Project title: Människans bästa vän - emotionell, fysiologisk och beteendemässig synkronisering

(Humans best friend – emotional, physiological and behavioral synchrony)

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Popular science summary:

Behavioral and physiological synchrony facilitate emotional closeness in attachment relationships. In this project, we investigated the emotional and physiological, two-way connection (designated as co-modulation) between dogs of cooperative breeds and their owners. We measured the electrocardiography (ECG) and physical activity of dogs and their owners during different neutral and positive tasks, including resting and positive interactions, such as stroking and playing. We also collected data on owner temperament and the dog-owner relationship.

We found that overall heart rate variability (HRV) and activity levels were correlated between dogs and their owners during free behavior periods, while activity levels correlated during pre-defined interaction tasks. Dog height, ownership duration, owner temperament (negative affectivity), and the quality of the dog-owner interaction influenced the HRV responses of the dog, but the best predictor for the owner HRV was the dog HRV. Thus, the dogs and their owners had a bi-directional effect on each other during the experiment. Owner affected the dog physiological state, but the dog also affected the owner physiological state.

Overall, the results suggest that the physiological and behavioral synchrony between cooperative breed dogs and their owners can be similar to the emotional connection found in human attachment relationships.

The following sections, requested in the Handbook for applicants, are included within an open-access publication in a scientific journal (Koskela et al. 2024) (as instructed in the Handbook): Introduction, background, purpose and question at issue; Materials and methods; Results; and Discussion. However, we include here the "Discussion with conclusions and practical benefit for the pet sector" in the following section, as it has not been part of the scientific publication as such.

Discussion with conclusions and practical benefit for the pet sector:

This study has several practical implications for the pet sector, particularly in enhancing the well-being and relationship between dogs and their owners.

Practical implications to behavioral therapy. Our results implicate the effect of human temperament/personality on the canine emotional arousal state. Previous research has already noted the connection of human mental health issues with the dog behavior (Barcelos et al. 2023; Ståhl 2023), suggesting that at least in some cases, human well-being is connected to dog welfare, fitting in the general idea of One Welfare (https://www.onewelfareworld.org/). Dog trainers may consider applying these results to offer improve behavioral therapy and counseling for dogs and their owners, focusing on improving the dog-owner relationship and reducing negative emotions in both parties. As the issues may be multifaceted, multidisciplinary teams should be beneficial in some cases, including not only animal behavior but also human psychological expertise within the counseling team.

Practical implications to pet ownership, adoption and matching. There is a strong hereditary component for the canine emotional reactivity (e.g. Liinamo et al. 2007; Sarviaho et al. 2019; Salonen et al. 2020). However, the owner influences the dog emotionality and behavior as well, and vice versa. Owner temperament/personality affects the dog behavior and emotional state—now shown at the heart rate level by our study, in addition to some previous research examining hormonal levels and behavior (Sundman et al. 2019; Höglin et al. 2021; Kujala et al. 2023). Thus, the dog breeders, pet shelters and adoption agencies could consider the emotional compatibility between potential dog owners and dogs in addition to other environmental and basic needs of the dog. Activity levels (Väätäjä et al 2021) and style (Bennett & Rohlf 2007; Curb et al. 2013; González-Ramírez et al. 2017) of both the dog and the owner can be an important part of the matching process to ensure successful and harmonious pet adoption, but also the emotional reactivity could be taken into account.

Practical implications to research and development activities. As there are 68 million pet dogs in the EU area alone, one in 27% of the households (FEDIAF, 2024), the emotional wellbeing of dogs and their owners have huge implications to the daily lives of countless individuals—both human and non-human. The results of this project, together with other research exploring these questions (Bennett & Rohlf 2007; Curb et al. 2013; González-Ramírez et al. 2017; Sundman et al. 2019; Höglin et al. 2021; Kujala et al. 2023) begin to reveal the bi-directional connection of the human-nonhuman bond. Nevertheless, the results also show the complex nature of the phenomenon, indicating that the effects are not applicable to all human-nonhuman dyads as such, but depend on the individual factors from both parties. Therefore, the pet sector could consider investing in further research to explore the co-modulation effects in different breeds and settings, leading to improved care practices and interventions.

Overall, the results of this project highlight the importance of the emotional and physiological connection between dogs and their owners, paving the way for more informed, structured and effective approaches in the pet industry.

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Journal publication:

Koskela A, Törnqvist H, Somppi S, Tiira K, Kykyri VL, Hänninen L, Kujala J, Nagasawa M, Kikusui T, Kujala MV (2024). Behavioral and emotional co-modulation during dog-owner interaction measured by heart rate variability and activity. Scientific Reports 14:25201. DOI: 10.1038/s41598-024-76831-x.

Abstracts in scientific conferences:

Koskela, A., Kujala, J., Törnqvist, H., Kykyri, V-L., Kikusui, T. & Kujala, M.V. (2025). Quantifying emotional synchrony between dogs and owners with heart rate variability. Canine Science Forum (22.-26.6.2025), Hamburg, Germany. URL: https://www.csf-hamburg.de/

Koskela, A., Törnqvist, H., Somppi, S., Tiira, K., Kykyri, V.-L., Hänninen, L., Kujala, J., Nagasawa, M., Kikusui, T., & Kujala, M.V. (2024). Co-modulation of the heart rate variability and activity between pet dogs and their owners during short-term interaction. Brain and Bodies in Social Interaction, Learning and Wellbeing Conference (11.-14.6.2024), Jyväskylä, Finland. URL: https://www.jyu.fi/en/events/brains-and-bodies-in-social-interaction-learning-and-wellbeing

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Links to web pages describing the project:

Principal investigator website:
https://www.jyu.fi/en/people/miiamaaria-kujala

Research group website:
https://www.jyu.fi/en/research-groups/interaction-of-dogs-and-humans

Press release of the University of Jyväskylä describing the project results:
https://www.jyu.fi/en/feature-article/dog-owner-interaction-is-reflected-in-heart-rate-variability

Media coverage of the project results, as tracked by Altmetric:
https://nature.altmetric.com/details/169626240/news

Press release of the University of Jyväskylä describing the overarching larger goals of the research group in the long run:
https://www.jyu.fi/en/feature-article/humans-best-friend-interaction-research-with-dogs