2018

Shared Creativity and Flow in Dance Improvisation Practice

ucznik, Klara

SHARED CREATIVITY AND FLOW IN DANCE IMPROVISATION PRACTICE.

by

Klara Łucznik

A thesis submitted to the University of Plymouth

in partial fulfilment for the degree of

DOCTOR OF PHILOSOPHY

School of Psychology | Faculty of Health and Human Sciences

September 2017

Copyright Statement

ACKNOWLEDGEMENTS

Firstly, I want to express my gratitude for all the support and encouragement I received during my doctoral training. In particular, I would like to thank my director of studies Jon May, whose patience and stimulating guidance kept me going, step-by-step, chapter-by-chapter, on my path to the following thesis. I would also like to thank John Matthias for his valuable insights and vivid conversations. I am very grateful to Emma Redding for welcoming and supporting me at Trinity Laban Conservatoire of Music and Dance during my secondment. Also, this journey would have been very different without my encounter with Adam Benjamin, whose mentoring and shared improvisation practice gently guided me over the years.

I feel fortunate to be completing this work as a part of the CogNovo community. The collaborative, multidisciplinary climate we created, and our unique combination of minds, allowed me to think about my project beyond the frames of a single discipline and to take risks in the research process. Thus, my gratitude goes to Sue Denham, the director of CogNovo, for her vision and ongoing support. I am also grateful to Frank Loesche, whose brilliant ideas, technical solutions, friendship and tea allowed the development of a distinctive methodology applied in the following research.

Last but not least, a very big thank you goes to Mona, Diego, Ola and Agnieszka for their dedicated friendship; and to my Mother, Urszula for empowering my choices.

AUTHOR'S DECLARATION

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award, without prior agreement of the Graduate Sub-Committee. Work submitted for this research degree at Plymouth University has not formed part of any other degree either at Plymouth University or at another establishment.

This study was financed and carried out with the research fellowship funded by the Marie Curie-Skłodowska Initial Training Network, FP7-PEOPLE-2013-ITN, grant number 604764. As a part of the programme, a series of interdisciplinary trainings were undertaken, hosted by CogNovo programme.

Ethics was applied for and granted for each experiment through the ethics committee.

Relevant scientific symposiums and conferences were regularly attended at which work was presented, both through poster and oral presentations. Trinity Laban Conservatoire of Music and Dance was visited as the secondment for carrying out research and for consultation purposes.

Publications:

Łucznik, K. (2015). Between minds and bodies: Some insights about creativity from dance improvisation. *Technoetic Arts*, 13(3), 301–308. doi:10.1386/tear.13.3.301_1

Łucznik, K., Jackson, A., Sakuta, A., Siarava, E. (2017) Let's Improv It – a participatory improvised performance. AVANT, 8, 301-310. doi:10.26913/80s02017.0111.0027

Łucznik, K., & Loesche, F. (2017). Dance improvisational cognition [Special Issue]. AVANT, 8, 227–238. doi:10.26913/80s02017.0111.0021

Word count of main body of thesis: 46442

Signed:……..

Date: 15.05.2018

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ABSTRACT

This thesis investigated shared creative processes and the role of flow experience in group dance improvisation. A literature review suggested that dancers associate high-quality performance with 'being in the flow', and that group flow is a peak experience when a group is performing at its highest level. The first study explored the role of flow in dance creative practice and improvisation through qualitative content analysis of individual interviews with six dancers. Absorption with activity and enjoyment were themes in dancers' reports of flow. Group improvisation facilitated flow and creativity through maintaining desired focus for longer, lowering self-judgment and inspiring novel solutions. The second study investigated the occurrence of flow and its shared character within group improvisation using video-stimulated recall and questionnaire methods (n=16, 4 groups of four dancers). It showed that group flow was rather rare and it was more likely when a group had worked together for longer. Dancers reported that a group in a high-flow state engaged with a task in a more complex way, sharing, transforming and supporting each other's ideas, while low-flow groups worked more with mimicry and bodily manipulation. Dancers perceived tasks performed in a high-flow state as more creative. The third study explored the relationship between dancers' flow experience and creative outcomes from a third person perspective. A total of 203 participants (77 experts and 126 nonexperts) rated excerpts of high- and low-flow dance improvisation (five each) using Consensual Assessment Technique. Experts judged high-flow collaborations as more creative, and more coherent, technically advanced,

aesthetically appealing and meaningful, however there were no significant differences in nonexperts' ratings. The fourth study explored whether synchronous arousal, measured by cross-recurrence quantification analysis of heart and breathing rate, was a physiological basis for group flow (n=8 group, 4 dancers per group). Although no relationship between synchronous arousal and flow was found, spontaneous synchronization of dancers' heart and breathing rate in improvisational group tasks was observed, unrelated to synchronized activity.

Overall, the studies conducted confirmed that flow was a highly creative state for dancers, in which they performed better. The presence of others and quality of group collaboration supported the occurrence and amount of flow. However, group flow occurred rarely and was more likely when a group had worked together for longer.

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1. INTRODUCTION

The present thesis explores the shared creative process and the particular role of flow experience in group dance improvisation, as an example of creative practice in contemporary dance. It proposes an interdisciplinary, multiple perspective approach to the phenomenon, drawing on dance practice and being informed by qualitative, quantitative and physiological methods of experimental psychology.

Improvisation as an artistic practice emphasises real-time decision making and collaborative skills in a creative act (Caines, Heble, 2015). Within contemporary dance, it is often a vital practice of the performance itself and part of the creative process, allowing and enabling dancers to explore movement beyond their habitual patterns. In this thesis, dance improvisation serves as a laboratory for group creativity research, which allows observation of dancers' creative processes, as well as the group dynamics of their collaboration, while they happened.

The specific interest in flow experience came from dance practice informed observations. Dancers, when reflecting on their creative process, in particular, improvisation, frequently refer to the experience of 'being in the flow' (Douse, 2015, Paskevska, 2001). They describe this experience as being fully absorbed with dancing and not being disrupted by any unnecessary thoughts. While in other domains (i.e., music, theatre, drawing, problem-solving) experiencing flow was linked to better creativity outcomes (Carney, 1986; Cseh, Phillips & Pearson, 2015; Csikszentmihalyi, 1988c, Finke & Slayton, 1988), flow research in the field of dance is still limited and has not addressed creativity. Thus, this thesis aims to establish the presence, features and

the role of flow experience in creative dance practice through close investigation of flow in dance improvisation.

To contextualise the current investigation in the wider field of contemporary dance practices, this chapter introduces the variety of approaches to dance-making, briefly reviews research into dance/embodied creativity and situates questions of this thesis in the wider field of the sociocultural approach to creativity. It finishes with the research questions and an outline of the following chapters, providing an overview of the thesis.

1.1 Contemporary Dance

Dance is primarily a nonverbal art form that places the physical body at the centre of interest. It carries the intriguing possibility of being very abstract and very literal at the same time. Contemporary dance, as a genre, does not refer to any specific dance technique but rather includes an eclectic collection of methods and approaches to embodied art practices. It developed from modern and post-modern dance in constant dialogue and interaction with other dance forms such as ballet, traditional dances, martial arts and urban movement practices (e.g., hip-hop, parkour). It values experimentation, invention and nonconformity, searching for new forms and meanings in movement expression (Roy, 2015). Thus, instead of trying to define or catalogue contemporary dance practices, this introduction defines two dimensions that help us to understand the variety and extent of this art form which contextualises the focus of this thesis.

First, contemporary dance includes multiple aesthetics of physicality. The variety of dance vocabulary lies between natural, 'pedestrian movement', a term

employed by Yvonne Rainer (2006) and technical mastery, that presents dancers as 'athletes of aesthetic movement' (Foster, 1997).

The creative work of Yvonne Rainer and her 'No Manifesto' from 1965 (Rainer, 2006) had a crucial influence on post-modern dance thinking and still resonates in contemporary dance practice. She aimed to remove the drama from dance movement and to question the role of entrainment in dance. Looking for neutrality in dance, and the objective presence of the human body and its movement, she focused on pedestrian movement: its functionality without any stylization (Burt, 2004). Dancers in her work would look for the utility of movements, without any extra expression, sometimes hardly acknowledging the presence of their audiences. Her minimalistic approach was a creative alternative to the stylistic mannerisms of ballet and dramatic or theatrical mode of modern dance (Roy, 2010).

At the other extreme, today, choreographers such as Wayne McGregor, explore the limits of movement possibilities of the body and its precise articulation, in the same way continuing the modern and ballet tradition of emphasis on mastery in performative dance, but without a codified movement vocabulary (Roy, 2004). McGregor's creative approach has a distinctive visual style and focuses the audience's attention on the kinetic physicality of an ensemble of highly skilled dancers. The choreographic score is created through combining various bodily shapes in time and space in an unusual, surprising way; emphasising the visual organisation of dance. It is often accompanied by multimedia experimental settings of lights and sound (DeLahunta, Clarke, & Barnard, 2012). In such work, dancers' consideration would be how they appear, in terms of lines of the body and form. Their role as performer lies in

the perfect physical embodiment of the choreographic score (Bull, 1997). The performance is designed to amaze the audience with virtuosity.

Perhaps the most crucial influence on current practice was the development of Contact Improvisation (CI), a dance form that involves an exploration of the body's weight in relation to other bodies and the flow of movement in relation to gravity (Paxton, 1979). Instead of a fixed movement vocabulary, it is based on the principles of maintaining the point of physical contact in duet form and an ongoing investigation of movement patterns through sensing, feeling and noticing bodily changes. In CI, touch, weight and momentum are prioritised over the visual aesthetic. There is no concern of the shape of the body as perceived by a spectator, as well as there being no ideal physical type for a skilled CI performer. A dancer's attention is focused towards the sense of weight and its shifts in response to their partners' movement. As it is an improvised form, each dance has a unique appearance bounded only by each dancers' movement potential. The spectator, through an empathic relationship, is encouraged to identify physically and kinaesthetically with the dancers. Small-scale performance settings, close proximity to dancers, clearly audible dancers' noises – breathing, grunting, the sound of falling or catching – stimulate such a reception (Bull, 1997).

These examples show the range of approaches to movement and aesthetics in dance practice: from a natural, 'untrained' body to technical excellence. It also emphasizes that excellence in contemporary dance is perceived in varied ways: while McGregor values technical excellence in the accurate execution of challenging, complex movement, the skill of a contact improviser rather lies in their kinaesthetic awareness of gravity and sensing the momentum of movement in a collaborative duet.

Another dimension of describing contemporary dance practices might be defined as the degree of structuring a performance piece in the process of preparation. Some choreographers use a very directive way of working, crafting and refining every movement of a dancer, their shape and the spatial appearance of the whole choreography, a tradition inherited from modern and classical ballet traditions (Bull, 1997). The final production is constructed through careful selection and integration of movement material and other elements of staging, such as music and lighting. An insightful model of such an approach to dance production was developed by Philip Barnard while observing Wayne McGregor's work (DeLahunta, Clarke, & Barnard, 2012), where after the initial phase of conceptualisation of the piece, they distinguished the three phases: *generating* movement material, *editing and selecting*, when initial material would be further developed, structured in longer phrases and redefined, and of *integrating* with other stage elements, like sound, lighting and scenography, into the final production. Dancers would enact each performance according to a well-known, rehearsed choreographic score. Of course, as in every performance art, there is the possibility that the unpredictable can happen, but it would be perceived as a mistake, and the rehearsal process is designed to reduce the possibility of such errors occurring.

Other choreographers navigate with more open approaches, where dancers are engaged in series of tasks or games, but the movement is generated in response to the parameters of a task rather than composed from bodily shapes. For example, Hagit Yakira does not identify her work with any particular movement aesthetic, even if she admits that it is influenced by modern and contemporary techniques as well as contact improvisation. In her creative process, she heavily relies on group improvisation,

placing her role as a facilitator who suggests improvisational tasks for a group to explore. The choreographic score is structured from refined tasks composed together in a non-narrative way. The structure of a piece is precisely defined, as well as music and light scores. At the same time, dancers are challenged to react to the given task each time afresh, to a large extent in an improvised way. The process of editing and refining is never finished, and even after the premiere, the choreographer continues this process with the group (Marriott, 2017).

Finally, the practice of improvisation, a spontaneous and less technically strict process of creating movement at the moment of dancing, reveals an interest in unstructured performance, where the process of creation happens on stage in real time (Carter, 2000). The improvisation approach provides, both for a performer and a viewer, an experience of initiating, playfully probing a dancer's physical and creative potential (Foster, 2003). What highly interests improvising artists is an active engagement in the actual creative moment, and its interactive relationship with the surrounding and spectators. As Foster (2003, p.9) pointed out, *'Viewers participate along with the performers in the open field of possible choices and the performer's construction and selection of those choices through which meaning is determined.'*

Most of the contemporary practices and choreographic approaches lie somewhere on the two dimensions of aesthetics of physicality and the degree of structuring the work outlined above. Of course, there are other ways to describe the field of contemporary dance and contemporary choreographers constantly experiment with the form and meaning of movement vocabulary, reacting against or developing from what has gone before, and creating their unique aesthetic vision of movement, the dancing body, and what may constitute a dance performance. The two above:

aesthetics of physicality and the degree of structuring the work felt useful in the context of the next section, which describes the current state of research into creativity in contemporary dance. It will reflect the variety of creative approaches and techniques used to develop movement material and performance scores.

1.2 Creativity Research In Contemporary Dance

The last two decades have brought a growing interest in studying dance through the lenses of cognitive psychology, as dance offers an insight into human cognition through exploration of the movement vocabulary, form and structure of 'bodily expression through space and time' (Stevens, Malloch, & McKechnie, 2001, p.55). Dance provides an opportunity to observe the process of physical thinking, understood as the process of using the body as an instrument of cognition (Kirsh, 2011a). It offers an opportunity to detect interesting properties of nonverbal social coordination in complex activities (Ribeiro & Fonseca, 2011; Torrents, Castañer, & Anguera, 2011). And, as an example of artistic practice, it also allows one to study the nature of creativity; in particular, its embodied aspect (Kirsh, 2011b; May et al., 2011; Stevens, Malloch, McKechnie, & Steven, 2003; Torrents, Ric, & Hristovski, 2015).

Primarily, the cognitive (and creative) process in dance might be seen as a process of embodied finding and solving of problems by experimenting with movement shapes and qualities in response to a given task (Kirsh, 2011a; May et al., 2011; Stevens, McKechnie, Malloch, & Petocz, 2000). As Kirsh (2011a) suggested, embodied creativity has a mainly non-propositional character: dancers use movement and their bodies as a cognitive medium for physical sketching, in a similar way that a graphic artist uses drawing as a cognitive medium for the development of their ideas. The embodied exploration of various movement solutions is as significant as the

conceptual thinking process (Sheets-Johnstone, 1981). What makes dance creation unique is that a dancer simultaneously creates the dance and is physically shaped by it, they are produced by their own dancing (Albright, 2010, p. 3), so it is difficult to differentiate between the embodied features in the process and the product of creation (Sheets-Johnstone, 1981).

Approaches to setting choreographic or movement problems differ between choreographers. A problem might require a response with the body to a simple cue, as in Anna Smith's practice: 'Right elbow behind back, shoulders tilting, left hand reaching' (McKechnie & Stevens, 2009, p. 40). In this case, dancers just tried to fulfil all the cues, finding a way to organise their bodies. Instead of a simple task, other choreographers use a pre-developed system, as in Merce Cunningham's practice, where previously defined movements had to be combined according to a randomly chosen order. The main challenge for Cunningham's dancers was to embody those nearly impossible connections, finding a way to enact the movement precisely in shape and timing (Noland, 2009). Another systematic approach, but with a significantly different system of setting tasks, was developed by William Forsythe. His *Improvisation Technologies* contain a collection of tasks and approaches that stimulate dancers to explore novel movement responses through establishing additional relationships in the body. For example, in the 'knee-to-elbow' task, a dancer explores the movement with their attention on a knee and an elbow, and their relationship in space; the task might be imagined as an elastic or rubber line between the joints (Forsythe & Haffner, 2012).

Many choreographers, like Forsythe, McGregor or Yakira, use imagery as a vital source of inspiration (DeLahunta et al., 2012; Forsythe, 2012; Marriott, 2017; Stevens et al., 2003). In such approaches, dancers engage in a variety of sensory modalities:

they might visually imagine an object, spatial shape or even an entire landscape and then transform it into a particular quality, shape or pathway of moving in the space. Using auditory imagery, they might imagine the music, rhythm or any sounds that influence their movement choices. They even might create a mental image of an emotion or a particular bodily sensation, such as moving through the ocean's waves or rolling a small ball inside their body. Having created the image, they transform it into a new form of movement or composed phrase (May et al., 2011).

The main goal of setting tasks, as problems to solve with the body or images to explore, is to enhance dancers' creativity in finding novel movement material through breaking their habitual way of moving (DeLahunta, 2010; Kirsh, 2011a; May et al., 2011).

It has also been suggested that the essence of novelty in artistic creativity might be metaphorical thinking (Stevens, McKechnie, Malloch, & Petocz, 2000). The example of the development of the dance piece "Red Rain" by Anna Smith gave insight into the use of metaphor while creating dance: inspiration for the movement and scenes arose from association with the colour red. Dancers gathered red – related objects and then they searched the objects' metaphorical meanings and uses. For example, kidney beans were transformed into symbols of blood, and life, while the sound of the beans being dropped turned into rain in the final scene, giving the title for the piece (Stevens et al., 2003). Also, the tactile sensation of dropping beans was the inspiration for movement material generated by dancers. It is an example in which simple associations with the colour red were used as a metaphor on many levels: as a symbol of different objects, a source of sounds and tactile sensations, all interwoven into the piece, influencing different movement solutions on each of those levels.

All of the research cited above was based on case studies of the creative process (or system) of a small number of particular choreographers. However, these examples represent a wide variety of commonly used techniques. It is important to note that they all include, to some extent, the process of improvisation as experimentation with creative ideas and movement responses to a given task. Hence, an alternative approach to studying creative cognition in dance, is to research dancers' —as opposed to choreographers'—creative cognition, examining their creative process directly during improvisation.

1.3 Improvisational Cognition In Dance

Improvisation in a contemporary dance context serves two main purposes: it is an open form performance practice (as described at the beginning of the chapter) and, as was mentioned above, is also widely used for generating novel movement material for choreographic phrases (Carter, 2000). Improvisation aims to give dancers a chance to explore movement beyond habitual patterns and to discover unknown possibilities and bodily solutions (Forsythe & Haffner, 2012). The nature of creativity in improvisation is very dynamic: the solution for given problems may occur while listening to the task, or may be discovered through the dance, or even appear later after the improvisation is finished. Typically, the recognition of 'Aha!' moments in creatively successful, well-formed improvisation pieces comes with the movement rather than as a prediscovered idea (Blom & Chaplin, 1988, p.9). Consistent with the observation that movement exploration is as important as the thinking process in improvisation (Sheets-Johnstone, 1981), new ideas come through dancing, while dancers think in a mostly non-propositional way. In group improvisation, dancers make the most of shared choices (of movement, use of space and timing) without any

previous agreement or verbal communication (Blom & Chaplin, 1988, p. 5; Łucznik, 2015).

Although improvisation plays an important role as a part of a creative process in contemporary dance practice and it is recognised –and widely presented– as a performance practice itself, psychological research in this field is limited and fragmented. Studies into improvisational cognition focused mostly on mental processes that enable dancers to pursue the constant composition of novel material.

Nakano and Okada's (2012) study of the process of improvisational creativity of professional dancers revealed that they create their dance by interacting with various stimuli that come both from internal and external sources. Among others, dancers were reacting to imagery and sensations (and feelings) that they perceived during the performance; as well as to music, space and their audience. Dancers made movement choices by responding to those stimuli and organised their movement extemporarily, using such techniques as intentionally switching perspective, changing speed, rhythm, image or texture of movement; developing the movement ideas or stories; seeing themselves from the third person perspective; and coordinating with other dancers by similarity or contrast of movement.

In series of solo improvisation sessions with experienced movement improvisers, De Spain (2003) explored improvisational cognition using a momentary awareness sampling method. He recorded 'momentary awareness reports' (improvisers were asked to 'report now' what was in the front of their mind) from random moments of improvisation. Similarly to Nakano & Okada's (2012) results, he found that improvisational awareness could be focused on internal sensations, especially on proprioception–the feeling from the dancer's body; mental images

related to the body, such as *'foot exploring space… have eyeballs in my toes'* (De Spain, 2003, p.31); emotional states; or on an aesthetic reaction to one's own movement. At the same time, improvisers' awareness was engaged with the external world, which they were sensing through seeing, hearing, tactile sensations, etc. This could also manifest as a visible movement, because of a necessity to direct and focus the action of sensing, such as turning the head to see or hear, in reaction to the surrounding. He also referred to the role of memories, especially kinaesthetic ones (such as remembering a particular quality of movement) that might be echoed in movement choices. Interestingly, dancers' awareness of intentionality could be direct (*'I'm walking'*) or indirect (*'It moved me'*), acting as a filter for movement choices and a feedback loop regarding the whole process.

Exploring the creative outcomes of an improvisation task, Torrents et al. (2015) focused their research on the role of instructional constraints, such as '*When dancing, try to keep your pelvis as close (as far) as possible to your partner*', in contact improvisation duets. They showed that imposing instructional constraints that necessitated different movement solutions to those most commonly produced by improvisers, might lead to a greater exploration of movement possibilities, and therefore to unusual and novel, creative outcomes. They proposed that the improvisational process could be understood as decision-making behaviour at the level of the improviser-environment relationship. Such a relationship emerged over time from the interaction of individuals with environmental constraints in the process of achieving specific functional goals. Consequently, they suggested the possibility of stimulating dancers' creativity through the design of scores (tasks), such as an instructional constraint included in improvisational tasks.

Finally, the research into the improvisation process in dance highly resembles, and overlaps with, studies on creative approaches. It is not surprising, as improvisation is seen as a fruitful practice for developing movement material in contemporary dance (Blom & Chaplin, 1988; Carter, 2000), and it is a basis for many creative tools (Forsythe, 2012; Marriott, 2017; May et al., 2011; McKechnie & Stevens, 2009). Both approaches in dance, improvisation and choreographic practice, constantly interact and support each other.

1.4 Distributed Creativity In Dance

A common feature of most of the creative strategies in contemporary dance, as in the examples given above, is that the choreographer and dancers continually work together exploring, selecting and developing dance material. As Kirsh (2011a) noticed, a choreographer tends to use dancers as creative tools, giving them a task to perform and picking up ideas from solutions they present. Many times, the responsibility of remembering movement solutions, or created phrases, is also delegated to dancers from the beginning of the creative process, while a choreographer remembers only general ideas, labels of phrases or qualities. And, if the creative process involves group improvisation, which is common in contemporary choreographic dance-making, problem-giving and problem-solving is even more collaborative and based on a dialogue between the dancers, the choreographer and the physical capabilities of the group (Stevens et al., 2000). Most of the contemporary improvising practices in dance focus their interest on ensemble work (Blom & Chaplin, 1988; Carter, 2000; De Spain, 2014; Koteen, Smith, & Paxton, 2008). Moving the focus from dance as an individual activity to dance as a group activity renders sociocultural approaches to creativity relevant in understanding dance creative processes.

A sociocultural approach analyses how culture, social interactions and human interactions with objects, alongside individual characteristics of the creators, result in creative success (Amabile, 1982; Csikszentmihalyi, 1996; Glăveanu & Lahlou, 2012; Sawyer, 1999, 2007). Csikszentmihalyi (1988/2014) suggested a three-level model to analyse creativity in a systematic manner: the 'person-field-domain' model. The first level, *a person* focuses on individual features of a particular creator (in dance, a dancer, a choreographer and the influence of their experience). The second level, *a field* analyses the social system within which the creation happens (in the case of dance it might be understood as a specific dance company or creative collective) and its influence on creative production. The third level, *a domain* describes the wider cultural context of creation, such as the field of contemporary dance practice and, more broadly, Western performance culture. Csikszentmihalyi (1988/2014) emphasised the generative and contextual nature of creativity, arguing that every act of creation must be considered in relation to the domain, and is a result of social interactions.

To summarise, the sociocultural approaches to creativity emphasise that creativity cannot only be defined as a property of an individual but can also be a property of a group or social interactions. At the same time, individual creativity is constantly influenced by the social (domain) and cultural (field) context (Sawyer, 2007, p. 25). The current thesis aims to combine the individual and group perspectives. Understanding of creative processes in collaborative, highly interactive settings, such as in dance, requires the integration of both approaches, as group processes are driven by individual decisions, while at the same time, individual decisions are also shaped by group dynamics and sociocultural expectations.

Sawyer and DeZutter (2009) introduced the term *distributed creativity* to refer to situations where the group collectively generates a shared creative product. They investigated the role of social interaction in artistic collaborative practice in improvised theatre. Distributed creativity is closely related to group structure and ranges from relatively predictable and constrained, to relatively unpredictable. In the context of strategies for constructing the dance piece, a precisely defined choreographic score (as in classical ballet or modern dance) would result in relatively predictable dynamics of group creative behaviour guided by a choreographer, while less constrained approaches, especially improvisation, would produce highly unexpected results. As creativity in a group results from the collective activity of the social group, it might be seen as *collaboratively emergent* (Sawyer, 1999). Further studies (Sawyer, 2003; Sawyer & DeZutter, 2009) emphasized four characteristics of a creative process that enhanced collaborative emergence: (1) unpredictable outcomes of activity, rather than a scripted known endpoint; (2) moment to moment contingency of each person's action upon the one just before; (3) an interactional effect of actions that can be changed at any time by any participant; (4) a collaboration, where each participant contributes equally. Sawyer and DeZutter (2009) argued that:

> *'Collaborative emergence is a defining characteristic of social encounters that are improvisational because only when the outcome is not scripted can there be unpredictability and contingency. Social encounters that are more ritualized—like formalized greetings between customers and store clerks—or that are controlled by a single individual, like a business meeting—are less likely to manifest collaborative emergence.'(p. 82)*

This perspective explains why improvisation is such a successful method for the generation of novel material and why collaborative practices in contemporary dance have such potential to develop unique artistic creations.

