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14 Emotion, Psychophysiology, and Intersubjectivity

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Abstract:

Conversation analytical studies on emotion show how expression of emotion is part of the intersubjective experience. Emotions, however, are as much physiological as experiential events. Physiological processes pertaining to emotion involve changes in cardiovascular activity, in the activation of sweat glands, and in muscular activity. The dyadic systems theory by Beebe and Lachmann suggests that actions that regulate social interaction also serve in the regulation of internal emotional states of interacting subjects. Drawing from this theory, our overall research questions was: how is the expression of emotion in social interaction linked to physiological responses in the participants? Our main result was that thorough conversational affiliation, the participants share the emotional load in the interaction.

1. Introduction

In the past decade or so, conversation analytical studies on emotion in interaction have proliferated (see, e.g., Peräkylä & Sorjonen 2012). Conversation analytical studies focus on emotion as it is expressed in social encounters through prosody, lexical choices, grammatical structures, and body and face kinematics, exploring the ways in which expression of emotion is embedded in the organisation of social interaction. They explicate the interactional context and consequences of emotional expressions. Thereby, they show how expression of emotion is part of the intersubjective experience.

Emotions are as much physiological as experiential events. Emotions are embodied when we blush, when our heart is pounding, when we sweat, or the corners of our mouth and eyes move, often in uncontrollable ways. More than 100 years ago, William James (1884) and Carl Lange (1885) independently suggested a hypothesis that has been discussed ever since: the experience of emotion (“feeling”) does not instigate the physiological response, but vice versa: the bodily reactions come first, and feeling only thereafter. Even though the theory is controversial, it is very illuminating in showing the central place of the body in the emotion process.

Physiological processes pertaining to emotion involve changes in cardiovascular activity (heart rate and blood flow), in the activation of sweat glands, and in muscular activity (startle reflex, body movement, and the activation of facial muscles) (Kreibig 2010). Many of these changes are controlled by the autonomic nervous system, which means that they are largely beyond the volitional control of the individual. Autonomic nervous system activation associated with emotion is called *arousal*. Positive or negative emotions can involve either a strong or weak arousal component (Bradley and Lang 2007).

There are well established methods of measurement of such physiological responses

(Cacioppo et al. 2007). The standard paradigm in the psychophysiological studies focuses on individual responses to emotionally arousing stimuli (Bradley & Lang 2007). However, already since 1950s, there have also been studies on “interpersonal physiology” (Kleinbub 2017; Palumbo et al. 2017). These studies focus on the ways in which the physiological responses in individuals are linked to such responses in other co-present individuals.

With a team of sociologists and psychologists associated with the Center of Excellence on Intersubjectivity in Interaction, we engaged in a study on the psychophysiology of emotional interaction. Our overall research questions was this: how is the expression of emotion in social interaction linked to physiological responses in the participants? From there, we examined the ways in which physiological responses are anchored in intersubjective experience.

In the project, we combined psychophysiological measurements with conversation analysis. To do so, we needed to quantify not only physiological responses, but also the conversational events, and use statistical data analysis techniques. The theoretical concepts that could embrace both social interaction and physiological processes came from dyadic systems theory as formulated by Beebe and Lachmann (2003). This theory basically suggests that expressions and actions that regulate social interaction also serve in the regulation of internal emotional states of interacting subjects. So, for example, smiling usually invites a co-participant to reciprocate the smile, but it also has consequences for the momentary psychophysiological states of the interacting individuals (increase of muscular activation associated with pleasant feelings).

The physiology of interactional affiliation has been a central theme in our work. In a number of studies, we have explored the ways in which interpersonal affiliation is mapped onto the physiological responses in the participants of interaction. We have found that interpersonal affiliation involves sharing of the physiological activation: the affiliating

participant becomes physiologically more aroused, while the recipient of the affiliation calms down, becoming physiologically less aroused. In what follows, we tell the story how we found this and how we repeatedly confirmed our finding.

2. Sharing the Emotional Load in Storytelling

Storytelling is one conversational environment where affiliation is particularly relevant. The storyteller not only recounts consecutive events, but also shows a particular emotional relation, or *stance*, to them. Affiliation involves the hearer reciprocating the teller's stance: "the hearer displays support of and endorses the teller's conveyed stance" (Stivers 2008: 35). Telling a story is in effect an invitation for the recipient to affiliate. (e.g. Couper-Kuhlen 2012). Several CA studies have shown how the teller monitors the hearer. In case the hearer does not affiliate, the tellers regularly pursue affiliation by means that can be verbal (such as rephrasing the punchline; see (Couper- Kuhlen 2012; Selting 2010, 2012) or non-verbal (such as facial expressions enhancing the stance after the completion of the story; see Peräkylä & Ruusuvuori 2012). In our study, we wanted to know whether this "need" for affiliation is connected to physiological processes.

In Peräkylä et al. 2015, we invited volunteers to take part in dyadic interactions with other volunteers that they did not know from before. We chose to have unacquainted dyads because we wanted them to tell about events that were not familiar to the co-participants. To avoid any gender-specific variation in the data, all the participants were female. The mean age of the participants was 23.5 years, ranging from 18 to 46 years. The 45-min-long interactions were video recorded, and the participants' physiological responses (heart rate, frequency of breathing, sweating of the palm, facial muscle activation) were recorded during the interactions. The participants were instructed to talk about happy events and losses in their

life in a freely chosen way. They ended up telling each other a lot of stories.

To combine conversation analysis with psychophysiological and statistical methods, we needed to code our data and count the frequencies of some of the coded events. From the 20 discussions, we found 317 stories. They were accounts of events in temporal succession usually extending over several turn construction units. Regarding emotional valence, 89 stories were happy, 95 sad and 89 ambivalent (involving both positive and negative emotion). 44 stories could not be classified. Adapting Labov & Waletzky's (1967) and Sacks' (1974) idea of the phasic structure of stories, we coded each story according to phases: build-up, climax, and evaluation. In some stories, there were only the two first phases but no evaluation as a separate phase.

We coded for the affiliative behaviours of the story recipients, distinguishing between 10 recipient actions that included minimal responses, full verbal responses, and non-verbal responses (see Table 1). Based on earlier interactional research (e.g. Stivers 2008; Couper-Kuhlen 2012; Selting 2012), we allocated each behaviour a proximate "weight" in term of affiliation (see Table 1). What earlier research considered as central affiliative practices – such as response cries or verbal responses affiliating with the teller's stance – was given bigger weight than behaviours that merely maintained the hearership (such as continuers) or acknowledged the ideational content of the story without sharing the teller's stance (such as neutral verbal responses). The overall score for recipients' affiliative behaviours involved the sum of the affiliative weights of all observed affiliative behaviours during the story.

