Chapter 7
EEG KISS: Shared Multi-modal, Multi Brain Computer Interface Experience, in Public Space

Karen Lancel, Hermen Maat and Frances Brazier

Abstract Can shared intimate experience of social touch be mediated through multi-brain-computer interface (Multi-brain BCI) interaction in public space? Two artistic EEG KISS orchestrations, both multi-modal, multi-brain BCIs, are shown to create novel shared experiences of social touch in public space. These orchestrations purposefully disrupt and translate known forms of face-to-face connection and sound, to re-orchestrate unfamiliar sensory syntheses of seeing, hearing, touching and moving, connected to data-visualization and audification of brain activity. The familiar sensory relations between 'who you kiss and who is being kissed, what you see and what you hear' are captured in a model of digital synaesthetics in multi-modal multi brain BCI interaction for social touch. This model links hosted self-disclosure, witnessing, dialogue and reflection to intimate experience in public space through syntheses of the senses. As such, this model facilitates the design of new shared intimate experiences of multi modal multi brain BCI interaction through social touch in public space.

Keywords Social engagement · Interactive digital art · Shared experience · Intimate touch · Multi-modal multi-brain computer interface · Public space

7.1 Introduction

Can shared intimate experience of multi-brain-computer interface interaction be mediated through social touch? Artistic orchestrations of multi-modal BCI mediated interaction have been shown to create novel shared experiences (Abramovic et al.

K. Lancel (✉) · F. Brazier
Delft University of Technology, Delft, The Netherlands
e-mail: lancel@xs4all.nl

F. Brazier
e-mail: F.M.Brazier@tudelft.nl

K. Lancel · H. Maat
Artists duo Lancel/Maat, Amsterdam, The Netherlands
e-mail: maat@xs4all.nl

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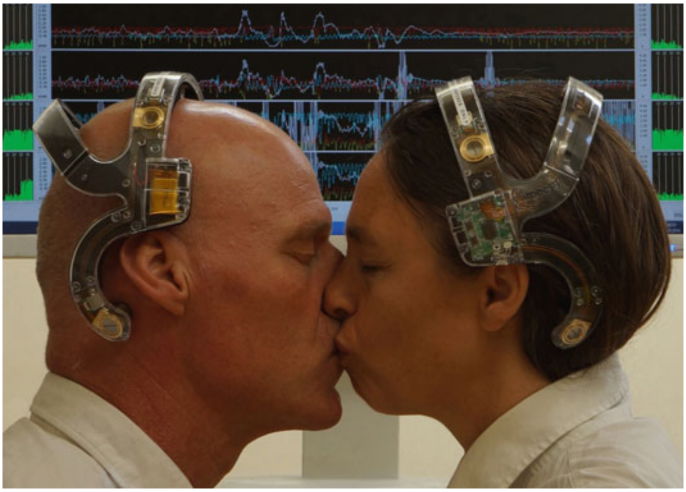

Fig. 7.1 EEG KISS (EEG KISS. Promotion Photo. © Lancel/Maat 2014)

2014; Dikker et al. 2016; Mori 2005; Novello 2016; Sobell 1974, 2001). They purposefully disrupt and translate known forms of face-to-face connection and sound, to re-orchestrate unfamiliar sensory syntheses of seeing, hearing and moving, connected to data visualization and audification of brain activity, often in playful exploration (Lysen 2019; Prpa and Pasquier 2019). This paper extends insights gained in such multi-modal BCI mediated orchestrations focusing explicitly on the effects of design choices for shared intimate experience of multi-brain multi-modal BCI interaction through social touch. Digital synaesthetic (Gsöllpointner et al. 2016), shared intimate social touch experience is explored and an integrated model of multi-modal, multi-brain BCI interaction for social touch is proposed. Two BCI mediated artistic orchestrations performed internationally by Lancel/Maat[1] are analysed to this purpose. In these artistic orchestrations, participants are invited to feel, see, touch and share an intimate kiss experience. The familiar relation between 'who you kiss and who is being kissed, what you see and what you hear' is purposefully disrupted and explored for a new, shared sensory synthesis (Fig. 7.1).

[1]Lancel/Maat are artistic partners whom have been working together since 1998. Their works include the artistic performance installation EEG KISS discussed in this paper. Their works have been presented in Venice Biennial 2015—China Pavilion; Ars Electronica Linz 2018; ZKM Karlsruhe; Transmediale Berlin; Stedelijk Museum Amsterdam; Rijksmuseum Amsterdam; World Expo Shanghai 2010; HeK Haus for Electronic Art Basel; ISEA2016 Hongkong; ISEA2011 Istanbul; Banff Center Canada; RIXC Riga; V2-Institute Rotterdam; Beall Center for Art + Technology USA; BCAC Beijing; 2nd TASIE Art Science exhibition at Millenium Museum Beijing; Third TASIE Art Science exhibition at Science & Technology Museum Beijing; Public Art Lab Berlin. http://www.lancelmaat.nl/work/e.e.g.-kiss/.

7.2 Related Work

Brain Computer Interfaces are being explored by a growing community of international artists (Lysen 2019; Prpa and Pasquier 2019). In interactive performances, installations, cinema, multi-user game and theatre, artists are exploring new types of BCI interaction that are often not primarily anchored in scientific understanding of physiological data (Delft University of Technology 2015). These installations often focus on aesthetics, ethics and affective experience (Gürkök and Nijholt 2013; Roeser et al. 2018).

