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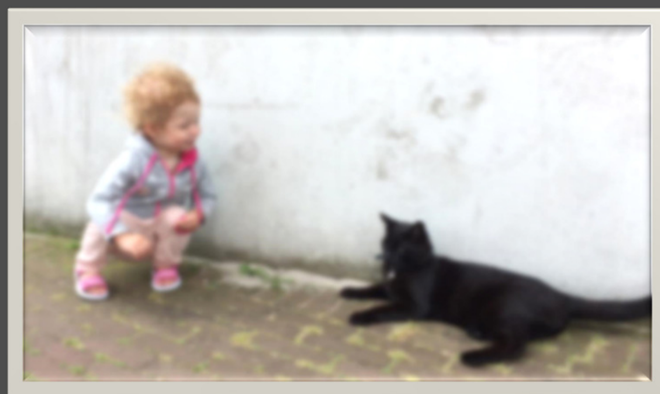
Theory and research methods in animal-assisted interventions



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This word cloud shows related terms found in articles on human-animal interactions in the last 5 years in the social sciences (source: Scival). The greener and the bigger, the more often a term is used. We can witness a 57% increase in the use of the term animal in research publications, and a 150% increase in the use of animal-assisted therapy.

We see an increase in practice as well. For instance, a rough Google search resulted in 40 organizations in the Netherlands offering some form of dog-assisted interventions.

My focus today will be on animal-assisted interventions and in particular animal-assisted therapy. This means that I focus on goal-oriented and structured therapeutic interventions, usually done in one-on-one sessions, offered by trained professionals with assistance of animals (IAHAIO white paper definition).

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e.g., Beetz et al., 2012; Fine, 2015; Nimer & Lundahl, 2007; O'Haire, 2017

In general, research articles have reported positive effects of animal-assisted interventions and therapy.

First, researchers have found decreased autistic symptoms, mostly in children.

Enhanced emotional wellbeing, across all age groups, but mostly studied in adults.

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e.g., Beetz et al., 2012; Fine, 2015; Nimer & Lundahl, 2007; O'Haire, 2017

Positive physiological effects across all age groups, buffering physiological reactions to stressors.

And a decrease in behavioral problems, mostly studied in adolescents and elderly.

Can we move on? This depends on who you ask, on what treatments you compare, the target group and comparison groups.

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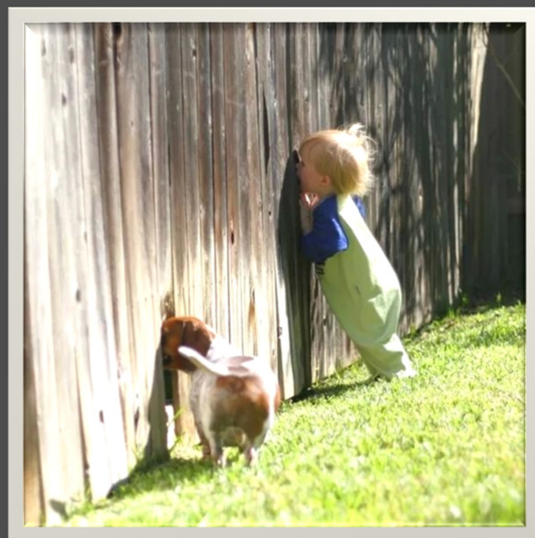


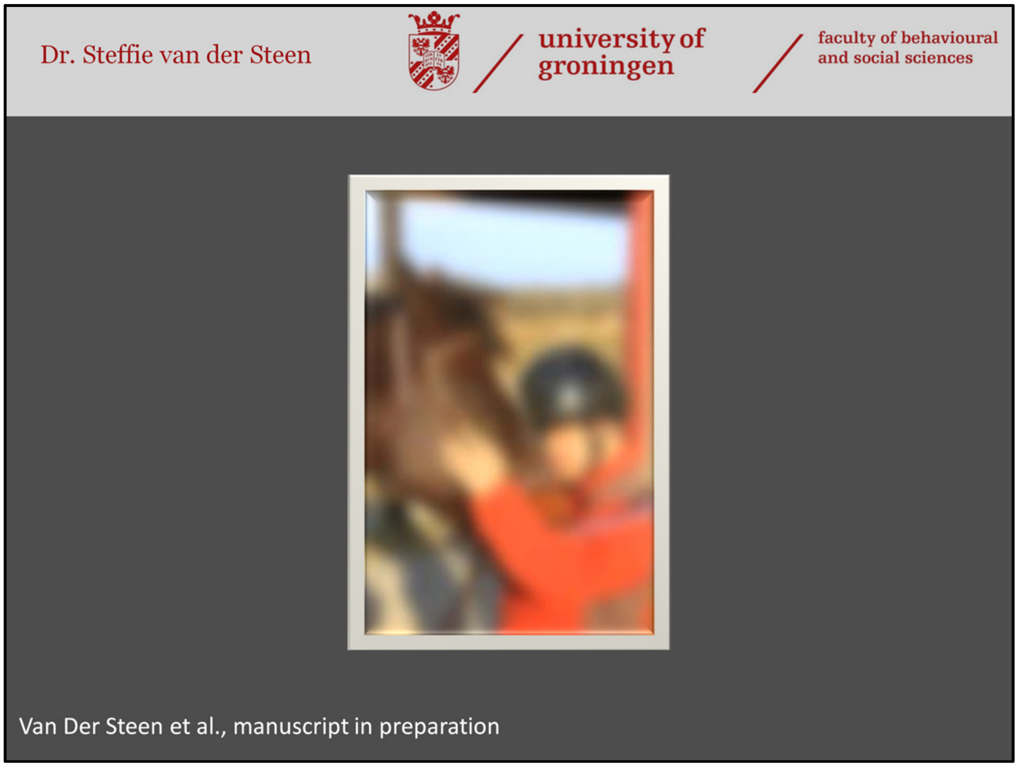
Serpell et al., 2017

Anestis et al., 2014; Griffin et al., 2011; Kamioka et al., 2014; Nimer & Lundahl, 2007

We need to explore the other side of the fence, and connect research findings to theory, for two important reasons.