Behaviours in each phase of the story were coded separately so that each phase received its affiliative score. The overall affiliative score for a story was obtained by adding up the phasic scores. Because climax is understood to be critical for affiliation, however, we multiplied the climax score by two.

Table 1. Story recipient actions and their affiliative weights

Recipient action	Affiliative weight
Minimal responses	
1. Continuers	1
2. Epistemic news-markers	2
3. Affective minimal responses	3
4. Response cries	5
Full verbal responses	
5. Verbal responses neutral regarding the teller's stance	3
6. Verbal responses affiliating with teller's stance	5
Nonverbal responses	
7. Nod	1-3
8. Sequentially adequate affiliative change in face	3
9. Sequentially adequate epistemic change in face	2
10. Sequentially adequate affiliative gesture, for example, headshake	2

For stories with rather non-affiliative and with more affiliative recipient, see Extracts 1 and 2, respectively, below. The phases of the stories and the observed affiliative behaviours are marked in the right-hand margins.

Excerpt 1. Passive story reception

01 A: **no siis (0.4) on mulki tota (.) .mthh (0.4)**
PRT PRT is me-too PRT
well I mean (0.4) I've too (.) .tskhh (0.4)

02 **no (.) mun yks kaveri (.) lähti vaihtoon italiaan**
PRT my one friend left to-exchange to-italy
well (.) a friend of mine (.) went to exchange to Italy

03 **jossain vaihees ja löys sielt miehen ja jäi sinne**
somewhere at-stage and found there man and stayed there
at some point and found there a man and stayed there

04 **.hhh (.) *ja siis* jotenki niinku aluks me pidettiin**
and PRT somehow PRT at-beginning we kept
.hhh (.) and so at the beginning we kept

b: *nods---*

05 **tosi paljon yhteyttä mut sit se ↑on jotenki jääny**
really much contact but then it is somehow left
in touch a lot but then tha:t ↑ has somehow stopped

06 **ja sit se sen mies on pikkasen är:syttävä .hhh (.)**
and then it her man is little annoying
and then that man of hers is a bit annoying .hhh (.)

07 **tai >jotenki et< aina ku ne suomessa (.) .hhh (.)**
or somehow that always when they in-finland
or >somehow that< always when they're in Finland (.) .hh (.)

08 **jos se on sen (.) miehen kanssa niin se ei voi**
if it is that man with PRT it not able
if she's with that (.) man of hers so she can't

09 **jättää sitä miestä sekunniks minnekkään ja se mies**

Buildup
Nod, line 4

leave that man for-a-second anywhere and it man
leave that man behind for a second and that man

10 **on kauhee jotenki (.) .mhhh (.) huomion kipee**
is terribly somehow attention sick
is terribly somehow (.) .mhhh (.) attention-seeking

11 **(.) ja (.) sit (.) m- tota (.) sillee >jotenki et<**
and then PRT PRT somehow PRT
(.) and (.) then (.) m- so (.) like >somehow<

12 **sen on pakko olla koko ajan osallisena keskustelussa**
it's is must be whole time taking-part conversation
he just has to be part of the conversation all the time

13 **ja jotenki et .hhh (.)**
and somehow PRT
and somehow that .hhh (.)

14 **sit mä oon vähän sillee**
then I am little PRT
then I'm a bit so that

15 **et y:::a:::rrrhh .hhh=**
that
like y:::a:::rrrhh .hhh=

16 B: **=nii.=**
PRT
=yeah.=

Climax
Continuer, line 16

17 A: **=mut tota .hh (0.4) nii (.) no (.) emmä tiiä ja**
but PRT PRT PRT I-don't know and
=but then .hh (0.4) so (.) well (.) I don't know and

18 **sit se on jotenki (.) >sillee et< (.) aina välillä**
PRT it is somehow PRT that always sometimes
then it's somehow (.) >so that< (.) every now and then

19 **mä yritän jotain meilailla sille mut ei se sit (.)**
I try something email to-that but not it then
I try to email her a bit but then she doesn't (.)

20 **m- vastaa se mun kaveri jotenki se on vähän huono**
reply it my friend somehow it is little bad
m- reply that friend of mine somehow she's not so good

21 **pitää yhteyttä ni**
keeping contact PRT
at keeping contact so

22 **sit se on kans vähän sillee**
PRT it is also a-little somehow
then it's a bit somehow

23 **(.) .mhhh harmi (.)**
pity
(.) .mhhh a pity (.)

Evaluation

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Excerpt 2. Active story reception

01 A: **mä (.) mul on >tai siis lähinnä sen takia et mä olin:<**
I I-have or PRT nearest because-of that I was
I (.) I've >or you know mostly because I was:< on I

02 A: **mä tulin: tiistai iltana Yllä:kseltä mis mä olin**
I came tuesday evening from-place where I was
came on Tuesday evening I came from Ylläs where I'd been

03 ***kuus päivää?* tai [siis (.)**
six days or PRT
for six days? or [you know (.)

b: ***smiles-----***

Buildup
Continuer, line 17
Epistemic newsmarker, line 14
Neutral verbal response, line 7
Nod, line 7
Affiliative change in face, line 3

04 B: [(↑°uuu°)

05 A: **no ensinnäkin tää on (.) mä oon meiän niinku<**
PRT first-ly this is I am our PRT
well first of all this is (.) I'm like our<

06 A: **>mäent < meil on siis nää killat?**
I-don't we have PRT these guilds
>I don't k < we have like these guilds?

07 B: ***↑joo tiiän.***
PRT I-know
↑yeah I know.
b: ***nods-----***

08 A: **niinku.**

PRT

like.

09 B: ***↑joo.***

PRT

↑yeah.

b: *nods-*

10 A: **ni meil on kröh paperi insinööriki- kilta mihin**

PRT we is paper engineering guild to-which

so we have krhm the paper engineers' g- guild to which

11 **mä kuulun ni mä oon siel niinku (0.3) meiän nn siel**

I belong PRT I am there PRT our there

I belong so I'm there like (0.3) our n: in the

12 **raa:dissa elikkä niinku meiän, .hh**

in-council PRT PRT our

.....co:uncil so that our, .hh

13 B: *↑aa.*

14 A: **mul on niinku virka?=siis tämmönen,**

I is PRT position PRT this-kind-of

I have a kind of position?=like this,

15 B: ***↑joo? joo.***

PRT PRT

↑yeah? yeah.

b: *nods-----*

16 A: **meiän siäl (0.3) hh >meil (oli) kaikkii näit<**
our there we-have had all-of these
in our (0.3) hh >we (had) all these<

17 B: **(joo.)**
PRT
(yeah.)

18 A: **virka >mä oon tavallaan niinku< ulko-**
position I am in-a-manner PRT foreign
position >I'm sort of like< the minister of foreign

19 **ministeri?= **mut mä oon niinku tämmönen****
minister but I am PRT this-kind-of
affairs? =but I'm like this person in charge of

20 **ulkovastaava on meil se termi.=ja m:ä pidän niinku.**
out-responsible is our it term and I hold PRT
.....international relations as we say.= and I sort of

21 **huolta *kaikist meiän vaihto opiskelijoista?***
care all-of our exchange students
.....take care of all our exchange students?

b:... *nods-----*

22 (.)

