Electrodermal activity measurement within a qualitative methodology: Exploring emotion in leisure experiences

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Abstract

Purpose - Reflecting, reliving and reforming experiences enhances the longer-term effects of travel and tourism, and has been highlighted as an important aspect in determining loyalty, re-visitation and post-consumption satisfaction. The purpose of this article is to develop new methodological approaches to investigate emotion, memory creation, and the resulting psychosocial effects.

Design/methodology/approach - The paper proposes a unique combination of physiological measures and photo-elicitation based discussions within a longitudinal design. A physiological measuring instrument (electrodermal activity tracking technology through Empatica E4 wristbands) is utilised to capture the 'unadulterated' emotional response both during the experience and in reliving or remembering it. This is combined with post-experience narrative discussion groups using photos and other artefacts to give further understanding of the process of collective memory creation.

Findings - EDA tracking can enhance qualitative research methodologies in three ways: through use as an 'artefact' to prompt reflection on feelings, through identifying peaks of emotional response and through highlighting changes in emotional response over time. Empirical evidence from studies into participatory arts events and the potential wellbeing effects upon women over the age of 70 are presented to illustrate the method.

Originality/value - The artificial environment created using experimental approaches to measure emotions and memory (common in many fields of psychology) has serious limitations. Our paper proposes new and more 'natural' methods for use in tourism, hospitality and events research, which have the potential to better capture participants' feelings, behaviours and the meanings they place upon them.

Keywords: emotion, memory creation, EDA, mixed methods, group socialisation

Article classification: Research paper

Introduction

It has been widely documented that tourism and planned events hold the potential to create a variety of social and cultural impacts for tourists, attendees, and local communities. Social impacts thereby include socialisation, bonding, meeting new people (Crompton and McKay, 1997; Uysal and Li, 2008; Chang and Yuan, 2011), as well as the creation of memories and experiences with friends or family (Jepson and Stadler, 2017; Stadler and Jepson, 2017; Wood and Kenyon, 2018) which trigger a range of emotional responses. Understanding the experienced memories and emotions created through travel, tourism and events has been highlighted as an important aspect in determining loyalty, re-visitation and post-consumption satisfaction (Tung and Ritchie, 2011; Kim and Fesenmaier, 2015) and can bring about changes in one's overall quality of life. There is, therefore, a need for studies within tourism to better understand the level of engagement with touristic activity and its individual and social benefits.

Recent research has further highlighted the importance of not just sharing the experience itself (Kim and Fesenmaier 2015), but also reflecting, reliving and reforming experiences in order to create longer term effects (Wood and Kenyon, 2018). Through these practices, collective emotions and shared memories emerge (Wood *et al.*, 2012; Woosnam *et al.*, 2014; Wood, 2015; Wood and Kenyon, 2018). Both emotion and memory have been researched extensively from a psychological perspective, however, new methodological approaches need to be developed to better understand their role in the social (or collective) experiences frequently found within tourism, hospitality and events.

We acknowledge the importance of experimental approaches used in many fields of psychology but believe that an artificial lab-based environment has serious limitations (Riddle and Arnold, 2007). Based on the assumption that the emotions felt, remembered and shared are socially constructed we believe our methods are more authentic to the participants' behaviours and the contextual environment. They therefore have the potential to better capture feelings and behaviours as well as the meanings placed upon them. With this in mind this paper documents the development, use and evaluation of a unique combination of physiological measurement of emotional response (electrodermal activity or EDA), photo-elicitation and narrative discussions. Our methods include, but go beyond, recording 'in-the moment' emotional response, by gathering longitudinal post-experience data and thus capturing semantic memory where beliefs and attitudes are formed (Allen *et al.*, 1992; Wood, 2015).

We present a theoretical discussion as well as empirical evidence of successfully using this methodology in studies into participatory arts events and the potential wellbeing effects upon women in rural areas over the age of 70. We highlight the utility, strengths and limitations of the methodology in a tourism and events context and structure the discussion as follows. We first present a discussion of emotions and memory creation specifically focusing on the methods employed in a tourism and events context thus far, as well as their limitations. The paper then advocates a more participatory humanist, co-creative knowledge approach to research, including a combination of physiological measures (EDA) and visual stimuli based narrative discussions. We go on to introduce the methods used in our studies and present findings to illustrate the benefits and limitations of our proposed methodology. Our conclusions, implications and suggestions for future research illustrate how this methodology can be used in other contexts.

Emotions and memory

It is not new to recognise that emotion rich experiences are at the core of tourism and event products (Robinson, 2012). However, despite work within consumer psychology exploring the link between emotion, memory and consumer experience there is still a relatively limited research base within tourism academia. The research that exists tends to have focused on individual emotional arousal (e.g. Hosany, 2012; Shoval *et al.*, 2017) and ignores three important factors: 1) the effect of sharing the experience with other travellers, attendees, locals (with the exception of Woosnam and Norman, 2010; Woosnam *et al.*, 2014; Hasani *et al*., 2016 and Li and Wan, 2017 who have explored emotional solidarity in this area), 2) the memory of the emotion felt after the experience, and 3) the sharing of the memory with those that experienced it and those that did not. The lack of research from a social sharing perspective is surprising as collective emotion was described as a 'red hot topic' in social psychology as long ago as 2011 (Dixon and Condor, 2011) and most would agree that tourism, hospitality and certainly events experiences are inherently social and often shared (Crompton and McKay, 1997; Uysal and Li, 2008; Chang and Yuan, 2011; Kim and Fesenmaier, 2017). There have been a few studies relating to memories within tourism experiences (e.g. Tung and Ritchie, 2011) and more recently within events (Jepson and Stadler, 2017; Stadler and Jepson, 2017). Again, few of these consider the importance of sharing those memories with others and the extent to which this affects future attitudes and behaviour.

A product that is largely experiential and therefore intangible creates the need for memory prompts and much research has been conducted on the importance of souvenirs or merchandise (e.g. Hitchcock and Teague, 2000; Morgan and Pritchard, 2005). The findings here reinforce the importance of the memory of the event as a key aspect of satisfaction and arguably the main motivator for attendance or travel. We consider memory then not as tourism for nostalgia but as a valued outcome of experience and one which is made more pleasurable through sharing.

From a broader perspective, and perhaps unsurprisingly, within the fields of psychology and neuroscience there has been a wealth of research exploring the physiological aspects of emotions (Ekman *et al.*,1983; Levenson, 1992; Cacioppo *et al.*,2000; Larsen *et al.*, 2008; Kreibig, 2010) and a growing body of research in social psychology (e.g. Rimé *et al.*, 2011; Salmela, 2012). Alongside these advances emotion has also been considered from a sociological perspective (Thoits, 1989) recognising the cultural influence on emotional reaction and expression as well as the role of emotions in societal bonding (Turner, 2009).

It is not the intention here to provide a critique of research in emotions and memory but to make the case for a new methodological approach to understand the complexity of the consumer experience. The discussion above suggests that this methodology needs to draw upon methods found in several disciplines and to be appropriate for the study of the engendered and remembered emotions, the effect of others on these and the effect of shared emotional memories on future behaviour.

Events provide an ideal context in which to study emotional memory formation for three important reasons. Firstly, they provide extraordinary (and therefore memorable) experiences, secondly, they have designed in emotional highs and lows (are affective) and, thirdly, they are social (creating the opportunity for collective emotion and memory sharing). Indeed, many events are experienced in order to create memories, reflecting Kahneman's (2011) view that we think of the 'future as anticipated memories'.