Brain Computer Interfaces (BCI) enable direct communication between brain activity (the input) and control of (internal or external) devices (the output). Often, BCIs process and combine representations of brain activity with other audio, visual and haptic information. BCI interfaces combined with virtual reality (VR) and augmented reality (AR) technologies have, for example, been designed to enhance realistic, immersive experiences, using haptic sensors, motor imagination and feedback based on action visualization, for art, entertainment, training, therapy, sex, gaming, robotics (Gomes and Wu 2017; Lupu et al. 2018; Nijholt and Nam 2015; Ramchurn et al. 2019). In other works, functional Near Infrared Spectroscopy (fNIRS) has been used in BCI Interfaces to explore arousal of shared engagement (Bennett et al. 2013; Lancel/Maat and Luehmann 2017).

Research of direct brain-to-brain communication between humans, or between humans and robots enhanced with Artificial Intelligence technologies, using EEG to record electrical activity in the brain and transcranial magnetic stimulation (TMS), is still in an early stage, but is promising (MIT 2018).

BCIs are designed for single users, or for multiple users in multi-brain interfaces (Multi-brain BCI) (Nijholt 2015). Multi-brain BCIs process brain activity of two or more participants as input for shared experience of joint (parallel or sequential) brain activity.

In some cases, output is based on 'spontaneous' (Gürkök and Nijholt 2013) participant input (Sobell 1974; De Boeck 2009; Casey 2010). In other cases, output is based on 'controlled' (Pike et al. 2016) or 'directed' input (Mori 2005; SPECS 2009). Sobell (1974) for example, explores the influence of different augmented representations of joint brain activity as output, predominantly based on 'spontaneous' participant input. In contrast, Dikker et al. (2016) and Gabriel (1993) have designed systems in which individual participants purposively influence their individual input (e.g. altering between level of arousal) to collectively 'direct' the output of the multi-brain BCI. In other systems, the threshold between 'spontaneous' and 'directed' is mixed (Novello 2016; Rosenboom 1990; Sobell 2001). In other artistic orchestrations, multi-brain BCIs have been used to direct brain activity synchrony in coordinated social interaction to explore empathy and connectedness (Dikker et al. 2016).[2]

[2]Note, that although many of these orchestrations combine co-located forms of interaction sometimes these are networked from different locations (Casey 2010). Multi-user game orchestrations, which are not subject to this chapter, are, for example, often networked from different locations.

Fig. 7.2 EEG KISS Orchestration 2 at Stedelijk Museum Amsterdam, 'Stedelijk Statements' Series 2017 and UvA University of Amsterdam 'Worlding the Brain Conference' 2017. © Lancel/Maat

However, although current BCI research includes hedonic and affective touch experience, intimate touch communication is not yet well understood (Björnsdotter et al. 2014). fMRI research shows that tactile experiences of slow (1–10 cm/s), gentle stroking (caressing) of the skin and the system is associated by participants with affection. This is in line with research that shows that intimate touch provides a means to share empathic, intimate emotions (Van Erp and Toet 2015), for which (a) vulnerability and self-disclosure, (b) physical proximity and (c) witnessing and responsibility are essential (Lomanowska and Guitton 2016) (Fig. 7.2).

Designing for witnessing (Nevejan 2007) and embodied vulnerability as an 'intimate aesthetic' (Loke and Khut 2014) through touch, is better understood with respect to shared experiences in hosted performance art with participants and spectators (Benford et al. 2012; Cillari 2006–2009; Clark 1963–1988; CREW 2016; Lancel et al. 2018; Osthoff 1997; Vlugt 2015).[3] In such artistic orchestrations, intimate touch is used to evoke embodied and cognitive reflection (Kwastek 2013).

In interactive digital art, components of intimate experience have been orchestrated based on aesthetic principles of disruption, unfamiliarity, risk and unpredictability in digital synaesthetic (Gsöllpointner et al. 2016) orchestrations. These aesthetic principles incite ambivalence and immersion, as essential conditions for engagement and reflection to emerge (Benford and Giannachi 2012; Kwastek 2013). Such orchestrations explore relations between brains, bodies, personal embodied

[3]Live Art, http://www.thisisliveart.co.uk/, last accessed 2018/10/20.

knowledge and perception, technologies and the surrounding environment (Gill 2015; Lysen 2019).

However, multi-modal, multi-brain orchestrations, for shared intimate experiences, through orchestration of social touch, are, to the authors' knowledge, not yet explored.

7.3 Artistic Motivation

This chapter explores the effects of multi-modal, multi-brain BCI designs of two artistic orchestrations on shared engagement through intimate touch. This section describes these two artistic orchestrations of the multi-modal multi-brain BCI interface EEG KISS (Lancel/Maat 2014–2018) from the perspective of the artists Lancel and Maat.

7.3.1 Introduction to the Artists' Research on Mediated Touch

Lancel and Maat have explored new approaches to interfacing mirroring affective touch. In their artworks, the person touching and being touched does not have to be the same (telematically present) person to whom the haptic connection is attributed (Lancel et al. 2018). Paradoxically, in these orchestrations, participants are requested to touch or caress themselves to haptically relate with other participants. For example, in the artwork Saving Face (Lancel/Maat 2012), based on use of face recognition technologies, participants are invited to caress their own faces to visually connect with others on an electronic screen. In the artwork Tele_Trust (Lancel/Maat 2009), participants wear a smart textile, full body covering 'data-veil'. Participants are invited to caress their bodies to connect with others through smart phones. In both artworks participants experience novel haptic connections from an individual to others in public, digitally distributed environments.

