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Expression of Emotions of People with Profound Intellectual and Multiple Disabilities. A Single-Case Design Including Physiological Data

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Abstract: Due to the challenging task of analysing the expression of emotions of people with profound intellectual and multiple disabilities (PIMD), studies in this field are underrepresented so far. Since obtaining self-reports on emotions within this group is limited and their highly individual behaviour signals are often hard to read, monitoring of physiological parameters in combination with behaviour observation can provide a deeper insight into emotional dimensions, i.e. valence and arousal according to the Circumplex Model.

Within a single case research approach, the expressions of three different emotional states of one participant with PIMD was recorded during nine emotion-triggering situations on nine measurement points. The data collection focuses on heart rate (HR) and skin conductance level (SCL).

The methodological approach was proved and some indications were shown regarding a higher activity in emotional phases, a low SCL while a relaxed stimulus was presented and a clearly higher SCL while experiencing an angry stimulus and the highest SCL during the presentation of a happy stimulus.

Further results will potentially broaden the understanding of emotional expression of people with PIMD. Derived therefrom, most promising implications for pedagogical scenarios were presented based on a quality of life concept.

Keywords: PIMD, emotions, single case design, physiological parameters, heart rate, skin conductance level

INTRODUCTION

Defined as an affective reaction oriented to a specific event, emotions are influencing our processes of learning, thinking and acting in terms of motivational, cognitive and social-communicative kind accompanied by temporary changes in experience and behaviour (Bundschuh, 2006; Eder & Brosch, 2017; Herz, 2014). Over the last decades, the scientific relevance of emotion research has increased tremendously. Nevertheless, studies on this topic in the area of profound intellectual and multiple disabilities (PIMD) are underrepresented so far (Adams & Oliver, 2011; Luxen, 2003). Most scientific work is based on evidences of developmental psychology regarding individuals without disabilities (Bundschuh, 2006; Luxen, 2003).

Focusing the very heterogeneous group of people with PIMD, a precise definition is a challenging task due to the large variety of causes and manifestations of the disability as

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well as the wide scale of functional, communicative and behaviour-related competencies (Axelsson, Imms, & Wilder, 2014; Nakken & Vlaskamp, 2007). Additionally, the prevalence of people with PIMD is relatively small and can only be estimated at 0.15 to 0.25 % based on several studies (Mohr, 2011).

However, one key characteristic of PIMD is the significantly low intellectual functioning combined with significantly low adaptive behaviour. PIMD is often accompanied by sensorial (mostly visually) and motor impairments as well as complex health issues (Nakken & Vlaskamp, 2007; World Health Organization, 2019). People with PIMD are usually not able to use verbal language and the additional lack of symbolic communication occurs often due to the fact that they did not (yet) learn the understanding of symbols like pictures or pictograms (Bellamy, Croot, Bush, Berry, & Smith, 2010; Maes, Lambrechts, Hostyn, & Petry, 2007). The characteristics of PIMD lead to intensive support needs and high dependence in almost all everyday tasks across their whole life (Axelsson et al., 2014) positively or negatively influenced by promoting or inhibiting contextual factors (World Health Organization, 2001).

Especially in terms of communication, the environment plays a key role. Using unconventional behaviour signals like specific body movements, facial expressions or vocalisations, an understanding of their needs is still possible if the environment is willing to interpret these behaviours (Brady et al., 2012; Carnaby, 2007). Hence, it may be possible to differentiate pleasure and displeasure. However, the number of those interaction partners being capable of understanding these highly individual signals and appropriately reacting to their communication and emotion related attempts, which includes the insight into more complex emotions as well, is limited in most cases even considering close direct support persons (DSPs), e.g. parents. Therefore, people with PIMD often remain misunderstood (Maes et al., 2007; Petry & Maes, 2006). This leads to a vicious circle, since the expansion of the personal emotion spectrum is influenced by the specific disability as well as by the less detailed feedback of DSPs in relation to the emotional state (Luxen, 2003).

To break this circle, the model of multidimensional perspectives offers a suitable approach to analyse emotional states of people with PIMD. Accordingly, an emotion is divided into a cognitive, motivational, expressive, physiological and subjective component (Bradley & Lang, 2000) with the focus on the latter three due their proven significant correlation (e.g. Bundschuh, 2003; Lench, A Flores, & W Bench, 2011).