Although the area of shared emotional memory is relatively underexplored within tourism, there have been a growing number of studies of emotion employing a variety of methods. These range from simple emotion recording surveys (e.g. Hosany, 2012; Woosnam, 2012), to physiological response measures (Kim and Fesenmaier, 2015; Shoval *et al.*, 2018) to netnography (Ji *et al.*, 2016) and ethnographic studies (Park, 2016). Kim and Fesenmaier (2015, p. 421-422) usefully summarise three key approaches that have been applied to researching emotions in a tourism context and highlight the advantages and disadvantages of each:

1) Self-report: This can be in the form of diaries, interviews or questionnaires and aims to collect subjective experiences. It is a fairly simple and unobtrusive method but based on the assumption that people are a) aware of their emotions during/after an experience and further, b) willing to report them, and c) able to articulate them. There is also greater potential for social desirability bias in self-reporting i.e. stating what is thought to be the 'right' emotional response. Levine and Pizarri (2004, p. 530) also noted, "(…) people process, encode, and retrieve information differently depending upon whether they are feeling happy, fearful, angry, or sad" and comparison between different people and studies is therefore difficult.
2) Observation: Here the focus is on observing travelers' behaviour in the form of facial expressions, gestures and speech. Like self-reporting, this is an unobtrusive way of measuring emotions, but respondents can potentially fake some behaviours. This emotional masking, mimicry or mirroring is expressed differently within different cultures (Russell, 1991; Mesquita and Nico, 1992). It is also highly dependent on environmental conditions, and interpretation of the data is susceptible to researcher bias.
3) Neuro-/physiological response: This includes measuring changes in skin conductance, as well as other bodily responses, such as pulse rate, blood pressure and brain activity. The main advantage of this method is that it cannot easily be faked, and short-term changes can be detected that respondents would not normally be aware of or interpret as significant themselves. Disadvantages and challenges include the use of special equipment which requires resources and expertise, some equipment can reduce people's mobility, and it might not always be possible to map data to specific emotions.

Despite the few exceptions there has been a growing critique of the lack of methodological innovation in both tourism and events research, with many claiming that conventional methods such as surveys, interviews and focus groups, are still largely dominating the field. A call for new approaches to data collection and analysis in order to advance the field has therefore emerged in recent years (Tribe, 2008; Rakic and Chambers, 2010; Rydzik *et al.*, 2013). More specifically, the post-experience self-reporting techniques mentioned above have been heavily criticised due to the 'time gap' which creates "'slippage' between the emotions travellers' truly experienced and what they described" (Kim and Fesenmaier, 2015, p. 419). It has therefore been suggested to complement these self-reporting approaches with physiological measurements of emotions during the activity itself (Kim and Fesenmaier, 2015). This has been picked up by Li *et al.* (2015, 2016, and 2017) in their studies of emotion and advertising. They discuss five specific psychophysiological methods in a tourism context (EDA, facial muscle activity, heart rate response, eye-tracking and vascular

measures) and emphasise the benefits of capturing spontaneous emotions that an individual may not themselves be aware of and in real time. The authors conclude that emotions are complex and should be measured through a combination of different methods in order to achieve validity and reliability. We are seeking to avoid self-report of in-the-moment emotional response by using an 'objective' EDA measure albeit enhanced by qualitative reflections on those feelings post experience.

There has also been a growing interest in championing a more humanist approach to research, whereby research is done *with* and *for* participants, rather than *to* them (Sedgley *et al.*, 2011). Using visual material and other artefacts to prompt more meaningful narrative discussions can benefit participants and researchers through releasing feelings and thoughts, and create collective memories (Emmison and Smith, 2000; Rydzik *et al.*, 2013). We argue that a combination of physiological measure and qualitative discussion is particularly suitable in a tourism and events context. Such a combination can explore the emotional responses to an experience both in situ as well as in reliving and remembering the experience with others.

Proposed methodology

We situate our work as interpretivist and take an inductive approach. In doing so we actively integrate human interests and assume that reality is socially constructed through language, consciousness, shared meanings, and instruments (Phillimore and Goodson, 2004). Our approach is guided by social constructivism with its foundational belief that reality is constructed not discovered through human activity and that societies together invent the properties of the world (Kukla, 2000). Social constructivism acknowledges that multiple realities exist in regard to the same phenomena (Crotty, 1998; Schunk, 2012). It places emphasis upon all cognitive functions, including learning to be dependent on sharing individual perspectives, or collaborative narratives (Van Meter and Stevens, 2000). In other words, group members are constructing understanding together in a way which would not be possible alone (Greeno *et al.*, 1996). This advocates that learning is critically dependent on the qualities of a collaborative process within a community, is situation specific and is context bound (Eggen and Kauchak, 1999; McInerney and McInerney, 2002; Schunk, 2012).

The methods employed within a constructivist approach therefore, need to be more 'natural' or 'humanistic' for the participants and the context (Denzin and Lincoln, 2000). This suggests an emic perspective "genuinely driven from the participants' full frame of reference" (Pearce

and Packer, 2013, p. 404). Humanist approaches to research have been associated more recently with the concept of 'hopeful tourism scholarship'. Ateljevic *et al.* (2007) and Tribe (2009) present this as an emergent network of tourism enquiry with a fundamental aim to enrol people within ideas and inscriptions. Ren *et al.* (2010) maintain that this type of inquiry is a value led 'bottom up' approach built on partnership and reciprocity. We considered this to be of paramount importance to our research setting as well as for the building and maintaining of trust. Hopeful tourism also advocates a transformation of relationships between the researcher and the researched, and it is through this transformation that co-creation of research can occur (Sedgley *et al.*, 2011; Richards *et al.*, 2010).

Sedgley *et al.* (2011), commenting upon critical tourism studies, suggest that they have been constrained by a market driven focus to understand and exploit the potential of various market segments. This has also been the case within event studies which has seen a proliferation in motivational and economic impact studies. Further to this, Sedgley *et al.* (2011) point out that this proliferation of quantitative studies has led to a tendency amongst tourism and events researchers to conduct research 'on' people rather than 'with' people. This has fuelled a desire to understand and control market forces upon a stereotyped group of people rather than view them as individuals. Ray (2007) suggests that much more than a mono consumerist approach is needed to bring about significant change in power relations or challenge existing stereotypes or traditional discourses. Our study advocates a participatory humanist, co-creative knowledge approach using creative sessions to stimulate individual and collective memory discussion. We suggest that co-creation is only achieved through a longitudinal period of trust and negotiation and re-negotiation of personal narratives built through a variety of qualitative methods.

A methodology that seeks to explain the complexity of emotional response to social experiences needs to draw upon psychological advances, sociological understanding and cultural contexts. For example, Ahmed's work on the 'sociality of emotion' is useful in its avoidance of distinction between physical, sensation, emotion and thought as they cannot be 'experienced' as distinct realms of human 'experience' (Ahmed, 2004, p. 6), as well as Von Scheve and Von Luede's (2004) work on interdisciplinarity within emotion and social structures. Memories of the experience itself, as well as the process of reflecting on it, trigger an emotional response, which might be moderated or remembered differently and can shape and reshape the experience over time (Kim and Fesenmaier, 2015; Wood, 2015; Wood and Kenyon, 2018).