This chapter describes two artistic orchestrations that explore new ways to similarly create a unique sense of communal haptic connections with others in the network. These two orchestrations have been designed by the artists to be both 'expressive' and 'magical', as defined by Reeves et al. (2005). As an 'expressive' interface, it has been designed to attract people, inviting them to participate, when encountered with its 'magical' and secretive nature. 'Spontaneous' EEG interaction between participants is part of the design. Brain signals during intimate interaction of kissing are made explicit to facilitate a shared experience of social touch through reflection and dialogue.

7.3.2 EEG KISS: Short Description of Two Artistic Orchestrations

In two EEG KISS, multi-modal, multi-brain BCI orchestrations (performance installations), shared intimate experience of social touch is explored. Participants are invited to feel, see, touch and share an intimate kiss to incite both an aesthetic and a sensory experience.

Both orchestrations combine one-to-one and multi-user participation. Members of the public are invited to kiss while wearing EEG headsets, as Actors in the orchestration. The 'kissing' brainwaves of the Actors, are measured and are made visible as EEG data, shared with surrounding Spectators. Spectators, in turn, are invited to watch the kiss. In the second orchestration, the EEG data of the kiss are translated real-time to a floor projection that encircles the kissers with their real-time streaming EEG data. The same data are 'translated' into a music score generated by the brain computer interface (based on a novel algorithm design to this purpose).

These artistic orchestrations have been designed to provide an immersive, engaging environment for intimate experiences in shared multi-modal, multi-brain computer interaction through social touch. A Host facilitates this process.

7.3.3 Design of Two EEG KISS Orchestrations

This section describes the technical, spatial and social design of two EEG KISS orchestrations, depicted in Fig. 7.3. The visual familiarity with aesthetics of medical BCI representations is purposefully deployed by the artists to evoke reflection, on current expectations towards scientific validations of intimate interaction.

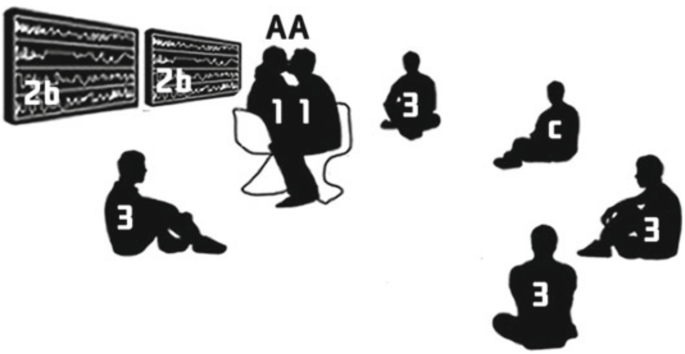

Fig. 7.3 Spatial model of digital synaesthetics in multi-modal multi brain BCI interaction for social touch: Artistic Orchestration 1 © Lancel/Maat and Studio Matusiak (2015)

Technically, the orchestrations consist of 2 EEG headsets[4] with four contact points on the skull (A) of which three positioned in the motor cortex. The brain activity is translated to a multi-modal, data visualization on two individual screens (2b) or as a floor projection that encircles the kissers in Orchestration 2 (2b in Fig. 7.9).

Spatially, two chairs are positioned across from each other, central stage, together forming ‘a love seat’, for Actors to take place and for Spectators to gather around.

Socially, people are invited to participate in various roles: that of Actor or Spectator. The staged acts of Actors kissing (1), have been designed to be ‘performative’.[5] Spectators (3) view from a distance (and can become Actors themselves). They watch the kissing and the EEG data.[6] In Orchestration 2, they data audification is added. Aspects of Hosting, data visualization and data audification are described in the sections below.

7.3.3.1 Host

A Host (C), performed by the artists or by volunteers, is part of the interface design. The performance procedure is depicted in Fig. 7.4.

In Phase 1 Actors interact with the Host. The Host explains that the artistic orchestration explores and studies social engagement through mediated touch and performative interaction, using words such as ‘online kissing’, ‘digital touch’, ‘kissing online’, ‘brain technology’, ‘share’, ‘privacy’ that are internationally understood. Body language is used to visualize ‘kissing’ and ‘being close’. The explanation serves both as a spoken manual and as contextualization indicating that EEG data primarily measure muscle tension and that scientific interpretation of EEG data from intimate kissing is not possible in this artistic orchestration.

Actors are asked to firstly close their eyes before kissing, secondly take all the time they need to kiss and thirdly, to keep their eyes closed when they feel the kiss is ending and to remember how the kiss felt. The Host then places EEG headsets on the Actors’ heads and asks them to close their eyes, to concentrate and to reflect on the experience to come.

In Phase 2, the Host determines when to proceed, based on observations of the Actors’ embodied behaviour and movements as well as the visual EEG data

[4]The wireless EEG headsets (IMEC 2014) are instrumented with dry electrodes. They measure at four contacts points on the skull [cz, pz, c3, c4 (Teplan 2002)]. Measuring emotional arousal is not the focus of these headsets, as the locations primarily associated with emotions [(pre)frontal cortex] are not measured. https://www.elektormagazine.com/news/wireless-activeelectrode-eeg-headset, last accessed 2018/12/17.