Subsequently, Sawyer's (2003) interest turned into an investigation of what made some groups (or processes) more creative than others and what the correlates of peak performance of creative groups were. By studying jazz ensembles, he established that high, creative performance of the group is related to the collective state of mind, which he called *group flow*. While being in the flow, groups seem to act naturally, and performers are in interactional synchrony. Moreover, group members seem to anticipate their fellow performers' actions. He identified group flow as an emergent property of the group that resulted in highly creative (and productive) behaviour. While in group flow, musicians might play things that they would not have been able to play alone, or that they would not have thought of without the inspiration of others (Sawyer, 2003, p. 45).

1.5 Outline Of The Thesis

It is notable that none of the discussed studies on distributed, group creativity addressed dance practice as a domain of research. This thesis aims to address this gap by an exploration of the shared creative process in group dance improvisation. Improvisation is used here as a laboratory to study group creativity in dance, which allows observation of the creative process as it happens. Sawyer (1999) stated that studying improvisation has key advantages over studying other creative processes, as the improvised performance is created in the moment and can be relatively easily observed by the researcher. Moreover, group improvisation is fundamentally collaborative, as it places group processes in the centre of practice (Foster, 2003). As

shown above, dance improvisation is an essential strategy in various choreographic approaches (DeLahunta et al., 2012; Forsythe, 2012; McKechnie, 2007) and the investigation into improvised cognition revealed that dancers' strategies while improvising highly resemble choreographic creative thinking (De Spain, 2014; Nakano & Okada, 2012).

The particular focus of this thesis on flow experience, a state of complete absorption with the activity, accompanied with energised focus and enjoyment (Csikszentmihalyi, 1988a; Sawyer, 2003), in shared creative practice in dance arises for two main reasons. First, studying improvisation shifts the emphasis of the investigation from the product (creative outcome) oriented to the process oriented, as it observes creativity in the process of emerging. Therefore, the central question of this thesis is: Does group flow experience make the process of dance improvisation highly creative? As the next chapter, a detailed literature review on flow and group flow experience, shows, there is evidence of positive linkage between flow, performance and creativity. However, the research in the field of dance has been very limited and has not addressed creativity. Thus, this thesis aims to establish the presence and role of flow experience in dance, and particularly in dance improvisation, and its relationship with creative outcomes of improvisational exploration.

Secondly, as flow is an established characteristic of highly creative collaboration, this thesis will also investigate the development of flow experience in a creative group. Sawyer (2003) emphasised that group flow is an emergent feature of a group that originates from the quality of interactions. Do some creative approaches in dance (such as sense awareness or imagery) influence group flow experience? If flow

experience might be described as a collective state of mind (Sawyer, 2003, 2007), are there any physiological correlates of group flow experience?

The thesis is divided into seven chapters: the first addresses the theoretical background of the thesis, the second takes a closer look at existing flow experience research. The subsequent four chapters present research findings and, in the final chapter, the thesis concludes with a general discussion. In summary, this thesis progresses as follows:

Chapter 2 presents a literature review on flow experience research. It begins with a formulation of flow experience theory and its phenomenological description. It then presents the studies on flow as optimal experience, which show the linkage between high performance and creative outcomes across various domains. The physiological changes associated with flow are also discussed. Finally, the social context of flow is considered, alongside phenomenology of group flow experience and comparison between individual and group levels of flow. The chapter concludes with the development of detailed aims of studies included in this thesis.

Chapter 3 includes the first study focusing on flow phenomenon in creative dance practice. This chapter opens with a consideration of the present state of research on flow in the context of dance, showing a clear gap in studies on the role of flow and creativity in the field of dance. Therefore, the first study has a qualitative character, based on interviews with dancers and qualitative context analysis. The three main topics are explored: the phenomenology of flow in contemporary dance practice and improvisation; the role of the group for flow experience; and the significance of flow in the creative process. Results indicate that dancers highly value flow in their

creative process, making such claims as that while in the flow they tend to produce highly novel, 'organic and natural' movement and phrases.

Chapter 4 investigates the shared character of flow in improvisation and its relationship with other group processes, dancers' focus and creativity. The chapter discusses quantitative approaches to evaluate flow experience and develops a video-recall method to recollect flow experience from multiple perspectives in the group. The new tool of assessing shared flow experience is piloted and its validity is tested against established flow measures. Further, the influence on creativity of the dancers' focus in group processes of shared flow and empathy is assessed, highlighting the positive linkage between group processes and shared experiences of creativity.

Chapter 5 presents the research on the relationship between shared flow experience and creative outcomes of the collaboration. The chapter opens with the discussion of existing methodologies for studying the evaluation of creative process, specifically the Consensual Assessment Technique (Amabile, 1982), and adapts it to the context of group dance improvisation. The study compares creativity judgments of video recordings of high and low-flow improvisation, concluding that high-flow improvisations are perceived as more creative by experts in the dance field.

Chapter 6 explores the physiological correlates of shared flow experience in dance practice. It starts with a brief literature review of physiological entrainment in a collective, collaborative setting; and the introduction of possible mechanisms that enable such entrainment and their relevance for the context of shared flow experience. Findings highlight differences of entrainment level base on the individual or shared character of the improvisational task. However, the results regarding flow are inconclusive.

Chapter 7, the final chapter, is dedicated to a general discussion of the four studies included in this thesis. Opening with a brief overview of the main results, it focuses on the central topic presented over this thesis: that of the relationship between flow experience and group creativity, and concludes with an indication of potential directions for future research into creativity and group flow.

2 FLOW EXPERIENCE

2.1 THE CONCEPT OF FLOW

The term 'flow' emerged as a native category – i.e., a term frequently used by interviewees themselves to describe the experience – in Csikszentmihalyi's (1975) studies on the phenomena of intrinsic motivation that persuaded people to engage with activities that might bring minimal financial or social status reward; and it refers to a psychological experience of total involvement with activity:

> *In the state of flow, action follows upon action according to an internal logic that seems to need no conscious intervention by the actor. They experience it as a unified flowing from one moment to the next. In which they are in control of their actions, and in which there is little distinction between self and environment, between stimulus and response, or between the past, present and future.*
>
> (Csikszentmihalyi, 1975, p. 36).

Experiencing flow was found to be the main motivation for engaging in certain type of activities: *flow activities;* among others: games, creativity in fields of art and science, sport, and rituals. In this state, a person becomes fully absorbed and experiences feelings of energised focus, deep involvement, and success in the process of doing things (Csikszentmihalyi, 1990). In others words, flow refers to the autotelic experience (Csikszentmihaly, 1975) or the state of 'being in the zone' (Krug, 1999).

In early studies, Csikszentmihalyi (1975) interviewed different groups of people that were likely to experience flow frequently and intensely. As a result, he formulated flow theory in terms of the balance between challenges and skills. Flow is experienced

in those activities where challenges, goals or demands meet personal skill, or action capabilities (Figure 2.1a). When a person believes that the demands of an activity are much higher than their personal capabilities, stress and anxiety are experienced. When a person's skills are greater than their opportunities, and they cannot find suitably challenging tasks, boredom is experienced, fading into anxiety if the ratio is too large (Csikszentmihalyi, 1975, p. 49).

The later studies showed that a certain level of competence and challenge in activity is needed, so flow experience is more likely for higher challenges. The current model differentiates the challenge/skill terrain into eight 'channels', as presented in Figure 2.1b. Flow is experienced when perceived challenges and skills are above personal average levels; but, when they are below, apathy is more likely. Moreover, the intensity of experience increases with distance from the central point of the graph that represents person's average levels of challenges and skills.

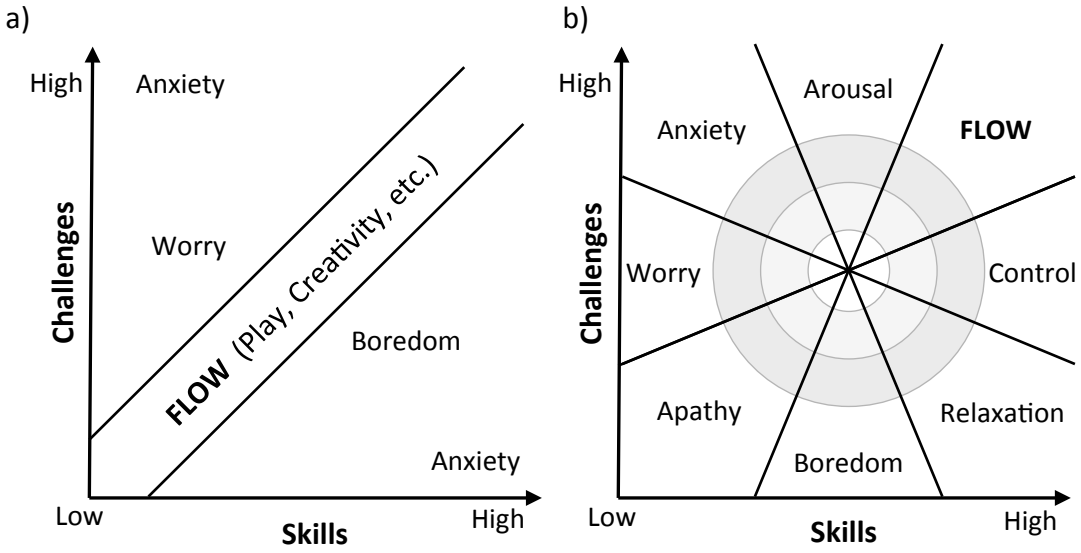


Figure 2.1 The representation of (a) the original Flow Model (adapted from Csikszentmihalyi 1975) and (b) the revised Eight Mental States Model (adapted from Csikszentmihalyi, 1997).

The flow experience is constantly shaped by both a person and environment. Csikszentmihalyi (1985) introduced a term 'emergent motivation' that reflects the dynamics of phenomena: What happens at any moment is responsive to what happened immediately before, rather than being directed by any pre-existing intentional structure, a fixed plan or trait of an actor or environment. Motivation emerges alongside the 'proximal goals' that arise out of the interaction. Thus, people might dynamically regulate their experience (maintaining flow) through adjusting challenges and goals to opportunities and own capabilities in every movement of activity. The next section introduces the conditions for entering flow, and further subjective characterises of this state.

2.2 DIMENSIONS OF FLOW EXPERIENCE

The phenomenology of flow experience has nine principal components. Three conditions for entering flow include challenge/skill balance; clear goals; and unambiguous feedback. Under those conditions, a person enters a subjective state that is characterised by concentration on the task at hand, action and awareness merging, loss of self-consciousness, a sense of control, a transformation of time, and intrinsic reward (Csikszentmihalyi, 1988a; S. A. Jackson, 1995; Massimini & Carli, 1988). Each of these dimensions is discussed separately below.

The flow state is usually reported to occur within goal-directed activities and requires that perceived challenges, or opportunities for action, stretch but do not overmatch one's abilities. It is particularly significant and visible within sport-related activities (Jackson, 1995). The challenges of competition were found to be stimulating and enjoyable if they matched levels of skill and proficiency. Without the right skills,

activities are experienced not as a challenge but rather as meaningless or stressful (Csikszentmihalyi, 1990, p.49).

Clear goals and immediate feedback about the progress being made allow complete focus on the activity itself. It is difficult to become immersed in an activity if one does not know what needs to be done or how well one is doing. A clear goal focuses attention and helps one to concentrate on the task (Csikszentmihalyi, 2002, p. 56). For example, in a game or sport the rules define the achievements, so players know precisely what their objectives are, such as returning the ball or scoring a goal. In such cases, feedback is objective and comes immediately with the successes or failures within the game. Not all activities have such clear and defined objectives. In creative tasks, goals are usually more ambiguous and vague. A person must develop a strong personal sense of what they intend to do and internal criteria for 'good' or 'bad', so they can navigate a process (Csikszentmihalyi, 1996, p.116). Therefore, feedback usually has personal character – it originates from ones' own assessment of progress, but also might be external, coming, for example, from other co-participants, from other musicians participating in a jam session, or from an audience.

One of the most frequently mentioned characteristics of the flow experience is a full concentration on the present moment and the task at hand. In such periods, a person forgets about all other things and, in particular, those aspects of life which are troublesome or worrying (Csikszentmihalyi, 1990, p.58). With such a focus, only the activity-related information is allowed into awareness. In consequence, one's consciousness is no longer intruded upon by the usual preoccupations of everyday life and the resultant activity becomes spontaneous, almost automatic, and effortless (Csikszentmihalyi, 1988b).

Because flow produces harmony within goals and self, attention can be fully invested into the activity (Csikszentmihalyi, 1988b). A person experiences the loss of self-consciousness, the sense of a self separated from the surrounding world. It is sometimes accompanied by a feeling of union with the environment, group or activity (Csikszentmihalyi, 1990, p. 63).

Flow experience typically involves a sense of control, power and positive thoughts based on believing in one's skills and being free from worry about performance (Jackson, 1999). However, what people enjoy is not the sense of being in control, but rather the sense of exercising control in the situation (Csikszentmihalyi, 1990, p.59). In other words, the flow state contains a sense of control without actually trying to be in control or worrying about the lack of control (Jackson, 1995).

Another common characteristic of flow experience is a loss of time awareness or time disorientation. As one dancer described: "Two things happen. One is that it seems to pass really fast in one sense. After it's passed, it seems to have passed really fast. I see that it's 1:00 in the morning, and I say: 'Aha, just a few minutes ago it was 8:00.' But then while I'm dancing (…) it seems like it's been much longer then maybe it really was." (Csikszentmihalyi, 2002, p. 66). A person can lose track of time altogether, as a flow activity has its own internal pace, not related to external, objective measures. On the other hand, time can appear to 'stand still', a person experiences the stretch of time when everything is experienced to happen much slower than usual, a phenomenon frequently reported in sport related research (Jackson, 1995).

The last key element of flow experience is its autotelic character, in that it is intrinsically enjoyable and rewarding, so people tend to engage with flow related activities for their own sake (Csikszentmihalyi, 1990, p.67). There is no need for

external reward or benefit, or if there is a reward, the person is not thinking about it, but rather focusing on the process of doing the activity (Jackson, 1995). The autotelic experience sometimes follows after a long period of doing the activity for external expectations or reasons such as improving the performance or earning money, but at the point when skills and challenges merge, an activity may become autotelic; and the main reason for doing an activity is to feel the experience it provides. In terms of the Self-Determination theory (SDT, Deci & Ryan, 2002), if a situation is not perceived as too controlling, the exposure to an activity might allow the person to experience satisfaction of their basic psychological needs of competence and autonomy (innate drives for optimal function and growth), and in consequence the activity becomes intrinsically interesting resulting in a shift towards intrinsic interest (Ryan, 1995). Notably, creative and artistic tasks are usually autotelic (Csikszentmihalyi, 1996, p. 113).

These dimensions of flow were originally proposed by Csikszentmihalyi (1975) on the basis of extensive exploratory studies on the experiences of high performers across a wide range of sport, art, science, games and leisure activities. Further experience sampling methods conformed the model of flow and extended it to everyday life experiences (Csikszentmihalyi & Csikszentmihalyi, 1988). This structure of experience is also reflected in all questionnaire measures of flow (Engeser & Rheinberg, 2008; S. A. Jackson & Marsh, 1996).

The positive affect that accompanies flow can explain why people are highly committed to tasks that lack external rewards. As individuals experiencing flow are highly concentrated and optimally challenged while being in control of the action, some researchers have equated flow to *optimal experience* (Csikszentmihalyi &

LeFevre, 1989), *peak experience* (Privette, 1983) and the state of *peak performance* (Eklund, 1994). All those terms, to some extent, overlap in their phenomenology, but are defined differently. Optimal experience refers to a meaningful time of great happiness and fulfilment and is used interchangeably with the term 'flow' in most of Csikszentmihalyi's (1975,1988a, 2002) writing. It is used in reference to the wider context of the activity than just that of the actor's state of mind. A peak experience is defined as the time of greatest happiness and fulfilment; it is associated with intense focus and high confidence, and in this sense, it overlaps with flow characteristics (Privette, 1983). It differs from usual psychological states as it is extremely intense and highly meaningful to the person experiencing it (S. A. Jackson, 1992). Being in peak performance means performing at an optimal level and might be objectively measured in terms of outcomes, such as scoring (S. A. Jackson, Thomas, Marsh, & Smethurst, 2001).

2.3 FLOW AND PEAK PERFORMANCE

Qualitative content analysis has shown that in a wide range of sports elite athletes' best results are associated with flow characteristics (Jackson, 1992, 1995). Factors such as confidence and commitment, total concentration on a task and optimal arousal, a sense of control and a feeling of fun, are among the most frequently mentioned by athletes when they are referring to their mental state during their best performances (Gould, Eklund, & Jackson, 1992). Quantitative research where they were asked to evaluate their current performance in comparison to all other similar competitions, as well as objective finishing position (S. A. Jackson et al., 2001) confirmed that flow experience is indeed associated with a subjective measure of success. Athletes in their best performances indicated higher ratings of flow than in

their worst or general competitions (S. A. Jackson & Roberts, 1992). In the latter, the perception of skilfulness was found to be essential to experience a positive mental state in the context of competing in sports, whereas the challenges of competing had a more secondary role in experiencing flow (Stavrou, Jackson, Zervas, Karteroliotis, & others, 2007). Research in the field of sport led to the development of the most popular tools to measure flow experience: Flow State Scale and Flow Dispositional Scale (S. A. Jackson & Eklund, 2002), and their shorter versions Short Flow Scale, again with dispositional and state versions (S. A. Jackson, Martin, & Eklund, 2008). Originating from the field of sport, these tools are commonly used in flow research across domains (Bakker, 2005; Cseh, Phillips, & Pearson, 2015a; MacDonald, Byrne, & Carlton, 2006; Martin & Cutler, 2002)

Another line of studies linked flow with achievements and commitment during high school (Carli, Fave, & Massimini, 1988; Mayers, 1978). A longitudinal study, using experience sampling methods, showed that students who had experienced more flow and less anxiety when engaged in school activities, were more likely to stay committed to their interest and talent area over the next four years (Csikszentmihalyi & Rathunde, 1993). Also, at the university level, in two studies, flow experienced during the course predicted the final semester results (Engeser, Rheinberg, Vollmeyer, & Bischoff, 2005). On the other side, teachers' flow experience was linked to students' cognitive engagement (Basom & Frase, 2004) and experience of flow (Bakker, 2005).

Similarly, in the work domain, flow experience is associated with such positive outcomes as work satisfaction and wellbeing (Bryce & Haworth, 2002; Csikszentmihalyi, 2002). Bryce and Haworth (2002) reported gender differences in the types of office work situation that provide flow in sales and customer support

departments. Women tended to find flow while engaged in problem-solving, organisational tasks and dealing with staff, while for men flowing activities had more competitive and individualistic character, including, meeting deadlines, completing projects, gaining new business and settling claims quickly. The effect of flow on work performance was found to be moderated by employee's level of conscientiousness: Demerouti (2006) studying in-role (defined by position) and extra-role (outside the required responsibilities) performance, found that being in flow significantly increased outcomes only for those employees who were hardworking and goal oriented. Job factors such as autonomy, and resources such as social support, supervisory coaching, and performance feedback were found to be important antecedents of flow experience among music teachers (Bakker, 2005). Similarly, in the longitudinal study of Spanish secondary school teachers, the social support climate of the organisation and clear goals were found to facilitate work-related flow (Salanova, Rodríguez-Sánchez, Schaufeli, & Cifre, 2014).

2.4 Flow as Optimized Physiological Activation

The Flow Model (Csikszentmihalyi, 1975) shares conceptual similarities with *transactional model of stress* (Lazarus & Folkman, 1987), however those theories are rarely discussed together (Engeser & Rheinberg, 2008; Lazarus, Kanner, Folkman, & others, 1980; Peifer, Schulz, Schächinger, Baumann, & Antoni, 2014). Lazarus and Folkman (1987) defined stress as a result of the imbalance between situational demands and personal resources, that occurs when *'pressure exceeds one's perceived ability to cope'.* In the Flow Model, Csikszentmihalyi (1975, p.49) included *anxiety* as a consequence of stress: *'When a person believes that his action opportunities are too demanding for his capabilities, the resulting stress is experienced as anxiety*'. Both

models use similar dimensions of personal competence/skill versus situational demands/challenges. Further, flow shows strong similarities to Selye's (1980) concept of *eustress*, the healthy form of stress, described as the pleasant and desirable state caused by challenging demands combined with high control and subjective importance. This state is also associated with positive arousal and increased productivity.

Based on similarities between flow and stress theories, and taking into account extensive research on affective, cognitive, physiological and behavioural components of the stress response, Peifer (2012, p. 148) proposed a working definition of flow experience:

"Flow is a positively valenced state (affective component), resulting from an activity that has been appraised as an optimal challenge (cognitive component), characterised by optimal physiological activation (physiological component) for full concentration on coping with environmental/task demands (behavioural component)."

This definition provides a conceptual framework for an overview of limited research on psychophysiological correlates of flow experience.

First, flow is experienced together with a highly positive affect. Marr (2001) suggested the possible relation of dopamine and flow, as it is the essential element in the brain reward system. Koepp et al.'s (1998) PET scan studies of video game players provide an indicator to support such a relation. They found a positive relationship between activity in the endogenous dopamine system and performance level. Further research explored the use of electromyography to measure facial muscle activity as an indicator of positive arousal, primarily activity of 'the smiling muscle' (*zygomaticus*

major, ZM). De Manzano et al. (2010) found a positive correlation of ZM activity and flow in their study with professional piano players. However, Kivikingas (2006) did not find such an association while observing flow experience in a first-person shooter video game.

The close relationship of the concept of flow and optimal experience in stress theory suggested a connection of the stress-hormone cortisol to flow experience: a significant positive correlation between cortisol level and flow was observed in a video game study (Keller, Bless, Blomann, & Kleinböhl, 2011). However, this relationship is not linear. Peifer et al. (2015) observed that flow decreased after the simulation of a cortisol response to a strong stressor through the oral administration of cortisol. This finding supports the theory of flow as optimal experience according with the terms of Yerkes and Dodson law (1908): the positive relationship between flow and physiological (cortisol) arousal is expected to be the certain, optimal (peak) level. Further increase of arousal results in the decrease of flow possibilities.

There have been few studies of cardiac and respiratory activity in relation to flow. Keller et al. (2011) used computer gaming, specifically Tetris, to manipulate the skills/challenges balance and therefore, by manipulating the game's demands, experimentally created conditions for flow experience. Besides confirmation of a cortisol-flow connection, he found that flow is related to reduced heart rate variability (HRV). Lower HRV, in comparison to the boredom condition, was connected to high task involvement during flow and interpreted as a sign of mental effort. De Mazano et al. (2010) found that the flow experience of professional piano players performing their favourite piece of music is associated with decreased heart rate and increased respiratory depth (i.e., a state of relaxation). Both results support the view that the

effortlessness experience during flow is a subjective experience that is not connected with the actual physiological cost, at least while measured by cardiovascular activity (Peifer, 2012).

2.5 FLOW AND CREATIVITY

Csikszentmihalyi (1988c) argued that an autotelic nature and associated intrinsic motivation for activity are central benefits of experiencing flow. Although extensive studies concentrate on performance benefits of being in the flow (Bryce & Haworth, 2002; Carli et al., 1988; Csikszentmihalyi, 2002; Demerouti, 2006; S. A. Jackson, 1992, 1995; Mayers, 1978), Csikszentmihalyi treated performance benefits rather as a secondary effect of flow because in any activity performance improves when the activity provides intrinsic rewards. Thus, he suggested, flow plays a vital role in innovation and creativity, as all such processes require high intrinsic motivation to break through to a new level of complexity of thoughts and ideas, while the social environment rarely provides sufficient extrinsic rewards to motivate people to extensive creative work (Csikszentmihalyi, 1988c). Studies on fine art artists found that those who had intrinsic motivation and found their rewards in the making art itself were more likely to maintain a creative practice in the long term (Carney, 1986). Experiencing flow in the creative process provides an optimal subjective experience for the creator and supports their practice through building their intrinsic motivation (Csikszentmihalyi, 1988a).

Indeed, most creators (artists, engineers or scientists - irrespective of their field) claim that their most enjoyable experience resembles a process of discovery. In fact, conditions for flow are easily identifiable in the creative process (Csikszentmihalyi, 1988c). Usually, the creative process begins with a problem to solve.

Typically, it is a challenging, sometimes even risky, goal to achieve, demanding skills from the creator. Creative activities are highly involving. Creative persons develop strategies to ignore external distractions so that they may lose themselves in the creative process. They tend to forget about time and the surrounding and place the joy of working above any extrinsic rewards. All those characteristics associated with a creative process are also indicators for flow experience (Csikszentmihalyi, 1996).