Methods similar to autobiographical memory interviews aim to discover issues and responses by asking about specific memories or "re-interpreted versions of the original experience" (Kirkegaard Thomsen and Brinkmann, 2009, p. 294). A further advantage of this technique is that it recognises that specific memories are not representative of experiences more generally but that they capture the novel, emotionally intense, and/or important aspects of the experience such as the peak experiences that live events aim to create. Through the use of a physiological measuring instrument these emotional responses to the activity itself, as well as during the process of remembering, can be tracked. Our methodology therefore includes a combination of these data collection methods: physiological measures (EDA) and visual stimuli based narrative discussions.

Electrodermal activity (EDA) complex

Our participants' emotional responses were gathered through Empatica E4 wearable wristbands. Electrodermal activity (EDA) is an umbrella term used to define autonomic changes in the electrical properties of the skin (Dawson *et al.*, 2001, or, more specifically, "the variation of the electrical properties of the skin in response to sweat secretion" (Benedek and Kaernbach, 2010, p. 80). The most widely studied property is skin conductance, which can be quantified and analysed by applying a small constant electrical current between two points of skin contact and measuring the resulting current flow and fluctuations between them.

EDA is arguably the most useful index of changes in sympathetic arousal that is trackable (via sympathetic fibres) to emotional and cognitive states (Dawson *et al*., 2001 Braithwaite *et al*., 2015). This is because it is the only autonomic (responsible for regulating the body's unconscious actions) psychophysiological variable that is not contaminated by the parasympathetic activity of the body such as the functioning of major organs (see Figure 1).

<INSERT FIGURE 1. HERE: *An illustration of parasympathetic and sympathetic activity in the human body*>

Figure 1 illustrates both the parasympathetic nervous system (PNS) and sympathetic activity controlled by the sympathetic nervous system (SNS). The PNS controls homeostasis and the body at rest and is responsible for stimulation of the body's "rest and digest" function, sometimes also known as “feed and breed activities” (Levenson, 2014). These occur when the body is at rest especially after eating, and include sexual arousal, salivation, lacrimation (tears), urination, digestion and defecation (Dawson *et al*., 2001. The sympathetic nervous system (SNS) controls the body's responses to a perceived threat and is responsible for the so called "fight or flight" response (Levenson, 2014). The SNS comes from the spinal cord and activates physiological changes in the body during the fight or flight response. In other words, it regulates the intensity of our emotional states of arousal and as a result the intensity of a person’s behavioural response.

A key benefit to researchers is that EDA can also be used to detect implicit emotional responses that may occur without conscious awareness or are beyond cognitive intent (i.e., threat, anticipation, salience, or novelty) (Braithwaite *et al*., 2015). EDA measurement has two main components, the first is the general tonic-level EDA which relates to the slower acting components and background characteristics of the signal (the overall level, slow climbing, slow declinations over time). The most common way in which this is measured is through the Skin Conductance Level (SCL) and it is the changes in the SCL that are thought to reflect general changes in autonomic arousal. The second component is the phasic component which refers to the faster changing elements of the signal, known as the Skin Conductance Response (SCR). Previous research suggests that both of these components are important and may rely on different neural mechanisms (Dawson *et al.*, 2001; Nagai *et al.*, 2004). Crucially, it is important to be aware that the phasic SCR, which often receives the most interest from researchers, only makes up a small proportion of the overall EDA complex as can be seen in Table 1 and Figure 2.

<INSERT TABLE 1. HERE: *Definitions for electrodermal components*>

Researchers using EDA should recognise that tonic EDA or SCL generates a constantly moving baseline as an individual reacts to changes in their environment, and as such has the potential to vary greatly between individuals. This has been a feature of debate with some researchers suggesting that, on its own, SCL is not an informative measure, is problematic to derive, and that simply averaging across the EDA signal is likely to cause overestimation of the individual’s emotional response (Dawson *et al*., 2001; Boucsein, 2012).

To overcome some of these issues it is suggested that researchers should first conduct pilot studies to establish an individual respondent's baseline SCL within the chosen research environment. Baseline SCL data capture is recommended to be between 2- 4 minutes (Dawson *et al*., 2001; Benedek and Kaernbach, 2010; Boucsein, 2012; Braithwaite *et al*., 2015) prior to the main data collection and should be done in tandem with non-specific SCR (NS-SCRs). This will ascertain the frequency of NS-SCRs to ensure an accurate picture of the environment and potential stimuli prior to capturing any Skin Conductance Response (SCR). The importance of this is to gain accurate readings of the SCR peaks associated with an individual's arousal to stimuli in the research environment. This is of particular importance to events, leisure, hospitality, and tourism research where the concern is mainly with event-related SCR (ER-SCR). These are SCRs that can be attributed to the specific emotion eliciting stimuli found within leisure and tourism environments and experiences.

<INSERT FIGURE 2. HERE: *Flow diagram demonstrating the EDA complex*>

The importance of qualitative methods

Shoval *et al.* (2017, p. 3) highlighted that when measuring emotions, "without a thorough grasp of the contextual setting and the integration of this information with other forms of data, our abilities to interpret this type of data are limited." Combining the method with other qualitative approaches allows a more in-depth understanding of the types of emotions experienced as well as the valence of such emotions (e.g. positive or negative) (Kim and Fesenmaier, 2017). Shoval *et al.* (2017, p. 4) explain how

> "*different emotional states are characterized by different levels of arousal. For instance, fear and excitement are both characterized by high arousal, although they differ significantly with regard to their valence. Similarly, sadness and calmness are both characterized by low arousal, although they too differ in valence. Arousal levels reflect the activation of the sympathetic nervous system, which prepares the body to respond to urgent situations."*

Visual analysis should therefore be considered critical in studies investigating the EDA complex, so researchers have a clear understanding how background variables, often referred to as 'drift' (Braithwaite *et al*., 2015), could be impacting upon the SCL data. Visual observation is also key for confirmation of ER-SCR's and that stimulation is taking place.

The inclusion of participant observation and post-experience narrative interviews is also vital as we remember more in a conversation than we might when remembering alone (Hirst and Echteroff, 2008). Rimé (2007) terms this collaborative facilitation although he also recognises the opposite in collaborative inhibition. The social context therefore enhances memory but has the potential to limit what is shared. The inhibition relates to what is willing to be shared. This also enriches the data as the narrator has 'choice' and in selecting and withholding the stories told is showing us something more about themselves. Photo elicitation (or visual stimuli) interviews have been used successfully for many years in sociological studies and other fields using photos taken (or selected) by the researcher and/or those taken by the participant. Using these photos in a recall interview "empowers the interviewee to teach the researcher about aspects of their social world otherwise ignored or taken for granted" (Clark-Ibáñez, 2004, p. 1524). This therefore provides a way to elicit more meaningful memories of emotions related to the phenomena being studied.

Methods employed in our studies

Like many studies before ours (e.g. Richards *et al.*, 2010; Sedgley *et al.*, 2011; Pritchard *et al.*, 2011) we had a need to develop a methodology which empowered people, gave them independence, and allowed them to share in the co-creation of knowledge. We have embedded the principles of humanistic inquiry within our research methods, a vital consideration for the particular context of our studies (i.e. art events participated in by rural living women over the age of 70). Through the creation of artworks, and through socialising with ourselves and others, participants were empowered to learn about their EDA complex data, the individually and group created memories and the importance of these to their lives and the lives of others.