Regarding the subjective component, the underlying dilemma arises in the common use of self-reports in emotion research, which cannot be used in this case due to the mostly missing verbal language and profound intellectual disability. This underlines the need of including other sources of information (Luxen, 2003; Vos, Cock, Munde, Petry, & van den Noortgate, 2012). Assessed by different types of DSPs and researchers, especially behaviour signals (expressive component) play not only a key role in (preverbal) communication development (Adams & Oliver, 2011) but are also considered to be the most meaningful expressions to show positive and negative emotions as well as moods (Petry & Maes, 2006). Although the emotional assessment of people with PIMD can provide a good orientation, there is always a lack of agreement between respondents (Hogg, Reeves, Roberts, & Mudford, 2001).

The missing piece in order to improve the understanding of non-symbolic and idiosyncratic behavioural signals is the integration of the physiological component (Munde, Vlaskamp, Vos, Maes, & Ruijssenaars, 2012). It has been shown that heart rate (HR) and skin temperature allow the same conclusions in people with and without disabilities regarding positive and negative emotions (Vos et al., 2012). In addition, specific stimuli can frequently be linked to consistent physiological reactions in terms of electrodermal reactions and HR changes (Lima, Silva, Amaral, Magalhães, & Sousa, 2011). While presenting positive emotional stimuli, people with PIMD showed a higher skin conductance level (SCL), less respiratory sinus arrhythmia, a shallow and fast breathing as well as a lower HR variability

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in contrast to a negative emotional experience (Vos, Cock, Petry, van den Noortgate, & Maes, 2010, 2013).

Besides the discrete emotion theory, which is based on a clearly distinguishable and thus very simplified representation of the basic emotions (e.g. Ekman & Cordaro, 2011; Izard, 2009; Plutchik, 1980), the above-mentioned studies as well as further empirical findings mainly support the dimensional theory in terms of the subjective, physiological and expressive component (e.g. Bradley, Codispoti, Cuthbert, & Lang, 2001; Bradley & Lang, 2000; Lang, Greenwald, Bradley, & Hamm, 1993; Russell & Barrett, 1999). The renowned Circumplex Model locates emotional states in four quadrants at the intersection of the specific values of the two dimensions, i.e. arousal (low – high) and valence (positive – negative) (Russell, 1980).

Based on this model, this preliminary study aimed to analyse one emotional state of each of the three quadrant to achieve a potential high differentiation in terms of valence and arousal:

- happy (positive, high arousal)
- relaxed (positive, low arousal)
- angry (negative, medium arousal)

Due to ethical reasons, the fourth quadrant (negative, low arousal) was not taken into account, since an active triggering of the appropriate emotional state, i.e. sadness, would not be justifiable. Sadness is usually defined as the experience of an irrevocable loss of a close person or social relationships. In comparison, anger can be caused, for example, by a brief interruption of interesting or joyful activities, by necessary nursing activities (e.g. combing hair, brushing teeth) or even by the temporary removal of a preferred object (Ulich & Mayring, 1992), which is common in the procedure for assessing pre-verbal communication skills (e.g. Kane, 2018; Rotter, Kane, & Gallé, 1992; Rowland & Fried-Oken, 2010). The analysis of the selected emotional states is embedded in the quality of life (QoL) concept by Felce and Perry (1995), which is internationally renowned to evaluate both objective living conditions and subjective wellbeing. The focus of this preliminary study was on the verification of the methodological approach and on the subjective analysis following the subsequent research questions:

- How can emotional expressions be distinguished in people with PIMD by analysing their behavioural signals and physiological parameters?
- Which consequences for pedagogical scenarios result from the analysis of emotional expression of people with PIMD?

METHOD

Participant

At the time of data acquisition, the participant was 20.9 years old and attended the local special school for students with intellectual disabilities. Mainly, she was living at the corresponding residential facility of those students. Based on the information of the DSPs, she was reported to be within the profound intellectual disability ranges (although no formal testing or IQ scores were conducted). Additionally, a diagnosed spastic tetraparesis and cerebral palsy were named. The participant was not able to walk on her own, but used a wheelchair and could move it independently on flat terrain. She had good physical control over her upper body including manipulating, but with a psychomotor delay.

