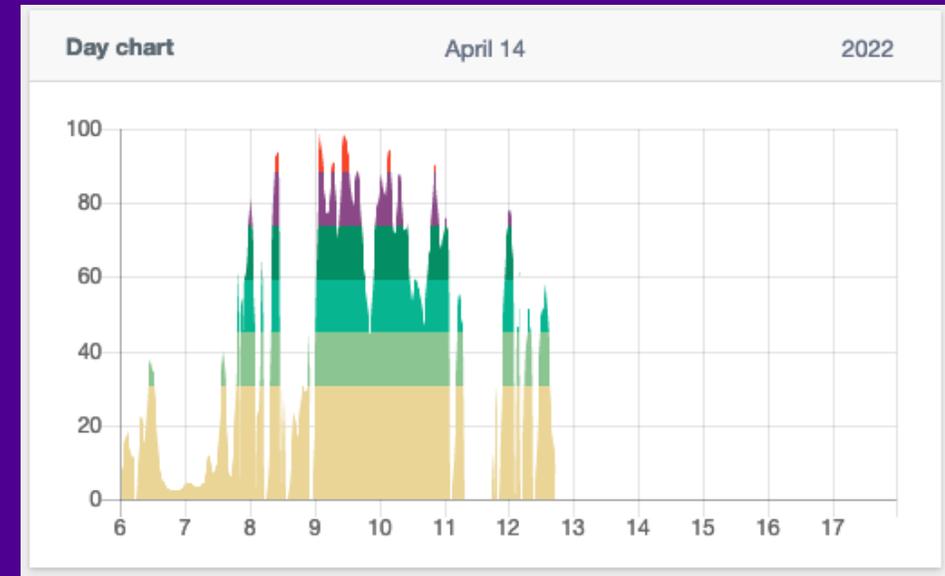
- Satisfaction of the basic psychological needs of autonomy and relatedness from the Self-Determination Theory (Ryan & Deci, 2017).
  - In addition to competence satisfaction which was not examined here -> instead, competence refers to task-related perceived competence development
  - Autonomy and relatedness satisfaction are considered important in work interaction situations.

# Perceived competence development

- Perceived competence development
  - Individual's task-related experience of competence development in interaction work situation.
  - Emotional valence and arousal are positively associated with perceived active competence development (Puhakka et al., manuscript in preparation).

# EDA

- Physiological arousal
  - Measured via electrodermal activity (EDA) that refers to the activation of sympathetic nervous system (Boucsein, 2012; Dawson et al., 2017).
  - EDA responds to cognitive and emotional processing.