The aims and objectives of our studies are threefold: (1) To provide new insights and robust evidence concerning the effects of arts participation on the holistic psychosocial wellbeing of older women in rural areas over the age of 70, (2) To gather and interpret data on participants' conscious and subconscious affective experiences, with a view to developing a more comprehensive understanding of how arts participation may influence identity, sense of community, social inclusion, and therefore wellbeing, and (3) To develop a rigorous and innovative methodology that is transferable to other populations and art forms, will inform best practice and help direct future investment. In order to achieve these, our studies employed a seven-stage sequential data collection strategy (as seen in Table 3). This was

designed to ensure that the methods could be adapted to the research and to provide opportunities for triangulation. Our study measured the EDA of women over 70 in two rural regions of England. This data was collected whilst they were engaged in arts and craft activities for one-hour sessions. In addition to this we audio recorded the session, took observational notes, and used an 'Autographer' device (worn by the arts leader) to generate random photographs across the session. Our study also used paired and group reminiscence interviews where participants again wore the E4 wristbands and were asked to comment on what happened in previous arts sessions they had attended using the objects created, the photographs taken and the EDA graphs as visual stimuli.

The purpose of this approach was to create a unique methodology whereby we could analyse the strength of the memory EDA complex against that of a live stimuli activity EDA complex. The multi-site/multi-method longitudinal approach generated data that could be analysed comparatively (i.e. supporting or contradicting outcomes). The involvement of the participants as co-researchers (stage 6) also served to improve the trustworthiness and credibility of the findings. In this way, the data was considered and reflected upon from several perspectives.

<INSERT TABLE 2. HERE: *Mixed Data Capture Methods employed over three-week periods*>

Sample size and methods

In the North of England two groups were targeted, an existing 'Living well' group organised by the charity Age UK and a group brought together for the project by an arts venue and provider. Five groups of three or four women over the age of 70 took part in the research facilitated by Age UK and four groups of four women over 70 participated in the research at sessions hosted by the art provider. Each group participated in a number of different art activities over a three-week period with the data gathering taking place weekly over a total of six months.

For the samples in the Southern region Age UK were again used to identify arts and craft groups and four rural villages where 'living well' groups met were identified. These are presented in Table 2.

<INSERT TABLE 3. HERE: *Multi-site samples*>

Simple questionnaires were employed to validate the respondents were aged over 70 and were residents in the rural areas where the data capture took place. Different venues including sheltered housing (specific housing also known as assisted living in the UK whereby residents have wardens on hand should they need assistance), community centres, arts centres, local libraries and village halls were used depending on where the participatory arts groups met on a weekly basis. All participants in the studies were advised of the purpose of the research through an initial consultation, and given a hand out detailing all the information. Following this, respondents signed consent forms and were advised of the right to withdraw at any time.

Participants were then fitted with an Empatica E4 wristband. Figure 3 illustrates the schematics of the E4 which been designed to be unobtrusive and comfortable for the wearer.

<INSERT FIGURE 3. HERE: *Empatica E4 wristband schematics*>

When respondents were comfortable with wearing the bands EDA data was captured for four minutes to establish each individual respondent's baseline SCLs while in a state of relaxation (as recommended by previous studies: Dawson *et al*., 2001; Benedek and Kaernbach, 2010; Boucsein, 2012; Braithwaite *et al*., 2015). Following the baseline tests the event began and participants were involved in creating art within a social group. These varied between groups and locations and included ceramics, textiles, printing, paper craft, iPad art, glass painting, and origami.

After the first event (week 1), the research team carried out an initial analysis of the EDA data captured by the wristbands to identify emotional peaks for each participant. In combination with the photos taken by the autographer camera and the researchers' notes, key moments during the activity were identified. These initial findings were then taken back to the participants during week 2 and discussed with them as part of the post-activity interviews. EDA complex data was again captured during these reminiscence interviews with the same participants wearing the same wristbands (carried out in groups of between two and four participants during weeks 2 and 3). Respondents were interviewed to find out their views on the previous event activity they participated in, what they enjoyed and their happiest memories from the activity, how they felt before/ during/ and after the activity, the significance of the activities they participated in and also to talk more generally about being over 70 and living in a rural location. EDA data, photos and researcher notes from week 1

were thereby used as prompts for discussion and reflection. Audio recordings of the interviews helped identify and cross-reference emotional peaks during the reminiscence interviews. The research team was then able to compare data from week 1 (the activity itself) with data from week 2 (reminiscence interviews about the activity) to identify similarities and differences in emotional responses to the activity and participants' memories of it. The same process was then repeated during the week 2 activity and week 3 interviews.

The breadth and depth of data gathered was therefore substantial with transcripts for three one-hour discussions for each of the fifty-six participants, plus EDA data for each from their three activities and from the discussions, the researchers' reflections, the photos taken, and artefacts produced.

Findings and discussion

This paper focuses on explaining and critiquing our unique mixed methods approach to understanding shared emotional memory in relation to events. Through our study discussed here we present an example of how the use of EDA tracking can enhance qualitative research methodologies in three main ways: (1) through use as an 'artefact' to prompt reflection on feelings, (2) through identifying where peaks of emotional response occur, and (3) through highlighting changes in emotional response over time. The full analysis and findings from the study will be presented in separate papers.

Participant P3 is 73 years old and has been living in rural Hertfordshire all her life. She is part of an arts and crafts group that meets regularly to work on projects for local events, clubs, and businesses. Together with four other people, she was at the time working on a banner for the local Pumpkin Festival. During the second session we attended, the banner was starting to come together, and the group was discussing details about where they wanted to place the scarecrow and the lettering. Participant P3's EDA data (depicted by the blue line in Figure 4 below and measured in μS) shows in the moment peaks of emotional response during this creative stage. If the temporal interval between stimulus (latency) and SCR peak is between 1-3 seconds, and the recovery time between stimuli is between 2-10 seconds, event-related SCRs can be identified and analysed. In Figure 4 this is, for example, the case with the peak at 10:25:30 and 10:26:50. Other elements of the data captured by the wristbands and shown in Figure 4 include: BVP (Blood Volume Pulse, red line), Accelerometer (captures motion-based activity, purple line), HR (Heart Rate, orange

line) and Temperature (green line). In some cases, EDA peaks and a sudden increase in BVP and HR go hand in hand (such as at 10:29:20 in Figure 4 below).

<INSERT FIGURE 4 HERE: *Participant P3 EDA data during activity*>

Without a further exploration of the contextual setting, however, interpretation of the EDA data is limited. Combining this approach with other qualitative methods allows a more in-depth understanding of the participants' experienced emotions (Kim and Fesenmaier, 2017; Shoval *et al.*, 2017). Observational notes, alongside the photos of the event, therefore helped to identify potential reasons for the participant's emotional peaks and can be further explored. For example, analysing all the data from this particular activity, it became evident that some of the peaks in P3's EDA data occurred during tea breaks or when the doorbell rang, whereas the above-mentioned peaks at 10:25:30 and 10:26:50 can clearly be attributed to the activity itself.

> "[10:25-10:30] the group are putting their heads together to discuss where to place the scarecrow. Participants P2 and P3 agree that the lettering should be slightly off centre to allow more space for the scarecrow. Different options are discussed, not everyone agrees." (researcher notes, 21/08/17)

The researcher notes demonstrate how the entire group was working together on the arrangement of the lettering and was very engaged at the time. However, in combination with the EDA data, P3 seemed to have had a particularly intense experience compared to P1 and P4 who were also wearing wristbands but did not experience emotional peaks during this discussion. In order to confirm these observations, during a post-activity paired interview with participants P3 and P4 two weeks later, participant P3's EDA data (Figure 4) was used as an 'artefact' to prompt reflection on feelings and to elicit more meaningful memories of emotions related to the previous activity. Using this trigger as well as a photo taken by the autographer (Figure 5) thereby helped to stimulate a depth of discussion between the researchers and participants (P3 and P4), aided recall of the activity, and released further feelings and thoughts (Emmison and Smith, 2000; Rydzik *et al.*, 2013). The conversation below illustrates how the two participants collectively recreated their memory of the experience.