In terms of communication, she did not use verbal language, but general vocalising had increased for about one year. According to the results of the Communication Matrix (Rowland & Fried-Oken, 2010), the participant primarily communicated by using

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intentional and unconventional behaviours. In terms of refusal or demand attempts, she often used eye contact, sometimes even by initiating joint attention, and touched or reached the desired object or the DSP performing an action to request more. Social communication, even attracting attention, was more difficult for her. She acted quite passively while often observing her environment. Previous attempts to promote symbolic communication had not yet shown any success. Based on the results of the Disability Distress Assessment Tool (DisDAT) (Regnard et al., 2007), the more positive an emotional reaction the higher were movement and muscle tone. Turning away was a sign for protest or no interest and a more negative reaction was accompanied by whining or groaning. Without offering any activity, she showed stereotypy by chewing on her fingers or a cloth.

Stimuli selection

Orientated towards previous emotion research with this target group or people with dementia (Marteau, Dalmat-Kasten, Kaye, Castillo, & Montreuil, 2014; Re, 2003; Vos et al., 2012; Vos et al., 2013), the DSPs were asked to name emotion-triggering stimuli, i.e. objects, activities or social interactions, with regard to the three emotional states.

Table 1. Selection of stimuli with conduct order, related emotional state, description of use and included objects.

Stimuli	Emotional state	Description of the stimuli use	Objects
S1	Relaxed	• DSP hands over cord • Participant plays with cord	Self-made braided cord
S2	Angry	• DSP takes cord away but keeps it in sight • Afterwards, DSP puts it out of sight	Self-made braided cord
S3	Happy	• Participant unpacks new spiral from a box • DSP adds verbal explanation (e.g. "Oh, what is this?", "This is so exciting!")	Spiral in a box
S4	Relaxed	• Participant continues playing with spiral (without verbal explanation) *Removing spiral*	Spiral
S5	Angry	• DSP brushes participant's hair *Removing hairbrush*	Hairbrush
S6	Happy	• DSP shows photos to participant while adding verbal and gestural explanation (e.g. description of illustrated persons/situations) *Removing photos*	Photos (activities with relatives)
S7	Relaxed	• Participant listens to music with headphones *Removing headphones*	Headphones
S8	Angry	• DSP inserts palatal plate *Removing palatal plate*	Palatal plate
S9	Happy	• DSP jokingly imitates noises (e.g. gurgling, breathing heavily, panting deeply, whistling, animal noises etc.)	/

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An additional two-day participatory observation provided an insight in everyday situations of the participant. In sum, 35 stimuli were gathered. Because of ethical considerations, activities and objects that were not known by the participant and were not part of her day-to-day life were excluded. Stimuli with high physical activity like aided walking were also disregarded due to their strong influence on physiology.

After discussing the selection with the DSPs, nine stimuli were chosen, three for each emotional state, aiming to evoke the clearest emotional responses.
Table 1 lists all selected situations in combination with the particular emotional state in the exact order of the later experimental conduct. Additionally, information on needed objects and their respective description of use is given.

Measures

The non-invasive Empatica E4 wristband with a size of 44 x 40 x 16 mm and a weight of 40 g has a battery life of more than 24 h in streaming mode and more than 48 h in recording mode with a storage capacity of 60 h (Empatica S.R.L., 2018).

Four sensors are included to measure HR, skin conductance, skin temperature and movement:

a) a photoplethysmography (PPG) sensor on the top of the wrist records BVP using two green and two red LEDs (sampling frequency: 64 Hz; resolution: .9 nW /digit),
b) an electrodermal activity (EDA) sensor on the ventral inner wrist measures changes in certain electrical properties of the skin using two stainless steel electrodes (sampling frequency: 4 Hz; resolution: 1 digit ~900 pSiemens),
c) an infrared thermopile records skin temperature (sampling frequency: 4 Hz, resolution: .02°C) and
d) a 3-axis accelerometer captures motion-based activity on 3 axes (X, Y, Z) within the range of ±2g (sampling frequency: 32 Hz; resolution: 8 bits) (Empatica S.R.L., 2018).