The relationship between flow experience during the creative process and the evaluation of creative outcomes is uncertain. Cseh, Phillips and Pearson (2015) studied the relationship between flow, positive affect and creative outcomes in the field of visual creativity. As a simulation of the creative process, they used a creative synthesis task (Finke & Slayton, 1988), where participants mentally combined visually presented geometrical shapes and then drew the combined forms. They found that flow was highly correlated with self-rated creativity. However, there was no significant relationship with judges' creativity ratings (nonexperts) or objective external measures of productivity, defined as the number of drawings produced in a certain time; nor transformational complexity, calculated for each drawing as a number of transformations such as rotations, flips, etc. Flow was found to improve positive affect and maintain its level during the session. It was suggested that flow provided a protective barrier against the usual fatiguing in the task, sustaining positive affect for longer and therefore helping to maintain the creative process.

The vast majority of flow research focuses on the individual experience of flow, yet many flow activities, especially creative ones, have a primarily social character: improvised music jams, dancing, team-working, sport. Even in the well-organised, task-oriented environment of work, Csikszentmihalyi (1975, p. 146) found that the most

common place people experienced flow was in conversation with others, moreover such informal chats were found to be a source of creative, innovative ideas (Sawyer, 2007, p.53). Thus, group flow experience becomes central in group creativity research. Sawyer (2003, p. 43), based on the study of a jazz improvisation ensemble, described group flow as a collective state of mind that is experienced by an improvising group and defined it as a peak experience–when a group is performing at its peak level of abilities. MacDonald, Byrne and Carlton (2006) investigated the link between musical creativity and flow in a group compositional task, as an example of a collaborative creative process widely used both in education and in creative practice. They showed a positive relation between individual and group level of flow experience, understood as the average level of participants' flow, within the process and assessment of creativity of completed music composition. However, it is argued that group flow cannot be simply understood as an individual flow in group setting (Sawyer, 2003, p. 46).

2.6 FLOW EXPERIENCE WITHIN GROUP – GROUP FLOW

Sawyer (2007) described group flow as a collective state of mind that is experienced by an improvising group. Group flow, a typical component of peak performance across many domains, from team sports, collective art to consulting companies and engineers' teams, is also called combined or shared flow and refers to group activities such as 'hot group', defined as absorbing, vital and hard working interactive teams or task forces (Lipman-Bluman, Leavitt, 1999). All highly successful and creative groups seem to achieve the best results, measures as the creativity of invented solutions as well as team performance and productivity, while they reach this state (Sawyer, 2003, p. 167). Group flow theory, similarly to the phenomenology of flow introduced by Csikszenmihalyi (1975), describes a set of condition and

characteristics of the highly creative team (Sawyer, 2003, p. 167). Conditions which facilitate an occurrence of a group's optimal state are: a common group goal and complete concentration of the group on the activity; good communication and listening skills; members' autonomy, competence, mutual connections and equal participation in the creation; blending egos of participants; familiarity with each other; an ability to build on the ideas of others; and finally, the potential for failure of the project, that means an activity takes place outside 'safe boundaries'. As in the previous section, all components of group flow will be briefly described below.

For group peak performance it is necessary to establish a goal that provides a focus for a team and gives a cue if they move closer to a solution, but which is open-ended enough for creative solutions to emerge (Sawyer, 2007, p. 45). While in improvisation settings the goal is very vague, such as 'performing together', in other situations, as in solving problems, the goal can be precisely defined. Whatever the goal, the range of means and approaches have to be varied enough to achieve group flow.

As with individual flow experience, complete concentration on a challenging task and a sense of control are characteristics of group flow. An activity has to be engaging enough to allow group members to be totally involved, and then the group's attention is centred on the task, obstacles are not noticed and progress emerges naturally from members' work (Sawyer, 2007, p. 48). Simultaneously, the group members have to be in control of their actions and their environment. Group flow increases when people feel autonomy, competence, and relatedness. At the same time, group members must remain flexible, listening and always be willing to defer.

The balance between being in control and giving away control to others group members allows the flow to emerge.

Group flow is more likely when everyone is fully engaged, 'deep listening' to the group. In such moments members of the group do not plan ahead, but they rather react and respond to what they hear in a particular moment (Sawyer, 2007, p. 46). Such unplanned approach to collaboration is typical for improvisation setting, in music, dance, theatre or any other improvisational art, game or activity.

> *'Group flow is the magical moment when it all comes together, when the group is in sync and the performers seems to be thinking with one mind' (Sawyer, 2007, p. 50).*

This description refers to the phenomenon of group members' egos blending. In group flow, participants experience the loss of self-consciousness, as each person's idea builds on those contributed by others. There is no sense of individual ownership of ideas, as they all appear from the interaction and participation of all members. The equal participation of all members facilitates group flow too. Their skill level has to be matched, as otherwise a person with higher expertise might be bored or a person with lower abilities might be frustrated; a hierarchy or unequal roles inside the group would block the flow experience. Finally, group flow is more likely to occur when participants are familiar with each other (Sawyer, 2007, p. 50).

Over time, the group members start to build familiarity with each other, sharing a common language and tacit knowledge about the group. Such knowledge originates from familiarity with the group, common practice and the deep domain-specific knowledge, such as technical details in engineering or compositional tools in music or dance. High communication skills and mutual response to each other's ideas

support this process. However, a certain level of diversity is also beneficial, as working with too homogeneous a group does not provide enough variety of ideas. If everyone in the group is too similar, sharing the same habits of thinking and communication, the possibility that something new and unexpected emerges is lowered. In group exchanges, there would be less space for surprises, members would put less effort into listening to each other's ideas as they are too predictable and similar to their own (Sawyer, 2007, p. 52).

Group flow requires a constant exchange of ideas, and therefore constant communication between the members. Sawyer (2007, p.53) found that informal setting, like coffee breaks or spontaneous conversations in the hallway, are more likely to lead the group into flow than highly structured meetings. A collaborative, dynamic style of working together facilitates flow experience and, consequentially, leads to peak performance of the group.

Sawyer (2007, p. 56) emphasises that there is no group flow without the risk of failure. That means an activity must take place outside 'safe boundaries'. The group task has to be challenging enough to be risky, but it has to meet participants' abilities. The right balance is needed between the novel and the conventional in a proposed solution, between individual voices and listening to the rest of the group, and between analytical, critical thinking and thinking outside-the-box. Usually, such a balance is found in improvisation settings where there are some rules, and a shared tacit understanding of the goal, but not too many regulations or structure.

Although Sawyer defines his concept of group flow as a phenomenon distinct from individual flow, as an emergent property of the group unit, both theories share many similarities: They both refer to optimal experience (performance) when a person

or a group reaches their peak abilities, is highly creative, productive, and successful. They both emphasise the importance of a clear goal as the framework for an activity and challenges that meet personal skills. They both include the high concentration on the task as the requirement to enter into the flow. While Csikszentmihalyi (1975) defines his theory in terms of skills/challenges balance as a requirement to enter the flow state, Sawyer (2007) emphasises the importance of personal competence in the group activity. Individual flow is associated with a sense of control. For group flow, the sense of member's autonomy to participate in the group activity equally is required. Both researchers include the 'blending egos' phenomenon, and the absence of sense of a self separated from the surrounding world (or group). The differences between models arise with Sawyer's focus on the qualities of group processes, which naturally are absent in the individual model of flow. The importance of mutual connections and group familiarity, good communication and listening skills and the ability to build on the ideas of others are included in group flow, characterised as essential for flow to emerge in a group activity.

It is not surprising that in a qualitative study of a music jam session Hart and Di Blasi (2013) found that combined (group) flow experience shared almost all the characteristics of individual flow experience. The musicians did not connect being in the flow either with clear goals or unambiguous feedback. Researchers suggested that this difference appeared as a result of the specificity of music jamming. Music improvisation rarely has defined clear goals, and the criteria of desired output are also unclear. Also, Sawyer's and DeZutter (2009) studies emphasised the improvisational emerging character of group activity as highly related to the group flow experience. However, they claimed that to have a flow experience, a group needs to have a

common goal. It is worth noting that gathering for playing music in a jam is already a set goal, so the lack of appearance of such a category in musicians' reports might be irrelevant.

The similarities, and lack of clear distinction, between individual and group flow phenomena are also visible in the strategies for measuring flow. While individual flow is usually assessed using questionnaires (Jackson & Eklund, 2002; Rheinberg, Vollmeyer & Engeser, 2003) or sampling methods (Csikszentmihalyi, 1975), group flow is addressed mostly through observational studies (Sawyer, 2007), interview-based remarks (Hart & Di Blasi, 2003) or indirectly, through measuring individual experience and averaging it in the group (Macdonald et al., 2006; Salanova et al., 2014). An overview of current tools for measuring flow (both, individual and group experience) is included in Chapter 4.1 (p. 78).

2.7 Thesis Summary

This thesis addresses the nature of Sawyer's proposed group flow phenomenon, by examining individual and shared flow experience within small groups of contemporary dancers improvising together given tasks (scores).

Flow research over more than 40 years has explored the importance of the flow phenomenon from everyday life activities to elite athletes' performance. Despite originating in studies on highly creative individuals, there is surprisingly little evidence on the role and effect of flow experience in creative practice. Sawyer (2003) addresses this gap in his studies on group creativity, describing through group flow theory the optimal group environment in which unexpected and highly creative ideas are more likely to emerge. He claimed group flow as a distinct phenomenon to Csikszentmihalyi's (1975) individual flow concept. Close analysis of both theories

shows clear overlaps in terms of individual mental state while experiencing flow. In research practice, those phenomena tend to be combined regarding methodological approaches of studies and findings (Hart & Di Blasi, 2013; MacDonald, 2006; Salanova et al., 2014).

Few studies have addressed the experience of flow in dance practice (Hefferon & Ollis, 2006; Jeong, 2012; Paskevska, 2001), and they will be discussed in the next chapter. Only Paskevska (2001), in her theoretical essay, has addressed the place of flow for creativity in dance. Moreover, due to the distributed, social character of creativity in dance improvisation, flow experience has to be assessed from a shared, group perspective. The first aim of this thesis is thus to explore the phenomenon of flow in dance practice using qualitative methods. The research questions that arise first are: How do dancers experience flow? What is the role of the group in flow experience? How does group flow influence their creativity?

A primary challenge results from methodological difficulties of measuring flow, especially in a social context and dance practice. An overview of common approaches to assessing flow is included in Chapter 4. One of the aims of that chapter is to develop a method that allows the character of flow in dance improvisation to be examined. Such a method should test whether flow experience in dance has an individual or a shared character.

An important question arises around the influence of flow experience on creativity and the evaluation of creative outcomes. Only a few studies have addressed this area, showing that flow increases subjective, first person ratings of creative outcomes (Cseh, Phillips, & Pearson, 2015b) as well as experts judgement on creative product (MacDonald et al., 2006). In this thesis, the link between flow and creative

outcome will be addressed through correlational and experimental studies from both perspectives: of subjective judgment in Chapter 4, and using more objective methods that includes expert ratings in Chapter 5.

The final part of this thesis explores the psychophysiological basis of shared flow experience. Previous research connected individual flow with positive affect (de Manzano et al., 2010; Koepp et al., 1998) and optimal arousal (Keller et al., 2011; Peifer et al., 2015). Sawyer (2007) describes group flow as a *'collective state of mind'*. Recent research in the domain of *collective experience* gives some interesting insight into the physiological mechanisms of entrainment associated with collective activities that explain the alignment of internal states (Konvalinka et al., 2011). Thus, the detailed exploration of these links is included in Chapter 6 with the following research question: Is shared flow experience associated with group members' entrainment on a physiological level?

3 FLOW EXPERIENCE IN DANCE CREATIVE PRACTICE

Dance was one of the flow activities included in early investigations central to the development of flow theory. Hendin and Csikszentmihalyi (1975) studied rock dancing, a social dance form of the late 1960s, with the aim to develop a simple questionnaire-based measure of the mental state of flow and analyse the factorial structure of the phenomena. As a form of activity, rock dancing was a purely participatory activity, as opposed to performance dancing. The form was acted out in couples; it was improvised rather than choreographed and rarely performed in front of an audience. Although the rules in the improvised form of dance are not strictly defined (as opposed to other flow activities, like sport), it does have rules, which participants recognised, as well as clear limits. Researchers argued that within this set of limits, the dancer is confronted with the set of opportunities for embodied actions in interaction with their partner; and a flow experience develops out of the match between the opportunities and actions (Hendin & Csikszentmihalyi, 1975, p. 104). Further, they commented on one major difference between dance improvisation and classic flow activities, namely the lack of the presence of direct, unambiguous feedback. The rules of rock dancing (as well as other improvised forms) are not clear enough to allow a dancer to evaluate if he or she is doing well. Such, ambiguity of the meaning of actions might be very confusing or worrying for less experienced dancers; however, for skilled dancers, it might be seen as an asset as it adds a whole new level of challenge (Hendin & Csikszentmihalyi, 1975, p. 107).

The close analysis of interviews with dancers showed that those who were predicted to be in flow, based on their reported involvement and active enjoyment of the activity, presented better performance in improvisational problem finding and solving: they more often knew the right thing to do, were less self-conscious, got clearer feedback, were more in control of social situation, felt more in harmony with the environment, felt that time passed faster, and were less distracted. Additionally, they presented a significantly closer balance between their skills and the challenges of dance, mostly due to their possessing higher skills (Hendin & Csikszentmihalyi, 1975). Thus, flow was related with a smoother process of improvisational social dancing.

In the field of contemporary dance, Hefferon and Ollis (2006) studied which factors influence dancer's individual flow experience in professional settings. First, they analysed the phenomenon of performing dance, as stage performance demands a distinguished set of skills to social dance, showing that this type of activity also enables participants to experience flow: it requires specific skills and dancers usually challenge themselves in performance; goals are clear (executing the movement or choreography), and feedback is immediate. Additionally, dance (choreographed) enables a person to fully concentrate on an activity, to be completely absorbed in the moment, and is often an enjoyable experience. Other characteristics of flow such as the sense of control, loss of self-consciousness and 'transformation of time' are also likely during dancing. Hefferon and Ollis (2006) attempted to specify common and unique factors and inhibitors of the flow experience in professional dance. Based on interviews with professional dancers with extended stage practice, they showed that flow in dance is closely related to autotelic experience, challenge vs. skills balance and absorption with a task. Further, they described facilitators and inhibitors of flow, such

as the importance of self-confidence, familiarity with movement material, the role of ritualistic preparation, and routine. An unfamiliar setting, for example, a new stage during a tour, was found to be the main barrier for flow to appear. The dancers emphasised the importance of good relationships among the company and building personal confidence as crucial factors that enable flow state on stage. To summarise, flow experience has similar characteristics in professional settings as in social activities, however as the level of demands is much higher (public presentation, technical demands of choreography, etc.), it requires from dancers better preparation (familiarity with choreography, routines) and it is sensitive to environmental and social factors, such as familiarity with the performance space and good relationships among the company.

In a similar context, Jeong (2012) investigated the links between the mental state of flow and stage performance at a professional level, looking for an intervention to enhance flow experience (and dancers' performance) on the stage. He found that imagery plays a significant role in experiencing flow, both in rehearsal and stage settings: Dancers used imagery to retrieve bodily sensations, to become absorbed in the performance, to explore the feeling of movements, to connect to the stream of performance, and to create links between thinking and movement of the body. Jeong's (2012) studies showed a moderate to high relationship between the use of imagery and specific factors of individual flow experience. Based on those findings, he created, and successfully tested, the imagery-based intervention to enhance dancers' flow experience on the stage, based on self-confidence and positive thoughts. Such intervention indeed enhanced the flow experiences of dancers, reduced anxiety, and improved their performance.

The role of the mental state of flow in the dancer's creative process was addressed by Paskevska (2001). Through analysis of professional dance pedagogy approaches, she argued that flow in dance is achieved through mastering a technique of performance that allows dancers to execute choreography in the 'no-mind' state, in which the performance proceeds without overt conscious control of decisions or judgement of actions. However, flow in her view has a crucial importance for creative practice. She commented that even if the intellectual process of making dance plays a significant role in the conceptualization of ideas, flow in the creative process allows dancers a free expression of their embodied ideas. She emphasised that to find truly a creative state, both technical excellence and flow were equally important: technical excellence allowed a dancer to fully express and embody their ideas; while a no-mind flow state gave access to innate creativity. As an example, she referred to the common post-modern creative practice, namely free improvisation tasks that inspired the movement vocabulary of a particular work.

To sum up, previous research has demonstrated an intrinsically rewarding, autotelic character of dance and places it as a flow-likely activity that can provide an optimal experience for participants. The mental state of flow shows positive linkage with dancers' performance, both in social dance and professional performance settings. In spite of that, there is limited, only theoretically based, research that explores the flow experience in dance with regard to creativity rather than excellence of performance. This thesis will focus on this missing link. The aim of the first study is to establish the existence of flow experience and investigate its nature in dance creative practice. Using a qualitative approach, the cognitive and emotional markers of

flow experience will be explored, as well as its role in the creative process of dancers and the role of others–the group–for experiencing flow.

This study focuses on the practice of group dance improvisation. Sawyer (2000) stated that observing improvisation has several advantages while studying creativity. First, there is no distinction between creative process and creative product, the creative process of improvisation is the product, so the audience (or researcher) is watching the creative act as it occurs. Further, improvisation is the moment-to-moment practice, in which all decisions and choices are made spontaneously, therefore the entire creative process is observed onstage. Second, many of the improvisational approaches in different genres, including dance, are fundamentally collaborative. In studying the social aspect of creativity, to observe the collaboration within the task on stage is relatively straightforward compared to the challenges of following other forms of creative collaboration, such as choreographic production (Grove, Stevens, & McKechnie, 2005; Waterhouse, Watts, & Bläsing, 2014).

Improvisation settings are used in the following study as a laboratory that allows observation of a group while they are creating (Sawyer, 2000). There is evidence of the importance of flow for other improvised creative practices: in music (Hart & Di Blasi, 2013) or theatre (Sawyer, 2007), showing positive relationship between shared, group flow and peak performance of the group. This study will extend those findings onto group improvisation dance practice.

3.1 METHODS

3.1.1 STUDY DESIGN

To capture the role of the group in a flow experience in dance, a qualitative research design was used. Dancers were invited to take a part in an improvisation

workshop where they engaged with several tasks and then had an opportunity to reflect on their experience of the creative process during group improvisation and any associated flow experience, using a video-stimulated recall method. This method will be discussed in detail in Chapter 4.3 (p. 83). In the following week, dancers' experiences were elicited in individual interviews. All participants took part in an interview, providing the opportunity to capture multiple individual perspectives of the same group experience.

The interview transcripts were analysed using qualitative content analysis (Gläser & Laudel, 2013). The method is based on extracting relevant information and processing it in relation to prior theory background, keeping open possibilities for new insights and developments.

3.1.2 PARTICIPANTS

Six dance students on a one-year professional formation programme at Trinity Laban Conservatoire of Music and Dance were recruited for the study. The programme is based on a professional development model, providing opportunities for dancers who have taken an unconventional route or have trained outside of formal education to study in a conservatoire environment. Thus, many of the students had already established their own artistic practice. The group consisted of four female and two male dancers aged between 22 and 28 (M=24.2). The participants had been on the same course for 30 weeks, and were regularly sharing dance and creative practice during the course. Each participant received £16 for taking part in a 1.5 hours group workshop session followed by a 25-40 minutes individual interview.

3.1.3 PROCEDURE

A workshop session was designed as a group improvisation practice. After initial introductions and filling in consent forms, the group warmed up for 10 minutes using walking exercises, focus changes, senses and group awareness building and finally a 'freezing game', where the group searches for common pauses (freezes) of movement and common beginnings of dancing again. The session design was used as a simple structure for initial group improvisation.

Three further tasks were then introduced, and the group was asked to improvise for five minutes for each task (Table 3.1). These tasks were chosen to explore commonly used improvisational practices and give participants a range of experiences (e.g., Benjamin, 2001; Blom & Chaplin, 1988; Tufnell & Crickmay, 2004). First, a 'sense awareness' task asked dancers for 'here and now' awareness, and for taking inspiration from their surroundings. Next, a free movement task simply provided a time frame for movement, as no additional instruction was given. Finally, an imagery task gave dancers multimodal imagery as a starting point for improvisation.

Table 3.1. The three improvisational tasks used in the workshop session.

1. Sense awareness
"Arrive in the space. Sense your weight… Let your eyes look around. (…) *Let your feet sense the floor. (…)* *Let all your senses open and lead you for the next few minutes of dance…"*
2. Free movement
"The only rule this time is the time limit… Please, enter the space, *find your way though* *and after 5 minutes I will ask you to find an ending."*
3. Imagery task
"Imagine the colour BLUE, you can image an object, landscape or just some substance or blue haze *how does it fill in the surrounding? What is it density?* *And its texture? Its sound?* *What kind of blue things comes to your mind? Place them in the space.* *(…)"*

3.1.4 VIDEO-STIMULATED RECALL OF FLOW EXPERIENCE

After each task had been performed, the dancers individually watched a recording of their group's performance on a tablet device and commented on their creative process and flow experience in the just finished task. The video-stimulated recall report was a pilot study for using such a method in the field of dance practice to

evaluate dancers' improvisational process, their 'being in the zone', and flow moments recognition. The method will be described and commented on in detail in the next Chapter 4. In the context of the following qualitative analysis, the use of video-stimulated recall reports during the workshop allowed dancers to engage in reflective thinking on their improvisation process and the place of flow within their practice.

After the three rounds of improvisational tasks and video-stimulated reporting, a group sharing and feedback circle was arranged to debrief the participants.

3.1.5 INTERVIEWS

Semi-structured interviews were conducted with all participants during the week following the workshop. The interviews were guided by previously developed key questions (Table 3.2). However, the exact order differed due to individual answers. Each interview started by establishing how the dancer understands and describes the flow experience in their own words. To facilitate the interview, the dancers were asked to choose one of the three previously performed tasks at the testing session as an example. While watching the video, they were asked to refer to where their attention was focussed, their feelings, and their moments of flow.

The interview focused mostly on the group role and the relation with others in flow experience. Also discussed were the relationship between flow and creativity, interaction between novel versus habitual movement solutions, and the role of flow in the creative process. Finally, participants were asked if they recognised any general moments or practices in which they were usually experiencing 'being in the zone' (in flow), to see if it is an experience specific to dance practice or whether it is more common in their everyday life. All interviews lasted between 25 and 40 minutes, were voice-recorded and were transcribed with NVivo software for data analysis.

Table 3.2. Scenario of semi-structured interviews on the role of flow experience in dance practice.

1) How would you describe a flow experience during improvisation in your words?

    i) Where is your attention?

    ii) How do you feel in those moments?

    iii) Are you able to recognize this state during improvising? Or you reflect on it later?

2) Are you more likely to experience flow in individual improvisation (for example in movement research), or in group improvisation?

3) What is the role of a group, other dancers, in flow experience?

4) If you could reflect on movement material and qualities during flow, are they in any way specific? Familiar for you? Or, maybe surprising or unexpected?

    i) How do you evaluate such moments?

    ii) Are you able to recollect that material after improvisation? For example, to use it for choreographic purposes?

5) Do you recognise some typical moments or practices when you are usually getting into flow easily?

3.1.6 QUALITATIVE CONTENT ANALYSIS

The qualitative content analysis (QCA) approach was used to structure and extract relevant material from transcribed interviews. This approach allows one to

understand the phenomenon of the flow experience from multiple perspectives and explore its shared, group character.

The core idea of this qualitative content analysis approach is the extraction of information from the original text and its separate processing. The process of analysis starts with the development of a set of categories that are then applied to the text. Initially, the set of categories is derived from a theoretical background, however it can still be modified in number (new categories can be added), structure (dimensions) and the possible nominal values. As a result, new data are interpreted with regard to theoretical background and previous data (Gläser & Laudel, 2013).

In this investigation, the conceptual approach was based on three general themes around the phenomenon of flow, which were used as categories for primary coding. The initial theme, 'cognitive and affective markers of flow experience', originating from Csikszentmihalyi's (1975) description of flow, described an individual flow experience and its cognitive components (Table 3.3). A second theme, 'the role of group', grounded in Sawyer's (2007) group flow theory, described the properties of a group that supports a participant's flow experience (Table 3.4). Finally, the third exploratory theme, 'creative flow', summarised the dancers' remarks regarding the role of flow in creative practice, describing the use, recollection and novelty of the 'being in the flow' movement material. In each theme, the additional categories were derived inductively from the data, paying special attention to the specificity of dance practice. The codes subsequently developed through the analysis process were revised and merged, and new codes were added as the review of the data proceeded (Table 3.3, 3.4). This process of analysis was performed by the author of this thesis.

Table 3.3. Cognitive and affective markers of flow. The predicted and emergent dimensions of dancers' flow experience is based on the qualitative content analysis of interviews. Arrows indicate how the initial, predicted dimensions were merged into the final dimensions.

Predicted dimensions	Final dimensions *(examples of keywords)*
Challenge/skill balance Clear goal and unambiguous feedback Full concentration on task Action-awareness merging Loss of self-consciousness/ / blending egos Sense of control/autonomy	Effortless attention *(focus, easiness, happens to me)*
Transformation of time Intrinsic motivation/reward Optimal experience Positive emotions	Enjoyment *(feels good, happiness, joy)*

Table 3.4. The role of group. The predicted and emergent dimensions of dancers' flow experience are based on qualitative content analysis of interviews. Arrows indicate how the initial, predicted dimensions were merged into the final dimensions.