23 A: **.hhh ja *sit mä olin niitten kaa siel Ylläksellä*h.**
and then I was them with there place-at
.hhh so and I was then with them there at Ylläs h.

b: *smiles-----*

24 B: ↑uuuh,

25 A: **oli siel kemialaisiiki ja oli sikki[läisiiki vähän.**

were there chemists-also and were eeg-members-too some
there were some chemists and electr[ic engineers too.

26 B: **[oliks iso porukka,**

was big group

[was it a large group,

27 A: **meit oli viistoista.**

us was fifteen

we were fifteen.

28.... (.)

29 B: ***↑joo.***

PRT

↑yeah.

b: ***nods-***

30 A: **ni siel oli [(.) ihan <sairaan kivaa>**

PRT there was PRT sick fun

so that was [(.) like <ridiculously great time>

31 B: **[() kiva.**

nice

[() nice.

32 A: ***ja sit mä oon vieläki jotenki hhe ihan niis maailmois***
and then I am still somehow totally those in-worlds
and then I'm still somehow hhe in those worlds

b: ***smiles-----***

33 ***et mä en oo viel flas↑keutunu maan pinnalle£.***
PRT I not am yet landed earth ground
I haven't flanded yet back to earth£.

b: ***smiles-----***

34 B: **[kävitsä siel (.) Hovissa.**
visit-you there name
[did you visit that (.) hovi. ((restaurant))

35 A: **[tai palautunu todellisuuteen.**
or returned to-reality
[or back to reality.

36 A: **ai pohjanhovissa.**
PRT name
you mean pohjanhovi.

37 B: **joo.=**
PRT
yeah.=

38 A: **=joo käytiin,**
PRT visit-we-did
=yeah we did,

39 A: *nhe he*

Climax

Continuer, line 44

Epistemic news-marker, line 50

Response cry, line 51

Neutral verbal response, line 34

Affiliating verbal response, line 31

Affiliative change in face, line 32

Epistemic change in face, line 36

40 B: **onks siel to:inenki se on se [Pohjanhovi halli ja**
is there another it is it name hall and
is there another it's the [Pohjanhovi hall and

41 A: **[joo.**
PRT
[yeah.

42 B: **sit on [se [Pohjanhovi**
then is that name
then there's [that [Pohjanhovi

43 A: **[joo [niit on [kaks**
PRT them-of is two
[yeah [there are [two of them

44 B: **[joo.**
PRT
[yeah.

45 A: **ni kyl me käytiin siel vanhas nii.**
PRT yes we visited there old PRT
and so we visited that old one so.

46 B: **joo.**
PRT
yeah.

47 A: **ja käytiin moottorikelkkailemassa ja?**
and visited driving-snowmobile and
and we went snowmobile driving and?

48 A: **mh tuota (.) lautailemassa tietty kahten päivän ja.**
PRT boarding of course on-two days and
mh I mean (.) snowboarding of course on two days and.

49 A: **[tällast näin ni**
this-like PRT PRT
[this sort of thing so

50 B: **[↑no noni,**
PRT PRT
[↑well oh my,

51 B: *wa:u*

52 A: **voi että siellä oli kivaa.**
oh that there was fun
my how it was fun.

End of story

53 B: **mäki kä[vin just niinku (.) Ylläksellä,**
I-too visited recently PRT name
I just vi[sited like (.) Ylläs too,

54 A: *[mh he*

55 A: **joo.**
PRT
yeah.

The affiliation scores of these two excerpts were calculated as follows. The affiliation score in the build-up of **Excerpt 1** is three (it comes from the nod shown in the right column of the transcript; following Stivers 2008 notion that nods are a sufficient display of affiliation in telling phase but not in the story climax, nods in buildup were weighted as 3, while in climax and evaluation they were 1), the initial score of affiliation in the climax of Extract 1 is one (coming from the continuer shown in the right column), and the score in evaluation is zero (as there is no coded recipient action during the evaluation). Likewise, the scores for affiliation in **Excerpt 2** are the following: build-up = 11 (coming from continuer, epistemic news marker, nonaffective verbal response, nod and affiliative change in face) and the initial score of the climax = 21 (including all responses present in the build-up except the nod and adding the response cry, affective verbal response and epistemic change in the face).

An overall score for affiliation was calculated for each story by adding up scores of each story phase. Furthermore, because some stories (such as Extract 2 above) did not have an evaluative phase at all, we divided the sum of affiliation scores by 4 in stories with evaluation, and by 3 in stories without evaluation (so that we could emphasize the climax in a way that is comparable in all the stories). Thus, the overall score of affiliation for Extract 1 is $1.25 [(3 + 2 \times 1 + 0)/4]$ and the overall score for affiliation in Extract 2 is $17.7 [(11 + 2 \times 21)/3]$.

We use electrodermal activity (EDA) – commonly known as skin conductance – as our primary indicator of arousal. When a person is aroused, his/her sympathetic nervous system is activated, resulting in increased sweat gland activity and skin conductance. (Sympathetic and parasympathetic nervous systems together form the autonomic nervous system.) Electrodermal activity has been shown to be sensitive to psychological states and processes, and it is widely used to study attention, information processing, and emotion (Dawson, Schell, and Filion 2007:159–60).

How might the physiological arousal of the participants be linked to affiliative behaviours such as those seen in Extracts 1 and 2? Earlier social psychological research has suggested that emotions are contagious (Hatfield et al. 1994). We can expect the behavioural contagion to have a physiological correlate, so we expected that the increased behavioural display of affiliation would bring about a corresponding increase in physiological arousal in the story recipient. Earlier CA research has suggested that the storyteller intensively monitors the story recipient's responses to the story, and that lack of affiliative responses activates the storyteller to behaviourally pursue response (Couper- Kuhlen 2012, Selting 2010 and 2012; Peräkylä & Ruusuvuori 2012).

Furthermore, a pioneering psychophysiological study (Butler et al. 2003) showed that suppression of emotion in interaction is associated with increased physiological response in interaction participants. Thus, we predicted that increased recipient affiliation is associated with decrease in the physiological arousal in the storyteller: affiliation calms down the storyteller.