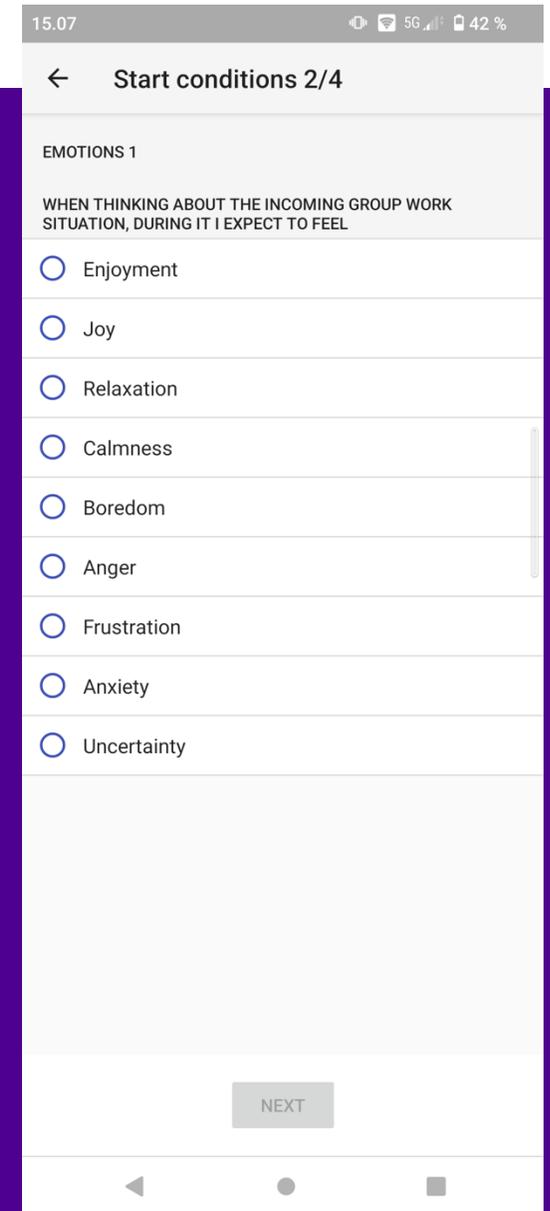


# Data and participants

- Participants ( $n = 56$ ) were white-collar employees from two companies operating in technology sector (software development and consulting) in Finland.
- Mean age was 41.4 years ( $SD = 9.122$ ) and 33 (58.9%) were women.
- The data were collected in May-November 2022.
- Participants wore smart rings and answered short questionnaires before and after work interaction situations during a two-week research period (10 work days).

# Measures – ESM-pre

- Experience sampling method (ESM) data were collected via LearningTracker (LT) smart phone application (Nokelainen & Hartikainen, 2020).
- Questions before interaction situation (prospective):
  - Prospective emotions
    - Related to the interaction situation (activity)
    - Related to goal fulfilment of the interaction situation (outcome)
  - Other information (e.g., own participation: face-to-face/online)



# Measures - ESM-post

- Questions after interaction situation (retrospective):
  - Setting (f2f/hybrid/online)
  - Perceived task-related competence development
  - Perceived task-related goal fulfilment
  - Retrospective emotions
    - Related to the interaction situation (activity)
    - Related to goal fulfilment of the interaction situation (outcome)
  - Task-related autonomy and relatedness satisfaction
  - Other information (e.g., role, size)

15.08 5G 42%

← End conditions 4/6

I FEEL THAT I WAS ABLE TO INFLUENCE THE COURSE AND SUBSTANCE OF THE GROUP WORK SITUATION

1 2 3 4 5

Totally disagree Totally agree

I FEEL THAT THE GROUP WORK SITUATION DEVELOPED MY COMPETENCE

1 2 3 4 5

Totally disagree Totally agree

I FELT RELATEDNESS WITH THE OTHER PARTICIPANTS OF THE GROUP WORK SITUATION

1 2 3 4 5

Totally disagree Totally agree

THE GOALS OF THE GROUP WORK SITUATION WERE FULFILLED

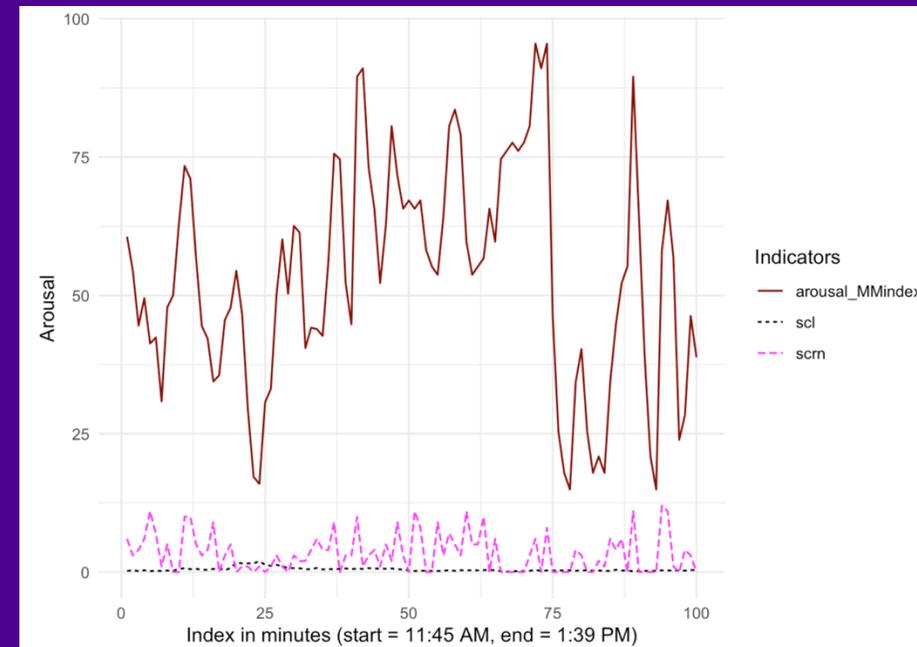
1 2 3 4 5

Not at all Totally

NEXT

# Measures - EDA

- Physiological arousal (EDA)
  - Recorded continuously using a smart ring
  - Double normalized EDA index, 1–100 index value per minute (Salonius et al., 2024)
  - Quiet (1-20), Calm (21-40), Active (41-60), Excited (61-80), Very excited (81-100)



# Research questions

- How task-related autonomy and relatedness satisfaction, perceived competence development, goal fulfilment, and EDA in work interaction situations predict

RQ1) post-event *activity*-focused emotional *valence*,

RQ2) post-event *outcome*-focused emotional *valence*,

RQ3) post-event *activity*-focused emotional *arousal*,

RQ4) post-event *outcome*-focused emotional *arousal*?