Predicted dimensions	Final dimensions *(examples of keywords)*
Good communication and listening skills →	Becoming one with the group *(connection, togetherness, shared process)*
Mutual connections →	
Ability to build on the ideas of others →	
Group familiarity →	Trust *(trust, acceptance, lack of judgment)*
	Touch *(touch, physical contact, contact improvisation)*

The credibility of QCA is dependent upon the trustworthiness (Lincoln & Guba, 1985) of the qualitative inquiry. To ensure the trustworthiness of the current study, the guidelines by Elo et al. (2014) for improving trustworthiness in each stage of investigation - preparation, organisation of content and reporting - were applied. In the preparation phase, trustworthiness is demonstrated in the adequate selection of the data collection method for ensuring the credibility of content analysis. In the case of this study, semi-structured interviews about specific topics (related to the workshop and testing task) and general topics (related to overall dance experience) were chosen to collect an overview of the dancers' experiences about flow in their creative practice. The interview was designed to reflect the research strategy and gather information about an individual's flow experience, the role of the other in experiencing flow (group

flow) and its link with creativity. Another important factor of credibility at this stage of research refers to the sampling strategy: *'Who are the best informants for my study? (…) Is my sample appropriate?'* (Elo et al., 2014, p.4). The current study included dancers during their professional training, meaning that they were engaged in creative practice on a daily basis. Moreover, the chosen strategy to interview all the participants of the conducted workshop allowed the holistic recognition of the group-level experience.

In the organisation phase, trustworthiness assesses the quality of coding. It includes the clarification of how the categories were created and grouped, what was the degree of interpretation of the data (e.g., if facial or bodily expressions were included) and how the created categories reflect the collected data (Elo et al., 2014). In this case, the initial categories were theory-driven and merged into the final ones (see Table 3.3 and Table 3.4), based on whether co-presence appeared in the dancers' remarks. Only the text transcription of the interviews was taken into account. As all data were analysed by one researcher (author of this thesis), the credibility of the analysis was confirmed by checking for representativeness of the data as a whole (Thomas & Magilvy, 2011): after the process of selecting and merging data-driven categories, the final categories had to be representative across the sample (in reports of three or more dancers).

In the reporting phase, trustworthiness was addressed in three ways. First, the structure of this section reflected the theoretical basis of the analysis and referred findings and emergent categories to the predicted ones, confirming the theoretical model of the phenomenon (Elo et al., 2014). Second, the included quotations reflected the participants' voice confirming that the data was accurately represented in the

analysis (Lincoln & Guba, 1985). Finally, the analysis referred to other studies on the phenomenon of flow, confirming the credibility of the findings (Graneheim & Lundman, 2004).

3.2 RESULTS

All dancers were familiar with a concept of flow, and they found it to be a vital component of their practice. They commonly perceived flow experience as a state when movement creation happens very naturally, in an effortless way.

> *Dancer F:*
>
> *'It is where it just feels completely natural. There is no question, it just comes and comes, and as long as my mind does not go, 'Oh, what am I doing? Oh, what was that?' or is affected negatively by other things around me–it could be the space, other people or thoughts in my head that has nothing to do with what I am doing now–then I am in flow.'*

They all associated flow with positive emotions, feeling good and not being bothered with random thoughts or self-judgment. The issue of self-judgment appeared frequently in interviews, being identified as one of the major obstacles to creativity and improvisation. The role of flow experience in the creative process varied depending on a dancer's practice, especially on the level of engagement with improvisation. Dancers with extensive improvisation practice, both as performers or in generating material, context-identified flow as a highly creative state.

The following section will be divided into three parts, reflecting the analysis strategy. The first part will focus on the characteristics of individual flow experience in dance practice. In the second, the role of a group for experiencing flow will be

discussed. The final part will focus on flow experience in the creative process of dancers.

3.2.1 COGNITIVE AND EMOTIONAL MARKERS OF FLOW

Most of the elements of flow experience previously described by Csikszentmihalyi (1975) were found in dancers' transcripts. Two main dimensions, of effortless attention in activity and enjoyment, emerged as the most significant. Conversely, dancers never referred to challenge versus skills balance or a need for unambiguous feedback, two requirements for flow predominant in sport and achieving peak performance activities (like performing a technically demanding ballet). There were also no direct comments on the time transformation aspect.

3.2.1.1 Effortless attention

The leading theme that emerged from transcripts was that while being in the flow, dancers merged their awareness with their movement creation: in other words, they were thinking, creating fully through moving, rather than observing their actions then preplanning the next ones.

Dancer B

'My body was really connected, but it was not my brain anymore telling me 'now, you have to lift your right arm.' I let my body parts to take the decision they wanted to.

Dancer A

'Flow is when I dance and everything that happens in movement happens naturally. That I do not need to think a few steps ahead: 'Now I do this or that.''

Dancer C

'Flow experience for me, I feel like the movement comes to me, that I do not have to make decisions like 'now I move my arm, I move over there'. I feel like it is happening to me. I can have thoughts about the thing. I would like to go on floor, but it is not like I have to decide now.'

The attention-awareness merging characteristic of flow describes an experience of loss of the sense of self, in separation from the activity and feeling of union with surroundings (Csikszentmihalyi, 1990, p. 63). With such a concentration on the task, dancers can fully engage with a non-propositional way of creating through their bodily responses rather than pre-planning movements that might lead them to new, novel movement solutions (Kirsh, 2011a).

To reach such a state, a person has to be fully concentrated on the task or, rather, not be bothered by any distractions. Dancers reported that interference both from the external environment as well as internal thinking were common obstacles for reaching and maintaining flow.

Dancer E

'Instead of realising that I am in flow, I more realise when I am not: when my brain is busy when I am thinking about the stuff, and I finish the improvisation thinking that it was nonsense.'

In particular, self-judgment appeared as highly problematic for dancers:

Dancer B

'Because, normally, sometimes when you dance, and you do not have that flow, you overthink too much and instead of doing the movement

you start to make a movement, so you struggle with it and it does not fit well.'

Dancer C

'Have a hard time to getting to flow if I think, 'Oh you always do this.' So trying to stop myself evaluating what I am doing.'

Dancers shared that they frequently critiqued their movement ideas and performance, how it might look from the outside, and how novel the idea is. While critical thinking is a vital part of dance study and creative practice, self-judgment might be limiting the creative process, stopping an artist from experimentation. What was surprising was that most of the dancers (5 out of 6) stated that they prefer to work and improvise within a group compared to improvising on their own, as with other people around, especially when they are engaged in the same activity, they self-critique less.

In summary, the dimension of *effortless attention* included such phenomenological markers of flow, described originally by Csikszentmihalyi (1988a), as full concentration on the task, action-awareness merging, loss of self-consciousness, and sense of control during the activity.

3.2.1.2 Enjoyment

Being in the flow simply feels good. All dancers referred to positive arousal associated with the flow:

Dancer B

'Really good feeling. When it happens, it is a bit meditative in a way.'

Dancer C

'It is a good feeling; I really enjoy it. It creates in a way more space for me; I feel free.'

Dancer A

'Happiness, joy; and I do not care anymore what other people might think about what I look like. So, it feels like flying. I feel very light.'

Similarly to Hefferon and Ollis's (2006) study on flow experience in dance performance, dancers perceived flow as an autotelic experience. They were commonly looking for being in flow while improvising. Moreover, they highly valued full engagement with actions that eventually led them into flow, in comparison to a more analytical external way of composing their movement. As Csikszentmihalyi (1996, p.120) stated, *'many of the peculiarities attributed to the creative persons are really just ways to protect the focus of concentration so that they may lose themselves in the creative process'*, as distractions usually interrupt flow and the creative work. In conclusion, the dimension of *enjoyment* combines affective aspects of flow: positive emotion, intrinsic reward and optimal experience.

Dancers highly valued the flow moments in improvisation as 'good bits' and as aesthetically appealing. In improvisation, the criteria of success are rather ambiguous: the practice contains a basic, culturally defined set of rules but their character is rather ephemeral (Sawyer, 2000). In this context, the enjoyment that accompanied flow experience provided dancers with primary feedback about their performance.

3.2.2 THE ROLE OF GROUP FOR EXPERIENCING FLOW

Dancers reported that entering and maintaining the flow state was easier while being in the group compared to being on their own, however the quality of the group, familiarity with others and levels of trust also mattered. Sawyer's properties of group flow were reflected in dancers' reports, merging into two main themes: becoming one

with the group and trust. An additional theme, the role of touch in flow experience, also emerged.

3.2.2.1 Becoming one with the group

Becoming one with the group was the predominant characteristic of flow in group improvisation. In their reports, dancers referred to the point where all actions or decisions were shared and the feeling of deep connection with others appeared.

> *Dancer B*
>
> *'Then the flow came when we were all like, even if it was not necessary contact like touching, but just being in relation, moving in relation to each other and just with other people instead of individuals moving alone in the same space.'*
>
> *Dancer C*
>
> *'I feel [flow] if with group I am in (…), we have something in common; we are on the same page. We are not doing completely different things. It could be different dynamics, but there is some energy.'*
>
> *Dancer E*
>
> *'What has happened for me and that did not happen before: I was not consciously having to think about what I was just doing as much; the move just came and I found nice moment with other people. In that moment I connected.'*

Similarly, in studies on jazz music ensembles and improvised theatre, Sawyer (2003, s.44) noticed that in group flow the performers were in interactional synchrony and their action seemed to come naturally. Each of the group members shared that they were able to anticipate fellow performers' actions before they even happened.

Later, describing the phenomena of blending egos, Sawyer (2007) suggested that group flow happens when the group comes together, is in sync and the performers seem to be thinking with one mind.

Further, dancers reported that being in the group enriched their choices, as they had the opportunity to get inspired or develop movement from what emerged in the group. The ability of parallel processing–creating and making choices while closely listening to other members and immediately responding to their action–was placed as one of main requirements for group flow to happen (Sawyers 2003, p.44). The ability to build on others' ideas is considered a learned skill that requires previous, extensive training and warm-up for the group to establish peak performance (Sawyers, 2007). However, dancers commonly reported that in the improvisational process, having other people to work with made the creative process easier to maintain and more fruitful compared to their solo creation.

Dancer E

'I find it is much easier to improvise in a pair, because then you work from each other; and then there is a contact. There are whole new possibilities open up to you, which are not there while you're on your own. So, for me it is much easier to achieve that flow sense in a group, because you are not just on your own. You are all in it together and it is much more enjoyable experience.'

Dancer F

'The most enjoyable part of dance improvisation with other people is when it works: you are keeping your own integrity while your movement is being, and your thought process are being, enriched by other people around you.'

Most of dance training includes opportunities for dancers to develop their non-verbal communication skill, spatial and sound awareness as a substantial part of practice is taught with rather limited verbal explanation, through demonstration, mimicking actions and mirroring, with an emphasis on coordinated movement of group. Such training naturally prepares dancers for group interactions and group creative processes.

In summary, *becoming one with the group* dimension merged such aspects of Sawyer's (2007) group flow charecterisitics as mutual connections, good communication and listening skills, and ability to build on the ideas of others.

3.2.2.2 Trust

While talking about conditions and obstacles to getting into flow, dancers referred to familiarity with others and trust within the group. Feeling safe and accepted is essential for improvisation and creativity, as those practices require dancers to experiment and publicly act outside of their familiar schemas.

> *Dancer C*
>
> *'I like if there is the environment for trust. Then I can experiment more and I enjoy it more.'*
>
> *Dancer D*
>
> *'When I dance with someone I do not know, I have no idea who they are, probably I feel they are watching me all the time, they would judge me.'*

Sawyer (2003) suggested that the familiarity with each others' expression and communication style helps group members to respond to each other quickly and accurately and builds shared understanding of the group's goals and roles. As noted

previously in this study, it also helps to lower dancers' self-judgment, a primary obstacle for creativity and getting into flow.

To summarise, dancers found it very useful to work in a group as they were less critical about themselves and they had to give up on controlling the situation.

Dancer A

'It is easier to drop this thing that I am being watched. Because, I know, if someone is watching I am not the only person who is watched and might be judged.'

Dancer C

'A group helps, because I accept that I cannot control everything. So people around me will do things, they could be in my way and then I have to move. The acceptance that I cannot decide everything anyway helps me to not evaluate too much what I do. It makes me bit more relaxed - not thinking too much.'

The last response reflected also the other characteristic of group flow: the potential of failure. Even if there are no explicit parameters of successful improvisations, dancers tend to judge their performance a lot. Improvisation, because of its nature, allows dancers to act on the edge of their abilities of creativity, performance technique and communication skills in the group. This keeps practice vivid and, for the most part, challenging over time.

Group flow is an emergent property that allows group members to engage in actions that they would not have thought of without the inspiration of the group (Sawyers, 2003, s.45). In many ways, through creative proposals, acceptance and support of one's ideas, group flow helps individuals to attain their own flow state.

Most participants in this study (5 of 6 dancers) confirmed that they were more likely to get into flow while being in a group. Safe setting and a certain level of trust between group members were required for the group to succeed. Although group familiarity is one of the original aspects of group flow experience (Sawyer, 2007), the emphasis on trust in the present study is novel.

3.2.2.3 Touch

A dimension of *touch* was not predicted in the initial categories, it emerged directly from the analysis of interviews. Dancers expressed that being in physical contact with others was one of the triggers for flow experience. In this regard, contact improvisation (improvisation that involves physical contact between dancers) requires focussed attention on body sensations in order to maintain contact with the other and sustain one's own integrity over time. Some dancers found this kind of attention to entail a state of flow.

> *Dancer D*
>
> *'I realized when we were doing it; I felt more flow when I touched someone, because that makes connection with other and you are not alone.'*
>
> *Dancer B*
>
> *'Then I had a moment of contact with someone - it made me forget what I am doing, and I follow what a touch and this kind of things are giving me.'*

Contact Improvisation is based on the principles of maintaining 'the point of contact' in duet form and an on-going investigation of movement patterns through sensing, feeling and noticing bodily changes (Bull, 1997). Little (2014) considers contact

improvisation to be a form of attention training that emphasizes the active sensing process, where the attention is shared between dancers with the aim of supporting shared complex actions. Responding to tactile information demands huge attention from the dancer as the information is highly complex. In contact improvisation, most of the communication between partners happens through sensing, touch and shifts in proprioception, while vision and auditory signals are usually diminished. Such shifts might promote flow experience through a more sustained focus of dancers' attention on shared embodied task.

One dancer highlighted that the quality of the relationship is very important and that being in physical contact when understanding and collaboration is poor can be very distracting.

> *Responded C*
>
> *'When I work in physical contact with another, if that is the task and I know I have to be with this person, it could disturb the flow experience if it does not run smoothly, and I get this more, considering again more thinking how can I solve it, what do we do know, what she or he wants.'*

This example again emphasizes the importance of listening and communication skills for successful collaboration.

3.2.3 CREATIVE FLOW

The last, explorative section of analysis summarised dancers' remarks regarding the role of flow in their creative practice. The findings are summarized around three emerging categories: outcomes of creative flow, flow as a state of mind and quality of movement, and recollection of flow material.

3.2.3.1 Outcomes of creative flow

While reflecting on the benefits of being in flow, dancers commonly commented that it was a highly creative state when they could surprise themselves with unusual movement solutions.

Dancer C

'When I get to the flow then I can be surprised, 'Oh really that just happened'. It leads me to more surprises.'

Dancer B

'I can surprise myself, I can find myself in the places like, I do not know how I get here and I do not necessarily know how to get out of there.'

Being novel was connected to looking for solutions through 'body-thinking'; solving problems in a non-propositional way in which the reflective processes and explicit knowledge were limited through full attention on the dance and body. Dancers highly valued this approach to movement creation, finding those solutions as more organic and 'natural' than one that originated from choreographic or technique knowledge.

Dancer F

'I think that if you are uninterrupted and you are in that moment, the movement you create is going to be interesting one way or another, because there will be no breaks in what is coming out. And that means you can push it. And the longer you can stay in that state the more experimental you can be without bringing your thinking and your knowledge about technique to it. That could make it more complicated or more interesting, but less organic in the way that is coming together.'

3.2.3.2 Flow as a state of mind and quality of movement

It is important to mention that flow in dance practice also describes a particular quality of movement, defined by Laban (Newlove & Dalby, 2004) as one of efforts, a dynamic factor of movement that is unimpeded or continuous such as hair floating in water or the passage of water in response to gravity. When utilizing flow quality, one body part follows another carrying the dynamic and there are no breaks or pauses in the movement. A similar description of flow movement was reported in this study.

Dancer B

' '(…) movements that are quite flow in the body, like wavy movements, that never really stop, and one movement just leads to another one to another one... It would be not jumps. It is something continuous, not that the speed is always the same, it could go faster and slower, but just continues, that the movement never stops.'

Dancer E

'There is a sort of way of moving with the word of flow itself. (….). You go with the way you are moving in the flow, you not doing inorganic movement (....) It is a much more fluid sense of movement in the body.'

Dancers were commonly conscious of an association of the term 'flow' with the movement quality description. Still, they noticed that a particular, organic and fluid way of moving would promote the mental state of being in the flow. At the same time, it did not limit the movement to one, particular quality; rather the way of connecting material and solutions was found to be highly fluid.

Dancer E

'I am not saying that all you movement became one big fluid massive

unite and you never stop moving. (…) It is the easiest way to come into that state and it makes that more interesting if you bring some more stochastic moves (…).'

Dancer C

'I often start with what I am very comfortable with and then I can speed up and I could have others qualities.'

3.2.3.3 Recollection of flow material

In previous studies on combined flow in a jazz ensemble (Hart & Di Blasi, 2013), it was noticed that musicians had rarely any clear memories of music material from 'being in the zone' moments. While for the purpose of improvisation as a performance practice it is not primarily important, as the improvised performance is a unique event, when using improvisation process for movement creation, lacking the memories of the most valued material might be an issue. Dancers (4 of 6, who frequently use improvisation as a part of creative process for setting movement) noticed this issue.

Dancer A

'When I'm in rich flow it is more for me, and when it is over then I regret that I did not film it. And I cannot remember. On the one hand, I want to keep it for my own, but then again, if it felt really good I want to show it to other people too.'

Dancer F

I chose to revisit the material. Obviously, you cannot recreate whole material because it is not set. What you can do (...), you remember few things that you've done that were really good for you (...). It can start from there and then develop. I do not think that it would ever be the same but it could.

One of the common solutions was the practice of video recording improvisation sessions with the aim to capture highly creative moments and be able to recreate them. It is interesting to notice that improvisation started to become more dominant in dance creative practice alongside the availability of affordable video technology, which allowed dancers to effectively document and transform their process through the use of technology which had not been possible previously (DeLahunta, 1998).

3.3 CONCLUSION

Individual interviews that followed the workshop revealed the primary characteristics and role of flow experience for improvisation and creative practices. Effortless attention and enjoyment were the most predominant themes that emerged from the dancers' reports while describing flow. These results confirm previous findings by Moneta and Csikszentmihalyi (1996) that associated flow with 'a psychological state in which the person feels simultaneously cognitively efficient, motivated, and happy'.

Not all core characteristics of the experience of flow were present in interviews. Dancers rarely related to the 'challenge-skill balance' idea, and only one person mentioned that being successful in improvisation requires a certain level of skill. This characteristic of flow is central from the conceptual point of view, as a person can experience flow only when their expertise and skills face an adequate challenge, otherwise they will experience boredom, when challenges are too low, or stress when the skills are not sufficient (Moneta & Csikszentmihalyi, 1996). On the other hand, Csikszentmyhalyi (1985) introduced the term of 'emergent motivation' to describe the dynamics of an actor and environment system. He argued that flow experience is shaped in such interaction on a moment-to-moment basis. The nature of

improvisation allows dancers to constantly regulate the situation according to their skills and modify their dance, making it more or less challenging through their movement choices. The capacity of dance improvisation to accommodate various abilities, challenges and interests is highlighted by inclusive dance practice, where disabled and non-disabled dancers successfully work together as equal creative partners, regardless of their physical abilities (Benjamin, 2002, p. 7). The improvisational and creative settings might naturally promote flow experience, as participants self-regulate their engagement with the task, having the possibility of fitting their skill to upcoming challenges and adapt the challenges to their skill level.

The dancers interviewed did not refer directly to the 'transformation of time', the funnelling of awareness characteristic of flow, related to loss of awareness of time (Csikszentmihalyi, 1990). As the interviews were conducted in context of a delivered workshop, and explored scores were rather short, it is possible that this topic was simply irrelevant regarding the settings. The workshop did not provide the environment for losing time awareness, as explored tasks were rather short; although dancers did commonly associate flow with their ability to maintain full focus on an activity for longer than usual.

Dancers also revealed that being in the flow lowered their self-critique. Previous studies gave evidence that flow experience positively influences affect within the creative process and might provide a protective barrier against usually fatiguing aspects in a task (Cseh et al., 2015b; Cseh, Phillips, & Pearson, 2016). This study suggests that flow experience also has protective abilities regarding self-esteem and helps the creative process though limiting self-judgment.

The study showed that group improvisation facilitated flow experience and the creativity of individuals through maintaining a desired creative focus for longer, lowering self-judgment and inspiring novel solutions. The positive influence of others on creative process was rather contradictory, as intuitively social judgment and social exposure should play a negative role in creative practice. In case of this investigation, dancers found the group to be a supportive, creative environment for their ideas to develop.

The results supported Sawyers' (2007) conditions that facilitated group flow– the optimal, peak experience in a group. Two main themes that emerged from interviews were: `becoming one with the group` and the importance of trust between group members before and during the activity. While talking about shared experience of becoming one with the group, dancers emphasized complete, shared concentration on the task and a feeling of mutual connection with others in co-creative process of improvisation. They highlighted the importance of good communication and listening skills, an ability to build on others' ideas and get inspired by others. They stressed that trust between each other is a basis for good communication and co-creative processes of sharing ideas.

The role of trust with regard to group flow had not previously been widely discussed, however Sawyers (2003, p.44) stated that for some groups (referring to musical ensembles and improvised theatre) a preliminary warm-up and team-building exercises were crucial to establish the group flow.

Some links between creativity and flow experience were established. Dancers commonly associated being in the flow with a highly creative state where they tended to find surprising, very 'organic and natural' movement solutions. It is important to

emphasize that the mental state of flow did not limit their expression in the use of a particular quality of movement, but rather they found linking between various ideas to be smooth and effortless, even when moving between extremes in movement.

Dancers reported that flow and being in the group helped them to maintain the creative process for longer, allowing exploration of novel material beyond their habitual responses. They were aware of a problem of gathering material created during the flow state, as reflective processes and memory tend to be limited, however they referred to some of the techniques they used to recollect 'flow material', such as recording improvisation, remembering general movement or creative cues, and re-enacting the improvisation.

In conclusion, flow in dance improvisation was characterised by effortless attention to a task and enjoyment. When experienced in collaborations, it was described as a state of 'becoming one with the group'. Dancers stated that the group would facilitate prolonged and deep engagement in a creative task and help to maintain flow for longer. However, these effects were related to the quality of collaboration and trust. Finally, dancers recognised flow as a highly creative state that allowed them to go beyond their habits and find new, yet organic movement solutions.

4 INDIVIDUAL OR SHARED FLOW EXPERIENCE

The previous chapter established the existence of flow experience in dance improvisation and investigated its nature in dance creative practice. Qualitative analysis of interviews revealed effortless attention and enjoyment as the predominate themes in dancers' descriptions of flow, that confirmed previous statements about the character of flow experience (Csikszentmihalyi, 1988a). Reflecting on the role of the group, the dancers found that working with others would facilitate engaging with a creative task as well as entering and maintain a flow state of mind for longer. They characterised group flow as a state of 'becoming one with the group', emphasising the importance of good relationships and trust among the collaborating group members. Finally, they found flow to be a highly creative state, where unexpected, surprising and very 'organic and natural' movement ideas originate. They valued flow moments as those where they can go beyond their usual movement habits. In light of those qualitative findings, the current chapter will assess flow in dance improvisation, and its shared, group character using quantitative methods.

A key difference between an individual flow experience and group flow, comes from being aware of the performance or contribution of the other group members. According to Sawyer (2007, p.46), group flow was more likely when everyone was fully engaged in 'deep listening' to the group. In such moments, members of the group did not plan ahead, rather they reacted and responded to what they heard at a particular time. Such an unplanned approach to collaboration is characteristic of an

improvisational setting–in music, dance, theatre or any other improvisational art, game or activity.

Discussing the importance of collective activities in culture; in particular, the role of rituals. Csikszentmihalyi (1990) considered them as affordances that a society offers to its members in order to allow them to meet optimal experience, i.e. flow, under a socially desirable form. He argued that many cultural activities (like religious rituals or social dance) had been mainly designed to improve the quality of the life experience. Although they might serve other purposes too, they had survived through many social changes because they had provided enjoyment to the members of the community (Csikszentmihalyi, 2002, p. 76). In such collective activities, participants got involved in a complex action system with other participants of the event and, experiencing flow, they felt at one with the other group members (Csikszentmihalyi & Csikszentmihalyi, 1988, p. 86).

Similarly, Walker (2010) suggested that in highly interdependent situations, like playing football on a team or joining a music jam, people might serve as an agent of flow for each other. Forms of activities that require interdependence and cooperation, where the unit of performance is a group, might enhance a social form of flow that is mutual and reciprocal. Using a mixed-methods design of qualitative and experimental studies, he confirmed that social flow was more intensive and more enjoyable in a highly interdependent situation where people must cooperate and coordinate their actions with each other.