The analysis of linkages between affiliative behaviours and physiological arousal (as indexed by skin conductivity) indeed confirmed these hypotheses. The more the story recipient affiliated, the less there was physiological arousal in the story teller, and the more there was physiological arousal in the story recipient himself. There happened something that we can call "sharing the emotional load" of the story telling. The results are illustrated in Figures 1 and 2 below.

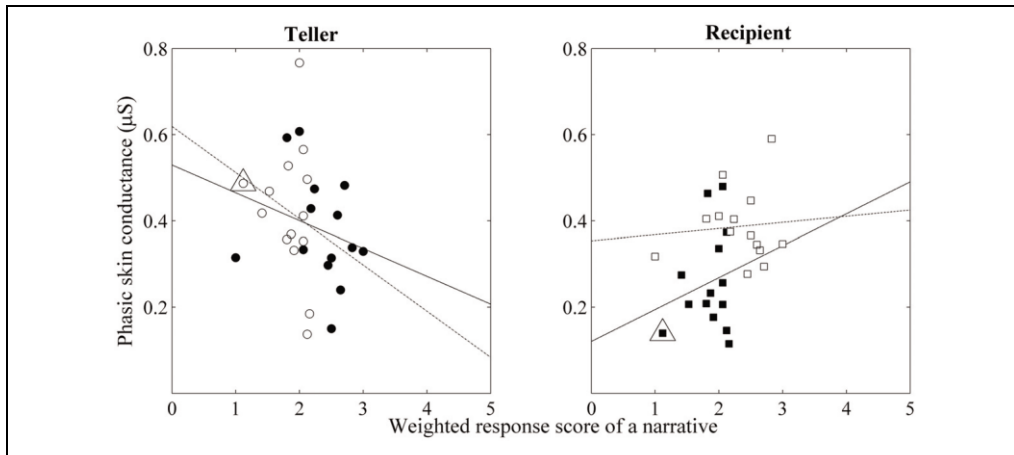


Fig. 1. The Relationship of Affiliative Response Score for the Stories of Dyad 1 with Electro- dermal Activity in the Tellers (Left Panel) and Recipients (Right Panel). Note: Black circles = person A as a teller; white circles = person B as a teller; black squares = person A as a recipient; white squares = person B as recipient; solid regression lines = person A as a teller and as a recipient; dashed regression line = person B as a teller and as a recipient; circles and squares in triangle = story shown in Excerpt 1.

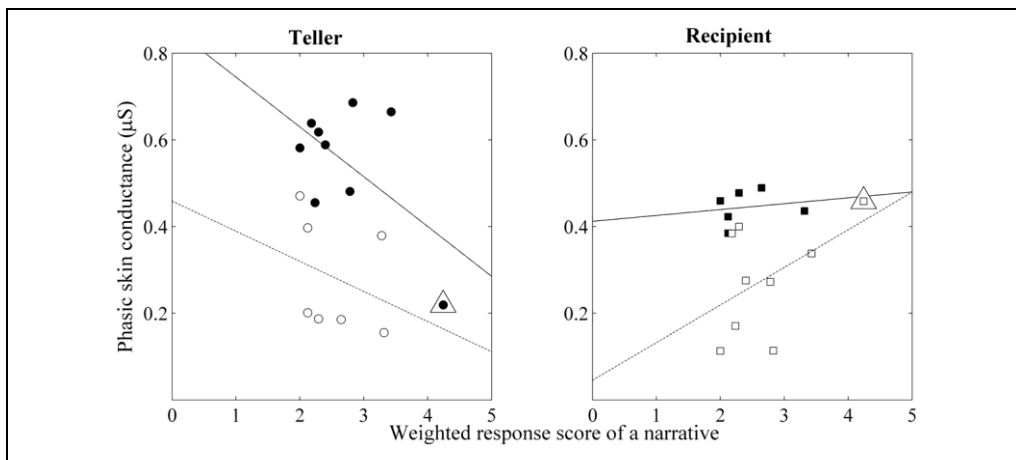


Fig. 2. The Relationship of Affiliative Response Score for the Stories of Dyad 2 with Electro- dermal Activity in the Tellers (Left Panel) and Recipients (Right Panel). Note: Black circles = person A as a teller; white circles = person B as a teller; black squares = person A as a recipient; white squares = person B as a recipient; solid regression lines = person A as a teller and as a recipient; dashed regression lines = person B as a teller and as a recipient; circles and squares in a triangle = story shown in Excerpt 2.

Figure 1 shows all the stories told in the interaction from which Excerpt 1 was taken (Dyad 1), and Figure 2 shows the stories in the interaction where Excerpt 2 took place (Dyad 2). In Dyad 1, 27 stories were told, and in Dyad 2, 15 stories. The circles or squares surrounded by a triangle correspond to the stories shown in Excerpt 1 and Excerpt 2. In both figures, X axis shows the affiliative weight of the recipient behaviours, and Y axis shows the skin conductance of the teller or the recipient. The regression lines (lines that go through the figures) indicate the linkage between the affiliative weight of the stories and the electrodermal activation in the tellers and the recipients. By looking at the Figures we can see the same as a statistical analysis of the whole data shows (see Peräkylä et al. 2015). There is such a linkage between affiliation and arousal as we expected; while the linkage is statistically significant, it is not very strong (probably due to the big amount of “noise” in the physiological data in a naturalistic setting).

In sum, our study demonstrates that the emotional load is shared: increased affiliation is associated to increased arousal in the story recipient and decreased arousal in the storyteller. Monitoring of affiliation by the storyteller, and interactional consequentiality of affiliation

reverberates in the participants' autonomic nervous system responses. As this statistically significant connection was not strong, replication studies are called for. In what follows, we will present results from two studies where we elaborated on these results, using different data and partially different methods.

3. Physiology of Affiliation and Dominance in Asperger's Syndrome

In a recent study (Stevanovic et al. 2019; see also Stevanovic et al. 2017), we re-investigated the connection between affiliation and the body, now using a different method in accounting for social interaction, and including in the study participants that might be expected to respond differently to affiliation.

Our data collection protocol was the same as in the study on affiliation in storytelling: participants who did not know each other were instructed to discuss happy events and losses in their lives. Nine dyadic conversations involved two "neurotypical" males (i.e., persons without major psychiatric disorders); in 10 dyads one of the participants was diagnosed with Asperger's syndrome.

Asperger's syndrome is a neurobiological disorder that manifests itself in patterns of socio-emotional behaviour that are unlike those in majority population. It does not involve lower intelligence. In 2013, Asperger's syndrome was merged into a broader diagnostic category of autism spectrum disorder, which is characterized by difficulties in social interaction and restricted patterns of behaviours, activities or interests (see American Psychiatric Association 2013). Since the participants in our study were diagnosed before the new diagnostic manual, we refer to them as participants with Asperger's.