[5]Instead of referring to the notion of *performance* as a form of ‘role-playing’, *performativity* (Butler 1990) is, in this context, considered to be a repetitive act designed for public spaces, to share reflection on social engagement.

[6]Spectators can only participate as Actors by giving verbal consent for recording all EEG data non-anonymously, by adding their first names. Adding their names also serves a second purpose, namely to identify their own contribution, to be able to engage with their replayed data visualization at a later date.

Fig. 7.4 Performative actions in both artistic EEG KISS orchestrations of Actors and Host

sequences. Once the Host observes that the participants are sitting quietly and the EEG data sequences depict low frequencies, the Host softly tells them they can start kissing.

In Phase 3, the Host then witnesses the Actors' performativity of kissing from a short distance, ensuring a feeling of safety.

In Phase 4, after kissing, the Actors keep their eyes closed to remember how the kiss felt. When necessary, the Host reminds Actors to keep their eyes closed and remember what they have experienced.

In Phase 5, the Actors again interact with the Host. Once the Host observes that Actors have started to talk and look around, their headsets are removed. The Host then mediates reflection through an open-ended dialogue, with questions such as: (1) How did your kiss feel and how did your kiss feel in EEG data? (2) Did you hear the sound during kissing and did it affect your kiss? (3) Did you feel the audience around? (4) How is this kiss different from your other kisses? (5) How intense did you experience the presence of Spectators, artificial system and data audification while kissing? (6) Can your kiss be measured? On a scale of 1–10: how intimate was this kiss? (7) Would you agree to save your kisses in a database to be used by others?[7] The Host, in fact, mediates between physical and virtual presence, between experience of kissing and representing datafication, between public space and intimate space. The Host mediates the multi-modal and multi-brain feedback processes between Actors, Spectators, data visualization and data audification.

7.3.3.2 Data Visualization

The EEG data visualization (2b in Fig. 7.3) emerges real-time from acts of kissing, in two different orchestrations. The first orchestration shows individual data of two kissing persons on separate screens.[8]

In the second orchestration (2b in Fig. 7.9), both data sequences are integrated into one visualization. The separate data sequences are visually placed on top of each other[9] in different colours, to both compare individually and merge. Spatially, the combined data sequences are projected real-time around the Actors kissing as 'Dancing Data', as a floor-projection designed to function as a dynamic stage, bridging and isolating Spectators and Actors in communal patterns and flow.[10]

The data sequences in both orchestrations are derived directly from the four electrodes and are shown as separate 'lines' on the screen. Top-down, the first three 'lines'

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[7] Note that these conversations are an essential part of the artwork and are not recorded.

[8] In this visualization, the feedback of starting and ending of kisses enable Spectators to synchronize the Actors kissing to the visualization of EEG data. The markers are activated by the Host, based on observing participants starting and ending their acts of kissing.

[9] The data-sequences are visually placed on top of each other without fusing them previously.

[10] In both orchestrations, data sequences differ in each performative phase (Fig. 7.4).

When Actors close their eyes from Phase 1 to Phase 2, waves become smaller. However, sometimes, interestingly, they seem to synchronize and 'flow.' In those cases, visual sequences move like waves that cross each other rhythmically.

are the data from the channels C3, Cz and C4, showing measurements from the motor cortex, including measurements of sensory and motor functions (Teplan 2002),[11] and weak motory intention (mu rhythms) (although more activities are reflected in C3 and C4 in comparison to Cz). In measurements of all positions (including Pz), motor artefacts (such as of neck, face and tongue muscles) measurements and alpha rhythms (due to the participants having their eyes closed while kissing and reflecting) and cognitive relaxation are measured. In the visual feedback, the measured arousal activity is not separated from the measured motor cortex activity. As a consequence, the data visualization predominantly shows motor intention and body movement of kissing.

7.3.3.3 Data Audification

In the second orchestration, a sound based sensory feedback module has been added[12] to enable Actors and Spectators to share multi-modal neurofeedback of the act of kissing 'digital synaesthesia'. The sound of each kiss is unique.

Technically, the algorithm on which the sound is based makes use of pre-defined combinations and averages of both of the participants' EEG data signals, to generate sound patterns.[13] The algorithm adapts to the various performative phases (Fig. 7.4), with different sound patterns, separated manually by the Host.

A 'sound flow' is acquired by crossfading separate sound patterns, as 'spheres', based on artistic choices.[14] In phases 1 and 5, the algorithm generates soft, 'ticking and crackling' sound patterns (by electric disturbances of the 50 Hz system). In phases 2 and 4, 'water bubbles tickling' sound patterns are dominant (based on low tones). In phase 3 (during kissing), the sound of phase 2 is combined with sparks of bells tingling (achieved through soft high tones).

7.4 Disruption for Engagement

These two multi-modal, multi-brain orchestrations focus on intimate touching, of kissing in public. Design of engagement for participants is based on disruption, as an aesthetic principle to orchestrate experiences of unfamiliarity, unpredictability and risk, to evoke ambivalence, immersion and reflection. Sensory perception of seeing and touching while 'intimately kissing in public' is disrupted. A new interaction between Spectators, Actors and EEG data is re-orchestrated, in three interdependent

[11] These functions relate to processing touch and sensation as well as keeping track of the location of body parts (proprioception).