<INSERT FIGURE 5 HERE: *Photo taken by 'Autographer' device during arts activity*>

I (interviewer showing them photo and EDA data from last session): What are your most vivid memories of your last session?

P4: Just being able to place everything, I think the scarecrow and the lettering, wasn't it? That was, trying to get the lettering in the right, where we thought it would be, either centred or off centre or, do you reckon?

P3: Yeah, I think… And placing the scarecrow… Towards the end, we were getting more of an idea of where we were going, weren't we?

P4: Yes. From not having a clue really.

P3: I think having got the lettering down, that really sort of set what else you could do around it.

I: Are you starting to see or experience a sort of sense of achievement from what you've done?

P3: Oh, I think so. Yeah, definitely. I was definitely getting more excited when I could see it all coming together.

P4: Whenever we do these projects it's, you know, you start out not knowing what you're doing and gradually as it goes on, I think you get more excited…

P3: I think the real sense [of achievement] becomes when you can embellish some of the things, like your scarecrow and like the pumpkins that have that detail on which you can't get to begin with.

Memories of the experience itself, as well as the process of reflecting on it, can shape and reshape the experience over time (Kim and Fesenmaier, 2015; Wood, 2015; Wood and Kenyon, 2018). Bringing together the qualitative interview data and the EDA data captured by the wristband, the following can be identified for participant P3: The process of reflecting and remembering the previous session once again triggered emotional peaks when she was talking about how she got excited to see it all coming together and the sense of achievement she started to feel (see blue EDA line in Figure 6 between 9:19-9:20). This confirms and shows similarities between earlier findings of her emotional response to the activity and her memory of it. The EDA data captured during the participatory arts activity, autographer photos and researcher observation notes were analysed together for two reasons: (1) to

discount non-specific SCR, and (2) to later use these 'artefacts' as a prompt for discussion during the post-activity interview. Reminiscence interviews with the same participants wearing Empatica E4 Wristbands helped verify EDA complex readings from live activities and contrast these with EDA complex readings from participant memory of the arts activities. The audio recordings of reminiscence interviews were again used to discount non-specific SCR and to verify EDA complex readings from participant memory of arts activities (see summary in Table 2).

<INSERT FIGURE 6 HERE: *Participant P3 EDA data during reminiscence interview*>

The example above shows how a combination of physiological measurement of electrodermal activity and photo elicitation interviews post-activity can be used to do research *with* and *for* participants, rather than *to* them (Sedgley *et al*., 2011). By engaging participants in the research process in different ways (participating in the activity, reflecting on it by looking at and providing their own interpretation of the EDA data and autographer photos, and by reminiscing with other participants), we give them opportunities to shape their own narratives and make their voices heard. Our combination of methods thereby aims to discover in the moment emotional responses to an arts activity, as well as relived and reinterpreted versions of the original experiences over time (Kirkegaard Thomsen and Brinkmann, 2009). The EDA data was beneficial in several ways. It acted as a prompt for discussions about felt emotions, it identified peaks of emotional response during the activity itself and identified how these re-emerged and changed when remembering it. This allowed us to track similarities or differences in emotional response over time. The post-activity interviews with two to four participants at a time on the other hand, were vital as they provided a collective memory of the experience, which might be different to simply remembering it alone (Hirst and Echteroff, 2008).

Conclusions and future research

Conclusions

This paper has provided an in-depth discussion of methods for investigating how tourism and event experiences create experiences and memories which trigger a range of emotional responses. We argued that reflecting, reliving and reforming these experiences can create longer term effects, particularly when they are shared with others and collective memories

emerge. Emotion and memory have been researched extensively from a psychological perspective, however, there are a number of limitations to researching emotion in an artificial lab-based environment (Riddle and Arnold, 2010), especially when taking into account that feelings do not reside in subjects or objects, but are produced as effects of circulation (Ahmed, 2004). It is only by applying innovative multi-method approaches across a range of contexts and populations that we will truly understand how extraordinary social experiences generate emotional responses and create and alter memories and attitudes. We proposed a unique combination of physiological measure and qualitative discussion to explore the emotional responses to an event experience both in situ as well as in reliving and remembering the experience with others.

Theoretical Implications

We advocated a more humanist approach to research on emotion and memory in a tourism and events context, where our suggested methods are more 'natural' to the participants' behaviours and the contextual environment. The paper developed and evaluated a unique combination of physiological measurement of electrodermal activity through the use of Empatica E4 wristbands, together with photo elicitation (or visual stimuli) interviews post-activity in order to empower participants as co-creators of knowledge. Our theoretical discussion of the proposed methodology provided a critical evaluation of EDA data capture and analysis. It highlighted how EDA data can be used as an 'artefact' to prompt reflection on feelings and emotions, as well as to identify where peaks of emotional response occur and how emotional responses may change over time.

However, we appreciate the highly subjective nature of the social environment in which our research is situated and that it is framed and bound by field theory (Lewin, 1946) which stipulates that in order to understand behaviour the individual and their environment must be considered as one constellation of independent factors. A study using the methods set out within this paper has the potential to advance field theory. The notion of 'field' refers to all aspects of individuals in relationship with their surroundings and conditions, that apparently influence the particular behaviours and developments of concern, at a particular point in time" (Lewin, 1946, p. 338).

Practical Implications

In terms of practical implications, within the research environment we acknowledge the power of others in the form of peer pressure to solicit or regulate behaviour and emotional

responses. Due to the exploratory sequential design of methods presented here we recommend that future research is longitudinal to ensure that greater credibility, transferability, dependability, and confirmability is realised through data triangulation over time (Decrop, 2004).

It is important that researchers apply a consistent criterion in their approach to data capture, one which will enable ER-SCR's to be collected naturally without stimuli manipulation or associated bias, as the capture of EDA complex data within the fields of tourism, leisure, hospitality and events can be highly problematic. This is due to the varying demographics of any given population, the diverse range of environments, and in identifying which variables can be considered as 'a-priori' i.e. whether an SCR is actually event-related or non-specific. Applying a consistent approach will ensure that no ER-SCR's are overlooked within a particular research environment and therefore the likelihood of an accurate interpretation of an individual's EDA complex is increased (Benedek and Kaernbach, 2010).

Limitations and Future Research

Limitations of conventional methods used in tourism and events, such as surveys, interviews, focus groups, self-reporting methods and observation, have already been mentioned above and have been discussed by many others (e.g., Tribe, 2008; Rakic and Chambers, 2010; Rydzik *et al*., 2013; Kim and Fesenmaier, 2015; Li *et al.*, 2015). We acknowledge that the same limitations apply to our methods of collecting and analysing interview and observation data, in the sense that participants might be subject to social desirability bias or other environmental conditions during the interviews. Therefore, any interpretation of the interview data, observational notes and photos taken using the autographer can be subject to researcher bias. It should also be noted that the visual artefacts presented to participants during the reminiscence interviews were chosen by the research team. Presentation and discussion of a different artefact could potentially have triggered a different emotional response and memory.