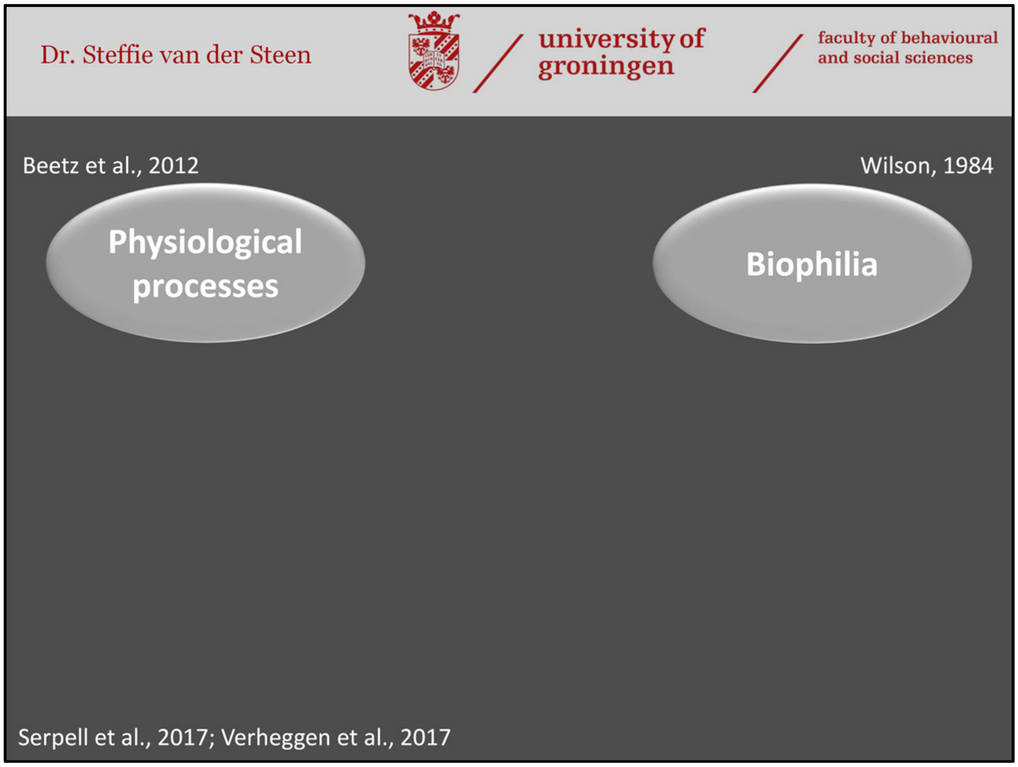
First, a stronger theoretical base can guide specific research questions that address *how* interactions with animals impact our behavior, and *when* they could be expected to be most beneficial. Needless to say, this will help practitioners to a great extent as well.

Second, animal-assisted interventions take place in real-life settings. Interventions differ with regard to the target group, the age of the clients, the type of animal, the actions performed with the animal, the length of the treatment and its location (see next slide for an example)



As an example, a survey we conducted among 20 practitioners of equine-assisted interventions in the Netherlands, showed that the methods used during the sessions varied widely, and that practitioners often use a combination of methods, inspired by cognitive behavioral therapy, play therapy, mindfulness, etcetera. In addition, the number of sessions varied widely.

But even if these factors were similar across interventions… settings, therapist, clients and animals differ. If we have a proper theoretical base, that is, if we have ideas or hypotheses about when and how animal-assisted interventions work, we can test these hypotheses, even in different settings.

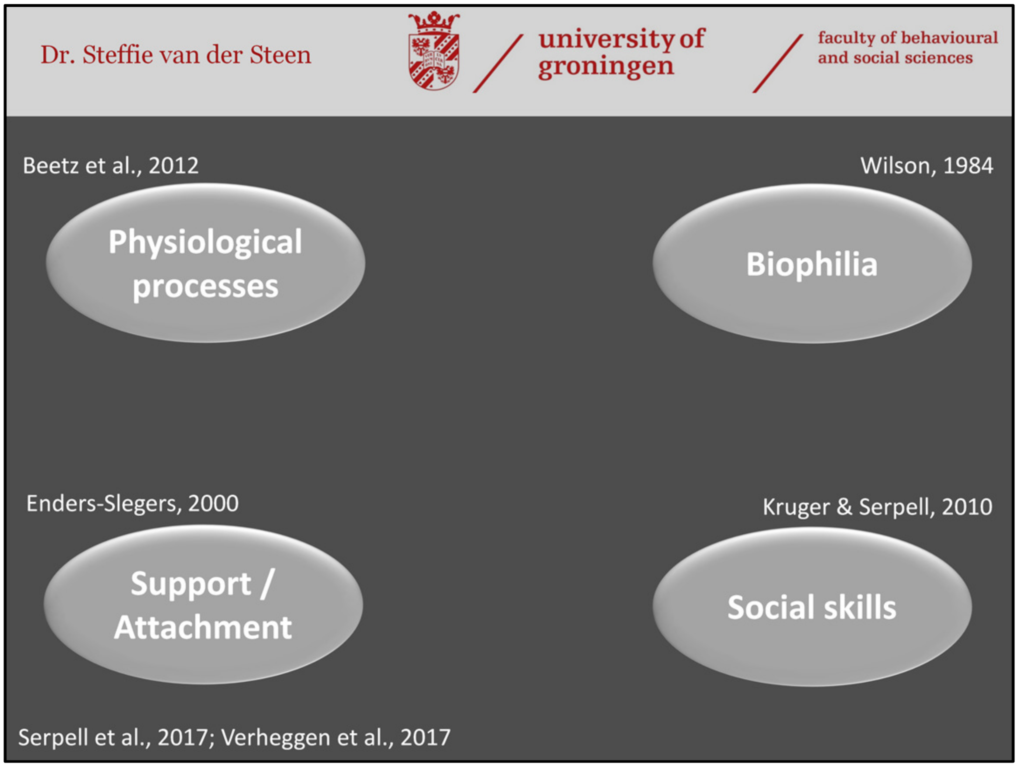


With the help of the references listed here, I made an attempt to synthesize theory in the field of human-animal interactions. First, we have the general Biophilia hypothesis, according to which humans have an innate tendency to affiliate with other life forms. Because we are more focused on natural stimuli, they distract us from stressors.