Instead of focusing on stories and their reception, we used continuous rating of the interactions. In every moment of the interaction, the behaviour of each participant of the dyad

was rated for two dimensions: affiliation and dominance. This two-dimensional view of interaction is based on the interpersonal theory developed by Leary (1957; for further developments, see Sadler et al. 2009; Lizdek et al. 2012), and we hypothesized that the physiological consequences of affiliation might vary depending on whether or not a participant is simultaneously dominating vs. not dominating the conversation. We adopted the joystick method developed by Lizdek and colleagues (Lizdek et al. 2012). Three independent raters were trained to observe the degree of affiliation and dominance in each participant while watching a video of the dyad discussing. The raters' understanding of affiliation and dominance was informed by 16 interpersonal adjectives, such as warm, trusting, passive, unsociable, indifferent, critical, assertive and outgoing, and a set of 21 one-sentence-long verbal descriptions of interactional events such as "The participant poses challenging questions" (maximally dominant) or "The participant provides friendly and encouraging backchannelling responses to his/her co-participant's telling" (maximally affiliative). The inter-observer reliability for different dimension of interaction (affiliation and dominance) and different participant groups varied between "acceptable" and "excellent".

In the rating, one axis of the joystick indicates the rater's observation of affiliation (unfriendly to friendly) and the other axis indicates the observation regarding dominance (from dominant to submissive). The movement of the joystick while the rater is watching the video gives a record of the moment-by-moment changes in affiliation and dominance in the interaction. As for the physiological responses in the participants, we used both heart rate variability (the variation of intervals between heartbeats in a timeframe), and electro-dermal activation as indicators of physiological arousal.

Our research design made it possible for us to re-test the hypothesis regarding the "sharing the emotional load" that was generated in the earlier study. In short, we confirmed

the hypothesis in the neurotypical participants: increased affiliation in the conversational partner was associated with decreased physiological arousal in the interacting subjects. This effect was the largest when the subject himself was dominating the conversation – situations that, in the context of this study, could involve the subject engaging in storytelling or being otherwise actively in charge of the conversation. Also in line of our previous study, the increased affiliation with the co-participant shown by the subject himself was associated with higher physiological arousal. Importantly, in this study, the results were consistent across the two measures of arousal (electrodermal activation and heart rate variability). What was specifically new in this study, however, were our findings that suggest that participants with Asperger's syndrome do not exhibit these affiliation-induced physiological response patterns.

In figures 3 and 4 below, key results regarding electrodermal activation are presented. In figure 3, the bars, each coloured with three shades of grey, show the effect of partner's affiliation (low or high) on subject's electro dermal activation in three types of dyads: neurotypical (NT) participant conversing with other NT participant (two bars of the left), NT participant conversing with Asperger (AS) participant (two bars in the middle) and AS participant in conversation with NT participant (two bars on the right). The mediating effect of dominance is indicated by the differences between the sections of three shades of grey in each bar: we see that in neurotypical participants conversing with other neurotypical participants, the calming effect of high affiliation is biggest when the subject is high in dominance, and that in Asperger subjects conversing with neurotypical subjects, the reverse effect (partner affiliation linked with increased arousal) is strongest when the subject is high in dominance.

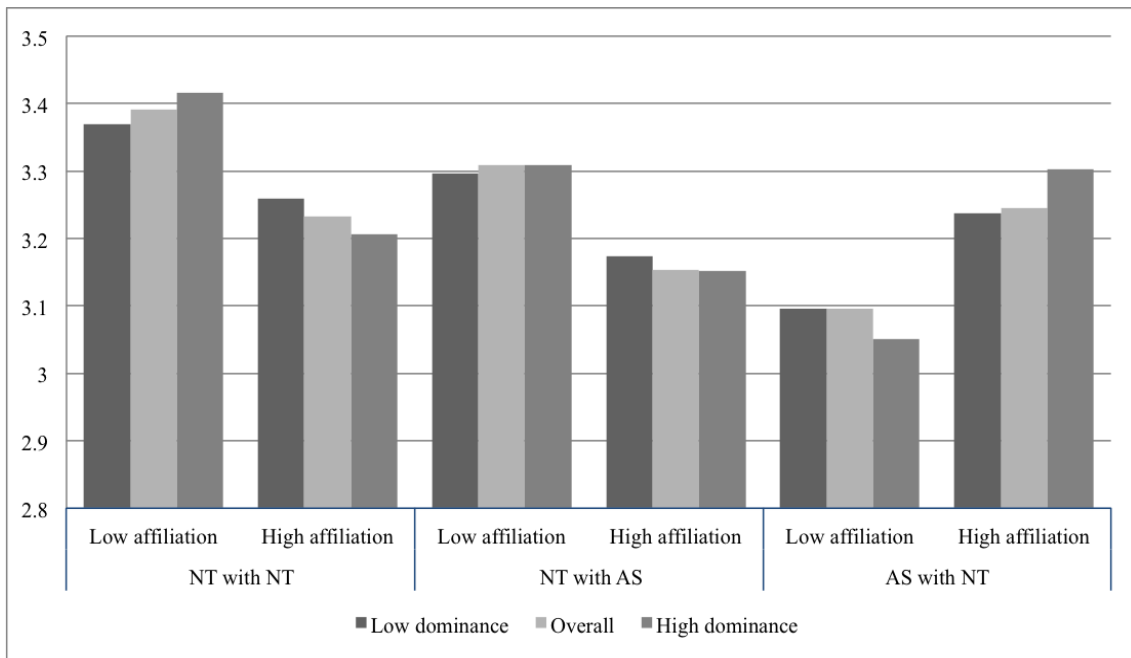


Fig. 3. Effects of partner’s affiliation on the Electro Dermal Activation.

NT=Neurotypical participant; AS=Asperger participant.

Figure 4 below shows how the subject’s own affiliation is associated with his arousal, as indicated by electrodermal activation. The neurotypical participants are more aroused when they show more affiliation. Again, our hypothesis regarding the sharing of the emotional load was confirmed. In the Asperger participants, a similar effect was found – but only when participant is low in dominance.