Waddington (2013) found that expert musicians playing in ensembles perceived their optimal, peak performance to result from co-performer empathy, some components of flow (focus, challenge/skills balance, and immediate feedback),

alongside performance conditions–principally repertoire choice and environment. Co-performer empathy, similarly to group flow, required some prerequisite conditions of a shared approach to musical interpretation and working together, it was characterised by a special, empathic connection between the players, and was likely to involve intentional awareness of others in an ensemble on both the musical and practical level. Myers & White (2012) observed that empathic connections between professional musicians were important for playing well together in collaborative performances. Similarly, Hart and Di Blasi (2013) stated that the development of empathic feeling among group members of a jazz ensemble was a key characteristic for combined group flow experience. The empathic relationships between group members allowed them to feel not only the high points in a collaboration, but also the low points of experience and, for instance, musicians tended to share the blame for each other's mistakes. Hart and Di Blasi (2013) concluded that such empathic relationships marked a difference between individual and combined flow experience, therefore developing empathy in the group setting might be central for group flow to appear.

Group flow shares many aspects with individual flow, but is inevitably different through its collaborative nature. Those similarities and differences were discussed in detail in Chapter 2, in the flow literature review (p.34). In this study, I sought to compare individual and group flow in dance improvisation, to explore the cognitive processes and strategies underlying group improvisation and their relation to flow experience; in particular, those that might support the aspects of group flow that are dependent upon understanding the other group members' states and intentions. Two different types of task were chosen, to examine whether an internal focus upon one's

own mental imagery might inhibit group flow, while an external focus upon the group's shared surroundings and awareness of others, facilitated a group flow experience or if these different focuses affected the shared character of the group improvisation.

Imagery is widely used in dance improvisation as a creative tool, which gives inspiration for shapes and qualities of movement (McKechnie, 2002; Tufnell & Crickmay, 2004). Mental image is a complex experience which has a kinaesthetic, visual, auditory, etc. nature, perceived in the absence of that which it represents (Blom & Chaplin, 1988, p. 11). Imagery may set limitations upon the dancer's space, such as dancing inside an imagined box; or the dancer's movement, such as when a dancer works with an imagined elastic 'knee-to-elbow' bond (Forsythe, 2012). This approach requires a dancer to focus upon the mental image (that might be multimodal, including different modalities of senses) and its transformation into a bodily response (Kirsh, 2010; May et al., 2011). In comparison, the 'open score' improvisation is based on sensory awareness and the practice of being fully present in the moment of improvisation (Benjamin, 2002, p. 55; Foster, 2003; Halprin, 2015, p. 200; Koteen et al., 2008). It is commonly used for group improvisations, as it allows dancers to draw on each other's actions and freely react to ideas of others (Blom & Chaplin, 1988, p. 22). Therefore, sensory awareness practice within a group setting implies a highly collaborative, interdependent character of group improvisation, when each dancer acts in response to the others. Based on previous findings (Sawyer, 2007; Walker, 2010), such practice might facilitate the development of group flow.

4.1 MEASURING GROUP FLOW

One of the biggest challenges of this project was to develop and validate a method to evaluate shared flow experience in the group. Previous research explored both quantitative questionnaire and sampling methods as well as qualitative, interview-based approaches.

In early studies, Csikszentmihalyi (1975) introduced the Experience Sampling Method (ESM), a procedure for measuring flow in everyday life and the associated variation of subjective experience. This method asks participants to report, repeatedly, at random time intervals during their daily activities, the details about an activity and the intensity of a range of subjective feelings associated with the flow, using a standardised questionnaire. The strength of this approach lies in its ecological validity, as the data is not collected retrospectively, based on generalisation, but at the moment of experiencing, in an everyday life setting; and in the psychometric rigour of collecting data that allows the quantification and comparison of experiences' components and qualities (Larson & Csikszentmihalyi, 2014). Other questionnaire methods are usually based on ESM and similarly measure flow as a state, but also measure dispositional flow, i.e. frequency of flow experience in general. The Flow State Scale and the Flow Trait Scale were developed by Jackson and Marsh (1996, 1999, reviewed: Jackson & Eklund, 2002), based on Csikszentmihalyi's theory (1990) and previous qualitative research (Jackson, 1995). The original nine dimensions of flow were included as factors: challenge/skill balance, clear goals, unambiguous feedback, concentration on the task at hand, action-awareness merging, loss of self-consciousness, a sense of control, a transformation of time, and intrinsic reward. The Flow State Scale was designed to assess the intensity of flow experience on occasions

(as a momentary state) in sport and physical activity; while The Flow Trait Scale measured flow experience in general, i.e. across many activities. In parallel, Rheinberg, Vollmeyer, and Engeser (2003; cf. Engeser & Rheinberg, 2008), noticing some weakness of Csikszentmihalyi's ESM and other experience-based assessment of flow and, in particular, its time-consuming aspect, developed the Flow Short Scale (FSS), which measures flow as a state. This tool, in contrast to Jackson's measure, that assesses each dimension of flow separately, has only two main scales: *flow* and *perceived importance* of activity, wherein the flow subscale consists of two factors: *fluency of performance* and *absorption by activity* (Engeser & Rheinberg, 2008). As the application of this measure is more general and can be easily administrated as an experience sampling tool, just after finishing the activity, in the following study, it was chosen as a momentary individual flow measure.

Assessing shared group flow brings additional challenges. Although group flow shares many aspects with solitary flow (as the basic conditions for flow for individuals must be first met), it is inevitably different because of its collaborative nature. For this reason, many researchers use qualitative methods, mainly observational studies (Sawyer, 2003) and in-depth interviews (Hart & Di Blasi, 2013). Macdonald et al. (2006) gives a quantitative approach example: they investigated the link between musical creativity and the concept of flow as an optimal performance. In their study, an Experience Sampling Form (Csikszentmihalyi & Csikszentmihalyi, 1988) was completed just after each of three successive creative sessions, as a measure of individual flow experience. Group flow was measured as an average of individual scores among all group members and sessions. A similar strategy was chosen by Salanova et al. (2014) in their study on collective flow experience among workgroups. To assess collective flow

they used aggregated group measures of individual ratings of a *group task absorption* scale (Salanova, Llorens, Cifre, MartÍNez, & Schaufeli, 2003) and a *group task enjoyment* scale. Items of those scales addressed the collective, shared experience of the group, such as "When the group is working, we forget everything else around us". Although, each of those studies shed a light on the nature of shared flow experience, neither of the introduced methods analysed the dynamic of flow experience in the group collaboration over time.

To capture the dynamics of shared group flow, the video-stimulated recall method was adopted. A video-stimulated recall approach has been increasingly used as a research tool in psychology, education, consulting and medicine over the last 30 years. The method involves video recording an activity and then presenting the recording to the participant so they can recall and comment on their actions, thoughts or other matters of interest. The interviews are usually semi-structured (Rowe, 2009). This method has a potential for studies into cognitive strategies, behaviour and learning processes, especially in a complex, interactive context, characterised by novelty or uncertainty and non-deliberative behaviour (Lyle, 2003). Compared to other methods, such as reflective diaries, retrospective reports or classic interviews, this approach leads to better recollection, does not require elaborate writing skills, or high commitment from participants and is time economic (Rowe, 2009). The video-stimulated recall of flow method asks participants to watch individually a recording of their group activity on a tablet device, identifying and annotating those moments when they remember experiencing flow (or, in others words, 'being in the zone'). Simultaneously, it allows the collection of narratives of thinking and awareness during the task, through the reporting aloud procedure.

The video-stimulated recall method of assessing flow has the advantage of analysing the dynamics of individual or group flow experience over time. Such an approach of investigating flow experience contributes to the discussion on the nature of flow experience. In early exploration, Csikszenmihalyi (1975) differentiated flow concerning intensity, defining *microflow experience* as a positively valenced activity in everyday life, (e.g., a conversation with a good friend); and *deep flow* as characteristic of creative processes or sport, when the person is totally absorbed with the activity. However, other researchers described flow experience as a yes-or-no phenomenon (Engeser, 2012), emphasising that the flow would not be experienced until the factors contributing to flow were sufficiently present. Such understanding of flow is consistent with the Flow Model (Csikszentmihalyi, 1975), introduced briefly in the previous Chapter 2 (p.22). It is also supported by findings from the earlier, qualitative study of this thesis (Chapter 3, p. 42), in which dancers described flow as a distinctive, highly focussed and creative state of mind. Consequently, the video-stimulated recall method assessed flow experience as a yes-or-no state, without exploration of intensity of the state. However, the frequency of experiencing flow, the stability of experience and patterns of sharing flow in the group, were explored. Accordingly, throughout this thesis, group flow was defined as those moments in a group activity (experimental tasks) when participants experienced flow simultaneously in a collaborative task.

4.2 OBJECTIVES

This study had three main objectives:

1. Validation of a new, video-stimulated recall method to assess flow over time (*Flow*).

To validate this method, *Flow* was compared with an established flow-sampling tool, FSS (Engeser & Rheinberg, 2008). Research into social, group flow emphasised the importance of the ability for 'deep listening' and sharing the empathic relation with others in the group. Therefore, the relationship between flow and empathy was measured. Additionally, the link with creativity was assessed using a consensual assessment technique (Amabile, 1982), as being in the flow is considered as one of the predictors of high creativity (Cseh, Phillips, Pearson, 2015; Csikszentmihalyi, 1988c; MacDonald, Byrne, Carlton, 2006).

2. Examination of a character of flow experience in group improvisation–its shared or individual character–and whether dancers' focus: internal vs. external influence the amount of shared, group flow.

To create a group measure of flow, the group flow factor (GF) was computed from the individual *Flow* reports by counting the proportion of pairs within the group simultaneously reporting flow experience. With groups of four, there were six possible pairs, so at any moment the group could score zero if no, or one, person reported a flow state; 1/6 or 17% if any single pair of individuals reported flow, 3/6 or 50% if three individuals reported flow, and 1 (100%) if all four participants reported flow (Figure 4.1). These values were computed for every 5 seconds, and the overall GF score for each task was the mean value over the entire task duration.

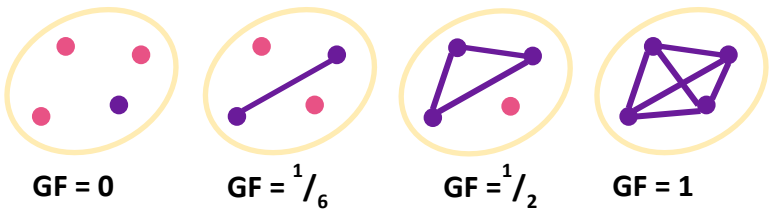


Figure 4.1. Group flow measure GF, as the proportion of pairs within the group simultaneously reporting a flow state.

During the experiment, the dancers' focus was manipulated using one of two improvisation tasks. The internal task focuses the dancers' attention onto an internal, imagery based task, while the external task asks a dancer to pay close attention to their surrounding and the others in the group. Although both types of tasks were highly enjoyable and creative, the external task facilitated more group interactions and 'close listening' to each other, so it was hypothesised that it would facilitate higher group flow than the internal task.

3. Exploration of cognitive meta-strategies that contributed to being in the group flow.

The cognitive processes and strategies underlying the group flow experience in the improvisational setting were explored in collected recalls of dancers' narratives of thinking and awareness during the tasks. The highest and lowest group flow narratives were compared through qualitative content analysis (Gläser & Laudel, 2013).

4.3 Preliminary Assessment of video-stimulated recall method to assess flow experience (*Flow*)

A video-stimulated recall method of capturing the temporal pattern of flow experience in group interaction was piloted during the workshop phase of the first study, *Flow experience in dance creative practice* (Chapter 3). The workshop consisted of the exploration of three different improvisational tasks in a group of six dancers who had taken part in the previous study (see p. 47). The video-recall process was facilitated by a dedicated online application (Łucznik & Loesche, 2017), which was designed to share a video recording with multiple users simultaneously on handheld tablets and collect the users' data (Figure 4.2); Dancers' reports were recorded on individual voice recorders, as the quality of the tablet microphone was not sufficient.

Each group improvisation was recorded and, between two to five minutes after completing the task, participants watched the recording simultaneously, with noise cancelling headphones to prevent distraction from the others (in the interview room). Participants were asked to report aloud their recollection of the thought pattern during a task, according to the instruction: "As you are watching your improvisation, try to narrate your conscious thinking, considering a question like, 'Where my awareness was at that moment?' We are looking for a narration similar to a director's commentary on a DVD" (Norgaard, 2011). Four categories for reflection were suggested: (1) my thoughts/images; (2) my senses; (3) my actions; (4) relation to others. However, they were not exclusive. Participants were able to pause or rewind the video at any moment, and this navigation was recorded to retain synchronisation between the recording of their voice and the video.

Following this, participants watched the recording again, this time they were asked to tap a *flow* button every time they recognised a flow moment and tap it again when it finished (Figure 4.2). The following definition of flow was given: "They are those moments in which you were totally absorbed in what you were doing, and which were highly enjoyable" (Hefferon & Ollis, 2006; Martin & Cutler, 2002). Participants were allowed to change their choices and jump backwards and forwards to any point of time in the recording.

This approach enabled exploration of the flow experience over time and compared individual experiences within the group. The pilot study intended to test such a method in the context of dance, to find out if the method could be used to evaluate dancers' improvisational process, as well as how well dancers could recognise 'being in the zone' moments.

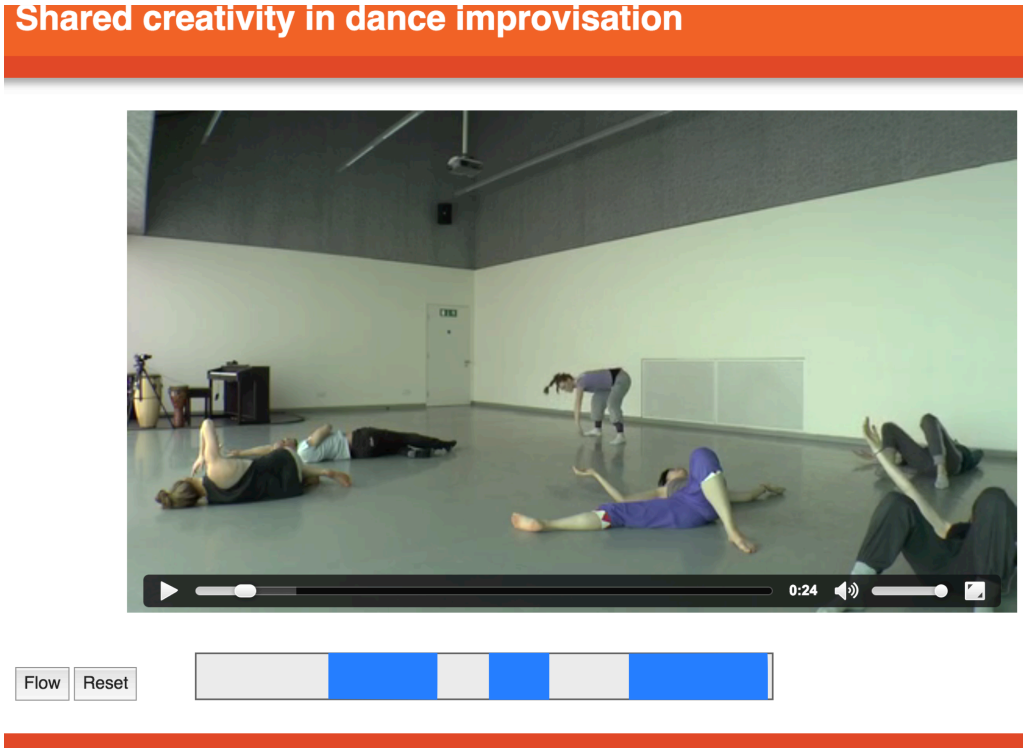


Figure 4.2. Dynamic evaluation of flow experience application – tablet view.

In interviews that followed the workshop, dancers commented that the use of the application was fairly easy and intuitive. First, the procedure of speaking aloud was found as unusual, as all of the dancers were speaking simultaneously; but after a short while, they all engaged with their own narrative and stopped paying attention to the others. The narrative over the improvisational choices was found to be easier than expected; the memories from the task came back to dancers naturally. There were individual differences in the amount of information collected from each report; some dancers were talking over the entire time of the improvisation, while others commented only on the most distinguished moments, when their point of attention in the improvisation changed. Dancers had no need to use the rewind option; sometimes they paused the video to add more details to the report.

While reporting flow experience, dancers found that it was easier to recall the exact moment when they lost the flow compared to recall of when it started. Usually, a burst of total involvement was interrupted by the actions of others, or by some strong shift in the dance, such as someone suddenly running or stopping, or self-judgment of their own actions. Generally, dancers rated the use of the tablet app as easy and intuitive and, after the first few trials, they found the task of recall of flow experience as natural to do. Figure 4.3 presents reports of flow experience collected from individual dancers, visualised for each task separately.

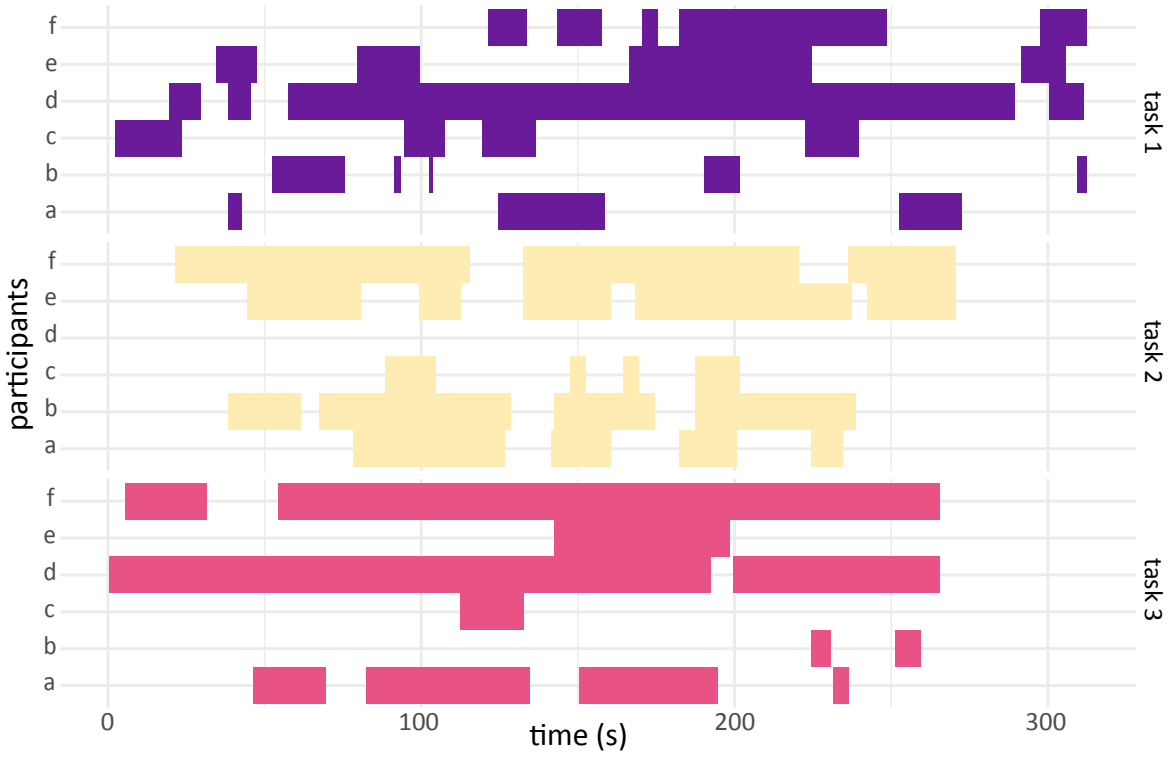


Figure 4.3. Video-stimulated recall of flow experience in improvisation. Each row separately represents reported flow experience of dancers over time, for each task.

The experience of flow differed between participants and tasks (the detailed statistics from this pilot study are presented at Appendix 2, p. 201). In general, flow was experienced in bursts of total involvement. During each task, dancers experienced up to five bursts of flow experience, varying in duration of up to almost four minutes.

In the raw data, a few times flow experiences of just 1-2 seconds were reported. However, participants said that those were errors (a double click on device), so events shorter than three seconds were excluded leaving M=38s, SD=48s. The percentage of flow experience during the tasks varied between 0% and 89% of total time of the task, M= 39%, SD = 19%. There was a strong personal preference for the task, as the example of dancer D shows: she experienced flow a lot, both in the first and the last task, but she did not report any in the second one. In the later interview, she explained that task two (free improvisation task, see Chapter 3.1.3, p. 48) required more engagement with the other dancers in the group and that she did not feel comfortable with them.

To summarise, the video-recall method of recollecting thought pattern and assessing flow was found to be intuitive and easy for dancers to use. The method allows information about flow to be collected from multiple perspectives and, therefore, to assist in the investigation of the phenomenon of group flow.

4.4 METHOD

4.4.1 PARTICIPANTS

Sixteen contemporary dancers with at least a year's experience of dance improvisation (including group improvisations) were recruited from a BA dance program of Plymouth University, together with four professional dancers (75% women, age M=23; SD=3.3). Participants worked in five groups of four dancers (four student groups and one professional group). Each participant received £12 for taking part in 1.5 hour testing session.

4.4.2 *Materials*

Flow: The *Video-Stimulated Recall Method of Assessing Flow Experience* method described in section 4.3 was used to capture individual and shared flow experience in improvisational tasks.

Fluency, Importance, and Absorption: *Flow Short Scale* (FSS; Rheinberg, Vollmeyer, & Engeser, 2003; cf. Engeser & Rheinberg, 2008). This 13-item questionnaire measures flow as a state using a 7-point scale. Participants are asked how much they experienced flow-related phenomena (e.g. do not notice time passing) in the just-finished task. The FSS has been validated and used in various experimental and correlational studies (see: Rheinberg et al., 2003; Schüler, 2007), and also with experience-sampling methods (Rheinberg, Manig, Kliegl, Engeser, & Vollmeyer, 2007). A factor structure (principal factor analysis with Varimax rotation) indicated the presence within the scale of two factors: 10-items *flow* (alpha .92) and *perceived importance* scale of 3 items (alpha .76), which were uncorrelated (r = -0.03, p = 0.65). In a three-factor solution, the flow items fell into two categories named *fluency of performance* (alpha .93) for six items, and *absorption by activity* (alpha .78) for four items, correlating r = 0.65, p=0.01 (Engeser & Rheinberg, 2008). In the following study, the three factors solution is used.

Empathy: *The Toronto Empathy Questionnaire* (TEQ; Spreng, McKinnon, Mar, & Levine, 2009) consists of 16 questions; each rated on a five-point scale from '*never*' to '*often*'. It conceptualises empathy as a primarily emotional process. The instrument has been shown to be positively correlated with measures of social decoding, other empathy measures, and to be negatively correlated with measures of autism

symptomatology. In this study, the scale was used to measure empathy as a covariate of group flow experience.

Creativity: The *Consensual Assessment Technique* (CAT; Amabile, 1982) was used to assess creative outcomes of experimental tasks. This allows for subjective viewpoints and preferences to be taken into account, recognising different views of what is considered creative. In the following study, the creativity of group improvisation was assessed by participants, individually, at the end of the session. They were given the following instruction: 'Using your own definition of creativity, rate the degree to which each dance was creative' and were asked to compare all performed tasks on the nine-item scale from '*not at all*' to '*very much'*.

4.4.3 PROCEDURE

Ethical approval for this study was granted by the University of Plymouth, Faculty of Health and Social Studies. All participants gave written, informed consent following a briefing session, in which they were given written and verbal information about the experiment.

The testing session was designed to be as similar to a regular improvisation workshop as possible. Each group warmed up with a set of walking exercises, focus changes, sense and group awareness building, and a freezing game that asks a group to co-ordinate movement: 'As soon as the first person starts moving we all start moving. Anyone may decide to stop at any time. As soon as one person stops, everyone needs to freeze too. As soon as everyone is frozen, someone can start again.'

After this warm up, the dancers were asked to complete four improvisational tasks together. Two different types of improvisation tasks commonly used in dance

practice were introduced. Two *internal focus* tasks were based upon multimodal imagery as a starting point for improvisation:

> *'It is dark. You are in an ancient woodland. Sense what is around you… in every direction… There is a variety of lush tangles of old trees, ferns, mosses and lichens. What is close by? What is far away? See how they might move and what you might hear. Sense the movements… of weather… land… sky… light… What calls to you… in this landscape? How might you respond to these surroundings?'*

> *'A crowd of people are milling around you. Sense what is around you… in every direction… behind… above… below… Imagine what people are saying. Locate the sounds that are furthest away. Those that are closer and those that are closest to you. Sense the movement. What smells are reaching you? What calls to you… in this landscape? How does it make you feel? Respond to the crowd.'*

Two *external focus* tasks were based upon sense-awareness and asked dancers to use 'here and now' cues from the surroundings:

> *'Let your ears listen to the sounds – of your body, of others, of space. Let your feet sense the floor. What can you see? What can you hear? What can you feel? Let all your senses open and lead you for the next few minutes of the dance.'*

> *'It is a journey. Find the starting point. Let all your senses open. Let your eyes look around; sense your weight. How does your skin perceive the surrounding? The others? The space? Find you way though the space till the ending. Let all your senses, what you see, feel, listen, scent, to lead you through the space.'*

These two different types of tasks were chosen to examine whether an internal focus upon imagery and an external focus upon sensation differentially facilitated a flow state or affected the shared character of the group improvisation. Three groups performed two imagery based tasks first, two others started with two sense-awareness tasks.

Each task lasted 4-5 minutes and was called to an end by the experimenters. Immediately after completing each improvisational task, participants were asked to fill out the FSS and to complete the two phases of the video-stimulated recall (recollection of improvisational awareness and assessment of flow), taking around 15-20 minutes in total.