More specifically, researchers have indicated that interacting with animals has an effect on our physiological system. It would increase the oxytocin release in our brains, which inhibits stress responses, and would positively affect heart rate, muscle tone, and blood pressure.

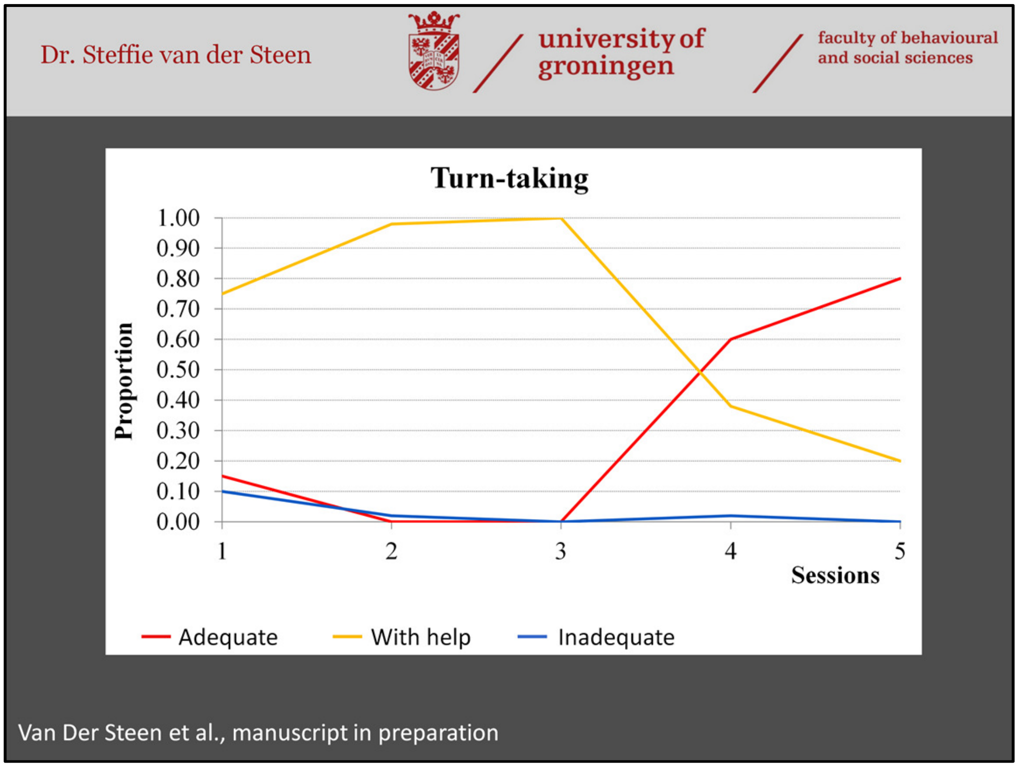
To illustrate this, we assessed cortisol in saliva of 12 children with either an Autism Spectrum Disorder or Down Syndrome who took part in a dog-assisted therapy program (Griffioen et al., in preparation).

This is a picture of the saliva collection, in which the child chews on a cotton ball. This procedure was done before and after each session of dog-assisted therapy. The samples were sent to the lab to assess the cortisol levels. Cortisol is considered the stress hormone and counteracts Oxytocin. In general, when cortisol levels decrease, oxytocin increases (and the other way around). In this particular study, the mean level of cortisol was usually lower at the end of each therapy session compared to the beginning. Apart from that, we saw a significant decline in average cortisol levels after three to four sessions.



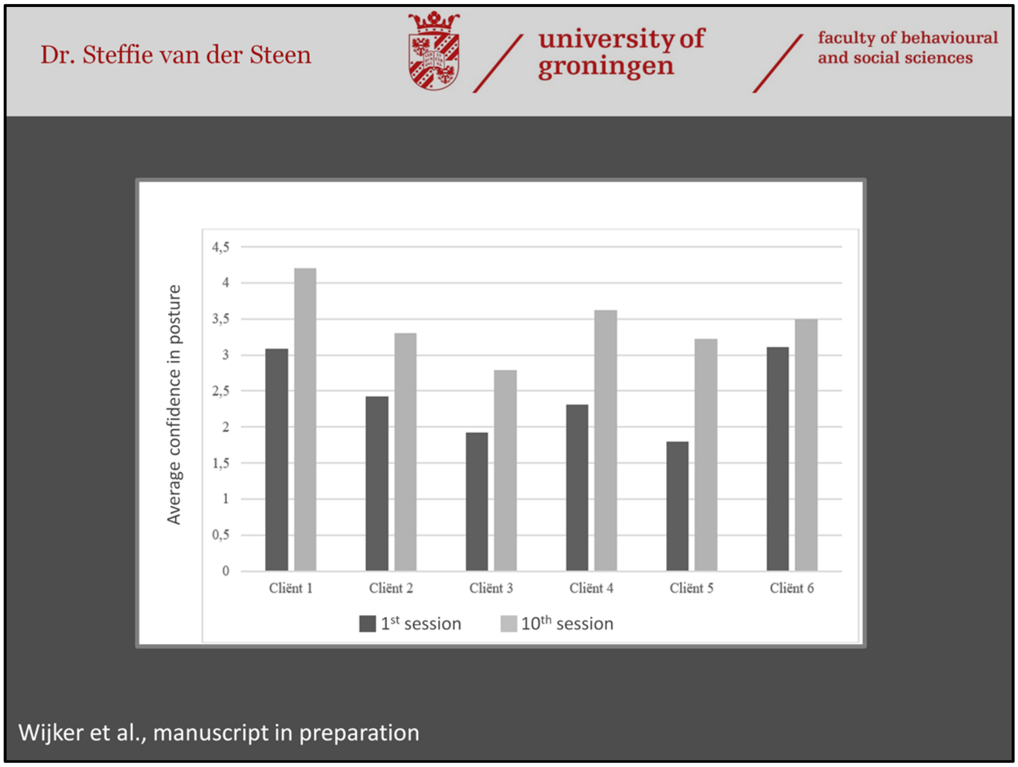
Interestingly, oxytocin levels are higher when you interact with someone you have a bond with. The bond between people and animals, their attachment, meets our basic human need for emotional closeness and provides social support.