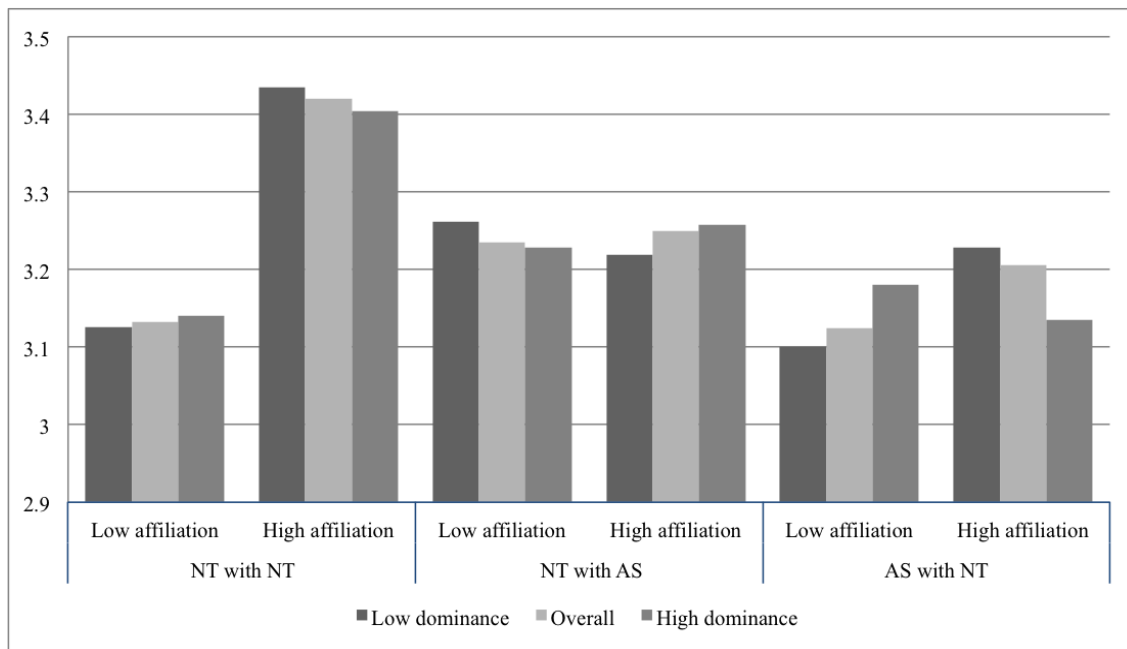


Fig. 4. Effects of own affiliation on the Electro-Dermal Activation. NT=Neurotypical participant; AS=Asperger participant.

Thus, besides offering confirmation of the hypothesis about sharing of the emotional load, this study showed that the Asperger participants' cognitive and emotional specificity plays out also in the physiological responses in conversation. The finding that partner's affiliation increases rather than decreases arousal in Asperger subjects lends support to the hypothesis put forward by Markram and colleagues (2007), who proposed autism to be characterized by a hypersensitivity to emotions, instead of being characterized by an empathy deficit.

Consequently, emotional expressions by others might in some cases become anxiety-inducing and stressful for individuals on the autism spectrum. (Markram et al. 2007; Markram & Markram 2010). Our results indeed showed that affiliation shown by others can be stressful for subjects on the autism spectrum.

4. Physiology, Affiliation and Challenge in Psychotherapy

Recently, we investigated the interconnections between interactional practices and physiological activation in yet another setting: psychotherapy. The motivation for this study arises from the idea that *empathy* and *challenge* are key facets in the client-therapist interaction. Bänninger-Huber & Widmer (1999) and Ribeiro et al. (2016) and many others (see also Voutilainen et al. 2010; Weiste & Peräkylä 2014) have maintained that a psychotherapist needs to balance between (1) attuning him- or herself to the client's experience, and (2) questioning the client's beliefs about self, the world and his or her ways of being with others. The former aspect of interaction entails empathy, and the latter aspect entails challenge. We wanted to know how these facets of interaction are linked to the physiological responses in the participants.

As data, we had 30 naturally occurring, video recorded psychotherapy sessions that came from 5 dyads. The therapists all had training in psychodynamic psychotherapy. The therapy approach draws theoretically from the psychoanalytical tradition, but unlike in classical psychoanalysis, in psychodynamic therapy the participants sit and face each other, and the frequency of the meetings is lower (usually two meetings per week). The participants' heart rate, electrodermal activation and facial muscle activation (EMG) were recorded during the sessions.

In the analysis of the interaction, our focus was on the therapists' *formulations*. Formulations are indeed one of the most researched practices in psychotherapy interaction research (see Antaki 2008; Peräkylä 2012; for formulations in general, see Heritage & Watson 1980, Deppermann 2011). In a formulation, the therapist says in other words what the patient has said, what the therapist takes the patient to have meant, or what can be inferred from the patient's talk. Such utterances are ubiquitous in psychotherapy. They

communicate and demonstrate that the therapist is understanding the patient, and how he/she understand him/her. Formulations can also redirect the focus of the talk, for example to build grounds for interpretations (Antaki 2008, Peräkylä 2011, Vehviläinen 2003, Weiste & Peräkylä, 2013) or to investigate a problematic emotion (Voutilainen et al. 2010, Weiste & Peräkylä 2014).

We coded 24 sessions (leaving out the first recoded sessions from all dyads) and found 694 formulations. In excerpt 3 below, there is an example of a formulation in our data.

Excerpt 3. A formulation

01 CLI: **mut se nyt tietyst on. (.) ö:: yliopiston suoritus ja**
but it now of+course is. university-GEN performance and
but that is of course. (.) erm an university assignment

02 **täytyy tehdä jotta ihan turha siit on valittaa.**
must do for quite useless it is complain
and has to be done so it is no use to complain.

03 (6.4)

04 THE: **joo mut se kuitenkin sua #ä::# miten sen sano- #e::# t-**
PRT but it nevertheless you how it say
yes but it is anyway #erm# how should I say #erm# you

05 **↑tekee mieli valift(h)taah e[t(h) vähä .hhf**
does mind complain PRT little
↑feel like complaining [a bit .hhf

06 CLI:

[ɛ↑no tekeɛ,ɛ yhy

PRT does

[ɛ↑well yes,ɛ yhy

In lines 1 and 2, the client, a university student, comes to the end of a telling about his coursework – he has told that the task at hand does not support his overall progress optimally. Yet, after having said this, he concludes in lines 1 and 2 that he should not complain. After a rather long gap, the therapist in lines 4 and 5 formulates his inference regarding the upshot of the client's talk: in contrast to what he claims (no use to complain) he actually does feel like complaining.

For our study, two properties of each formulation were assessed: challenge and empathy. These two properties are understood as independent: a formulation that was coded as challenging could also receive a high score in empathy. For challenge, we chose to use coders who had conversation analytical training; they were asked to decide whether or not each formulation had the following qualities in relation to the prior talk:

Shifting the focus of talk from outer world to inner experience

Adding emotional intensity to the experience that was being described

Changing the content of the experience that was being described

If at least one of the three criteria were fulfilled, then the formulation was coded as *challenging*. If none of them was fulfilled, then it was coded as *benign* (i.e., non-challenging). Out of our 694 formulations, 455 were benign and 239 challenging. As for the formulation shown in extract 3 above, it was coded as challenging, because there was a shift of focus

from the outer world to inner experience, and the content of the experience was changed.