# Statistical analyses

- The four research questions were investigated with generalized linear mixed-effects models (GLMMs) with a binomial family using the *lme4* package's *glmer* function (Bates et al., 2015).
- All analyses were conducted in the *R* statistical computing environment (R Core Team, 2020).

# Bivariate two-level correlations

- Correlations indicated that perceived goal fulfilment, relatedness and autonomy satisfaction, and perceived competence development were robust predictors of positive post-event emotional outcomes.
- EDA showed limited direct correlation with emotional response measures.

# RQ1: activity-related emotional valence

“When thinking about the finished group work situation, during it I felt mainly...”

Setting  
Goal fulfilment  
Relatedness

	Model 0			Model 1			Model 2			Model 3			Model 4		
	Log-Odds (C.I.)	S.E.	p	Log-Odds (C.I.)	S.E.	p	Log-Odds (C.I.)	S.E.	p	Log-Odds (C.I.)	S.E.	p	Log-Odds (C.I.)	S.E.	p
(Intercept)	1.35 (1.01 – 1.69)	0.17	<0.001	1.39 (1.04 – 1.74)	0.18	<0.001	1.55 (1.19 – 1.92)	0.19	<0.001	1.61 (1.24 – 1.98)	0.19	<0.001	1.58 (1.22 – 1.94)	0.19	<0.001
n participants cwc				-0.32 (-0.54 – -0.11)	0.11	0.003	-0.22 (-0.46 – 0.02)	0.12	0.068	0.07 (-0.21 – 0.34)	0.14	0.637	0.04 (-0.24 – 0.33)	0.15	0.771
n participants cbc										0.61 (-0.27 – 1.49)	0.45	0.174	0.50 (-0.38 – 1.39)	0.45	0.267
work mode cwc										0.19 (-0.11 – 0.22)	0.21	0.363	-0.27 (-0.70 – 0.16)	0.22	0.218
work mode cbc										0.02 (-0.10 – 1.07)	0.55	0.978	-0.18 (-1.30 – 0.93)	0.57	0.749
goal fulfillment cwc										0.76 (-1.07 – 1.07)	0.16	<0.001	0.80 (0.46 – 1.14)	0.17	<0.001
goal fulfillment cbc										0.63 (-0.10 – 1.65)	0.52	0.231	0.61 (-0.43 – 1.65)	0.53	0.250
autonomy cwc										0.24 (-0.38 – 0.50)	0.14	0.084	0.21 (-0.06 – 0.48)	0.14	0.128
autonomy cbc										0.48 (-0.38 – 1.40)	0.47	0.299	0.37 (-0.54 – 1.28)	0.47	0.428
relatedness cwc										0.82 (0.51 – 1.14)	0.16	<0.001	0.81 (0.49 – 1.13)	0.16	<0.001
relatedness cbc										0.66 (-0.34 – 1.66)	0.51	0.193	0.82 (-0.22 – 1.87)	0.53	0.122

Face-to-face -> hybrid -> fully online

# RQ2: outcome-related emotional valence

“When thinking about the fulfillment of the goals of finished group work situation, I feel...”

Goal fulfilment

Relatedness

	Model 0			Model 1			Model 2			Model 3		
	Log-Odds (C.I.)	S.E.	p									
(Intercept)	2.28	0.26	<0.001	2.28	0.26	<0.001	2.84	0.28	<0.001	2.84	0.28	<0.001
gender cgr							-0.72	0.40	0.073	-0.72	0.40	0.073
n participa							0.00	0.17	0.980	0.00	0.17	0.980
n participa							-0.45	0.44	0.311	-0.45	0.44	0.311
goal fulfil							1.49	0.22	<0.001	1.49	0.22	<0.001
goal fulfil							1.50	0.61	0.014	1.50	0.61	0.014
relatednes							0.90	0.19	<0.001	0.90	0.19	<0.001
relatednes cbc							0.35	0.53	0.510	0.35	0.53	0.510

# RQ3: activity-related emotional arousal

“When thinking about the finished group work situation, during it I felt mainly...”