[12] The algorithm and sound were designed in collaboration with Tijs Ham (STEIM Amsterdam). In his artworks he applies programming, live-electronics techniques and system design. https://www.soundlings.com/staff/tijs-ham/, last accessed 2019/1/30.

[13] In the data processing, EEG signals are translated via OSC to Super Collider.

[14] This research does not focus on soundtrack valences in relation to emotion elicitation.

forms of digital synaesthetics, starting from the kiss as source, in which feedback is defined, as depicted in Fig. 7.5.

The three models in Fig. 7.5 show interdependent, cross-modal feedback processes in both orchestrations. The first shows audification feedback, the second visualization feedback and the third model shows social feedback.

(1) In the audio-feedback, the direct sensory intimate connection between Actors is disrupted through amplified, EEG data audification, for kissing Actors and Spectators to share. The Actors' brain activity affects the BCI input and the brain activity itself is affected by the BCI output, and as a consequence, in fact input and output inform a loop (Gürkök and Nijholt 2013).
(2) The visual connection Actors and Spectators is disrupted when Actors close their eyes to kiss. The kissing Actors' brainwaves are translated to a EEG data visualization for Spectators to watch. They watch and compare an aesthetic, ambivalent orchestration, of both physical acts of kissing and an abstract, digital data visualization that represents the kiss.
(3) Social feedback builds on the witnessing Spectators in relation to the self-disclosure of Actors and discussions with the Host on embodiment and cognitive reflection with both Actors and Spectators.

The fourth model (Fig. 7.6) combines all models in an integrated model of digital synaesthetics in multi-modal, multi brain BCI feedback processes for shared intimate experience of social touch.

7.5 EEG KISS: Two Artistic Orchestrations

This section analyses the two artistic orchestrations described above to answer the question: Can shared intimate experience of social touch be mediated through multi-brain-computer interface (multi-brain BCI) interaction? These orchestrations are evaluated based on interaction between the components described above and depicted in Figs. 7.5 and 7.6.

7.5.1 Research Method

The effects of the artistic design choices behind these two artistic orchestrations are analysed on the basis of (1) observations (by the Host) of Actors and Spectators' actions and reactions; (2) thick descriptions of open ended interviews with Actors and Spectators. The analysis is further based on (3) photo and short video documentations that support these observations, when available.

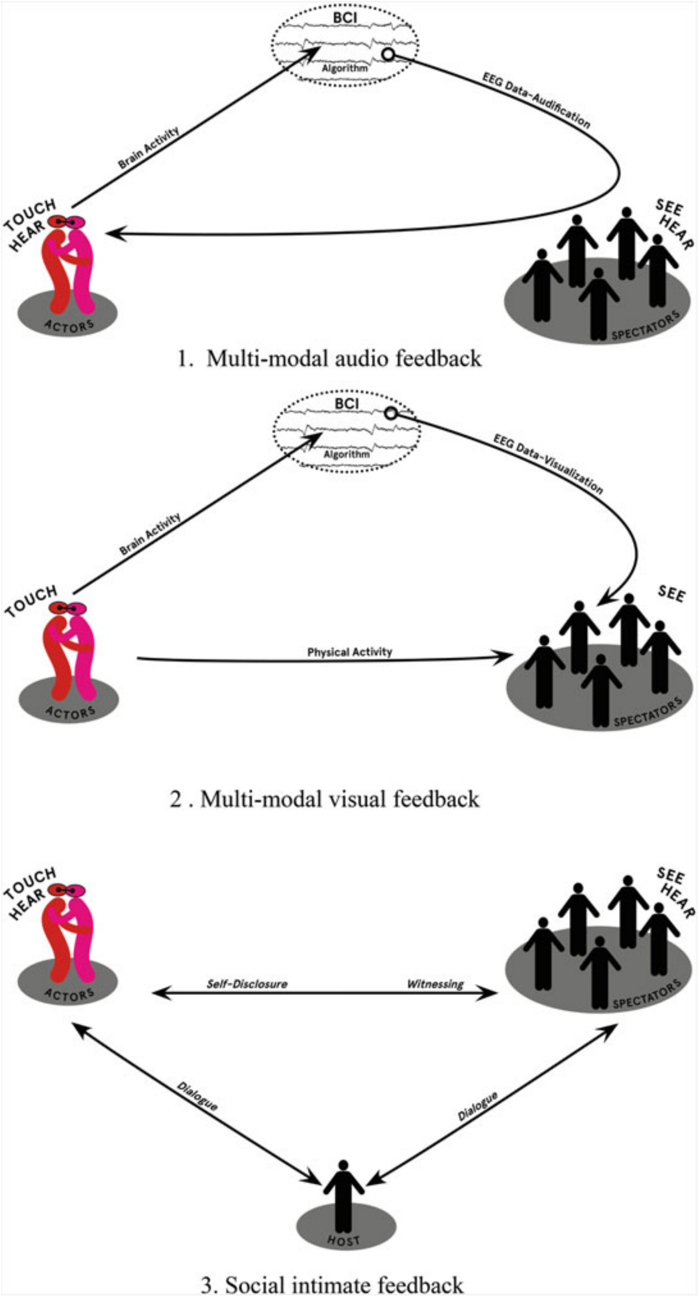

Fig. 7.5 Three models of digital synaesthetics in multi-modal, multi-brain BCI interaction of social touch