The evaluation of empathy was done in a different way. Rather than analysing the formulations in their conversational context (as we did for the coding of challenge), we asked naïve raters (university students who did not know about our research aims) to assess on a scale of 1-9 how empathetic the therapist appeared in each formulation. The raters saw short segment of client's earlier talk and the focus formulations in random order from all five therapists. We chose to use naïve raters (rather than CA coders) because of the multimodality of empathetic displays (e.g., Peräkylä and Sorjonen, 2013), and because we thought that ordinary persons are competent for recognizing emotional events. Each formulation was rated for empathy by two raters. The agreement between raters was measured by calculating a score for inter-rater reliability; we achieved a score indicative of fair reliability, close to the limit of good reliability.

In measuring the physiological responses to challenge and empathy in formulations, we had two temporal foci. One was the physiological activation level during whole sessions. We investigated how the average scores of empathy and challenge in formulation during each session were linked to the physiological activation in the participants during that session. The other temporal focus involved the physiological activation during and immediately after the formulations: we investigated how the participants responded to empathy and challenge in each individual formulation. We will first consider our results at the level of the whole session.

Regarding empathy, the session-level picture was quite clear, and it corresponded to our earlier observations regarding the sharing of the emotional load. Key results regarding skin conductivity are illustrated in Figure 5 below. The X-axis shows the mean empathy score in therapist's interventions during a session and the Y axis shows the change in skin conductance during a session. Each therapy session is marked with an open (white) symbol.

The shape of the symbol (circle, square, etc.) indicates the dyad; and the filled (black) symbols show the mean values of each dyad. Basically, when the therapist's formulations were more empathetic, the therapists became more aroused, while the clients became quite dramatically less aroused.

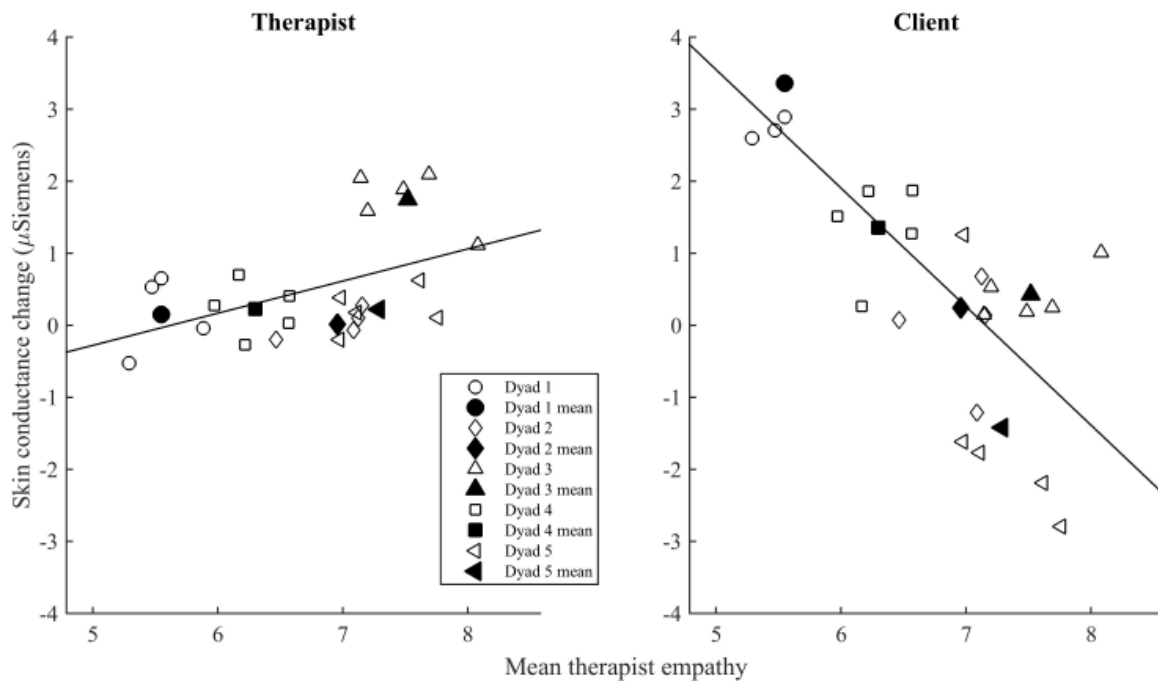


Fig. 5. The relationship of mean empathy with change in skin conductance level (SCL) across a session. The open symbols indicate the mean of empathy and SCL change in each session for the therapist and the client. The filled symbols indicate the mean empathy and SCL change of the therapist and the client in each dyad.

Regarding challenge, the picture is somewhat less clear, as Figure 6 below shows. Here, the X axis shows the relative ratio of challenging interventions during a session. While the association between the ratio of challenging interventions and skin conductivity change failed

to reach statistical significance, it appears that in the clients, this association was there if we would exclude the sessions of one dyad (dyad 5). In the remaining 4 dyads, the increase in the ratio of challenging interventions seems to be strongly associated with increase in skin conductance.