We further recognise that there is potential for signal distortion and pollution whilst collecting EDA data. For example, respondents should be in good health as coughs, sneezes, and deep respiratory movements can generate SCRs which lead to false readings. Additionally, research suggests that as high as 10% of participants are estimated to be non-responders (known as hypo-responsive) in terms of their EDA (Dawson *et al*., 2001; Benedek and Kaernbach, 2010; Boucsein, 2012; Braithwaite *et al*., 2015). As well as this some participants may have cardiovascular abnormalities which can, in some circumstances, produce rhythmic artefacts (spiking) in the EDA. Braithwaite *et al.* (2015) suggest that if

attempts to get a good EDA signal fail this might be the result of the participant being hypo-responsive. In this case, it may simply not be possible to obtain high quality EDA measurements from this individual.

The focal point of our study was on the individual and their relationships with creative arts stimuli, and with other members of the group. We suggest that the focus of future studies could be extended beyond 'consumers' to organisational settings. For example, hospitality service providers, hosts/ activity leaders, exhibitors, guides or event volunteers. We further suggest that the methods proposed here could easily be applied to generate understanding across different contexts where memory and group association are of significant importance such as tourism and travel story sharing, hotel and restaurant experiences, music events, festivals, conferences and human resource training events. The use of EDA monitoring and self-reflection post-experience opens up new avenues of research to address a number of questions within hospitality marketing. For example, how do post-visit experiences affect the memory of the visit and how is this influenced by others. This might be particularly pertinent in times of social media influence and the proliferation of hospitality rating sites. The method has the potential to provide real insights into the process through which the views of others change how visitors remember what they felt.

Continuing research in this area provides an opportunity to create a database of individual narrative cases through replicated research. This is much needed if generalisation is to be achieved across the contexts and fields highlighted in this paper or those argued for through traditional quantitative approaches such as those of neuroscience.

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Table 1. Definitions for Electrodermal components

Measure	**Definition**
Skin conductance level (SCL)	Tonic level of electrical conductivity of skin
Skin conductance response (SCR)	Phasic change in electrical conductivity of skin
Non-specific SCR (NS-SCRs)	SCRs that occur in the absence of an identifiable eliciting stimuli
Frequency of NS-SCRs	Rate of NS-SCRs that occur in the absence of identifiable stimuli over time
Event-related SCR (ER-SCR)	SCRs that can be attributed to specific eliciting stimuli

(Adapted from Dawson *et al.*, 2001 Braithwaite *et al.*, 2015).

Table 2. Mixed Data Capture Methods employed over three-week periods

Method sequence number	Week employed (1.-3.)	Data collection method	Justification for use	Duration
1.	1	Preliminary Questionnaires	To validate respondents, live in a rural area & are aged over 70	n/a
2.	1-3	Stimulus activity; Participants wearing Empatica E4 Wristbands	Collection of EDA complex data across Stimulus activity; Participatory Arts activities	2 -4 mins Baseline 60 mins stimulus activity
3.	1-3	Audio recording of Stimulus activities	Verification of EDA complex data, discount Non-specific SCR (NS-SCRs)	60 mins
4.	1-3	Autographer digital camera	Verification of EDA complex data, discount Non-specific SCR (NS-SCRs)	60 mins
5.	1-3	Researcher Observation notes	To document emotional responses during stimulus activities to discount Non-specific SCR (NS-SCRs)	n/a
6.	2 & 3	Reminiscence interviews; Participants wearing Empatica E4 Wristbands	Verify EDA complex reading from live activities and contrast with EDA complex readings from participant memory of arts activities	2 -4 mins Baseline 60 mins
7.	2 & 3	Audio recording of Reminiscence interviews	Verify EDA complex readings from participant memory of arts activities	60 mins

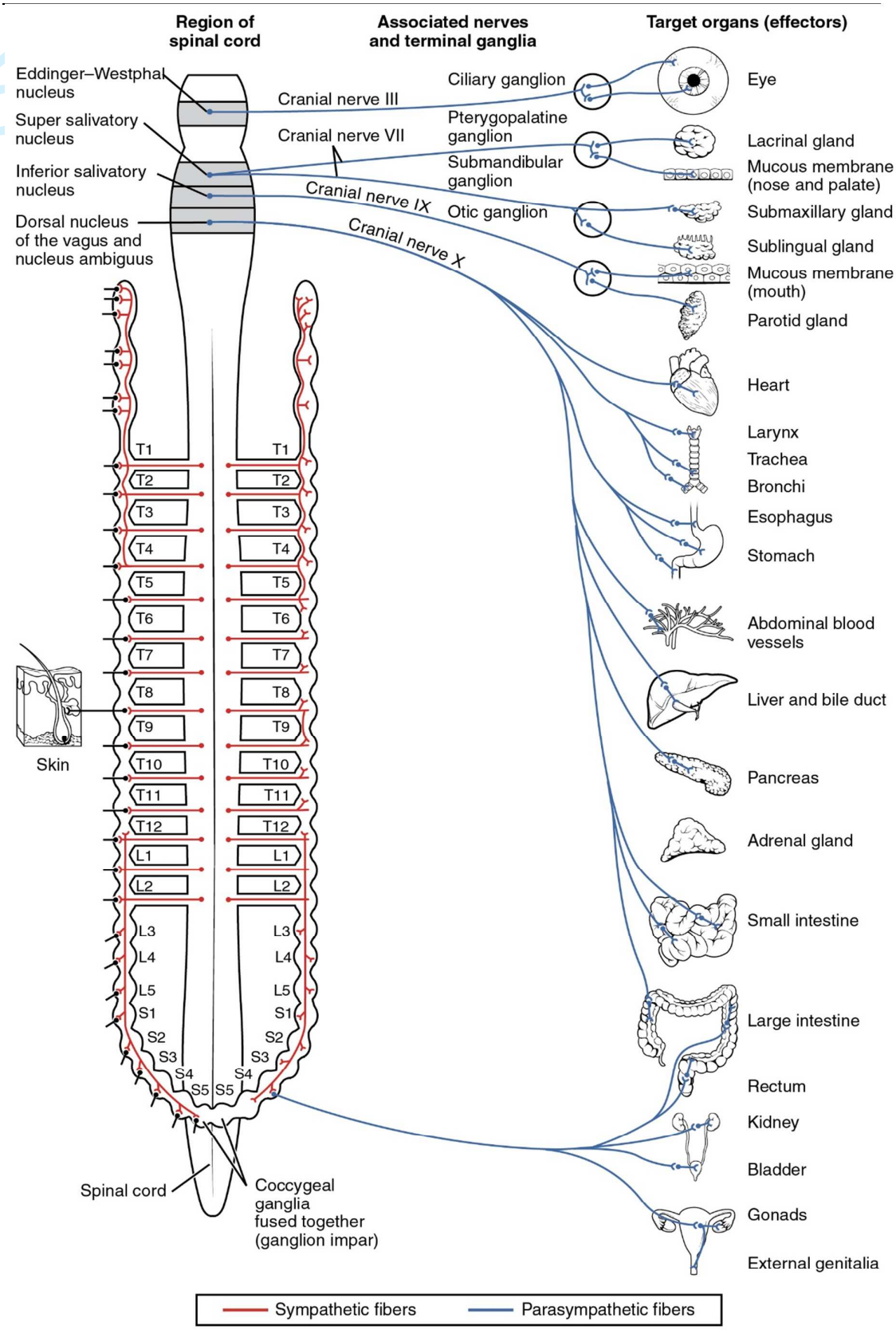
Authors, 2017

Table 3: Multi-site samples

Location	Number of participants
Northallerton	17
Thirsk	15
Pirton	6
Codicote	6
Whitwell	6
Royston	6
Stanstead Abbots	6
Total	62