The focus of the present study was on HR and SCL. HR calculated in beats per minute (bpm) was derived from the BVP measured by the PPG sensor and SCL was calculated in microSiemens (μS) measured by the EDA sensor (Empatica S.R.L., 2018).

Comparable to a wristwatch, the wireless E4 enables a comfortable and unobtrusive wearing (McCarthy, Pradhan, Redpath, & Adler, 2016). The possibility of measuring both EDA and cardiovascular activity makes this wearable very valuable and unique compared to other options on the market (van Lier et al., 2019).

Following the manufacturer's recommendation, it was placed on the participant's non-dominant hand with the case on the top of the wrist and the EDA electrodes on the inner wrist in line with the middle and ring fingers. To avoid both position changes and restriction of blood flow or uncomfortable wearing, the wristband was worn just tight enough that no sensor light is visible without lifting it from the wrist. Before starting the recording, the participant wore the E4 for at least 15 min to ensure the signal quality, which was additionally checked by comparing it to earlier recordings (Empatica S.R.L., 2018).

Synchronized with the physiological measurements by means of the wristband's event marking button, the situations were videotaped as inconspicuous as possible covering two perspectives to record behaviour signals in terms of the validation phase as well as further analysis.

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Procedure

The study was carried out according to a reversal ABABA single case design (SCD) approach meeting international standards in terms of numbers of phases and measurement points (MPs) (U.S. Department of Education, 2017). It took place over a span of six weeks consisting of the preparation phase, the experimental phase and the validation phase.

Preparation phase. At the beginning, the participant's daily functioning and well-being while wearing the wristband were carefully observed by the present DSPs and the researcher. With reference to research recommendations (Calveley, 2012; Coons & Watson, 2013; Dederich, 2017; Mietola, Miettinen, & Vehmas, 2017), the parents and other DSPs were informed about the research approach, its benefits and risks to consent with the additional request to take the perspective of the participant at the best possible rate. Regarding the ongoing consent, permanent and transparent reflection with optional readjustment took place by all persons involved during the whole research process. In case of doubt, i.e. if the participant or a DSP had felt uncomfortable, the study would have been discontinued. Additionally, the study was approved by the local Ethics Committee (Heidelberg University of Education; approval number EV2019/04) following international standards (Williams, 2008).

Experimental phase. During the three A-phases, a baseline with the length of four MPs in the first phase and three MPs in the second and third phase was measured (see Figure 2) while one MP corresponds to one day. According to previous studies in this field (Vos et al., 2012; Vos et al., 2013), the data acquisition always took place at the same time directly after school lasting between six and seven minutes in a low-irritant but known environment with no special offer and in company with the researcher without direct interaction.

The intermediate B-phases lasted for four and five MPs conducted in the same room and at the same time. In a one-to-one situation, a DSP of the residential facility guided by the researcher or the researcher himself presented the nine stimuli to the participant in the exact order and procedure shown in Table 1. The average presentation time of one specific stimulus as well as the average time of all stimuli are provided by Table 2. The whole duration of one MP of both B-phases was half an hour on average. The data acquisition was identical in all phases.

Validation phase. The Delphi method (Linstone & Turoff, 1975) systematically and interactively gathers the professional answers of a group of experts on an issue by conducting at least two rounds of evaluation. After each round, the experts are confronted with the answers of the co-experts to encourage a revision of their earlier opinions. The aim is to decrease the range of answers and to improve the common evaluation.

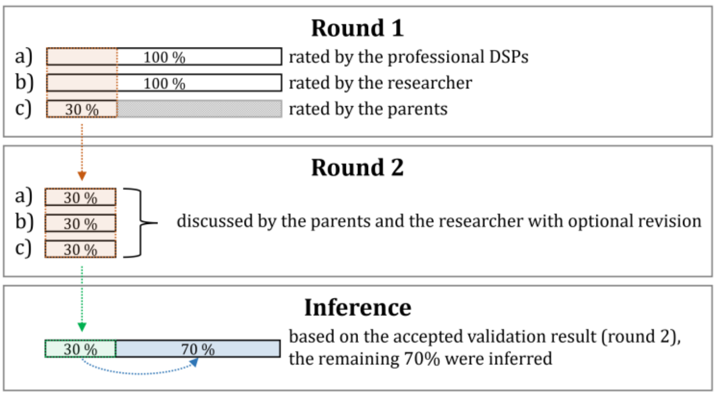

Figure 1. Procedure of the validation phase oriented towards the Delphi method.