After four rounds of improvisational task and reporting, the group formed a circle to share feedback, and were debriefed.

4.5 RESULTS

The group of the professional freelance dancers was excluded from analysis as it differed significantly from the student groups in the form of engagement during session and flow reports. Although they were all members of the same company, it turned out they rarely had the chance to work together, especially in improvisation settings. They found group improvisation tasks as rather difficult to engage with, and two of the group members shared that even when tasks were introduced as collaborative, they did not interact with others at all, maintaining an individual improvisational process. Interestingly, lack of engagement in-group activity did not prevent them from experiencing flow during experimental tasks. However, their flow experience had no social component, but rather happened despite distractions from the rest of the group. A strong, individual character of dancers' creative process in this

group and lack of interactions with others did not comply with requirements of this study to observe flow in a group activity.

In contrast, the students (i.e., in all other groups recruited in this study) found group improvisation to be natural, similar to tasks in their training at Plymouth University, and they all declared that they performed the experimental tasks in a collaborative, highly interactive way.

Table 4.1 summarises the descriptive statistics of the measures from the 16 student dancers. It is worth noting that dancers reported medium to high ratings of absorption with activity (M=21, SD=3.79) and fluency (M=29.1, SD=6.42), but Importance of activity was rather low (M=7, SD=2.52). It indicates dancers' high engagement with tasks with the lack of pressure on achieving 'right' results. The *Flow* measure indicates that dancers spent on average 52.2% of tasks time in flow states. However, there were large individual, inter-tasks differences (Min=11, Max=97, SD=17.71). The shared flow experience, measured by GF, was rather rare (M=31.4, SD=15.24). Dancers evaluated their improvisation as moderate to highly creative (M=5.3, SD=1.43).

Table 4.1. Descriptive statistics of used measures.

	Individual measure (n=16)			
	Mean	*SD*	*Min.*	*Max.*
Flow	52.2	17.71	11	97
Absorption (FSS)	21.0	3.79	7	28
Fluency (FSS)	29.1	6.42	12	39
Importance (FFS)	7.0	2.52	3	15
Empathy (TEQ)	43.5	5.10	35	55
Creativity (CAT)	5.3	1.43	2	7
	Group measure (n=4)			
Group flow (GF)	31.4	15.24	9.3	68.3

Due to group activity and the repeated measures design of this study, the data had a highly structured, hierarchically nested character. Such a structure suggested the use of the Multi-Level Modelling (MLM) for hypothesis testing to differentiate between the individual, group and task-related effects (Quené & van den Bergh, 2004). The data set was structured into a three-level model: the level 1 units were measurements occasions (tasks), further clustered within individuals (dancers), who represented the level 2 units. In this study, also the group measures were taken into consideration; therefore groups were the level 3 units of the model (Figure 4.4). All analyses below were performed using R (R Core Team, 2015) with R2MLWin package (Zhang at al., 2016).

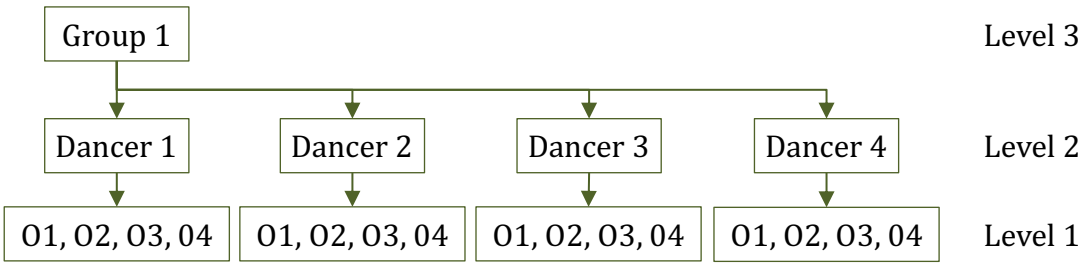


Figure 4.4. A diagram of three level structure of data set of flow experience.

As each of the sixteen dancers completed four tasks, there were 64 observations for analysis. This might be considered underpowered, but there are no accepted methods for computing power analyses in hierarchically nested multi-level modelling (Judd, Westfall, & Kenny, 2012). By analogy with repeated measures ANOVA, for an estimated effect size f = 0.33, with alpha of .05, a design with four measurements from 16 participants and no group factors would achieve a power of 0.86.

4.5.1 Prediction of Dynamic Flow from Flow dimensions and Empathy

A multilevel modelling analysis of the relationship between *Flow* and FSS subscales and empathy was performed. As fixed effects, absorption, fluency, importance and empathy (without interaction terms) were entered into the model. As random effects, intercepts for groups, subjects and occasions were added, reflecting the fact that observations tend to be more similar if they are (a) taken on the same occasion (experience effect), (b) taken from the same person, (c) taken within the same group:

Null model F1: Flow ~ (1 | Group) + (1 | Dancer) + (1 | Occasion)

Full model F3: Flow ~ Absorption + Fluency + Importance + Empathy +

+ (1 | Group) + (1 | Dancer) + (1 | Occasion)

To ease interpretation, and reduce multicollinearity, variables were centred on their respective grand means. Table 4.2 presents the summary of exploration: The Null Model, F1, sums variability in the dependent measure *Flow* related to individual and group random effects, with none of the fixed effects of interest. Due to centering all variables, the intercept in the null model equals 0 and corresponds to the mean value of *Flow* (M=49.1). In tested models, *Estimate* describes a change in *Flow* for one standard deviation of change in the predictor. In Model F2, the fluency, absorption and importance subscales of FSS were added as fixed effects that predict changes in *Flow*. Fluency was the only significant predictor of *Flow*, *B*=.38, z=2.66, p=.006: the rise of 1 Z-score on fluency scale (6.4 points), predicted grow of approximately 17.7 points on *Flow* scale. The other fixed effects were no statistically significant. The FSS factors explained 80% of *Flow* variance on the group level but only 8% of the variance on occasion level. Including FSS factors significantly improved model fit over the null model, (change in log likelihood: $\chi^2(3)=9.31$, p=.015).

Table 4.2. Multi-level modelling analysis of the relationship between *Flow*, FSS subscales and empathy (TEQ).

	Model F1		Model F2		Model F3	
Parameter	*Estimate*	*SE*	*Estimate*	*SE*	*Estimate*	*SE*
Fixed:						
Intercept	0	.23	0	.156	0	.142
Absorption (FSS)			.01	.145	0.04	.154
Fluency (FSS)			.38**	.142	.37*	.149
Importance (FSS)			.11	.126	.13	.134
Empathy (TEQ)					-.09	.152
Random:						
Group (Intercept)	.15	.155	.03	.074	.03	.058
Dancer (Intercept)	.10	.122	.10	.112	.12	.088
Occasion (Intercept)	.74	.151	.67	.136	.53	.096
Deviance	173.7		164.4		164.2	

*Note. **p<.01, *p<.05.*

Model F3 additionally included Empathy as a fixed effect. The pattern of FSS factors was similar, but empathy showed no significant effect on predicting *Flow* and did not improve model fit. Further exploration, such as adding random slopes for empathy in each group, did not improve the model either.

In conclusion, the *Flow* measure obtained from the video-stimulated recall method was mostly related to the fluency of performance dimension of flow, which described the ease of keeping the right level of concentration and moving between different aspects of an activity. Empathy was not a significant predictor of flow.

4.5.2 *FLOW AND DANCERS' FOCUS*

Subsequently, the relationship between *Flow* and dancers' focus (internal imagery or external environment) was tested. This time focus was added as a fixed effect to the model. Additionally, to check if shared flow develops over time, a fixed factor of experience (the order number of the task) was added as another fixed effect to the model. The intercepts for occasions, dancers and groups, as well as by-occasion, by-dancer, by- group random slopes for shared experience were added as random effects. The full model tested the interaction between focus and experience factors in the three-level hierarchy of data:

Model DF6: Flow ~ Focus * Experience +

+ (1 | Group) + (1 | Dancer) + (1 | Occasion)

The null model remained the same as in the previous analysis and just accounted for differences between dancers, groups, and changes over time. Table 4.3 summarises the exploration of the model.

Model F6 included fixed effects of focus and experience and their interaction. The interaction was significant (*B*=.73, z=3.65, p<.001), as well as the focus of task (*B*=-1.65, z=-3.08, p=.002). Figure 4.5 illustrates the different relationship between flow and group experience for internal and external focused tasks. While the level of flow in internal focus tasks remained at a similar level regardless of the order number of the task in the session (adjusted *B*=-.02), an external focus was beneficial for flow experience in the latter tasks of the session (adjusted *B*=.62). Model F6 significantly improved model fit in comparison to F5 (change in log likelihood: $\chi^2(1)=7.46$, p=.006) and explained the variance on the group level. Further exploration of model did not improve fit significantly.

Table 4.3. Multi-level modelling analysis of the relationship between *Flow* and dancers' focus.

	Model F1		Model F5		Model F6	
Parameter	*Estimate*	*SE*	*Estimate*	*SE*	*Estimate*	*SE*
Fixed:						
Intercept	0	.23	-.96**	.32	-.04	.357
Focus_external			.19	.182	-1.65**	.535
Experience			.35***	.082	-.02	.130
Focus*Experience					.73***	.201
Random:						
Group (Intercept)	.14	.156	.14	.155	0	0
Dancer (Intercept)	.10	.122	.15	.119	.10	.087
Occasion (Intercept)	.74	.151	.53	.108	.53	.109
Deviance	173.7		157.8		150.3	

*Note. **p<.01, ***p<.001.*

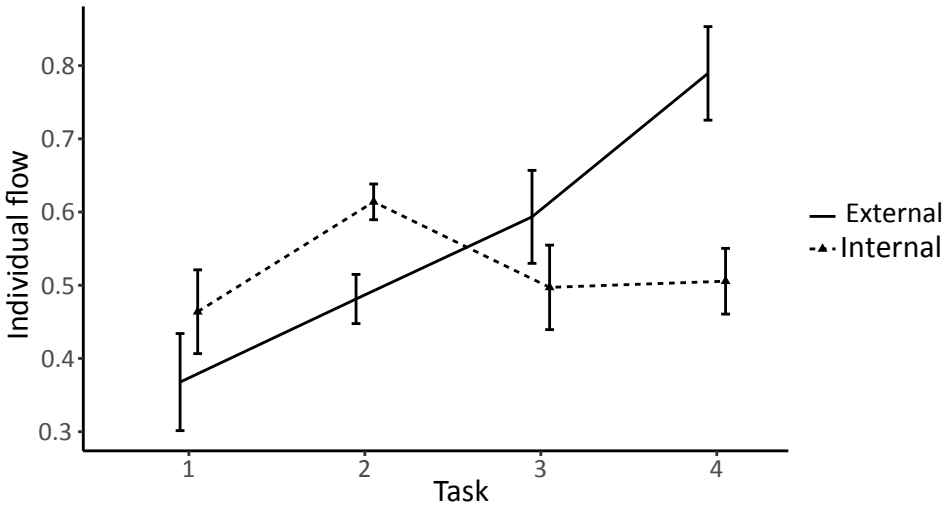


Figure 4.5. Impact of shared experience and type of task on flow.

To summarise, an externally focussed task did positively influence individual flow experience, but only if the external focus task was performed later in the session, after the internally focussed task (effect of shared experience). The difference in the level of flow between the internal and external focus in the last task of the session proved to be significant (t= 3.64, p=.002).

4.5.3 CREATIVITY AND INDIVIDUAL FLOW

Flow experience was commonly reported as a highly creative state (Csikszentmihalyi, 1996; Sawyer, 2003). All participants, after completing the testing session were asked to evaluate the four tasks in terms of their group's creative outcome, based on their subjective viewpoints and preferences, using the consensual assessment technique (Amabile, 1982). The relationship between these subjectively perceived creative outcomes and flow experience were explored using MLM approach. This time, in addition to the flow subscales of FSS (absorption, fluency and importance) and empathy, the DF measure of *Flow* was used as a fixed effect.

Two families of models were created: in one flow was predicted based on FSS subscales and second based on *Flow* (we could not include *Flow* and Fluency in the same models, as they were too highly correlated, leading to collinearity). The data were organised in the same structure as in previous analysis, therefore as random effects intercepts for groups, subjects and occasions were added. The full models, Model C2 and C3 included fixed effects of flow and empathy on creativity ratings:

Model C2, C3: Creativity ~ *Flow* + Empathy +

+ (1 | Group) + (1 | Dancer) + (1 | Occasion)

The table 4.4 presents summarised analyses for explored models. Model C2 explored the relation between flow measured by FSS factors, Empathy and Creativity. Fluency was a significant predictor of creative outcomes (*B*=.54, z=4.08, p<.001). Additionally, empathy had a significant linkage to creativity (*B*=.29, z=2.51, p=.012). The inclusion of FSS dimensions and empathy explained 38% of the variance and significantly improved model fit over the null model C1, change in log likelihood $\chi^2(4)=28.48$, p <.001.

In parallel to Model C2, Model C3 included flow experience measured by *Flow*, a video-stimulated recall method. In this model both fixed effects were significant: *Flow* (*B*=.31, z=2.63, p=.009) and empathy (*B*=.23, z=2.00, p=0.05) were predicting positively creativity ratings. The model was significantly better than the null model C1, with change in log likelihood of $\chi^2(2)=9.18$, p=.01; however, the fit of *Flow* and empathy explained only 13% of variance and the relationship between *Flow* and creativity was weaker than between fluency and creativity. It is worth remembering that fluency is a momentary experience sampling measure taken at the end of the task, while *Flow* retrospectively explores flow experience over the entire duration of task. The *Flow* measure is thus based partially on time before any creative ideas will have happened, whereas fluency is assessed only afterwards, so a weaker relationship between *Flow* and creative outcome is not surprising.

Table 4.4. Multi-level modelling analysis of the relationship between Creativity, *Flow*, FSS factors and empathy (TEQ).

	Model C1		Model C2		Model C3	
Parameter	*Estimate*	*SE*	*Estimate*	*SE*	*Estimate*	*SE*
Fixed:						
Intercept	0	.124	0	.099	0	0
Absorption (FSS)			.05	.132		
Fluency (FSS)			.54***	.131		
Importance (FSS)			0	.107		
Flow					.31**	.117
Empathy (TEQ)			.29*	.114	.23*	.117
Random:						
Group (Intercept)	0	0	0	0	0	0
Dancer (Intercept)	0	0	0	0	0	0
Occasion (Intercept)	.98	.174	.63	.111	.85	.151
Deviance	180.6		152.1		171.4	

*Note. *p<.05, **p<.01, ***p<.001.*

In conclusion, there was a significant relationship between individual flow experience and group creativity: higher fluency (FSS) in a task and overall flow measured by DF were correlated, and positively influenced ratings of creative outcomes. Interestingly, the individual's level of empathy was also positively correlated with the group's creative outcomes. Therefore, empathy might be seen as another group process that facilitates group creativity.

4.5.4 *Group Flow*

The aim of the following section is to explore whether empathy is a positive predictor of group flow experience. As mentioned above in the Objectives, group flow factor (GF) was computed from the individual DF reports by counting the proportion of pairs within the group simultaneously reporting flow experience. Similar to individual flow analysis, multilevel models were constructed. This time, empathy (TEQ) was added to the model as a fixed effect. Intercepts for groups, subjects and occasions, and, in the final model, by-group random slopes for the effect of empathy level within the group, were added as random effect:

Final model E3: Group flow ~ Empathy +

+ (1 + Empathy | Group) + (1 + Empathy | Dancer) + (1 | Occasion)

Table 4.5 presents exploration of the model. Neither Model E2 nor E3 significantly improved fit compared to the Null Model E1 (change in log likelihood for E2: χ^2 (1)=.07, p=.79, and for E3: χ^2 (3)=.07, p=.99); the fixed effect of empathy and moderated by group effect of empathy were not statistically significant predictors of GF. Thus, there is no evidence in this study to support the hypothesis of a relationship between empathy level of participants and experiencing group flow.

Table 4.5. Multi-level modelling analysis of the relationship between group flow (GF) and empathy (TEQ).

	Model E1		Model E2		Model E3	
Parameter	*Estimate*	*SE*	*Estimate*	*SE*	*Estimate*	*SE*
Fixed:						
Intercept	0	.304	0	.299	0	0
Empathy (TEQ)			-.04	.133	-.04	.133
Random:						
Group (Intercept)	.33	.261	.32	.253	.32	.253
Empathy					0	0
Intercept*Empathy					0	0
Dancer (Intercept)	0	0	0	0	0	0
Occasion (Intercept)	.65	.120	.66	.120	.66	.120
Deviance	163.4		163.3		163.3	

In the second part of this section, the relationship between group flow and dancers' focus is explored. This time, the data was structured into a two-level solution: the level 1 units are measurements occasions (tasks), further clustered within groups (level 2). There was no level to represent individual dancers, as the group measure of flow (GF) was specified only at the group level and no other individual measures were included. Two fixed effects were entered into the model: dancers' focus and the degree of shared experience, defined as the order number of the task (so shared experience increases during the session). The model explored the interaction between fixed effects, as it was found significant for the individual flow model. Intercepts for groups and occasion were added as random effects to the model:

Full model GF3: Group Flow ~ Focus * Experience +

+ (1 | Group) + (1 | Dancer) + (1 | Occasion)

GF was centred on its respective grand mean to ease the interpretation of results.

Table 4.6 and Figure 4.6 summarise MLM exploration. In Model GF3 an interaction effect between the focus of the task and experience was introduced and it significantly improved the model fit; compared with Model GF2, with change of likelihood of $\chi^2(1)=9.70$, p=.002. Similarly, as for individual flow, the interaction effect was significant (*B*=1.03, z=4.89, p<.001), as well as the fixed effect of task's focus (*B*=-2.10, z=-3.64, p<.001).

Table 4.6. Multi-level modelling analysis of the relationship between group flow (GF) and dancers' focus.

	Model GF1		Model GF2		Model GF3	
Parameter	*Estimate*	*SE*	*Estimate*	*SE*	*Estimate*	*SE*
Fixed:						
Intercept	0	.29	-1.51**	.44	-0.23	.409
Focus_External			.47'	.260	-2.10***	.578
Experience			.51***	.116	-.01	.149
Focus*Experience					1.03***	.211
Random:						
Group (Intercept)	.15	.262	.28	.251	.	.
Occasion (Intercept)	.77	.318	.270	.110	.22	.079
Deviance	43.8		31.1		21.4	

*Note.'p<.1, **p<.01, ***p<.001.*

Figure 4.6 helps to explain the nature of the interaction. While the level of group flow in internally focused tasks remained at a similar level regardless of the session's progression (adjusted *B*=-.01), an external focus was beneficial for group flow experience in the latter tasks of the session (adjusted *B*=.80). Again, the difference in the level of group flow between an internal and external focus in the last task of the session was significant (t= 4.77, p=.03). The interaction of experience and focus helped to explain variation on the group level, as well as 77% of variation on the occasion level.

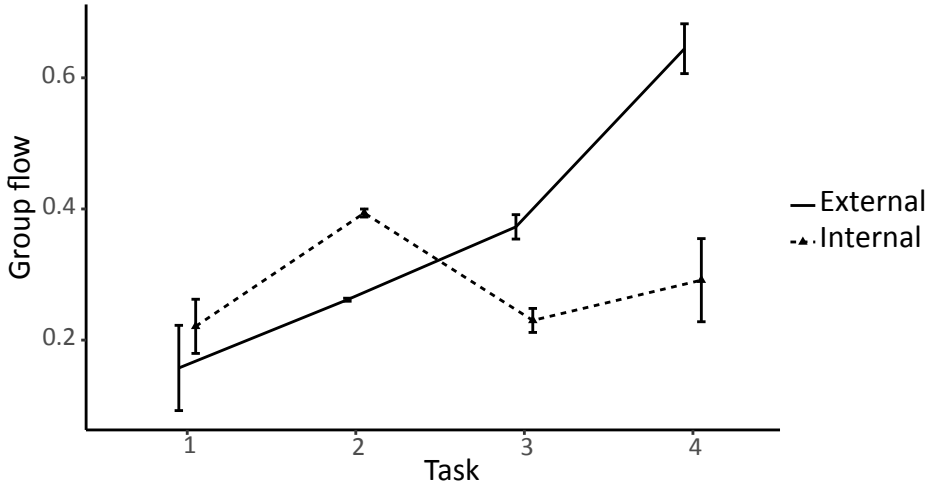


Figure 4.6 Impact of shared experience and type of the task on group flow (GF).

In summary, there was no difference in the level of group flow between the tasks at the beginning of the session; but in the latter tasks, the external focus facilitated group flow experience.

4.5.5 QUALITATIVE COMPONENTS OF BEING IN THE GROUP FLOW

The final section explores dancers' strategies that contribute to group flow experience in dance improvisation. To capture how collaboration differed in high and low-flow groups, video-recall reports of the creative process from the highest and matching low flow scoring tasks were compared. The two highest group flow cases of

GF (scoring 68% and 61%) were associated with an external focus task when completed fourth. Two other low-flow group cases (both scoring 26) were chosen according to the similarity of task (external focus), and order–they were performed as the second external focus tasks. They were not the lowest GF scores in the collected data but were chosen to match the high flow cases in terms of focus and minimise the difference with the others in terms of task order. To compare the reports, qualitative content analysis (QCA) was employed (Gläser & Laudel, 2013), the method described in detail in section 3.1.6.

The conceptual framework for analysis emerged from the initial set of categories of reflection, suggested to dancers during the data collection: (1) thoughts and imagery, (2) use of senses; (3) actions; (4) relation to others. Through the exploration of collected reports, this structure evolved resulting in the following final set of five categories: (1) use of senses; (2) use of imagery; (3) embodied creativity; (4) relation to others, with subcategories of (4a) mutual connection and (4b) mimicry and manipulation; and (5) emotional responses, with subcategory of (5a) being stuck. All these themes are analysed in the following section separately.

4.5.5.1 Use of senses

External focus tasks asked dancers to use 'here and now' cues from their surroundings and to base their movement choices upon sense-awareness in response to the group, the studio space, and sounds around them. Thus, the presence of sensory awareness was expected. However, dancers from high flow groups referred to the wider variety of sensory experiences more often, and commented that they were creating movement in response to such sensory stimuli:

Dancer 1 C (high flow group)

'Hearing those steps and my hand gestures, listening to the noises here, picking up sounds of L and A. And then I made my own squeak with my own feet. Feeling the air around me and still following the sound with my movement.'

Dancers from low-flow groups also referred to senses, but they did not find sensory stimulation so inspiring. Often they reported that sensory awareness was overwhelming and resulted in the feeling of being stuck.

Dancer 2D (low flow group)

'I was feeling the air. I was trying to see what the air felt like on my arm. It was quite soft, quite warm. S and N, and the touch again. I was really conscious of my senses, which I found quite hard.'

There was a clear difference in the attitude towards the use of stimuli offered by the space and others. Dancers from high-flow groups found them as inspiring for their creative choices and supportive to their creative process. They acted in response to sounds or other stimuli (like touch or moving air), co-creating the sensory experience for the group, for example by playing with different sounds. In low-flow groups, such collaboration was not present. Dancers were highly focused on their own sensory experience, to the point of feeling uncomfortable. It was more of an individual experience; the interactions and responses to others' actions were limited.

4.5.5.2 Imagery

As only external focus tasks were taken into account in this analysis, the use of imagery was not commonly present in dancer's reports. However, even in a non-

imagery task, one dancer shared a vivid image as a starting point for improvisation that she maintained through most of the task.

Dancer 2C (low flow group)

'This time, before I entered the space, I do not know why, I imaged water; so I thought, my actions were based on that theme. I imaged that I was walking on a quite high water.'

Throughout the improvisation, she repeatedly commented that she interpreted actions of others through the lenses of her imagery, she was 'placing them inside' her imagined world. She also reflected that it limited her interactions with others as she was interested in maintaining the created imagery space.

4.5.5.3 Embodied Creativity

In high-flow tasks, dancers described their improvisation process as an immediate reaction, through the movement response, to the sensory stimulation from their surroundings. In other words, various stimuli from the group and space: images, sounds, sensations, were easily, and without hesitation, translated into movement ideas:

Dancer 1C (high flow group)

'M rattled weights in the bottom of the curtain. I'm letting that structure my elbows movement.'

Dancer 1D (high flow group)

'Taking the movement from Danielle and then hearing the curtain rattle on the floor. Interpreting that through my fingers.'

Although all dancers discussed their creative process through embodied actions, in the high flow activity the transformation of available cues was richer, many times including

multiple sensory experiences (sound, image, movement). While descriptions of low-flow groups more often referred to copying others, manipulating body parts or exploring a single movement idea. This difference will be discussed further in the next section.

4.5.5.4 Relation to others

Quality and type of interactions differed between high and low-flow groups. The high-flow groups reported a deep feeling of connection with each other, a sense of togetherness that provided them with space for sharing the movement and interacting with each other. They presented multiple *supportive connections* within the group:

> *Dancer 1C (high flow group)*
>
> *'Feeling like I needed to join the group for this swirled position school of fish. Coming in, swirling with L.; needing to join with the sound from the back. Translating that to both hands and stopping, to flow into the next. Sharing.'*

Such characteristics of group flow as mutual connection and shared goal were commonly present. Dancers often referred to offering and noticing the physical support from other dancers in the group:

> *Dancer 3B (high flow group)*
>
> *'I come to K, she sits there, and she is giving me support. Each time, when my back was falling, K was offering support. I used it as a way to get down to the floor.'*

In summary, the collaboration in high flow tasks was complex and based on exchange: dancers sourced the inspiration from each other and supported others' choices. They were closely listening but had no hesitation in expressing themselves freely.