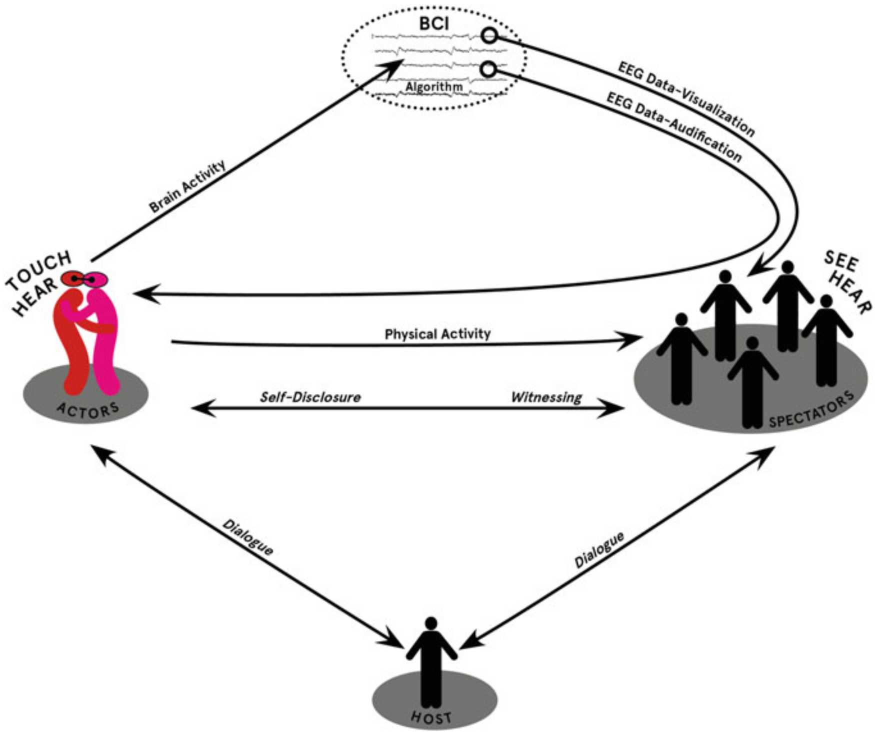

Fig. 7.6 Integrated model of digital synaesthetics in multi-modal, multi-brain BCI interaction of social touch (based on the three models depicted in Fig. 7.5)

7.5.2 EEG KISS: Artistic Orchestration 1

Orchestration 1 was held during the exhibition Reality Shift, during the Discovery Festival at Tolhuistuin in Amsterdam in 2014.[15] 14 Couples and 300 Spectators participated. This orchestration explores the reactions of the public to disrupted connections, and new sensory and social connections and data visualization.

7.5.2.1 Results

Many Spectators stop to see the orchestration, seemingly attracted by people kissing. The Host observes that many Spectators become immersed in the orchestration once they are told that they too can become participants and see that others are also participating. While Actors are kissing, the Host almost always observes that Spectators

[15]Orchestration 1 at Tolhuistuin Amsterdam. Discovery and Transnatural Festival 2014: Beyond Biennial Exhibition 2014 © Lancel/Maat.

Fig. 7.7 EEG KISS Orchestration 1 at Tolhuistuin Amsterdam. Discovery Festival/Transnatural and Beyond Biennial Exhibition. 2014 © Lancel/Maat

are immersed in a disrupted, twofold gaze, shifting between kissing acts and data representations on the screens. They turn to the data on the screens, look back at the kissing act and back to the screens again, seemingly linking the kissing gestures and the emerging data traces. Their focus remains on the Actors after the act of kissing, when the Actors eyes are still closed, even if this phase takes up to 5 min.

Couples, friends and strangers, people of all ages, kiss. Initial reactions expressed to the Host such as: “All of those people who are watching!” often include indications of shyness, nervousness and discomfort, but also enthusiasm.

As indicated in Fig. 7.7, Actors are asked to firstly close their eyes before kissing, secondly take all the time they need to kiss and thirdly, to keep their eyes closed when they feel the kiss is ending and to remember how the kiss felt. Some couples start kissing right away while others wait a few minutes to seemingly overcome shyness. The duration of kissing is between 20 s and 2 min. Different ways of kissing are observed and interpreted by the Host to vary between still, silent, tender, dynamic and expressive. Giggling a little before or during the kiss is not unusual. The Host observes that if Actors do not close their eyes and reflect on their kiss, both Actors and Spectators do not concentrate on the act of kissing.

When Actors open their eyes after the kiss, different reactions are perceived by the Host: some Actors express exaltation, others express tension, others are silent, perceived by the Host to be opening their eyes as if awakening, needing time to find words and staring in mid-space. Expressions include “I feel disoriented” or “I forgot where I was”.

Not all but many Actors state that while kissing, they are first aware of the surrounding Spectators, but that after some time they lose touch with the Spectators, expressed e.g. as “I felt fear at the beginning but soon forgot all around us. Our kiss was all that mattered”. Nevertheless, during some performances, the Host observes that the Actors’ hands dwell towards sexually arousing parts of the body but stop at that.[16] One Actor expressed the role of Spectators as that they "come and go" in his mind "like waves".

Comparably, in most cases, Actors state that they 'forget about visualization of the data'. However, ambivalently, the Host observes that Actors only start kissing if they have seen the data visualization before kissing. In the few cases that Actors started kissing without Spectators being present, they indicated to the Host that they experienced their act of kissing as instrumental to digital data production and interpretation, and not as an intimate act. A few of these Actors also expressed concern about what data visualisation of their kiss may be "giving away". One these Actors stated "I am concerned that these data are judged by others."