Because of the nonjudgmental and warm attachment people can have to animals, they can also stimulate our social skills. In an environment in which the person feels safe, they provide feedback, for instance in terms of a better understanding of the effect of your actions. In this way, interactions with animals affect our social perceptions, interaction skills such as turn taking, and self-esteem.

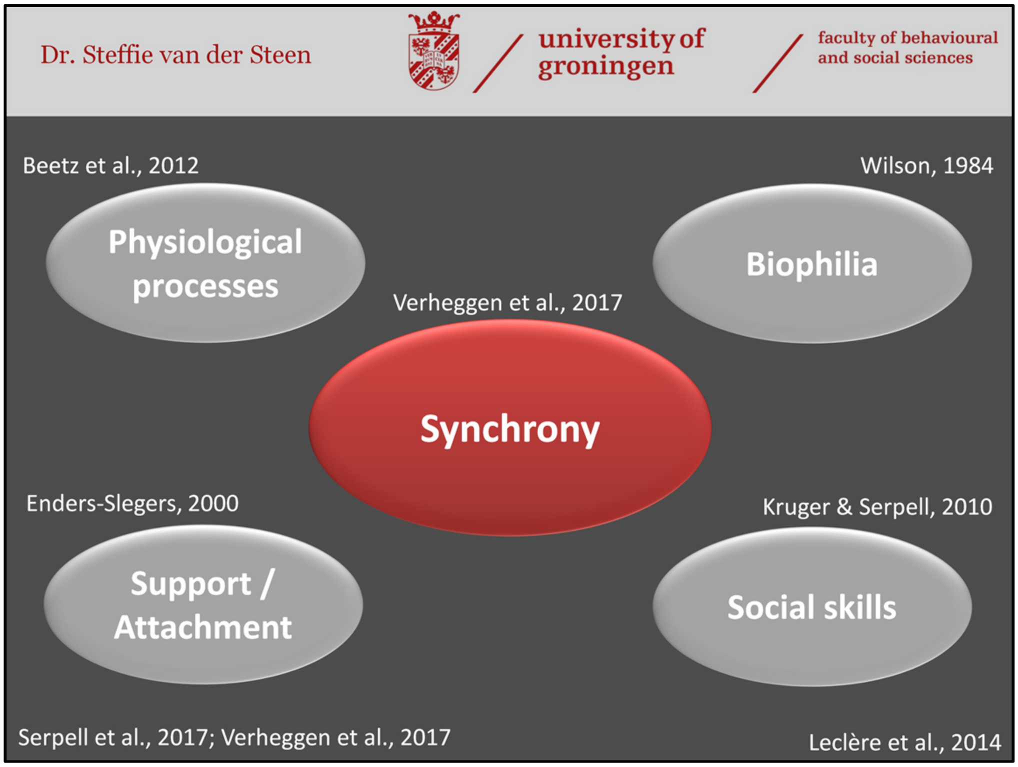


Take the results of this case study on equine-assisted therapy, for instance (Van der Steen et al., in preparation).

We found our participant (a girl of 8 years old diagnosed with an Autism Spectrum Disorder) needed considerable help with turn-taking in interactions during the first three sessions, after which we saw an increase in independent and adequate turn-taking.



Regarding self-esteem, for this study on dog-assisted therapy for adults with Autism Spectrum Disorders, on which I collaborated (Wijker et al., in preparation), we coded the behavior of 6 clients during the first and last of 10 sessions dog-assisted therapy. The results showed an increase in confidence as visible in participant’s posture after 10 sessions. Participants were also less hesitant in their voice.



I mentioned a couple of theories/hypotheses about the mechanisms of animal-assisted interventions. The common ground that all the theoretical underpins share, is synchrony. Researchers have also called this attunement or interpersonal coordination.

Synchrony has a long research history in caregiver-child interactions. During early development, synchrony involves a matching of behavior, emotional states, and movement rhythms between caregivers and infants. Let's look at the parallels with human-animal interactions. Synchrony emerges when caregivers and children are particularly attuned or focused on each other. This coordination between caregivers and children is the basis of the bond between them, the attachment. Oxytocin appears to enhance this bond and also increases synchrony. Lastly, synchrony facilitates the development of social emotional skills. Therefore the study of synchrony, with its origins in research on parent-child interactions, provides a very good fit with research on human-animal interactions.

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Feldman, 2007; Fogel, 1993; Harrist & Waugh, 2002 ; Leclère et al., 2014; Lindsey et al., 2009 ; Stern, 1977 ; Trevarthen, 1979

Synchrony is a pattern that occurs in the behavior or emotions of two individuals. It is mutually regulated, reciprocal, and harmonious. In contrast to mimicry or behavioral matching, synchrony requires anticipating others' behaviors to coordinate your own behavior. This has two important implications.

First, synchrony is something that emerges out of the interaction between two individuals. It is quite possible that one of these individuals leads while the other follows, but at the same time, it can only happen when two individuals actively respond to each other. Researchers have therefore compared it to a dance.

Second, synchrony can be studied by looking for temporal matches between the behaviors of the interaction partners, but fine-grained analysis methods are needed, because the timing is complex. The patterns of behavior can be simultaneous, but there is often a delay. The behavioral patterns can also be alternating or mirrored, and sudden transitions from in-sync to out-of-sync can occur, making synchrony a nonlinear process.