The interactions in the low-flow groups were qualitatively different, based mostly on *mimicry and manipulation* of others' body parts. Instead of complex interaction, dancers often referred to copying others' movements or transforming them through their body:

> *Dancer 2B (low flow group)*
>
> *'I did not have any specific thoughts. (…) I used other people's movement a lot in this score. I've just mimicked what I could see and took them into my own body.'*

Such an approach to dance creation, based on movement mimicry might be perceived as more basic, as the element of creative transformation is not present. In those groups, dancers commented on being manipulated or disturbed by others' bodies more often than in high flow activity groups.

> *Dancer 2D low flow group)*
>
> *'I was very still at this moment, watching the lift. Felt D pushed me, so responded. Lots of arms movements.'*

Bodily manipulation is not uncommon in improvisation practice, as dancers interact with each other in shared space and physical contact is quite frequent. However, the rules in improvisation usually emphasise a respectful and non-violent way of collaborating, that includes lack of forcing one's own ideas on others. Usually, if dancers comment that they are feeling manipulated, pushed, disturbed; it means that the group have not developed listening skills in improvisation yet (Blom & Chaplin, 1988).

Comparing both ways of interacting, high-flow groups were included more complex interactions, where movement responses emphasised, complemented and

transformed others' actions; and dancers offered each other necessary support for ideas to appear in the space. In low-flow groups the interactions were more straightforward, based mostly on coping, mimicry of movement and physical manipulation of others' bodies. The feeling of deep connection was not present.

4.5.5.5 Emotional response

All dancers in the study described a joy, comfort and amusement associated with improvising tasks and dancing with others.

> *Dancer 5A (low flow group)*
>
> *'I felt very free and like there was nothing to stop me, but I was going to the 150 % mark. I just felt free. (…) Kind of, I lost control, and the movement felt great.'*

These comments emphasise that dance is a naturally autotelic activity. However, dancers from low-flow groups also reported some negative feelings and difficulties with connecting to the task, or other dancers.

> *Dancer 5B (low flow group)*
>
> *'I found this one a lot more difficult to enter. I was looking for something, some sort of inspiration or window to enter the space. In the end, I mimicked something that someone else had done.'*

Sometimes, they felt overwhelmed with sensory stimulation or unhappy with their own creative choices, which could result in being stuck with the creative process. Such negative emotional response could be a barrier for entering the flow state. As the skills/demands model of flow (Csikszentmihalyi, 1975) predicted, it might indicate that the proposed task was too demanding for those groups and it caused elevated anxiety among the dancers.

Moreover, only in low-flow groups, did dancers report a feeling of being lost or stuck with the creative process. They found difficulties in finding their point of interest that sometimes resulted in stillness or repetition of movement.

Dancer 2C (low flow group)

'Some stages I felt a bit lost. Do not really know how to approach it. Felt this place was a little bit dense sometimes.'

Dancer 2A (low flow group)

'I felt like I should have done something here further, but I lack ideas. I was too busy to figure out what my senses were doing.'

In high-flow groups, such moments were not present.

4.6 Discussion

Despite the growing interest in group creativity research and group flow experience, there is a narrow choice of tools to assess group flow. So far, most of the researchers limited their exploration to the qualitative methods of observing collaborative groups (Hart & Di Blasi, 2013; Sawyer, 2003) or use of aggregated individual flow ratings from group members (MacDonald et al., 2006). These issues were partially addressed by Salanova et al., 2003, as he created the combined flow scale that would ask participants to evaluate the group process as a whole. Still, such an approach raises the questions about how fairly group members might assess the mental state of others. Addressing these limitations, in this study flow was evaluated from an individual perspective, using the video-recall method; and the group flow measure was calculated in the second step of exploration as a shared, simultaneous flow experience.

The video-stimulated recall method of assessing flow *(Flow)* revealed that flow was experienced in dance as bursts of total involvement rather than over an entire creative task. It might be interrupted by some strong shift in the group dynamic, like the sudden movement of the other dancers, but also by critical self-reflection. The stable and long-lasting flow experience was rather rare. Also, flow was experienced more often in the latter part of the task, and the session. This finding showed up some limitations of the sampling method of measuring flow, which is usually used just after finishing the task. Sampling methods ask a participant to report their mental state 'now' or refer to the just finished task (Moneta, 2012). Because flow is more likely to be experienced in the latter part of the activity, sampling measures might overestimate the intensity of flow experience during the entire activity. Such a trend was visible in the current exploration too: the flow experience assessed by FSS scale was usually moderate to high, while the variance of *Flow* and GF measures was much bigger (from very short periods of flow experience, to almost entire task in the flow).

The validity of the video-recall method of assessing flow (*Flow)* was determined through comparison with Flow Short Scale (Engeser & Rheinberg, 2008). *Flow* was mostly influenced by the fluency of performance aspect of flow experience: there was no relationship with absorption by activity nor with the importance subscale of FSS. The fluency of performance items address characteristics such as the merging of action and awareness, the sense of control and the presence in the moment of activity. The absorption by activity, describes these aspects of flow connected with the right amount of challenge, losing time awareness, total absorption with the activity, the feeling of being lost in thoughts. The lack of relationship of flow with this dimension of FFS scale might be due to specific characteristics of dance practice and, in particular,

group improvisation. The social aspect of creation facilitates the interactive process between dancers, rather than 'getting lost in thoughts' (Hart & Di Blasi, 2013; Sawyer, 2007). Additionally, improvisation is not usually perceived as a goal-directed practice, so it is hard to define clear challenges. For the same reason, a relationship between *Flow* and importance of activity was not expected.

4.6.1 THE EFFECT OF FOCUS ON FLOW EXPERIENCE

Two different types of tasks were chosen to examine whether an internal focus upon imagery and an external focus upon sensation differentially facilitated a flow state or affected the shared character of the group improvisation. The MLM analysis did not confirm the main effect of the task's focus on individual or shared flow experience; however, there was a significant interaction between focus (internal versus external) and experience of the order of tasks within the session. The pattern of dependency was consistent across individual and group ratings of flow. It was found that although there was no difference in frequency of flow experience between internal and external focus tasks at the beginning of the session, a difference appeared in the latter tasks. In the last task, flow is more likely in the external focus tasks. The influence of the shared experience on flow is not surprising. Sawyer (2007, p. 55), describing creative activities like music improvisation, emphasised that many of the successful groups require a preliminary warm-up period to move into group flow. For this exact reason, the testing session was preceded by a warm-up and freezing game. Still, dancers had had no experience with the 'testing situation' before, so the procedures of recording and video-recall of improvisations were very new to them. In consequence, the effect of tasks was visible only in the latter part of the session. As the qualitative analysis of dancers' video-reports revealed, focusing upon external

stimuli, and highlighting sensory awareness in dance improvisation might facilitate the close interaction between dancers and build mutual connections within their practice; in consequence, building conditions for the development of group flow (Sawyer, 2007, p. 43).

4.6.2 The effect of individual flow on creative outcomes

As expected, there was a significant relationship between flow experience and creativity. Dancers placed a higher value on the creative outcome from tasks when they were experiencing more flow. This connection was confirmed by two different ways of evaluating flow. The FSS fluency scale showed a positive link with creativity; but absorption and importance did not. As pointed out above, absorption refers to a highly individualist state of mind, 'being lost in thought', that is not preferable in social settings of dance improvisation. The video-recall method of assessing flow also showed a positive relationship with creativity; however, the linkage was not so strong. These findings support the positive influence of flow on creativity found within other domains (Cseh et al., 2016; MacDonald et al., 2006). There are two major limitations of this result: creativity in this study was a subjective measure, as participants retrospectively evaluated the session they had just finished; and, as the previous study in Chapter 3 revealed, dancers have a strong belief that they are highly creative in the state of flow. Thus, as they evaluated first their flow experience and afterwards they were asked to reflect on creative outcomes of the task, their creative judgment could be influenced by previous flow ratings.

4.6.3 Empathy, creativity and flow

Interestingly, there was also a positive relationship between empathy level and creativity. Previously, empathy was considered as a significant factor of group or

shared flow (Hart & Di Blasi, 2013; Waddington, 2013). Further, Sawyer (2003) suggested that many group flow characteristics, such as mutual connection, listening and communication skills, and the phenomenon of blending egos, are closely related to the empathic traits of group members. Consequently, empathy was claimed to be an important factor of social creativity (Cross, Laurence, & Rabinowitch, 2012). The results of this study support these conclusions from the complementary perspective, showing that empathy not only supports a positive climate in the group but is also a positive predictor of group creative outcomes.

Surprisingly, there was no significant relationship between empathy and individual or group flow experience. Careful analysis of multilevel models did not reveal any significant main or interactive effects. Moreover, estimators in the model were always close to zero. This result is inconsistent with the previous, qualitative studies on the development of group flow (Hart & Di Blasi, 2013; Sawyer, 2003).

4.6.4 Qualitative differences between low and high-flow collaboration

Video-recall reports of the improvisational process revealed some essential differences between low and high flow group collaborations. In this part of the exploration, only externally focused tasks were compared, as the level of flow in the internal-focus task remained at the same average level across the groups and occasions. Primarily, the way of collaborating differs between low and high-flow group activities. A feeling of deeply supportive, mutual connection was typical for high-flow collaboration. Dancers in those groups were engaged with each other in a complex way, sharing ideas, and supporting each other's actions. They described creative process as being largely embodied, where any stimuli from the environment were naturally interpreted through the movement. These descriptions of creative process

highly resemble previous studies on group flow in jazz jams (Hart & Di Blasi, 2013; Sawyer, 2007), with the additional emphasis on the embodiment of the dance practice. In contrast, groups in a low-flow state worked more with mimicry and bodily manipulation as ways to relate to each other; they were less likely to be engaged with sensory stimuli and were more likely to directly copy others' ideas, generally presenting a less creative approach to the improvisational process.

All groups reported positive feelings of joy and amusement associated with performing improvisational tasks and dancing together. However, in low-flow groups, negative emotions and difficulties were reported too, alongside moments of being creatively stuck. Those comments are consistent with Csiksznetmihalyi's (1975) skill/challenge balance model of flow, where the extent of challenges over personal skill would result in anxiety and discomfort.

These qualitative differences between low and high-flow collaborations highlight the importance of group processes for creativity. The positive climate of collaboration described in high-flow reports allowed dancers' creativity to bloom, engaging them in complex group actions. Finally, this comparison gave the additional evidence for the validity of the GF measure of group flow experience, as high-flow groups were describing the improvisational process in very similar terms to the group flow characteristics described by Sawyer (2003) or Hart and Di Blasi (2013), while low-flow groups exhibited distress elements, as predicted by the Flow Model (Csikszentmihalyi, 1975).

4.6.5 LIMITATIONS

While the present study has provided a number of findings on the nature of the flow experience and its shared character, there are several limitations of the current

work. First, due to time limitation and specificity of the research interest, the sample size was very small, so all findings should be considered as preliminary results that need future research based on more groups. This recommendation is not easy to address; as the exploration in this study exposed, the sample has to be selected carefully according to the specific requirements of the task. The attempt to expand sample size by including the professional freelance dancers beside the student groups was unsuccessful, as that group had a limited experience with working together as a group and with the improvisational practice examined in the current study; so were unable to engage with tasks as instructed. Recruiting other dancers familiar with each other and group improvisation; for example, a professional ensemble engaged in improvisational practice, would be highly beneficial for this exploration. Nevertheless, the a priori power analysis indicated that reasonable power could be achieved, and statistically significant findings were observed, so this does not seem to have adversely affected the analyses.

The second major limitation of the study is that, while improvisation is commonly practised in contemporary dance and used as a creative device for performance practice on its own (Blom & Chaplin, 1988), the way that dancers engage in improvisation is highly dependent on their training and personal preference. This study was conducted with students of Plymouth University, and their improvisation training is highly influenced by Adam Benjamin's inclusive, open score improvisation practice (Benjamin, 2002). Such a context might influence dancers' preference of external focus over internal focus tasks and therefore facilitate the flow experience in the former. However, dancers never referred to such a preference, either in video-recall reports or closing discussions of the session, so this is thought to be unlikely.

4.6.6 CONCLUSIONS

In conclusion, this study developed a novel, video-stimulated recall method of assessing flow *(Flow)* that allowed the investigation of the dynamics of flow experience over time and the derivation of a measure of group flow experience (GF). The validity of this method was confirmed with the well-established FSS scale (Engeser & Rheinberg, 2008) and a qualitative comparison of the creative processes of high and low group flow tasks. The analysis of the influence of dancers' focus upon group flow experience, revealed an interactive effect of shared experience and dancers' focus: an external focus (upon senses awareness, surrounding and others), facilitated flow experience in the latter tasks in the session. Finally, it was shown that flow was a predictor of groups' creative outcomes.

5 SHARED FLOW AND CREATIVITY

The previous chapter focused on the role of shared flow experience in the creative process of group dance improvisation. A relationship between shared flow experience and subjective measures of creativity was examined, showing that fluency of performance and flow (a video-stimulated recall of an experience) are predictors of creative outcomes of the process. However, that study had some limitations. First, the creativity of performances was evaluated by the dancers who had performed them, without any comparison with other groups. Second, in the previous qualitative study (Chapter 3, p.66), dancers revealed a strong belief that they are more creative while being in the flow, and so as these creativity measures were collected after they had evaluated flow experience, the dancers could be biased in judging their creative outcomes. Those limitations underline the methodological difficulties with assessing creative practice and creative outcomes.

As a response, this chapter incorporates the wider, social perspective by including independent viewers' evaluations of the creative outcomes. As mentioned before, Sawyer (2003) defined group flow as the peak experience when a group is performing at its highest level of abilities and reached a collective state of mind. The following study examined the relationship between the shared flow experience of an improvising group and the third person evaluation of creative outcomes of the same improvisation, using the consensual assessment method (Amabile, 1982).

5.1 THE SOCIAL PERSPECTIVE OF CREATIVITY

From a social perspective, 'creativity is the generation of the product that is judged to be novel, and also to be appropriate, useful or valuable by a suitably knowledgeable social group' (Sawyer, 2012, p. 8). Thus, instead of focusing only on the intrinsic attributes of particular artefacts, such as the characteristics of movement or use of space in dance practice, creativity judgments emerge from multiple factors: domain specific knowledge such as the evolution of contemporary dance practice; the individual, who acquires that existing knowledge and applies it to their practice; and the field, comprised of other experts and members of the discipline who decide what is creative and worth cultivating at that particular time (Csikszentmihalyi & Sternberg, 1988). This approach suggests that interpersonal judgments are a part of all creative work. Csikszentmihalyi (1990) described creativity as something that begins with the individual who has an idea or product that influences the field and eventually changes a domain. He argued that an artefact becomes creative (or a person who produced it) only after the positive recognition by the field, other creators, curators and critiques (Csikszentmihalyi & Sternberg, 1988). In conclusion, the inclusion of a third person perspective, and especially domain experts' judgement, is necessary in the assessment of creative outcomes of work. The social approach to creativity has one main limitation: it does not define the specific conditions of what is creative, neither in general or in a specific domain, rather it acknowledges that the social and cultural context plays a major role in judging what is creative.

5.2 CONSENSUAL ASSESSMENT TECHNIQUE

The Consensual Assessment Technique (CAT) was first applied to creativity research by Amabile (1982) as a response to the problem of how to include a

sociocultural perspective, in particular experts' knowledge in an assessment of creativity, when the clear definition and appropriate criterion for creative outcomes are lacking. The method is grounded in a consensual definition of creativity, in domain-specific expertise, and based explicitly on subjective judgments over the creative outcomes:

> *'A product or response is creative to the extent that appropriate observers independently agree it is creative. Appropriate observers are those familiar with the domain in which the product is created or the response articulated. Thus, creativity can be regarded as creative by appropriate observers, and it can also be regarded as the process by which something so judged is produced' (Amabile, 1982, p.1001).*

Such an approach overcomes the difficulty of attempting to specify ultimate objective criteria for identifying a product as creative.

There are numerous requirements for the assessment procedure. CAT demands a panel of experts from the domain. They should work independently of one another and are given no detailed guidance for how to rate, other than to follow their own sense of what is more or less creative. Further, judges should be asked to assess the artefact on other dimensions in addition to creativity, at least rating technical aspects of the work and, if appropriate, its aesthetic appeal. Finally, they should be instructed to evaluate the products relatively to one another, being presented with them in random order (Amabile, 1982, 1983). The method has been used in such diverse creative tasks as creative writing (Baer, 1998; Baer & Kaufman, 2005), dramatic performance (Myford, 1991), musical composition (Hickey, 2001), personal narratives

(Baer, Kaufman, & Gentile, 2004) and captions written for pictures (Sternberg & Lubart, 1995).

The main challenge in using CAT is finding appropriate judges. In practice, the method requires that all judges are familiar enough with the domain and have developed some implicit criteria for creativity, technical mastery and aesthetic appeal (Amabile, 1982). Usual inter-rater reliability of experts judgements ranges from .70 to .90 when measured by Cronbach's coefficient alpha, the Spearman-Brown prediction formula, or the interclass correlation method (Baer & McKool, 2010). It shows consistent agreement among experts over creativity criterion, even if no definition of creativity is given.

Since finding the right experts might be expensive and challenging, a few studies tried to use nonexpert raters in their place. It was found that nonexperts' ratings of creativity had lower inter-rater reliability, thus had been inconsistent and did not match those of expert raters (Kaufman, Baer, & Cole, 2009; Kaufman, Baer, Cole, & Sexton, 2008; Lee, Lee, & Youn, 2005). Kaufman and Baer (2012) distinguished another group of raters: the quasi-experts (or gifted novice). In comparison to established experts this group has some experience with the domain; for example, being art students or teachers, though they have not reached the expert level in their field (their achievements are not publically recognised). Quasi-experts' ratings are much more reliable than novices' and highly coherent with experts'. The interest of including quasi-experts in creativity research comes from practical reasons, as they are easier to recruit and it is possible to collect ratings from a bigger sample.

CAT does not provide a method to measure general creative abilities: it is usually applied to domain-specific skills and creative abilities. Cross-domain studies

showed that when CAT was applied to diverse creative practices, there was very little generality of the results, and the correlations of subjects' creativity ratings in different domains tended to hover near zero (Baer, 1998; Baer & McKool, 2010).

5.3 USING CAT TO EVALUATE DANCE IMPROVISATION

CAT methodology recommends that raters evaluate creativity alongside some other attributes of the rated product. Amabile (1982) suggested adding explicit questions about aesthetic appreciation and technical execution to lessen the influence of these aspects on the creativity rating and so improve the validity of the method. Links between those dimensions rely heavily on creative discipline. Amabile (1982,1983), while looking into a creative task of collage-making, found that creativity ratings were not the same as the judgment of technical goodness, neatness or expression. Although, she found a positive correlation between creativity and novel use of materials and complexity, and a moderate correlation with aesthetic appeal. Similarly, analysing design creativity, Christiaans (2002) found strong links between creativity and aesthetic criteria, but not with the technical quality of the artefact. In contrast, (Jeffries, Zamenopoulos, & Green, 2016a), examining graphic design, found very strong correlations between all three: aesthetic appeal, technical execution and creativity dimensions. Stefanic and Randles (2015) found similar, high correlations between creativity, craftsmanship and aesthetic appeal in the evaluation of individual and group music composition task.

As the previous research showed some contradictory results, measuring additional factors of creative outcomes is essential to capture the phenomenon of creativity. In the following study, besides creativity, aesthetic appeal, and technique,

two further factors of evaluation were added: meaningfulness and collaborative coherence.

Meaningfulness indicates the additional value of presented work. It refers to the standard definition of creativity, agreed upon by most researchers: that a creative outcome is (a) novel and (b) of value (Runco & Jaeger, 2012; Stein, 1953). While novelty manifests in unexpected, unusual solutions for creative tasks, the added value is displayed in the contextual meaningfulness of the artefact. From the viewer's point of view, meaningfulness alongside appropriateness leads to satisfaction with the message (P. W. Jackson & Messick, 1964).

Analysing group creativity demands acknowledgment of underlying group processes. In the case of dance improvisation, both the process of making and the process of executing the idea are distributed among group members. Sawyer and DeZutter (2009) observed that a high quality of collaboration in a setting that allows free, unscripted, improvised actions, leads to unexpected creativity. Sawyer (2007) linked such high-quality collaboration with being in the state of group flow. He argued that creativity emerged from the bottom up, through a self-managing process of equal contributions from all group members. As the following study focused on group creativity in dance improvisation, coherence–a quality of collaboration–was another relevant factor of the group creative outcomes.

5.4 Objectives

The purpose of this study was to examine the relationship between shared flow experience in group improvisation and creative outcomes, rated from the viewer's perspective. Using the previous study design, dance improvisations were video recorded and the sections of dance where groups shared flow experience or not, were

identified. Those excerpts could then be shown to raters and evaluated using CAT. The following hypotheses were verified:

Hypothesis 5.1. High-flow improvisations will be rated as more creative in comparison to low-flow improvisation.

Although the CAT approach mainly requires experts' evaluations, nonexperts rates were included too with the aim of learning how a wider audience perceives dance improvisation. It was not expected that nonexperts' judgments would match those of experts. Rather, it was expected that experts' ratings would be more coherent:

Hypothesis 5.2. Experts' ratings of dance excerpts will be characterised by higher interrater reliability than nonexperts' once.

Additionally, the creativity judgment was examined in the context of related features of presented work. In the context of dance and, specifically, group performance, four factors were chosen: aesthetic appeal, technical demands of performance, meaningfulness, and coherence of performance. All raters used these criteria to judge the presented videos in addition to creativity judgments. Again, the differences between experts and nonexperts was explored.

5.5 Methods Part One: Recording improvisations

5.5.1 Participants

Eight groups of four dancers were recruited from the second and third year of the BA dance program of Trinity Laban Conservatoire of Music and Dance. The sample included 28 women and four men; with a mean age of 21.3 years (SD= 1.9 years). Participants received £12 for taking part in a 1.5-hour session.

5.5.2 PROCEDURE

Ethical approval for this study was granted by the University of Plymouth, Faculty of Health and Social Studies. All participants gave written informed consent following a briefing session, in which they were given written and verbal information about the experiment and the purpose of video recording.

The session was conducted as a dance workshop and data was collected alongside the session. Each group warmed up with a set of exercises, as in the previous study (Chapter 4.4.3, p. 89). Additionally, dancers were asked to complete one individual improvisation task (but simultaneously in the same space). This was followed by two group improvisation tasks. The tasks were developed from the previous studies, to enhance the probability of group flow experience during improvisation.

These two tasks were as follows:

> *'Watch the surface of your body from inside. See how the inner surface changes as you move in relation to others. It may be helpful to imagine yourself and others as a large balloon in the shape of the entire group. Place your mind's eye inside this balloon and watch it change shape from your inner point. How do those changes sound? How does it make you feel? What is your relation to others? As you move, certain areas of the common balloon extend outward, while other areas are pulled inward. Pay special attention to the changes of the inner contours of this balloon as well as you relation to others.'*

And:

'In next moment, arrive in the space.

Respond to another's moving

Move… in response to what you have seen;

Not knowing how the response may develop

Let you ears listen to the sounds – of your body, of others, of space.

Let your eyes see the surrounding

Let your body feels the space, the energy of movement, of others.

Let all your senses open and lead you in response to others. '

Each task lasted 4-5 minutes and was called to an end by the experimenters.

The flow-rating phase was arranged similarly to the previous study (Chapter 4.4.3, p.89). Immediately after completing each task, participants were individually asked to complete the video-stimulated recall task (*Flow*) on tablet computers to annotate flow experience over time during the improvisations. Additionally, in this study, dancers were wearing biosensors, tracing their physiological reaction over the session: heart rate, breathing rate, and movement dynamics. These data are reported in study four (Chapter 7).

The individual flow ratings (*Flow*) were used to compute the group flow experience over time. High and low group flow fragments of improvisation that lasted between 35 and 45 seconds were selected for each group. Three groups were excluded at this stage as, in two of the groups, the group flow experience was not consistently present; while in the last group there were no low-flow moments. Five groups remained in the study.

In the second part, the online study, two clips from each of the five groups were presented to raters–one clip of low and one of high group flow improvisation from each group.

5.6 Methods Part Two: Judging the Improvisations

5.6.1 Participants

The recruitment was addressed to two groups of raters: dance experts and the general public. Both groups were recruited through social media, dance related forums and professional mailing groups, and Plymouth University participant pool system. The sample included 215 participants, of whom 203 completed the whole study (153 women and 43 men) and were included in the analysis.

Experts (or quasi-experts in Kaufman and Baer's, 2012 definition) were required to have formal dance training, dance degrees, or active performance or research practice in dance. 77 participants met this criterion: 56 women and 15 men, with a mean age of 31.97 years (SD=11.31 years), originating mostly from the UK (64%) and other European countries (16%).

The nonexpert sample included 126 participants–97 women and 28 men–with a mean age of 28.04 years (SD=12.04 years), also originating mostly from the UK (87%).

5.6.2 Procedure

The study was conducted online. Participants first read the introduction and signed a consent form. They then answered a series of questions about their experience in dancing and spectator's habits, which were used to determine whether they were classified as expert or nonexpert.

Experience in dancing was measured on an ordinal four-point scale from *'not at all'*, followed by *'I used to do some classes as a child'*, through *'I am a dance enthusiast, I practice dance, do some classes but not professionally'*, to '*I did (or am still doing) professional dance training*'. The option *'other'* was also available in the case when participants would not be able to match their experience with listed options. Those participants who reported professional dance training or active performance or research into dance practice (using the open answer option) were included into the experts group. Additionally, participants were asked to list dance techniques that they were familiar with, defined as taking classes for more than three months.