Actors are always interested in the data visualisation of their kiss. Although at forehand Actors have been told that scientific interpretation of EEG data from intimate kissing is not possible in this artistic orchestration, and not the focus of this research, almost all participants seem to be convinced that the artistic orchestration reveals information about their kiss, their 'kiss-qualities', and the quality of the Actors' relationships (as expressed to the Host).

Although the individual data sequences are visible on two different screens, Actors often talk about both sequences as a composed representation of the kiss and often refer to the combination of sequences as "the portrait of our kiss", as an act of co-creation. When discussing the data in dialogue with the Host, Actors' expressions include 'an enigmatic mirror of their kisses': "It leaves sense making to ourselves" and "Only we know what these traces mean", interpreting data as depicting their experience of intenseness ('on fire'), concentration ('like waves of a river"), or the feeling of togetherness during their kiss ("This reminds me of the intimate moment we just had together."). In some cases, Actors are observed to silently gaze at the data, smile and seem to lose all sense of time with expressions interpreted by the Host to indicate tenderness, disbelief and curiosity.

Spectators express attribution of meaning to the data sequences. Example of such attributions are: "I can clearly see from the data sequences that one of the persons kissing was more passionate than the other." Or "I love how these data-lines move together and many times I could see whose line belongs to who from the way they kiss." One of the Spectators stated "I could see the kiss being mirrored in the data visualization. Although in fact I don't know what I was seeing, I felt I could see it." Others expressed other experiences related to emergence: "I could see they were passionate and I could see that feeling in the data too.", "You really see them going in the data", and "I love the data emerging. Of course, I knew they were emerging from kissing." Some Spectators indicate the importance of synchronization between the beginning and end of physical kissing and its visualization of EEG data, for their experience. Often lively discussions start about data interpretation, intimacy in public and issues of privacy, in relation to the information value of EEG data.

[16] Visible in video documentation.

7.5.2.2 Discussion

Couples, friends and strangers of various ages and diverse cultural backgrounds have participated in these experiments, some for hours. Ambivalence, both purposefully designed and emergent, is shown to be essential to evoke engagement and immersion of Actors and Spectators in the shared orchestration.

Firstly, Kissing Actors need to ambivalently trust the Host while simultaneously risking judgement of their vulnerable act of kissing and the resulting data by Spectators. For immersion in intimate experience, it has shown to be important for Actors to 'semi-lose touch' with Spectators. However, ambivalently, they also have expressed the need to have confirmation that Spectators are present.

Secondly, ambivalently, individual Spectators have expressed the need to witness the Actors' physical (intimate kissing) gestures and simultaneously give meaning to the emerging abstract data visualization. In this process, seeing the Actors kissing gestures is shown to be needed to 'feel' the data visualization as being intimate.

Thirdly, to individually interpret the EEG data visualization as an expression of intimacy, Spectators and Actors have indicated the need to be confirmed of each other's presence during the kiss. Ambivalently, they express the need of a shared experience to interpret individually. Spectators also express the need to be able to witness other Spectators. Actors have shown the need the presence of Spectators witnessing their emerging BCI data, to appropriate the data visualization in retrospect as 'their portrait' of shared intimacy.

Importantly, shared intimate experience is only reported if reflection is facilitated, for all to share and co-experience.

7.5.3 EEG KISS: Artistic Orchestration 2

Orchestration 2 took place at the Frascati Theaters Amsterdam, 2016. 11 Couples and 43 Spectators participated. In this adapted orchestration Actors are surrounded by sound and by a visual, abstract, streaming EEG data floor projection witnessed by Spectators, depicted in Fig. 7.9. This orchestration explores whether spatial data visualization and data audification enhance shared engagement for BCI mediated intimate connections, as described above. Note, that in this second orchestration, Actors and Spectators behaviour observed by the Host was comparable to Orchestration 1. Only new aspects are described Fig. 7.8.

7.5.3.1 Results

When asked by the Host, Actors indicate that they experience kissing the other person as both familiar and unfamiliar. Actors follow the Host's invitation to close their eyes, to listen to the sound, and to immerse in each other's kiss.

Fig. 7.8 EEG KISS Orchestration 2 at Frascati Theaters, Amsterdam. 2016. © Lancel/Maat

As in the previous orchestration, in phase 5, Actors are asked to reflect about the kiss in dialogue with the Host. Actors refer to the impact of sound with words such as: “The sound made my kiss more intense and more focused. The tickling sound, that emerged from my brain activity, made me imagine electric rain drops that enhanced and merged with my experience of electrified kissing.” and “It felt like our kiss was being borne by the music”. A few Actors, who indicated that they tried to control the sound through different ways of kissing, referred to their kiss as ‘fun’ rather than as intimate.

Spectators are observed by the Host to be more concentrated and immersed in the circular data environment and data audification, in comparison to Orchestration 1. Both Actors and Spectators express for example: “This situation is weird but feels strangely safe.”, “The sound makes the space reflective”, “This feels like a kind of trance” or “I could stay here forever.” Some stay for hours, talking quietly with each other. More often than in Orchestration 1, the Host observes that Spectators encourage each other to become Actors and kiss. Even strangers kiss. While the average time for Actors to start to kiss is between 1 and 30 s, strangers starting to kiss can take up to 5 min. These 5 min are reported by all Actors and Spectators to be experienced as being very intense. Furthermore, in this second orchestration, the duration of kissing is longer (between 20 s and 10 min) in comparison to orchestration 1.