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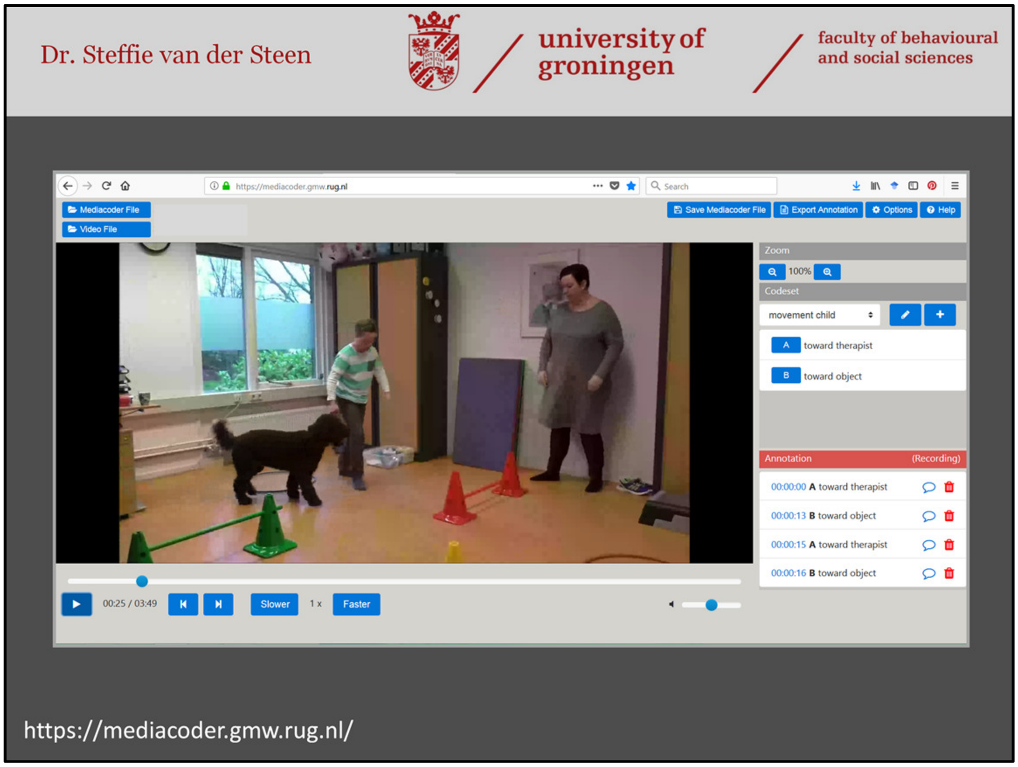
Field et al., 1990; Næss et al., 2017; Osterling et al., 2002; Sigman et al., 1999; Varlet et al., 2012

In case of developmental, neurological or emotional disorders, people have trouble to engage in social interactions.

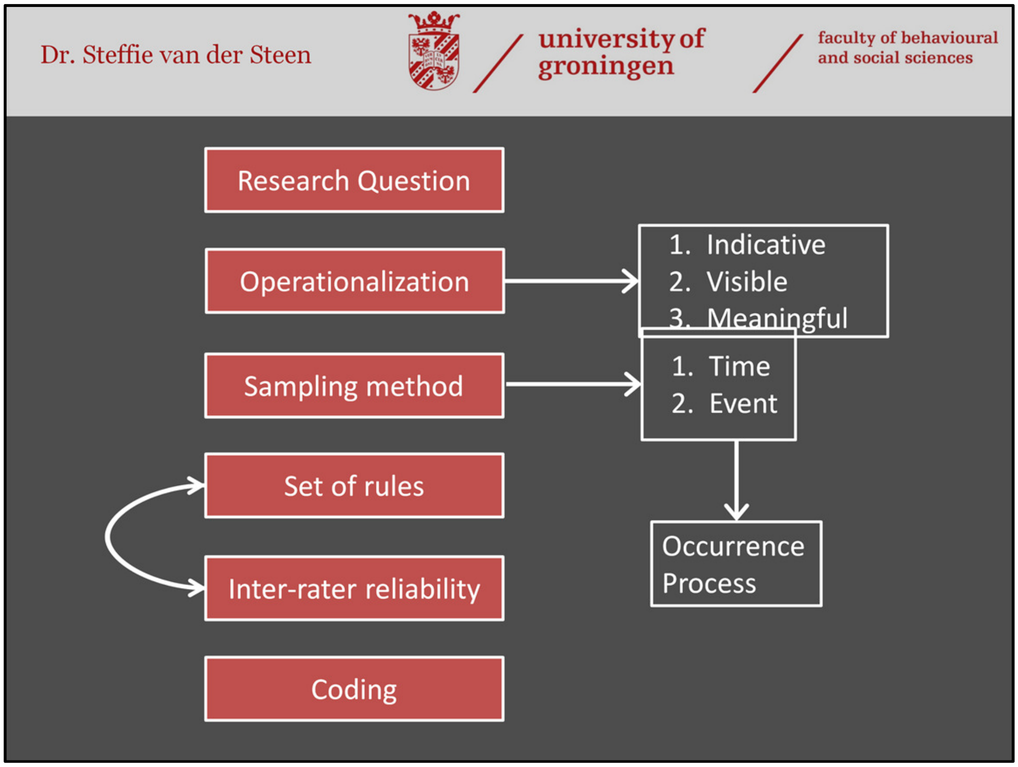
For example, studies suggest that parent-child dyads often fail to achieve synchrony when the child is diagnosed with Down Syndrome or an Autism Spectrum Disorder. Their condition makes it hard to achieve mutual regulation and temporal coordination in their interactions, and as a consequence, to develop their social-emotional skills. In other fields, researchers have found limited interpersonal synchrony in patients with depression, dementia and schizophrenia.

Now let’s look at synchrony during animal assisted therapy. In one of our studies (a pilot study, Griffioen et al., in preparation), we compared the synchrony between children and dogs during the first and last session of Dog-Assisted Therapy. Five children with Down syndrome and five children with Autism Spectrum disorders participated.



The therapy sessions were recorded on video, and we coded the movement onset and directions of child and dog using video coding software. We did this using freeware from the University of Groningen. I provided a link, so you can use this program as well, if you properly cite it:

Most studies I have discussed so far, are based on video coding.