Setting  
Face-to-face -> hybrid -> fully online

Goal fulfilment

Autonomy

Relatedness

	Model 0			Model 1			Model 2			Model 3		
	Log-Odds (C.I.)	S.E.	p	Log-Odds (C.I.)	S.E.	p	Log-Odds (C.I.)	S.E.	p	Log-Odds (C.I.)	S.E.	p
(Intercept)	-0.41 (-0.73 – -0.08)	0.17	<b>0.014</b>	-0.47 (-0.76 – -0.17)	0.15	<b>0.002</b>	-0.48 (-0.77 – -0.19)	0.15	<b>0.001</b>	-0.50 (-0.80 – -0.20)	0.15	<b>0.001</b>
gender cgm				-0.86 (-1.43 – -0.29)	0.29	<b>0.003</b>	-0.86 (-1.42 – -0.29)	0.29	<b>0.003</b>	-1.01 (-1.62 – -0.40)	0.31	<b>0.001</b>
n participants								0.10	<b>0.008</b>	-0.10 (-0.32 – -0.12)	0.11	0.377
n participants									0.471	-0.29 (-1.07 – -0.48)	0.39	0.455
work mode c									<b>0.011</b>	-0.33 (-0.65 – -0.01)	0.16	<b>0.043</b>
work mode c									<b>0.010</b>	-1.37 (-2.37 – -0.37)	0.51	<b>0.008</b>
goal fulfillment				<b>relatedness cwc</b>	0.28 (0.00 – 0.55)	0.14	<b>0.047</b>		<b>0.011</b>	0.08 (-0.20 – -0.37)	0.15	0.565
goal fulfillment				<b>relatedness cbc</b>	-0.68 (-1.64 – -0.29)	0.49	0.172		<b>0.027</b>	1.12 (0.15 – 2.08)	0.49	<b>0.023</b>
autonomy cwc										0.34 (0.10 – 0.58)	0.12	<b>0.006</b>
autonomy cbc										0.27 (-0.56 – -1.11)	0.43	0.525
relatedness cwc										0.28 (0.00 – 0.55)	0.14	<b>0.047</b>
relatedness cbc										-0.68 (-1.64 – -0.29)	0.49	0.172

# RQ4: outcome-related emotional arousal

“When thinking about the fulfillment of the goals of finished group work situation, I feel...”

Goal fulfilment

Relatedness

		Model 0	Model 1	<i>p</i>	Model 2	<i>p</i>	
		<i>Log-Odds (C.I.)</i>	<i>S.E.</i>		<i>Log-Odds (C.I.)</i>	<i>S.E.</i>	
(Int					-1.85 (-2.22 – -1.48)	0.19	<0.001
goa					0.33 (-0.05 – 0.71)	0.20	0.093
goa	relatedness cwc	0.58 (0.24 – 0.91)	0.17	0.001	1.10 (0.04 – 2.16)	0.54	0.041
rela	relatedness cbc	0.00 (-0.94 – 0.95)	0.48	0.993	0.58 (0.24 – 0.91)	0.17	0.001
rela					0.00 (-0.94 – 0.95)	0.48	0.993

# Discussion

- Goal fulfilment and relatedness satisfaction had generally the strongest positive and activating influences on emotional valence and arousal.
- Work setting was also a contributor with hybrid and fully online interaction situations having a more negative valence and lower emotional arousal.
- Physiological arousal (EDA) had no distinct association with emotional valence or arousal.
  - Interesting result as emotional (categorized from self-assessed emotions) and EDA (objective physiological arousal) are expected to related.

# Discussion

- Interestingly, perceived competence development was not a significant predictor in the models, even though it had positive bivariate correlations to emotional valence and arousal
  - This indicates that goal fulfilment and relatedness are more impactful in producing positive and activating emotions.
  - Informal workplace learning was not directly associated with work well-being (compared to e.g., relatedness satisfaction) (Puhakka et al., in press).

# Implications

- It is important to not forget to meet face-to-face.
- Informal interaction should be encouraged and facilitated to enhance relatedness satisfaction during work encounters and collaboration.
- Clarity of situation goals and monitoring their fulfilment can enhance the perception of goal fulfilment which also links to positive emotions.
- Unexpected lack of EDA-results raises question about the link between emotional and physiological arousal (Pekrun, 2019).
  - Further research on methodological and theoretical questions should be undertaken (e.g., related to possible scaling and linearity issues).

**Thank you!**



SKYFOX / Marko Kallio

**PGL research group:** <https://research.tuni.fi/pglresearch/>

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