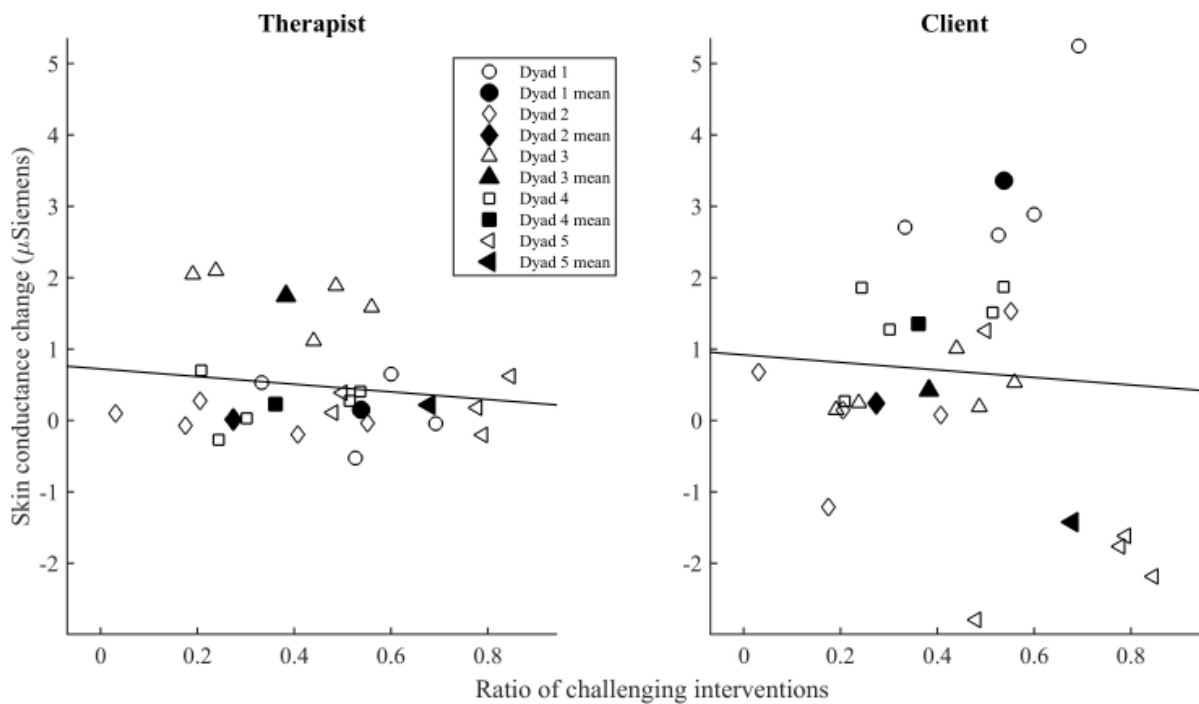


Fig. 6. The relationship of ratio of challenging interventions with change in SCL across a session. The symbols indicate the mean of challenge ratio and mean SCL in each session for the therapist and the client. The colored symbols indicate the mean of the therapist and the client in each dyad.

Finally, let us turn to the physiological changes during and immediately after the formulations. Against our expectation, empathy in formulations was not related to

skin conductance level in the either participant. Regarding challenge of the formulations, there was however a significant result: the challenging formulations increased the skin conductance level in the therapists (the statistical significance was very strong, $p < 0.001$), but not in the patients. Now we can put together this observation regarding the “momentary” effect of challenge in the therapists, and the picture given in Figure 6 above – that at the session level, the challenge in formulations tended to affect the patients rather than the therapists. Thus, it appears that the therapists respond physiologically to their challenging formulation in a *momentary* way, and the patients in a more *long-term* manner. This can be indicative of professional management of emotion (cf. Hochschild 1979). The therapists are momentarily sensitive to the challenge that they impose upon the patients, but the effect does not remain in their bodies; while the patients do not respond physiologically in the moment, but in the long run, the challenge seems to have an effect on them.

5. Discussion

In this chapter, we presented a string of studies that explored the ways in which physiological arousal is associated with interactional expression of emotion, exploring the intersection between intersubjective experience and bodily processes. We will now first summarise our results, and then discuss the ways in which they possibly enhance our understanding of intersubjectivity.

The baseline for these studies was the connection that we established between interactional affiliation and physiological arousal in storytelling in female dyads. We encapsulated that connection in the hypothesis about sharing the emotional load (Peräkylä et

al. 2015): increased affiliation by the story recipient is associated with decreased arousal in storyteller and increased arousal in the recipient. Our results were statistically significant, but the linkage between affiliation and arousal was not strong; hence, the study needed replication.

In the first replication (Stevanovic et al. 2019) we investigated male dyads and employed a different way of annotating interactions (continuous rating of affiliation and dominance rather than CA-based coding of stories). We also introduced new type of population as participants: alongside the typically developed adults, we now had adults with Asperger's syndrome. The hypothesis of sharing the emotional load was confirmed (importantly, not only regarding electro dermal activation but also regarding cardiac response). Furthermore, the hypothesis was elaborated as the Asperger participants' responses exhibited different patterns (Stevanovic et al. 2019).

The second replication (Voutilainen et al. 2018) involved a new interactional setting: instead of the quasi natural dyadic discussion between unacquainted people, we investigated naturally occurring psychotherapy sessions. The focal action was formulation by therapist, and the annotation of interaction was partly based on CA-informed coding, and partly on rating by naïve observers. The time frame of the analysis was also different, as alongside the momentary responses (like those examined in the baseline study and the first replication), we also examined the levels of physiological activation during entire psychotherapy sessions. Our results confirmed the hypothesis of the sharing of the emotional load, but only at the level of physiological responses during entire sessions.

In terms of method, our studies were the first ones where CA-informed understanding of interaction was linked to the measurements of physiological responses in the participants. It goes without saying that combining the two methods had its price. From the point of view of psychophysiological research, using natural and quasi-natural interactions as data led to

lack of experimental control of many aspects of interaction (what exactly was done, what exactly was spoken about, what exactly was the sequence of events) and the use of complicated statistics. From the point of view of CA, our techniques coding and rating were unable to catch many aspects of the granularity of interaction. For example, the role of second stories in the co-regulation of emotion was not explored. Yet we think that the price was reasonable, as we did come up with positive results and were able to replicate them.

Where, then, is intersubjectivity in these observations? We can take a narrow or a broad view. According to the narrow view, intersubjectivity resided only in the interactional expression of emotion, but the physiological responses are not part of it. In other words, intersubjectivity would involve (only) the uses of language, voice, face, and body that conveyed affiliation or empathy. These expressions are monitored moment-by-moment and responded to by the co-participants, and their being available for the co-participants makes them available also for the conversation analysts and naïve or trained raters. The narrow view would imply that the physiological arousal is not part of those expressions. It is hidden in brains and bodies, not part of the interactional organization or the intersubjective field. The narrow view suggests that showing linkages between physiological arousal and interactive events may be of some interest, but basically, such linkages go beyond what the participants of interaction actually orient to, and are therefore beyond the field of interest for conversation analysis.

The broader view, in contrast, suggests that as humans, we perceive our own bodies while we interact with other people. The tension or relaxation in our bodies is part of the experience of being in interaction with others: what we do together with others reverberates in our muscles, heart, breathing and sweating (Beebe and Lachmann 2003). It is reasonable to think that these bodily experiences inform our choice of next action in interaction (Damasio 1994). Likewise, we sense these bodily reactions in others: in the rigidity or plasticity of their

movements, in the colour of their skin, in the rhythm of their breathing. Even if we do not have very good means for recording and analyzing these events, they cannot be cut off from the intersubjective field, or excluded from our thinking about intersubjectivity. This question, that is how much the bodily arousal that can be measured by scientists is actually shown in the intersubjective field, remains for future research.

More than many others, Goffman was aware of this aspect of social interaction, as he characterized the experience of embarrassment as involving “blushing (...) sweating (...) blinking, tremor of the hand, hesitating or vacillating movement (...) constriction of the diaphragm (...) dryness of the mouth, and tenseness of the muscles” (Goffman 1956: 264). Using a combination of interactional and physiological research methods, we have tried to explicate something of the organization of such experiences.

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