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Oriented towards the Delphi method, the validation was realised in two rounds and an inference at the end (see Figure 1). The first one included professional DSPs, parents and the researcher. Right after a MP the participating professional DSP was asked to state the successfully triggered stimuli in consideration of the daily mood (e.g. a bad condition at the particular day). Subsequently, the researcher rated all stimuli regarding their successfulness in a post video analysis knowing the answers of the professional DSPs. Afterwards, the parents unbiasedly rated a limited set of video sequences to minimize the effort. This set prepared by the researcher included 30 % of all recorded situations covering each stimuli presentation with examples of positive, negative and unclear ratings as well as examples for each specific way of expressing (e.g. one negatively rated and two positively rated ways of showing happiness).

The second round offers the opportunity for the parents and the researcher to revise previous ratings discussing only the limited set of sequences but knowing the ratings of all three parties. Due to the fact that each way of expressing was rated before, the remaining 70 % of the recorded situations could be inferred with the mutually accepted validation result regarding the ratings of the 30 %. As a result, the success rate, i.e. the percentage of successfully triggered situations, was calculated for all recorded situations and each stimulus (see Table 2) and serves as manipulation check to exclude interferences.

Table 2. Selection of stimuli with average presentation time and success rate based on validation phase.

Stimuli	Emotional state	Average presentation time (min)	Success rate
S1	Relaxed	01:38	67 %
S2	Angry	00:33	11 %
S3	Happy	00:47	22 %
S4	Relaxed	01:07	78 %
S5	Angry	00:34	100 %
S6	Happy	05:34	44 %
S7	Relaxed	03:15	44 %
S8	Angry	01:14	100 %
S9	Happy	01:50	67 %
	Mean value:	**01:51**	**59 %**

Data Processing

In terms of the EDA signal, the binary artifact detection of the EDA-Explorer, which also takes data of temperature and movement into account, was used to detect noise (Taylor et al., 2015). Afterwards, the affected areas were cleaned by artifact correction with spline interpolation using the toolbox Ledalab (Benedeka & Kaernbach, 2010). Artifacts of the HR were adjusted with the software Kubios HRV using threshold based correction with a medium value of 0.25 seconds (Kubios Oy, 2019).

RESULTS (VISUAL ANALYSIS)

The analysis is performed using visual analysis as the common method of a SCD (Horner et al., 2005; U.S. Department of Education, 2017). Figure 2 is divided into the measurements of the HR (upper part) and the SCL (lower part) showing the five different phases with the mean values of each MP (blue line), the variabilities of each MP (black error bars), the mean values of each phase (orange line), the variabilities of each phase (yellow area) and the trends of each phase (green line). Within the calculations, the whole measurement from S1 to S9 on each MP of both B-phases was included without considering whether the stimuli

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were validated successfully or not (see validation phase). Otherwise, the calculations would be falsified due to varied length of the MPs. Comparing variability (i.e. the difference between the highest and lowest value) and mean value, there are huge differences between A-phases and B-phases as well as between the specific MPs of these phases, especially focusing the second A-phase and B-phase of HR measurements as well as all graphs of SCL. The trend – i.e. "the slope of the best-fitting straight line for the data within a phase" (U.S. Department of Education, 2017, A-7) meaning a linear regression considering mean values of all MPs of the specific phase – is inconsistent concerning all phases.