The circular data visualization is designed for Spectators to stand around the Actors. A few Actors indicate that they experience the circular, emerging data visualization as ‘a radar.’ Spectators are observed to never enter the floor projection while Actors kiss. Most Actors and Spectators describe their experience of the data visualization as immersive, indicated by for example “Can I step into it?”, “Is this a sort of brain data space?”, “These lines here are moving more wildly than those lines over there” (while observed to be pointing at the projection on the ground proximate to their bodies)”, or “Am I staying in their brain activity?”.

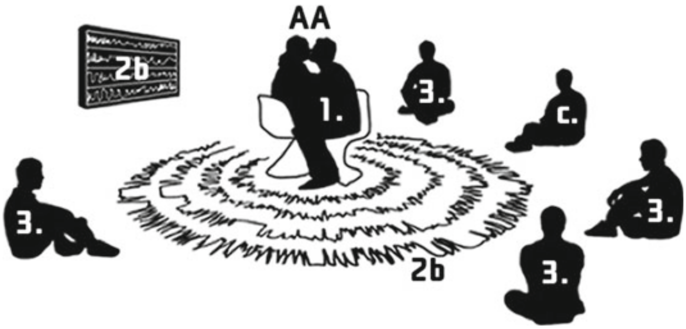

Fig. 7.9 Spatial model of digital synaesthetics in multi-modal multi brain BCI interaction for social touch: Artistic orchestration 2. © Lancel/Maat and Studio Matusiak (2016) (Lancel et al. 2018)

The Host observes that Actors seem more comfortable entering the staged space and to being exposed, in comparison to Orchestration 1. Furthermore, after kissing, Actors take more time to talk about their kisses with the Host, to explore their memories of kissing. They are, in general, seen to be more comfortable, talking while watching the streaming data around them, indicated by one Actor to be both 'beautiful and strange'.

7.5.3.2 Discussion

Orchestration 2 shows that circular, streaming visual data and data audification, of the multi-brain BCI enhances focus and immersion for all participants. Ambivalently, spatially, the data visualization distances Actors from the Spectators, while at the same time bridging them. Furthermore, ambivalently, Actors have shown to need the data visualization to experience and remember an intimate kiss, but most Actors express forgetting the data visualization while kissing. For Actors, the shared data audification is perceived by many to be shared feedback of their performativity, merging with their kissing experience. The combination of shared sound and spatial data visualization has been observed to increase embodied, immersive experience of the BCI data for Spectators. This multi-modal BCI orchestration with spatial visualization and shared sound has shown to increase participants' feeling of safety and involvement, both in time and in intimate connection with each other.

7.6 Conclusion and Future Research

This chapter explores design syntheses for artistic orchestrations of shared intimate experiences, of multi-brain, multi-modal BCI interaction, through touch. Digital synaesthetic, shared intimate social touch experience is explored through disruption of familiar relations between 'who you kiss and who is being kissed, what you see and what you hear'. A model of digital synaesthetics in multi-modal, multi-brain BCI interaction for social touch is proposed.

Two orchestrations show that for engagement in shared, intimate experiences mediated by multi-brain BCI, sensory connections and feedback processes through seeing, hearing, and touching need to be disrupted. They need re-orchestration into multiple ambivalent connections, such as connections between participants (Actors and Spectators), senses, actions and connections between physical presence and virtual, spontaneously emerging BCI representations. Audification of BCI data of touch, enhances the Actors and Spectators' experience of feedback. Spatial data visualization provides an embodied, immersive relation to the BCI data, both isolating and bridging Actors and Spectators. The combination of spatial BCI data visualization and audification increases focus, concentration, immersion and feelings of safety. Central stage intimate touch is essential to shared experience and reflection.

Meaningful shared intimate experience mandates an orchestration that includes vulnerable self-disclosure, witnessing, dialogue and reflection, embedded in individual and shared interpretation, in co-presence with all participants. The mediating role of the Host is a crucial element of the design. The proposed model in which the role of Hosting is defined, is based on shared perception of a social, sensory synthesis.

This model of digital synaesthetics facilitates the design of new shared intimate experiences of social touch mediated by multi modal multi brain BCI interaction in public spaces.

Current and future research extends the BCI interface to include brain activity of both Actors (touching) and Spectators (mirror-touching) for a Multi Brain BCI visualization (Lancel/Maat 2018).

The correlation of EEG and fNIRS data visualization to experiences of connectedness (synchronization), in a social-technical performative synthesis, is currently being explored. These data visualizations are studied from an aesthetic perspective, for a new approach to understanding data patterns. This approach is explored in dialogue with participants in the artistic orchestrations, for an emotionally intelligent machine learning system for intimate experience (Figs. 7.10 and 7.11).

Fig. 7.10 EEG KISS Orchestration 2 at HeK, Haus for Electronic Art, Basel, 2018 (EEG KISS Orchestration 2, HeK Haus for Electronic Art, Basel, 2018 © Lancel/Maat 2018.)

Fig. 7.11 Kissing Data, Ars Electronica Linz, 2018 (Kissing Data, Ars Electronica Linz, 2018 © Lancel/Maat 2018.)

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