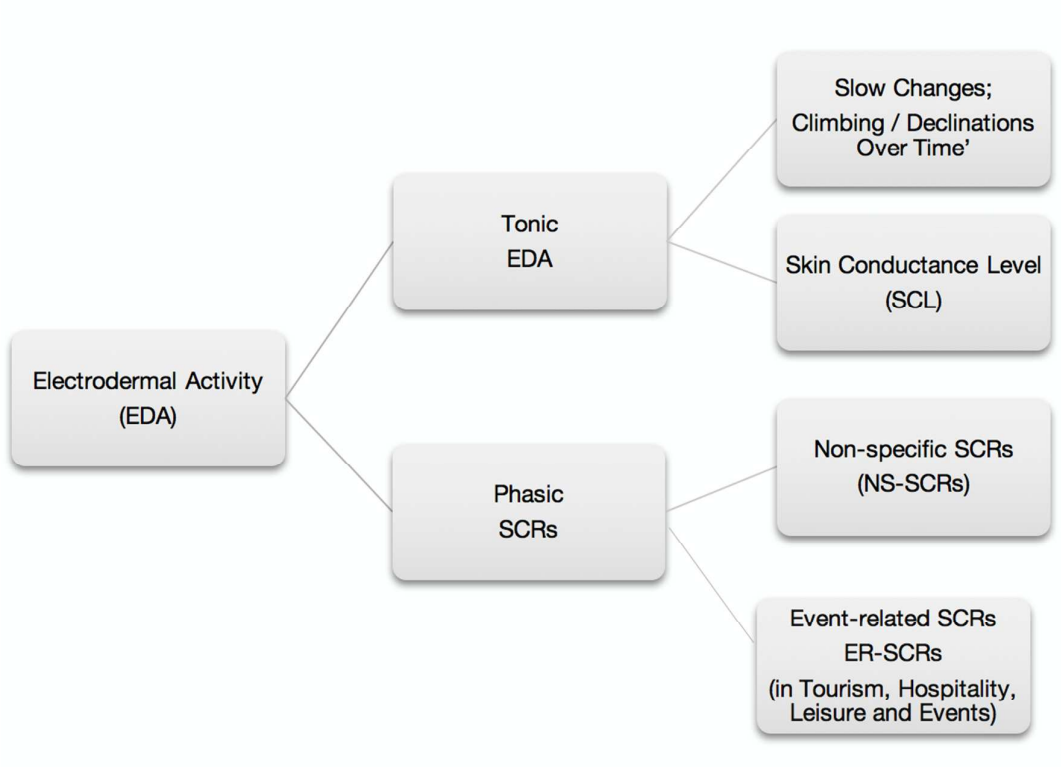
Authors, 2017

Figure 1. An illustration of Parasympathetic and Sympathetic Activity in the Human Body



Source: Anatomy & Physiology, Connexions, (2013) http://cnx.org/content/col11496/1.6/

Figure 2. Flow Diagram demonstrating the EDA complex



Adapted; Dawson *et al.*, 2001

Figure 3. Empatica E4 Wristband Schematics

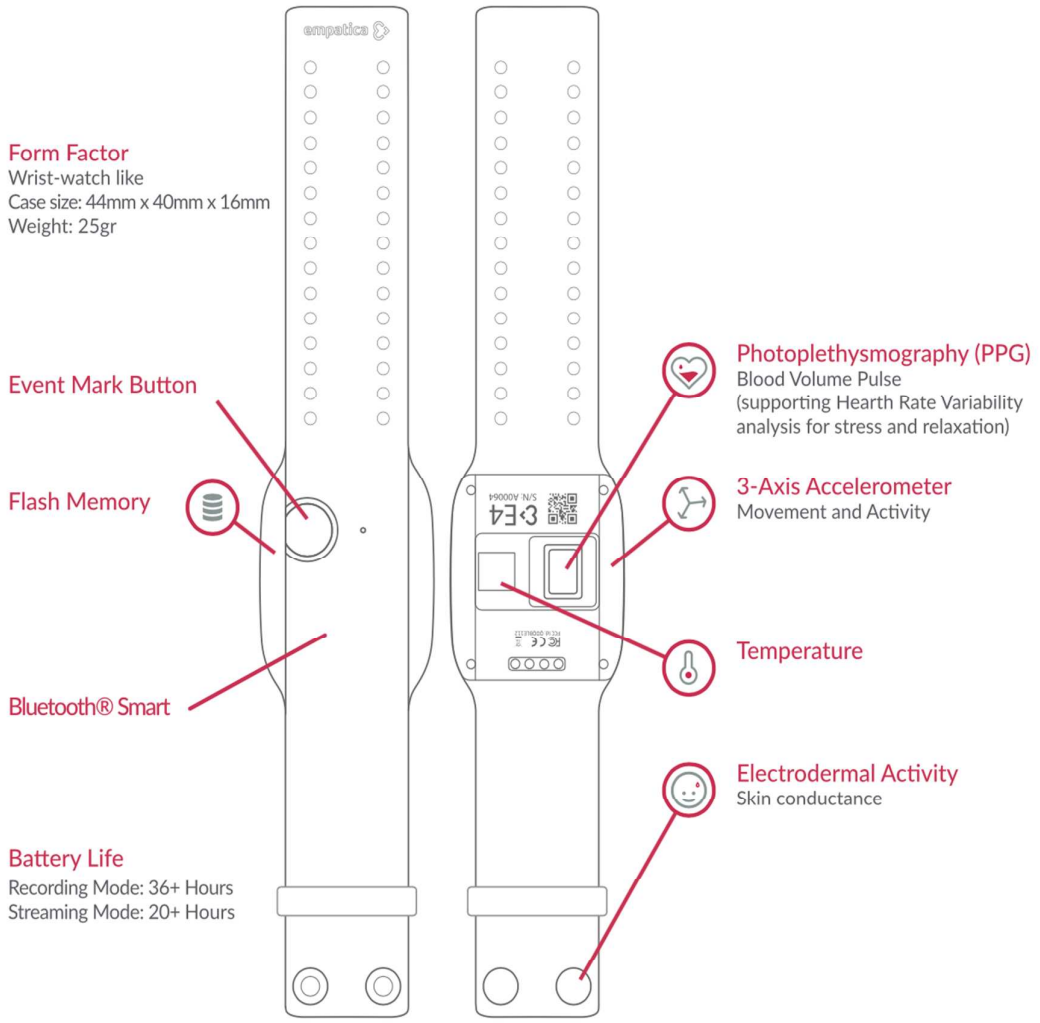
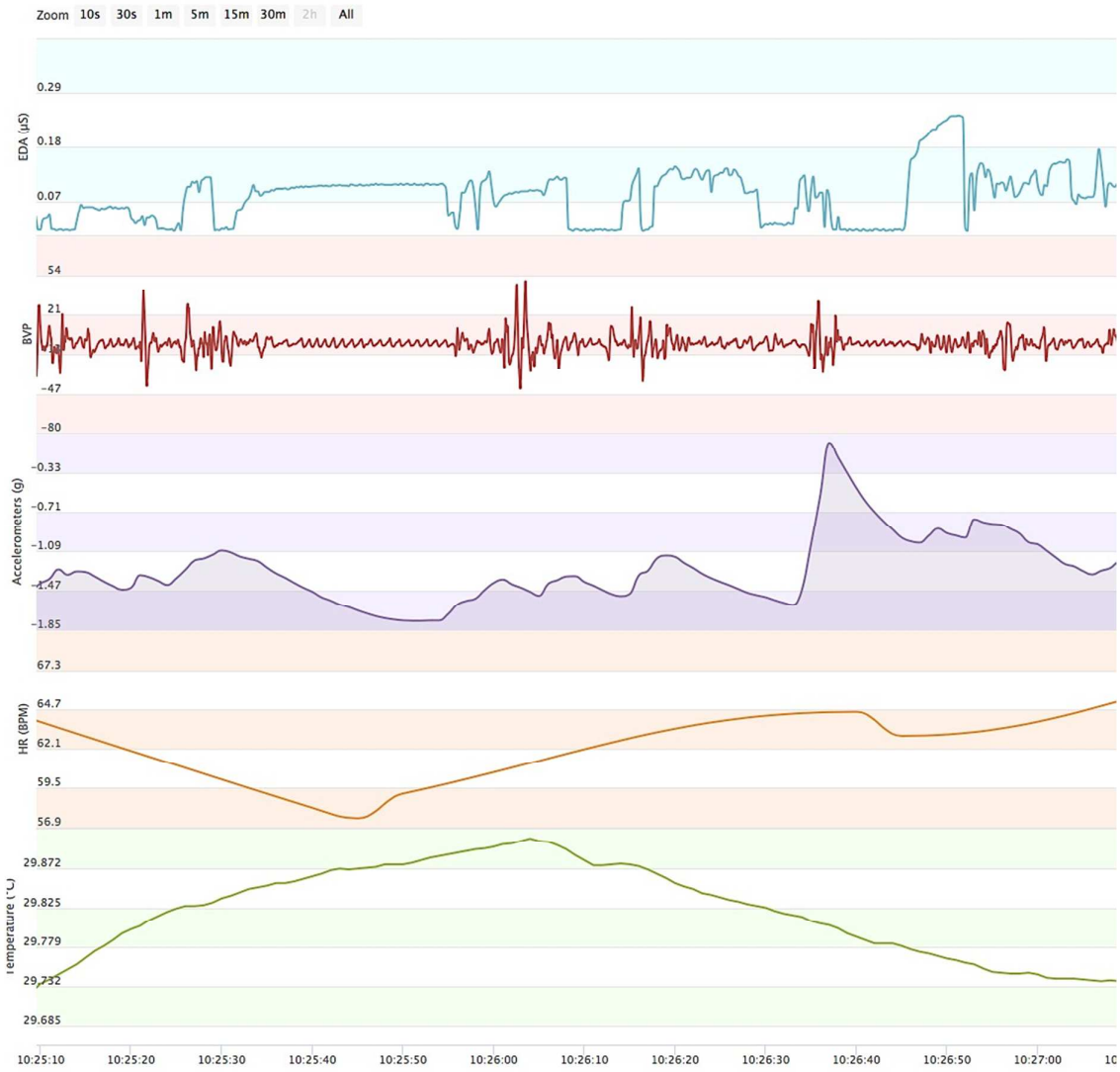