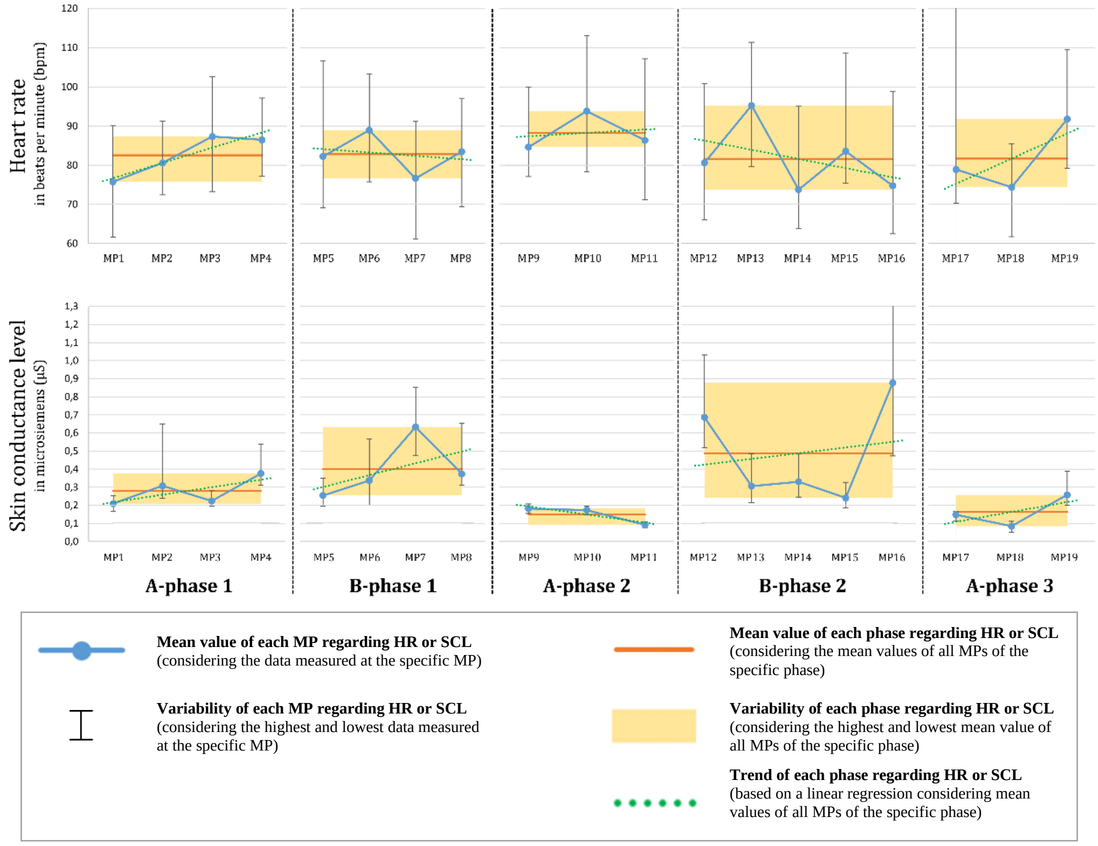

Figure 2. Analysis of SCL and HR including all phases and MPs without considering positive or negative validation of the stimuli to avoid false calculations due to varied length of the MPs.

According to validation phase (i.e. manipulation check), only positively validated emotional situations (see Table 1) are included within the further analysis focusing only SCL. Table 3 highlights those two stimuli of each emotional state with the highest success rates showing that the mean values of all selected situations of each stimulus is quite similar with an outlier of S6 (happy). Both the highest and the lowest score within the calculated minimum and maximum of all mean values was measured during the presentation of relaxed stimuli. Regarding the mean value of all trends in all selected situations (trend, i.e. a linear regression considering the data measured in the specific situation), each stimulus shows a unique slope.

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Table 3. Analysis of SCL including those two stimuli of each emotional state with the highest success rates and considering only positively validated emotional situations.

	Happy		Relaxed		Angry	
	S6	**S9**	**S1**	**S4**	**S5**	**S8**
Mean value of all selected situations	0,56	0,46	0,44	0,48	0,44	0,46
Minimum of all mean values of all selected situations (i.e. the lowest mean value)	0,26	0,29	0,20	0,23	0,24	0,27
Maximum of all mean values of all selected situations (i.e. the highest mean value)	0,97	0,84	1,20	1,16	0,73	0,80
Variability of all selected situations (referring the difference between minimum and maximum)	0,71	0,55	1,00	0,94	0,49	0,53
Mean value of all trends of all selected situations (trend, i.e. a linear regression considering the data measured in the specific situation)	-1,10E-5	6,18E-5	1,65E-5	-2,16E-4	2,50E-4	-5,44E-5