Coding always starts with a research question. What would you like to study? For example, maybe you would like to study changes in synchrony during animal-assisted interventions over time, or changes in social skills. Then you need to operationalize this. There are three important elements that underlie this operationalization. First, the behavior should be an indicator of wat you would like to study. You can base this on the literature. For example, turn-taking in interactions is an important social skill and seems to be impaired in children with several developmental disabilities, according to a number of studies. Second, the behavior should be visible. It is very hard to study eye contact, because you cannot infer from videos that the person is looking someone else directly in the eye. You can instead study gaze directions, or you could equip your participants with a wearable eye-tracker during the sessions. Third, the behavior should be meaningful: is the person really spontaneously approaching the animal, or is it suggested by the practitioner?

After the operationalization, you need to determine in which way you will register the codes. If you opt for time sampling, you specify a certain interval (e.g., a minute) and code what happens every minute, fast-forward to the next minute, and so on. This yields snapshots of the interaction, because you know what the participant did every 60 seconds, but not what happened in between. You can also use event sampling, which means that you code behavior every time it occurs, for example each time the child speaks to the horse. You can simply do this by counting, this will give you can aggregated picture. But you can also use process coding, in which you code the event with a time stamp. This allows you to see when behaviors occurred. This can be useful if you're interested in how behavior develops over time.

After determining the sampling method, you construct a set of rules that researchers need to keep in mind when coding. These are specific rules about when and how you code. After the set of rules is constructed, at least two observers code a video using the set of rules. There is always some error, sometimes you miss a certain behavior, but the codes should overlap at least 80% to be reliable. If not, the rules need to be adjusted and need to be tested again. After reaching the 80% overlap, you can code the videos and analyze.

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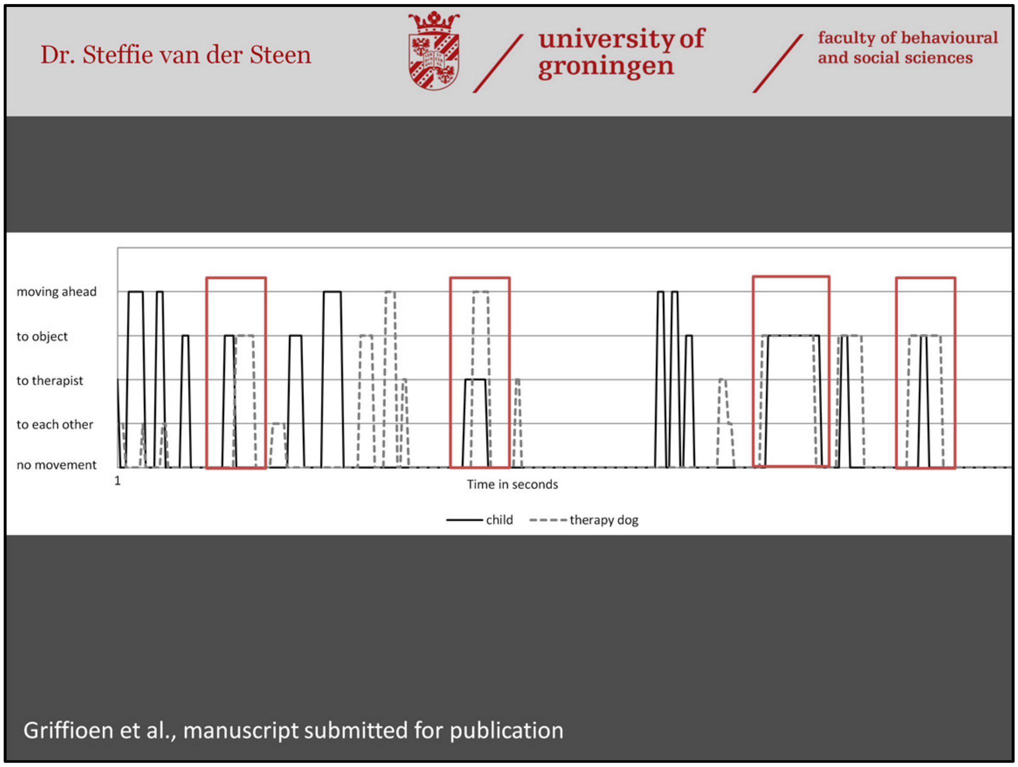
child A								
first session					final session			
timeseries child		timeseries dog			timeseries child		timeseries dog	
1755.12	4	1855.08	3		399.51	1	437.204	3
1756.12	4	1856.08	3		400.51	1	438.204	3
1757.12	4	1857.08	3		401.51	1	439.204	0
1758.12	4	1858.08	3		402.51	1	440.204	0
1759.12	4	1859.08	3		403.51	1	441.204	2
1760.12	4	1860.08	3		404.51	1	442.204	2
1761.12	4	1861.08	3		405.51	0	443.204	2
1762.12	4	1862.08	3		406.51	0	444.204	2
1763.12	4	1863.08	3		407.51	0	445.204	2
1764.12	4	1864.08	3		408.51	0	446.204	2
1765.12	4	1865.08	3		409.51	0	447.204	2
1766.12	0	1866.08	3		410.51	0	448.204	2
1767.12	0	1867.08	3		411.51	0	449.204	2
1768.12	0	1868.08	3		412.51	0	450.204	2
1769.12	0	1869.08	3		413.51	0	451.204	2
1770.12	0	1870.08	3		414.51	0	452.204	0
1771.12	0	1871.08	3		415.51	0	453.204	3
1772.12	0	1872.08	3		416.51	0	454.204	3
1773.12	0	1873.08	3		417.51	0	455.204	3
1774.12	0	1874.08	3		418.51	0	456.204	3
1775.12	0	1875.08	3		419.51	0	457.204	3
1776.12	0	1876.08	3		420.51	0	458.204	3
1777.12	0	1877.08	3		421.51	0	459.204	3
1778.12	0	1878.08	0		422.51	0	460.204	3
1779.12	0	1879.08	0		423.51	0	461.204	3