Image Source: https://empatica.app.box.com/v/E4-User-Manual

Figure 4: Participant P3 EDA data during activity

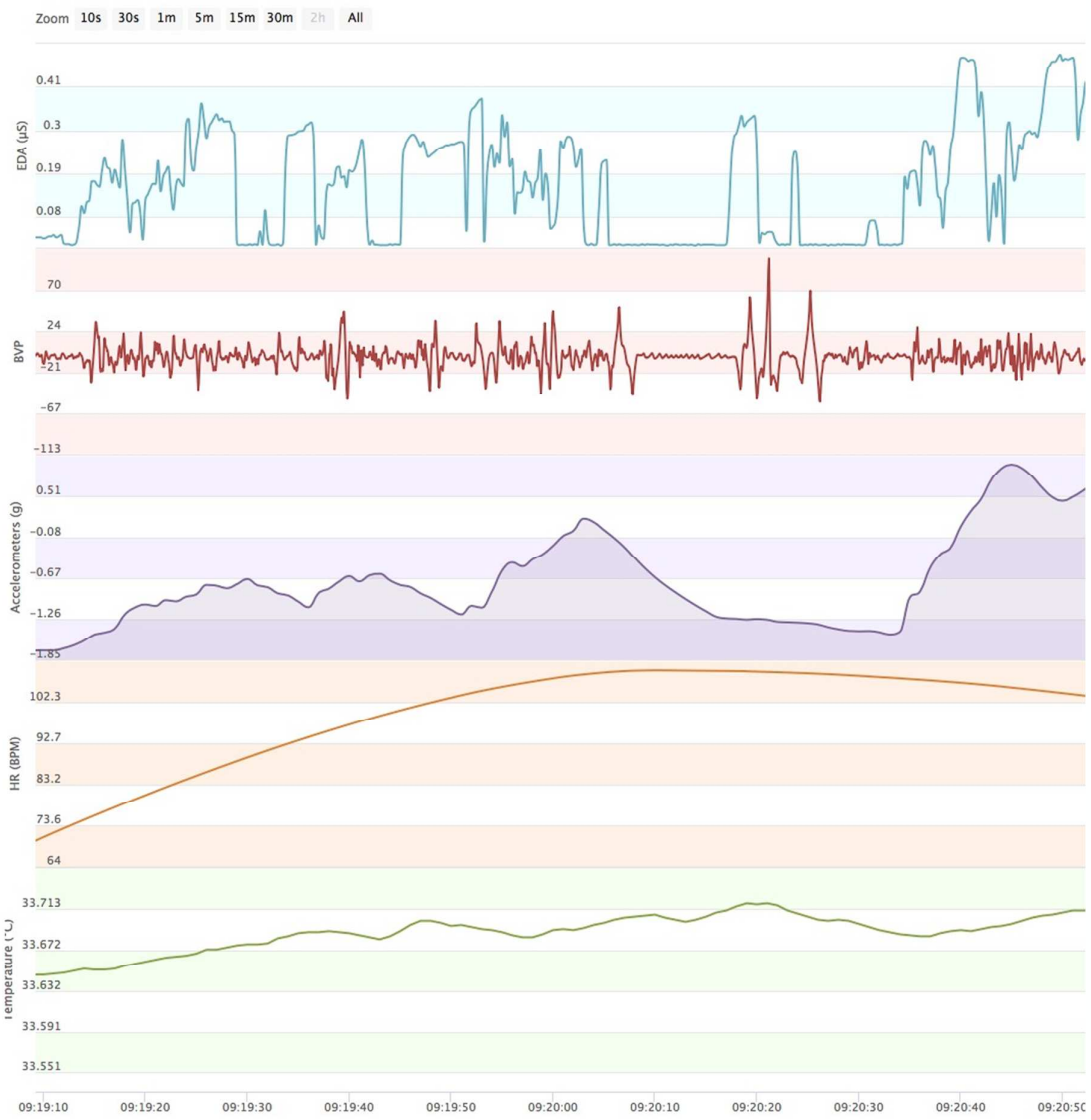


Source: 'Empatica Connect', 2017

Figure 5: Photo taken by 'Autographer' device during arts activity

Source: Pirton Arts and Crafts Group Participant, 2017

Figure 6: Participant P3 EDA data during reminiscence interview



Source: 'Empatica Connect', 2017

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2. Revisit the Discussion and Conclusions sections one more time to better answer the "So What" question. There should be four sub-sections under this section: (1) Conclusions, (2) Theoretical Implications, (3) Practical Implications and (4) Limitations and Future Research.	We have revised this section, re-emphasised the purpose of the paper and restructured it using the suggested four sub-headings.
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