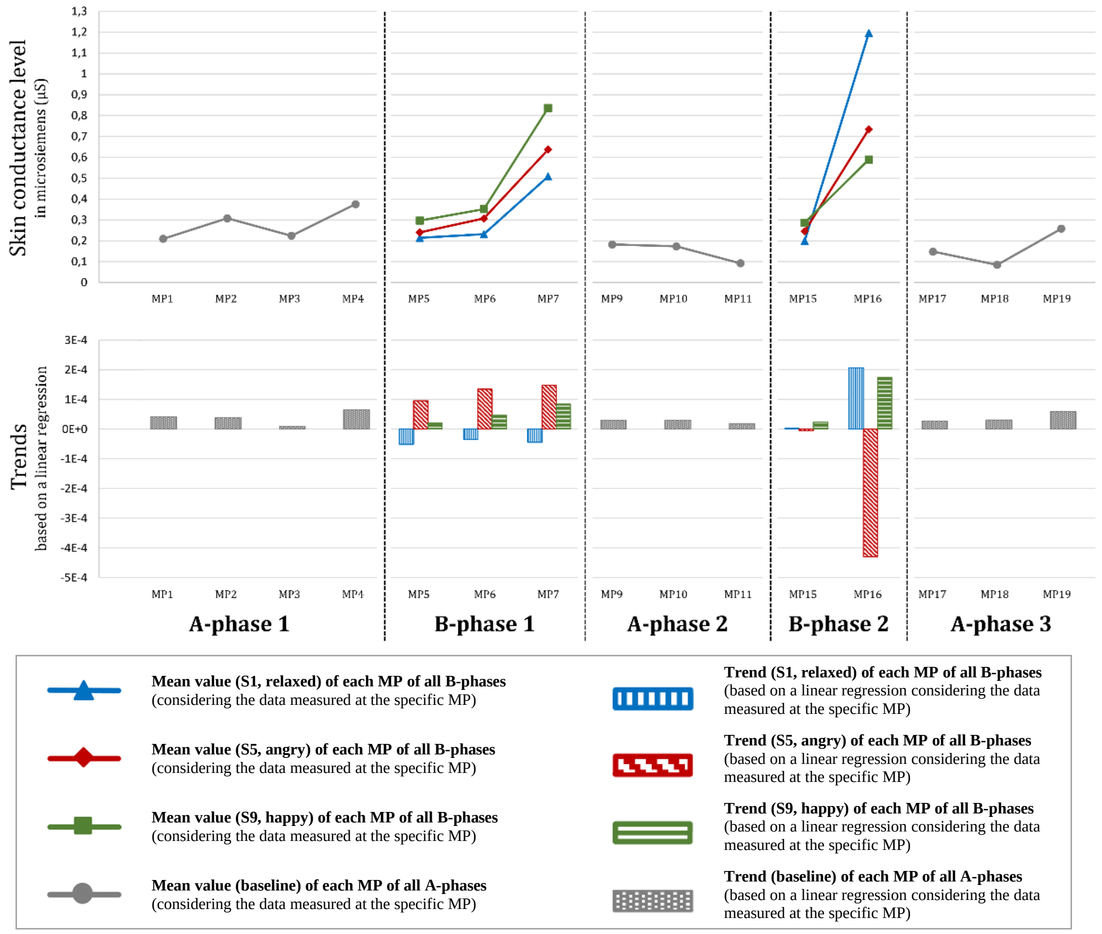

Figure 3. Analysis of SCL including only one stimulus with high success rate for each emotional state and considering only MPs with a positive validation of these three stimuli.

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To precise the analysis, Figure 3 includes only one stimulus with high success rate for each emotional state. Due to daily variations in SCL, only MPs with a positive validation of these three stimuli were considered to achieve an expedient comparison per each MP. This leads to the selection of S1 (relaxed), S5 (angry) and S9 (happy). Especially in the MP5, MP6 and MP7 of the first B-phase, the mean values (upper part) and the trends (i.e. a linear regression considering the data measured at the specific MP) presented in bar charts (lower part) have the same distribution. MP15 still confirms this to some extent, whereas MP16 is differently distributed.