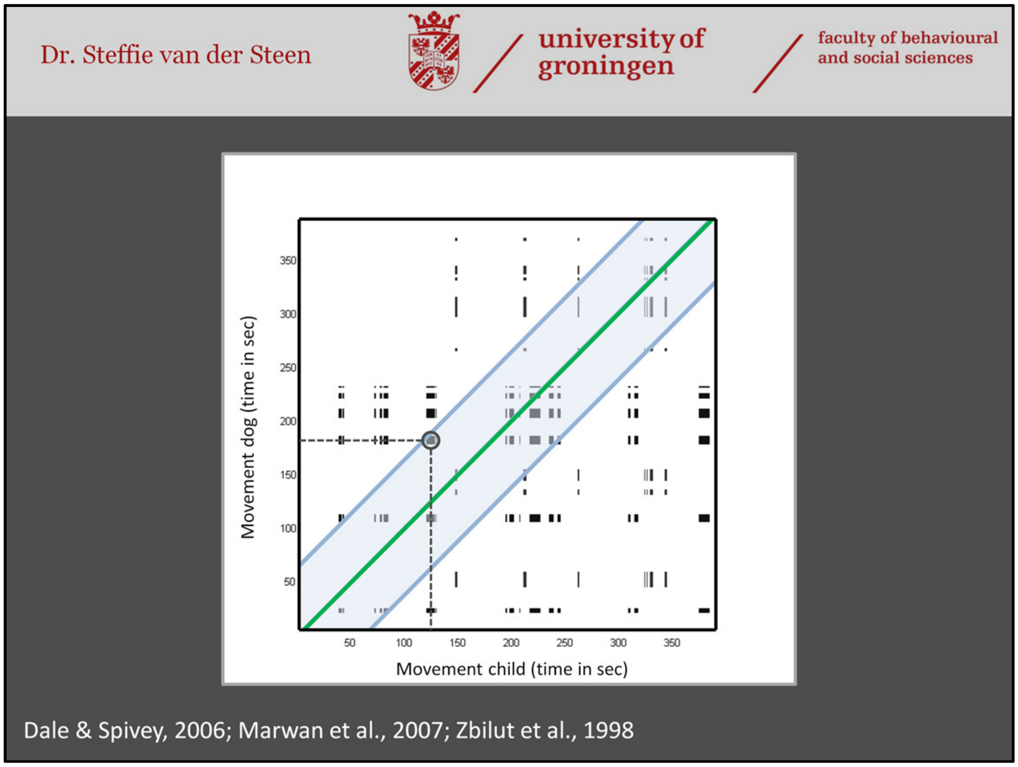
Griffioen et al., manuscript submitted for publication

Let’s get back to our synchrony in movement study. After coding, we had a massive excel spreadsheet with the times at which movement of child and dog started and ended, and a specific code for the direction of movement.



If you visualize part of these data, it looks like this. These are the movement directions for child and dog during part of a session. Sometimes they move for a longer period of time than at other times. I want to highlight three instances during this session. In the first red rectangle, both child and dog move to the same object, right after each other. When the child's movement stops, the dog's movement begins. In the second rectangle, child and dog move at the same time, but their direction is different. In the third rectangle, child and dog move in the same direction at roughly the same time, although the dog starts and stops moving slightly earlier.

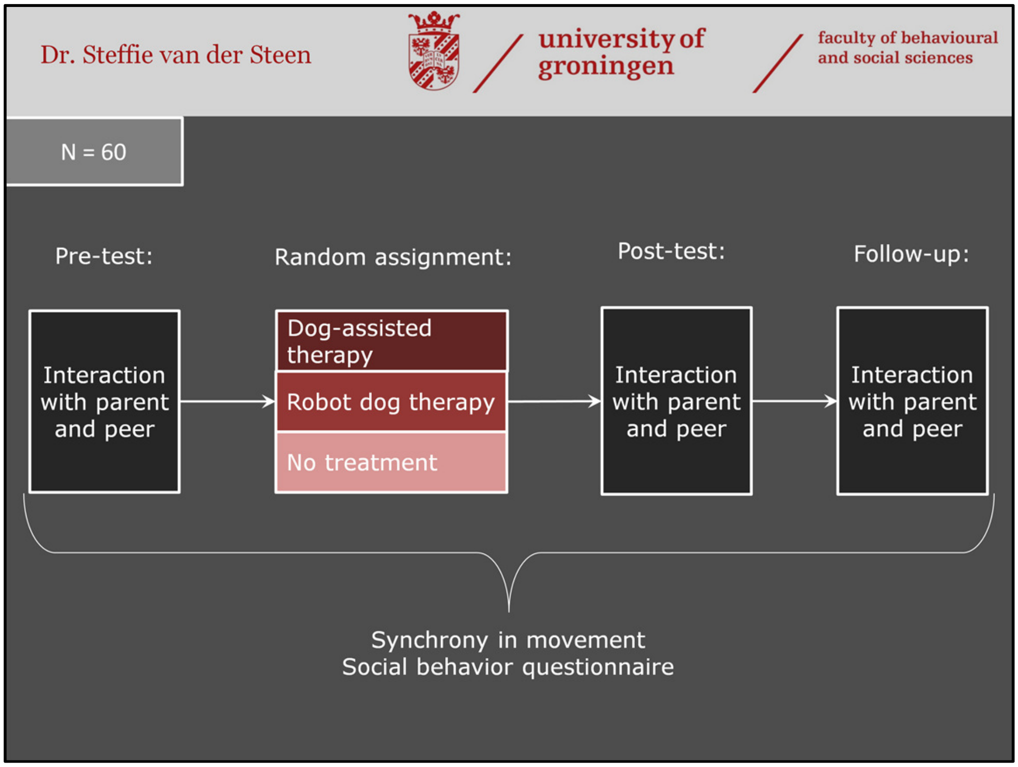
As I said, fine-grained analysis methods are needed if you want to assess synchrony, because there is often a delay (first rectangle), or behavior does not overlap completely (fourth rectangle). We therefore used a technique from the natural sciences called Cross Recurrence Quantification Analysis.