Discussion

Since the autonomic nervous system is influenced, inter alia, by emotional responding (e.g. Myers, Hoppe-Graff, & Keller, 2014), the results confirm the expected higher physiological activity of both parameters (HR and SCL) regarding variability and mean values of both B-phases and its MPs in contrast to all A-phases (see Figure 2).

Grouped in the three emotional states, Table 3 presents inconsistent results for SCL. The assumption of three clearly distinguishable groups (e.g. Bradley & Lang, 2000; Vos et al., 2010) concerning their mean value and trend was not fulfilled. Although the relaxed stimuli show the lowest SCL and meets the expectations (e.g. Lang et al., 1993), it represents also the highest value and variability in contrast to previous findings.

Focusing only the most promising stimuli in Figure 3, S1 (relaxed) predefined to have a low arousal actually had the lowest SCL with a negative or very small positive trend in contrast to S5 (angry) and S9 (happy) (e.g. Bradley & Lang, 2000). Additionally, the positive stimulus (S9) elicits a higher value than the negative stimulus (S5) meeting previous results (e.g. Vos et al., 2010) whereas the negative stimulus (S5) mostly shows the highest positive trend. Only the results of MP16 do not confirm the preliminary findings, which can possibly be explained by the fact that this was the only MP directly conducted by the researcher.

Nevertheless, several limitations to this study can be stated. Firstly, this was just a preliminary analysis, which offered not enough consistent results so far. Other parameters like HR variability (e.g. Jönsson & Sonnby-Borgström, 2003; Nardelli, Valenza, Greco, Lanata, & Scilingo, 2015; Vos et al., 2013; Xiefeng, Wang, Dai, Zhao, & Liu, 2019) or skin conductance response (e.g. Mauss & Robinson, 2009) should be considered in future research as it is known as a good emotional indicator. Secondly, changes of the autonomic nervous system are not only connected to emotional states but also to movements, which additionally have a negative influence on data quality (e.g. via loose electrodes) of SCL (Boucsein et al., 2012; Vos et al., 2010; Vos et al., 2012) and HR (Menghini et al., 2019; Pollreisz & TaheriNejad, 2019). Since the selected stimuli still include more movement than recommended, future research should reduce (hand) movement to a minimum (Menghini et al., 2019; Schäfer & Vagedes, 2013). In addition, the needed individual stimuli selection approach does not allow direct comparisons with other studies. Thirdly, there is a lack of prove that the selected and validated stimuli actually match the emotional states since no self-reports were possible and the statements of the DSPs may be unknowingly biased. Of course, this is a general limitation to these kind of studies with this special population. Fourthly, the standardized procedure has suffered from a readjustment reasoned by suspected discomfort of the participant and the frequent changes of the participating DSPs. Hence, it may be possible that a reaction is related to the present persons and not to the stimulus itself. Fifthly, the setting approach of the A-phases aiming ata stable baseline by evoking no special emotional feeling (i.e. neutral valence and low arousal) in contrast to the B-phases leads to two issues. On the one hand, this situation might be quite similar to the relaxed one of the B-phases and, on the other hand, it might lead to raising discomfort of the

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participant although the behaviour was carefully observed and the conduct was limited to just a few minutes.

However, this study proved its research approach and stated some indications based on initial results that the integration of physiological data can strengthen the understanding of the emotional expression of people with PIMD.

Further work regarding this study will include the behavioural annotation and a subsequent statistical analysis. Moreover, four additional SCD studies will be conducted aiming to broaden the understanding of the emotional expression of people with PIMD and to provide implications for pedagogical scenarios by establishing references to the above-mentioned QoL concept regarding

- the emotional well-being by enabling a better recognition of different emotional expressions (Vos et al., 2010; Vos et al., 2012; Vos et al., 2013),
- the social well-being by promoting the communication development, especially in the transition to intentional communication through more adequate recognition and reinforcement of relevant behavioural signals (Petry & Maes, 2006) as well as related social relationships (Hostyn & Maes, 2009) and
- the development and activity by improving the services with a better understanding of preferences, habits and interests of persons with PIMD (Marteau et al. 2014; Petry & Maes 2006), which also enables to enhance participation, self-determination and self-efficacy in everyday activities, thus reducing their dependency (Adams & Oliver, 2011; Helm, 2000; Ross & Oliver, 2003).

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