Cross Recurrence Quantification Analysis (CRQA) can detect similar behaviors of two living systems. This is a cross recurrence plot, in which similar behavior is noted with a black dot. For example, the cluster of dots in the circle indicates that the behavior of the child at 125 seconds in time is also performed by the dog, but then at 180 seconds in time. Similar behaviors of child and dog at the exact same time are noted on the green line, but you can also look at similar behaviors across the whole session, or within a certain interval (bue area). The black dots form line structures. The shape and position of these structures tells you something about the coupling between child and dog and the strength of the coupling. Vertical lines, for instance, tell you to what extent the child influences the movement of the dog, and for the horizontal lines, it is the other way around.

The results of our synchrony study show an increase in synchrony between the child and dog after six sessions. Importantly, there was not only an increase in synchrony at the exact same time, but also across an interval of 30 seconds. This highlights the importance of analysis methods like the one I just discussed. Children more often took the lead in demonstrating synchronous behavior during the final session.

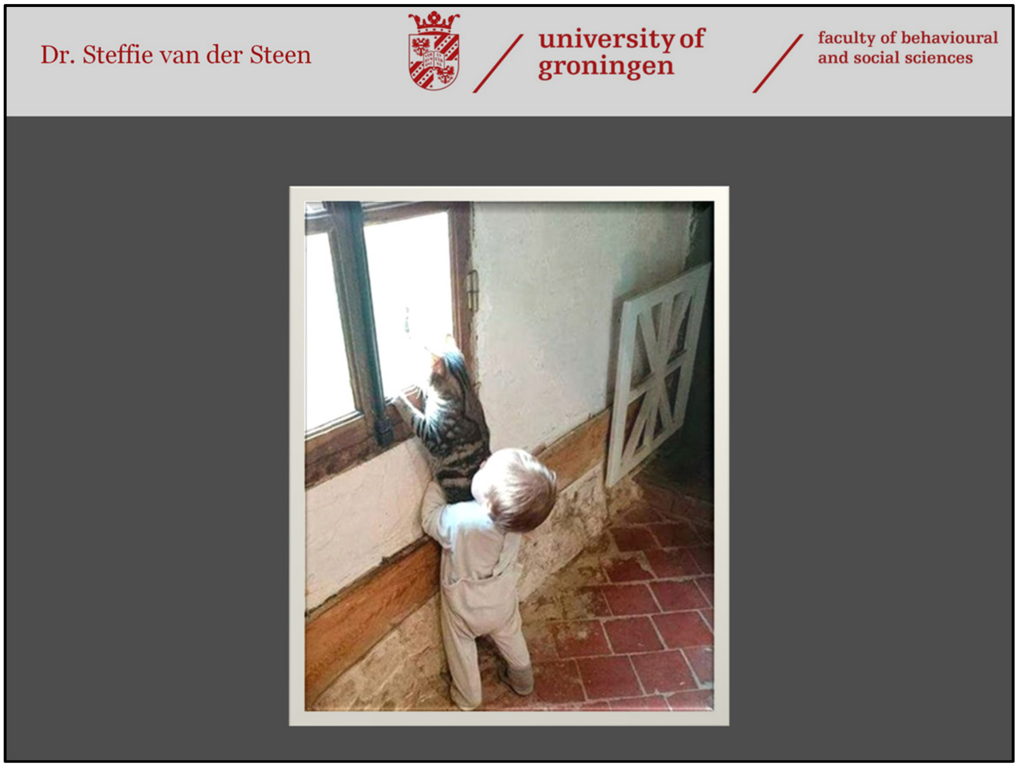
I recently received funding from NWO to further build on this line of research, in which synchrony during animal-assisted therapy plays an important part. Apart from a much bigger sample, my future project will not only assess synchrony with the dog during dog-assisted therapy, but also look whether children's synchrony with parents and peers in daily life increases after therapy. In other words, whether there is a transfer of synchrony from the therapy situation to the real-life situation.



This is an overview of the study. Sixty children, thirty with Down's syndrome and thirty with Autism Spectrum Disorders will participate. First, we will look at the interaction of these children with one of their caregivers and with a peer. Then we randomly assign children to a dog-assisted therapy group, a therapy with a robot dog or a no-treatment control group. After this, we again look at the interactions in daily life, and we have a follow-up after three months. During the pre-test, post-test, follow-up and during the therapy sessions, we assess synchrony between the child and the interaction partner: the parent, peer, dog, or robot. We also plan to assess children's social skills and behavior with a parental questionnaire.

A group of children will receive therapy with a robot dog. We make sure this is done in a similar setting, in which the child gets therapy from a trained professional and performs certain tasks with the robot dog. This particular robot dog can follow his ball, knows certain commands, and learns to respond to your voice. At the same time, it is not a living animal, and therefore limited in the ways in which he can adapt to the child. There is no natural attunement possible. And therefore the biggest question of this study is whether or not we will see less progress in synchrony in daily life for those children who received robot dog therapy, compared to children who had dog-assisted therapy

Because the sample is bigger and because we want to take accurate measures of movement, we will not code videos for movement and movement direction anymore, but we will use smartwatches instead. A smartwatch contains a three-axis accelerometer that can accurately measure movement onset, offset, rate and direction. If you then feed this to the Cross Recurrence Quantification Analysis that I just talked about, you can analyze the synchrony between two interaction partners.



So the field of human-animal interactions and particularly animal-assisted interventions is not in its infancy anymore. Interesting studies have been published, especially in the last five years. I gave you some examples of forthcoming work: the cortisol study, and the equine-assisted therapy study.

I have also argued that in order to move forward, we need to engage in building and testing theories, and my future study is an example of this.

I want to end this presentation with a call for collaboration. As researchers, we want to make sure that the field gains something from our studies. That we create hands-on knowledge that practitioners can actually use. This means that we have to investigate human-animal interactions in settings closely related to the current practice, using, for instance, protocols like the ones that are used in practice. At the same time, we need the practitioners to open their practice to study human-animal interactions as they happen in practice. As you just witnessed, it sometimes only requires a smartwatch around your client's wrist and the dog's collar.

Thank you for viewing this presentation. I would be happy to answer any questions you may have, via e-mail.

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