The frequency of watching dance was measured on an ordinal three-point scale from: *'never or hardly ever'*, through a *'couple of times a year'*, to at least a *'couple of times a month'*. Similarly to the previous question, participants were asked to list what genre of dance performance they were watching. This question served to determine whether there were differences in participation as spectators of dance.

The Consensual Assessment Technique (CAT), as described above, was used to measure creative outcomes of dance improvisation. Participants were asked to watch ten videos of excerpts of group improvisation and rate each of the video recordings individually, just after watching. To control for the order effect, the participants each watched the videos in a different, random order. Using the 7-point scale with semantic anchors, '*not at all'* and *'very much'* at points 1 and 7, each participant retrospectively rated each recording according to the following dimensions: aesthetic appeal, technique demands, meaningfulness, coherence /collaboration of the group, and creativity (Table 5.1). Participants based ratings on their own definitions of each dimension; no additional definition or explanation was provided. CAT assumes that

experts within a domain share the criteria with which they identify work in that domain as being more or less creative (Amabile, 1983; Stefanic & Randles, 2015).

Table 5.1. Consensual assessment of dance improvisation excerpts, questions for raters.

1. How much did you like this dance improvisation?
2. How technically demanding was this dance improvisation?
3. How meaningful for you was this dance improvisation?
4. How coherent or collaborative did you feel that the group were while dancing?
5. Using your own definition of creativity, rate the degree to which this dance improvisation was creative.

5.7 RESULTS

5.7.1 EXPERTS AND NONEXPERTS COMPARISON

As discussed above, the CAT method is mainly intended for expert raters, as ability to evaluate creativity in the specific domain is obtained through familiarity and engagement with the discipline. The experts were identified based on their prior professional dance training, dance degree or active performance practice. However, no particular type of the training or practice was specified. Therefore, the frequency of watching dance and practical familiarity with specific dance techniques were examined (Table 5.2, Table 5.3). Comparing frequency of watching dance, experts had gained more familiarity with dance as spectators than nonexperts had; $t(201)=10.72$, $p<0.001$. They more commonly watched genres such as contemporary dance, improvisation and ballet.

Table 5.2. Frequency of watching dance (0-never or hardly ever, 1- a couple of times a year, 2- couple of times a month) and chosen genres of dance performances.

	Experts (n=77)	Nonexperts (n=126)	χ^2
Frequency of watching	1.8 (*SD*=0.46)	0.8 (*SD*=0.77)	
Genres:			
Ballet	54%	23%	20.89***
Contemporary	94%	49%	41.80***
Musical	39%	33%	.66
Improvisation	70%	25%	39.69***

*Note. (*** $p < 0.001$).*

Furthermore, Table 5.3 shows the practical familiarity, measured by whether they have been studying the specific dance technique for more than three months. The comparison of both form of engagement, through watching and practicing dance, indicates that the group of experts, in comparison with the nonexperts, is much more engaged with dance practice, both as spectators and practitioners. As CAT method is mainly intended for expert raters, all analyses below are performed separately for experts and nonexperts.

Table 5.3. Practical familiarity (taking class) with different dance techniques of expert and nonexperts.

	Experts (n=77)	Nonexperts (n=126)	χ^2
Familiarity with technique:			
None	-	35%	32.30***
Ballet	87%	37%	47.97***
Contemporary	88%	27%	16.35***
Modern	60%	18%	36.66***
Jazz	57%	14%	41.38***
Improvisation	82%	15%	54.89***
Contact Improvisation	71%	18%	57.12***

*Note. (*** p<0.001).*

5.7.2 CAT RATINGS

Figure 5.1 presents mean ratings for high-flow and low-flow videos of both groups of rater: experts and nonexperts. The central line of each boxplot shows the median of the data. The box shows the interquartile range (IQR) between 25 and 75 percentile of data; the line adds or subtracts an additional 1.5 times the IQR to the edges of the box. Further, the notches display the confidence interval around the median. Following the Graphical Methods for Data Analysis (Chambers, 1983), if two boxes' notches do not overlap there is a strong evidence (95% confidence) that their medians differ. All five factors correlated together, as shown in Table 5.4.

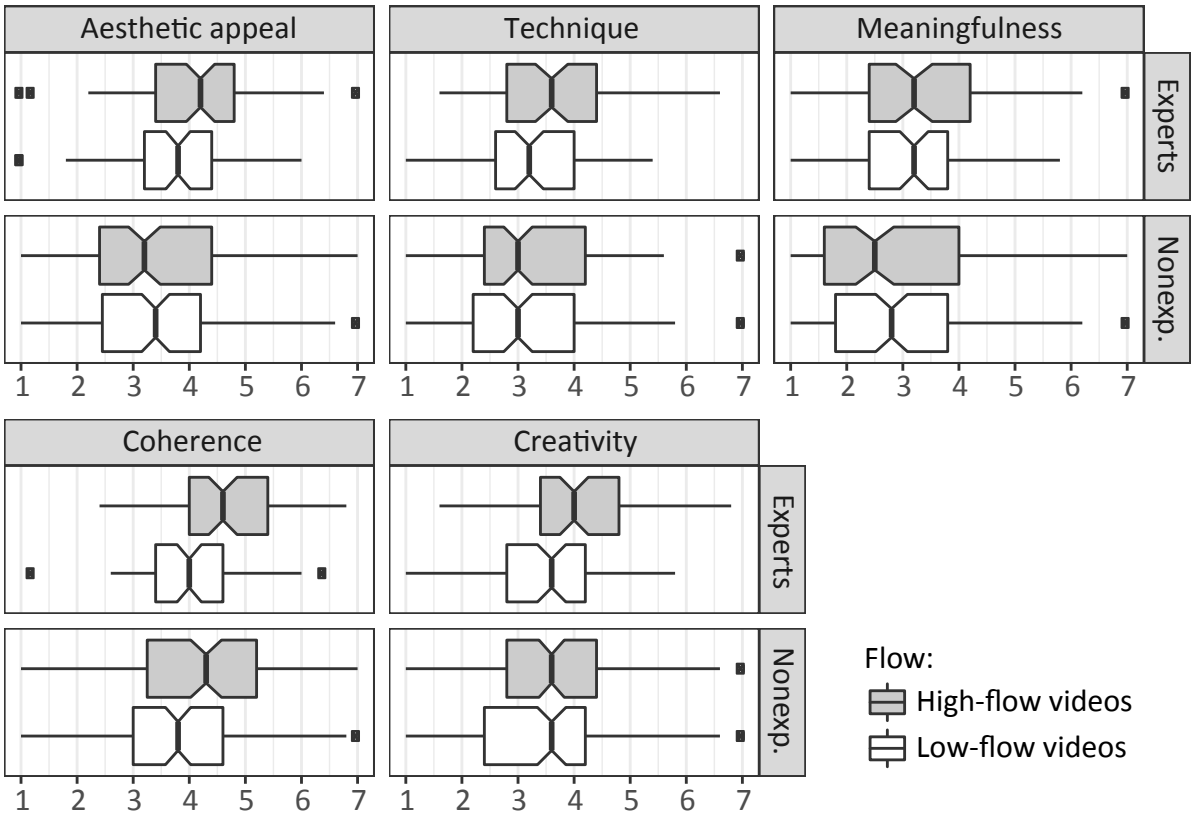


Figure 5.1 Mean rating of high and low-flow videos from experts (upper row) and non-experts (lower row). Boxplots show median, interquartile range, and 95%CI.

Table 5.4. Correlations between five CAT factors.

Measure	1	2	3	4
1. Aesthetic appeal	-			
2. Technique	.71***	-		
3. Meaningfulness	.82***	.68***	-	
4. Coherence	.74***	.63***	.67***	-
5. Creativity	.79***	.73***	.74***	.75***

*Note. ***p<.001*

Experts' aesthetic appreciation of the videos is generally higher than that of non-experts (Table 5.5). However, with regard to other dimensions, both groups rate low-flow improvisations similarly. In contrast, for high-flow improvisations, experts'

ratings are systematically higher than non-experts. The differences are not very big, between .40 for coherence to 0.69 for the aesthetic appeal.

Table 5.5. CAT rating differences between experts and non-experts.

	High-flow		Low-flow	
	Means' Difference	*t (df)*	*Means' Difference*	*t (df)*
Aesthetic appeal	.34	2.48 (199)*	.49	3.79 (188)***
Technique	.09	0.55 (186)	.43	2.58 (168)*
Meaningfulness	.19	1.91 (191)	.56	3.06 (184)**
Coherence	.23	1.58 (196)	.40	2.52 (186)*
Creativity	.09	0.58 (192)	.44	2.60 (172)**

*Note. *p<.05, **p<.01, ***p<.001.*

5.7.3 RATERS' RELIABILITY

Before further analysis of the result, the inter-rater reliability was established using the interclass correlation coefficient, ICC (Shrout & Fleiss, 1979). ICC measures the proportion of variance attributable to measurement, and not-measurement error, using a general ANOVA model. To estimate consistency and absolute agreement between judges, the two-way mixed model ICC model for average measures (Cronbach's alpha) was calculated using *irr* package (Gamer, Lemon, Fellows, & Singh, 2012) in R (R Development Core Team, 2008). This method estimates the consistency and absolute agreement of the measurements when ratings from all judges are combined into a composite score by averaging them. The consistency measure looks into a general pattern of rating, excluding the rater's between-item variance as irrelevant. The absolute agreement is based on absolute values; if the ratings between

judges differ, regardless of the reason, they are viewed as disagreement (McGraw & Wong, 1996). Table 5.6 presents ICC reliability measures for both groups: experts and non-experts, on all five dimensions of CAT.

Table 5.6. Reliability estimates for rating of the dance improvisation video. First values is a point estimate. Values in brackets correspond to an upper and lower bound of a 95% confidence interval.

	Consistency		Absolute Agreement	
	Experts N=77	Nonexperts N=128	Experts N=77	Nonexperts N=128
Creativity	.919 [.827, .976]	.934 [.859, .980]	.863 [.724, .957]	.852 [.710, .957]
Technique	.964 [.923, 989]	.970 [.936, .991]	.929 [.852, .978]	.934 [.863, .980]
Aesthetic Appeal	.905 [.797, .972]	.899 [.785, .970]	.856 [.708, .955]	.770 [.575, .924]
Meaningfulness	.873 [.729, .962]	.834 [.647, .950]	.781 [.578, .930]	.641 [.388, .872]
Coherence	.921 [.832, .976]	.926 [.843, 978]	.887 [.768, .966]	.863 [.727, .957]

The absolute agreement ratings were highly consistent only for technique of the improvised piece, with a coefficient alpha of .929 for experts and .934 nonexperts. Good reliability, with coefficient alpha higher than .8 was obtained by experts and nonexperts groups for creativity and coherence measurements; while for aesthetic appeal absolute agreement was good in the group of experts, coefficient alpha = .854, and sufficient in the group of nonexperts, coefficient alpha =.77. The lowest

agreement was obtained for meaningfulness ratings, with coefficient alpha .781 for expert raters and .641.

The interrater reliability of experts and nonexperts was similar; however, coefficient alpha increases with the size of a group, and the nonexperts group was significantly larger: 126 nonexperts versus 77 experts. The Spearman-Brown adjusted coefficient alpha formula (Bjorner, Damsgaard, Watt, & Groenvold, 1998), standardized to 77 raters per group was applied to address the group size effect of nonexpert judgments. New reliability measures dropped: new consistency for creativity ratings was reduced to .79; and absolute agreement measure dropped to .77. Both measures remain fairly high, although much lower than experts. The overall reliability of nonexpert raters was lower than expert ones, as predicted in *Hypothesis 2.*

5.7.4 FLOW AND CREATIVE OUTCOMES

The relationship between group flow experience and the ratings of creative outcome was examined with a linear mixed-effects analysis. This approach overcomes the limitation of data aggregation. In particular, the case of Simpson's paradox, when data show one relationship to a chosen parameter at the individual level, while the aggregated data reveal the opposite direction of dependency (Pollet, Stulp, Henzi, & Barrett, 2015). Linear mixed-effect analysis was performed using R (R Core Team, 2015) with R2MLWin package (Zhang at al., 2016). Flow (low-flow vs. high-flow group improvisation recording) was entered into the model as a fixed effect. As random effects, the intercepts for raters and recorded videos were included, as the study design collected multiple responses per participant and comprised low and high flow exerts of ten different group improvisations. The null model explored variability in the

creativity measure related to random effects of rater and video, while the tested model additionally included flow:

Null model: creativity ~ (1|rater) + (1|video)

Tested model: creativity ~ flow + (1|rater) + (1|video)

As in the previous section, models for all five measured dimensions were tested separately for experts and nonexperts (Table 5.7).

Table 5.7. Multi-level modelling of the relationship between flow and creative outcomes of improvisation in experts and nonexperts rating.

	Experts' rating				Nonexperts' rating			
	Null Model		Tested Model		Null Model		Tested Model	
Parameter	*Estimate*	*SE*	*Estimate*	*SE*	*Estimate*	*SE*	*Estimate*	*SE*
Fixed:								
Intercept	3.82***	.052	3.57***	.072	3.55***	.042	3.48***	.061
Flow_High			.49***	.102			.15(.)	.086
Random:								
Rater	2.06	.105	2.00	.102	2.31	.092	2.31	.092
Video	0	0	0	0	0	0	0	0
Deviance	2743.4		2720.4		4631.9		4629	

Note. $^{(.)}p<.1$, $***p<.001$.

The significance of fitted models was tested by comparison with the null model using the likelihood ratio test. Experts rated high-flow improvisations as more creative (change in log likelihood: $\chi^2(1)= 23.05$, $p <.001$) than the low-flow ones. Being in group flow increased creativity rating by $B=.49$ ($z=4.84$, $p<.001$).

In comparison, nonexperts' ratings of high and low-flow improvisation did not differ. The tested model was not improved by including flow (change in log likelihood: $\chi^2(1)= 2.91$, p=.09), nor did flow lower the variance of random effect related to raters' level of the model.

Further exploration of similar models, examining the relationship between flow and other CAT factors, provided similar findings. Experts found high-flow improvisations as significantly more coherent (*B*=.58, z=5.75, p<.001; change in log likelihood: $\chi^2(1)= 32.378$, p <.001), technically demanding (*B*=.48, z=4.88, p<.001; $\chi^2(1)= 23.45$, p <.001), aesthetically appealing (*B*=.36, z=54.85, p<.001; $\chi^2(1)= 11.10$, p <.001) and meaningful (*B*=.33, z=3.18, p=.002; $\chi^2(1)= 10.056$, p <.002). In comparison, nonexperts recognised high-flow improvisations only as more coherent (*B*=.41, z=4.54, p<.001; $\chi^2(1)= 20.44$, p <.001).

The above results support *Hypothesis 5.1,* that high-flow improvisations would be rated as more creative in comparison to those which were low-flow. The differences were only significant in the experts group. However, such discrepancy is acceptable, as nonexperts' ratings are usually less reliable than those of experts. The next section analyses further differences in judgments between these groups.

5.7.5 CREATIVITY JUDGMENT FACTORS

To explore what factors contributed to creativity judgments and whether experts and nonexperts used the same criteria to evaluate creativity *(Hypothesis 2),* a linear mixed-effects analysis was employed. As in the previous section, the data was structured into a two-level solution: the level 1 units are videos, further clustered within raters (level 2). Further, as fixed effects, all four CAT factors related to Creativity were introduced: technique, aesthetic appeal, meaningfulness, and coherence.

Intercepts for raters and videos were added as random effects. The null model, CAT1, as in the previous exploration, explored variability in the dependent measure related to the rater and group random effects; while in the tested models, all four creativity-related factors were added, one at the time, as fixed effects to create Models CAT2 to CAT5. The complete Model CAT5 is presented below:

Model CAT5: creativity ~ (1 | Rater) + (1| Video) +

+ technique + aesthetic appeal + meaningfulness + coherence

Table 5.8. Multi-level modelling analysis of the relationship between creativity judgments and related CAT factors rated by experts.

	Null Model		Model CAT5	
Parameter	*Estimate*	*SE*	*Estimate*	*SE*
Fixed:				
Intercept	0	.036	0	.020
Technique			.24***	.028
Aesthetic appeal			.26***	.035
Meaningfulness			.20***	.031
Coherence			.26***	.030
Random:				
Rater (Intercept)	.999	.0.51	.30	.016
Video (Intercept)	0	0	0	0
Deviance	2184.2		1269.1	

*Note. ***p<.001.*

To aid in the interpretation of results, all measures were centered on their respective grand mean. Again, the analysis was performed separately for experts (CAT

models) and nonexperts (CATN models). Table 5.8 and Table 5.9 summarises the models.

Adding fixed effects of four creativity-related factors in Model CAT5 significantly improved null model CAT1, with the change in log likelihood $\chi^2(4)$= 915.02, p<.001. All four factors were significant predictors of creativity ratings of experts: technique (*B*=.24, z=8.44, p<0.001), aesthetic appeal (*B*=.26, z=7.38, p<0.001), meaningfulness (*B*=.20, z=6.54, p<0.001) and coherence (*B*=.26, z=8.69, p<0.001). All factors quite equally contributed to creativity prediction. Between the null and CAT5 model, experts' variance reduced from .999 to .30; therefore, approximately 70% of the variation in creativity judgments was explained by related CAT factors: technique, aesthetic appeal, meaningfulness and coherence of improvisation.

The structure of the CATN5 model of nonexperts' ratings, was very similar to CAT5. Again, adding fixed effects significantly improved null model CATN1, with the change in log likelihood $\chi^2(4)$=1733.8, p<.001. All four factors were significant predictors of creativity ratings of experts: technique (*B*=.26, z=11.94, p<0.001), aesthetic appeal (*B*=.29, z=9.13, p<0.001), meaningfulness (*B*=.14, z=5.16, p<0.001) and coherence (*B*=.28, z=12.64, p<0.001). In comparison to experts' ratings, meaningfulness influenced creativity ratings on the lower level. Adding four CAT factors to the null model explained approximately 74% of creativity ratings, with a drop of random effect variance of nonexperts' ratings from .99 to .26.

Table 5.9. Multi-level modelling analysis of the relationship between creativity judgments and related CAT factors rated by nonexperts.

	Null Model		Model CATN5	
Parameter	*Estimate*	*SE*	*Estimate*	*SE*
Fixed:				
Intercept	0	.028	0	.014
Technique			.26***	.022
Aesthetic appeal			.29***	.031
Meaningfulness			.15***	.028
Coherence			.28***	.021
Random:				
Rater (Intercept)	.99	.04	.26	.01
Video (Intercept)	0	0	0	0
Deviance	3600.3		1866.5	

*Note. ***p<.001.*

The analysis above suggests that, regardless of expertise, creativity judgments were significantly related to all other CAT factors: aesthetic appeal, technique, meaningfulness and coherence of improvisation. This might suggest that, in the case of dance improvisation, creativity judgment is based on other aspects of performance and raters do not possess independent internalised models of creativity. Then again, due to the nature of dance improvisation, it might be that highly creative work is also perceived as more aesthetic, meaningful, etc.

5.8 DISCUSSION

5.8.1 FLOW AND CREATIVE OUTCOMES

This study was designed to investigate the relationship between shared flow experience, as an important aspect of the group process in dance improvisation, and the creative outcomes of such processes. The results clearly indicate that being in the flow is indeed related to increased level of creativity. The analysis of the *creativity ~ flow* model demonstrated that high-flow improvisation was rated as more creative by experts, increasing the creativity ratings by .49 point. This result is coherent with previous outcomes from Study 1 in which dancers in interviews commonly claimed that they are more creative and find more unusual movement qualities while being in the flow. Further, Study 2 showed that self-evaluated creativity was significantly related to the flow experience measured by both the video-stimulated recall of flow *(Flow)* method and the questionnaire-based fluency dimension of flow (*FSS*).

This result gives evidence of the relationship between quality of creative process and the creative outcomes achieved. Flow describes the quality of the creative process; while being in the flow, dancers experience total absorption with, and high enjoyment of, the activity (Csikszentmihalyi, 1996). On a group level, flow is related to close collaboration and good communication among the group (Sawyer & DeZutter, 2009). Although group flow is described as a peak performance–when the group perform at the highest level of their abilities (Sawyer, 2003)–there has been little empirical evidence on the influence of group flow on creative outcomes (MacDonald et al., 2006). This study provides evidence that group flow leads to higher creativity in dance, especially in dance improvisation.

It is worth noting that high-flow improvisations were also rated higher by experts, on four other factors: technique, aesthetic appeal, coherence and meaningfulness. Such results support Sawyer's (2003) claim that group flow is connected with peak performance of an assembly.

5.8.2 Assessing creativity with CAT

The results suggest that subjective judgments of creativity of performance arts cannot be easily separated from judgments of their technical level, aesthetic appeal, meaningfulness or coherence of the group. All those factors significantly predicted both experts and nonexperts' ratings of creativity (model CAT5, CATN5). Also, the structure of the regression models of creativity was similar for both groups. Such a result is not consistent with initial studies on CAT that demonstrated that those factors are distinguished and independent in the view of raters (Amabile, 1983). However, other research, from the field of design, found that creativity, technique and aesthetic appeal are highly related (Hennessey, 1994; Jeffries, Zamenopoulos, & Green, 2016b). Amabile (1983) suggested that the relation between creativity and other factors, such as the technical execution of the work, might differ between domains. This study showed that in the case of dance improvisation, the judges' rating of creativity and related factors, especially aesthetic appeal, technical execution and coherence of the group, were highly related. It might be due to the lack of any internalised standard of what makes dance creative, separate from other factors that evaluate the 'goodness' of work. At the same time, highly creative dance might be just perceived as technically better, aesthetically appealing and coherent. Also, it is worth noting that this study focused on improvisation, the unplanned, spontaneous creative process. In such a case, the ability of dancers to create interesting work 'in the moment' might heavily

rely on their technical and collaborative abilities. Therefore, those qualities of improvised work might be inseparable.

In the current study, meaningfulness of the work was the factor that had the lowest reliability ratings and had the weakest influence on creativity ratings. It might suggest that raters did not possess a clear internalised model of the meaningfulness of dance.

Surprisingly, the four-factor model of creativity was very similar between expert (CAT5) and nonexpert raters (CATN5). Despite limited experience with dance (both as spectators or practitioners), nonexperts relied on similar cues while rating creativity. However, their ratings were usually lower across all dimensions of CAT and variance of rating higher. This trend is in contrast to the previous studies that showed that experts' assessments of work might be harsher than students (Runco, McCarthy, & Svenson, 1994). That leads to the discussion on the reliability of experts' and nonexperts' judgments.

As expected (*Hypothesis 2*), the reliability of nonexpert judges was lower than those of expert. This is consistent with previous research (Kaufman et al., 2009, 2008). Overall, experts' judgments were highly reliable, with consistency measures higher than .9 for all factors apart from meaningfulness (icc_{con}=.87), and absolute agreement higher than .85 for all factors; again, aside from meaningfulness (icc_{ag}=.78). In comparison, after adjusting the nonexpert group size to match the experts', the reliability measures of nonexperts creativity judgments were noticeably lower. The lower reliability of nonexperts might suggest that they had insufficient expertise in the judged domain; therefore their understanding of creativity and related factors for this domain was limited.

In a typical CAT study, the panel of experts is small (between 6 and 15 people), composed of well-recognised creators or critics of the discipline (Baer & McKool, 2010). In this study the expert group included dance professionals, who either had dance training to at least university level, or active research or performance dance practice. Such selection has the advantage of including a much bigger population of judges. However, it raises some questions. Kaufman and Baer (2012) suggested that quasi-experts might represent a compromise between ideal scientific rigour and practical time and budget restriction. The reliability analysis of this study of experts' judgments confirms that use of a larger group of quasi-experts allows obtaining good reliability of results, regarding both consistency and absolute agreement.

In conclusion, the results suggest that group flow enhance the creative process and outcomes in improvisational settings. Experts judged high-flow improvisations as more creative. However, this effect was not present in the nonexperts' assessment. The creativity ratings were closely related with other features of improvisation such as coherence, technique, aesthetic appeal and meaningfulness, both for experts and nonexperts. Such results raise questions around the appropriateness of using CAT for dance artworks and the ability to distinguish between creative outcome and other elements, like technique or aesthetics of dance work, or more specifically, of an improvisation task.

6 PHYSIOLOGY OF SHARED FLOW EXPERIENCE

A growing number of studies suggest that there is a crucial role for shared physiological dynamics in social coordination, rapport, empathy and even team performance. It has been found that during social activities people tend to spontaneously coordinate their physiological processes such as heart rate (Elkins et al., 2009; Fusaroli, Bjørndahl, Roepstorff, & Tylén, 2015a; Henning, Boucsein, & Claudia Gil, 2001; Konvalinka et al., 2011), breathing patterns (Bachrach, Fontbonne, Joufflineau, & Ulloa, 2015) or brain activity (Friston & Frith, 2015; Hasson, Ghazanfar, Galantucci, Garrod, & Keysers, 2012; Konvalinka et al., 2014). This chapter investigates the presence and temporal development of shared interpersonal physiological dynamics of heart rate (heart-rate) and breathing rate (breathing) during dance improvisation and examines whether coordination of physiological state is an underlying component of the group flow experience.

Group flow experience emerges in such activities that enable the development of close interdependence between group members. Sawyer (2007) emphasized that the improvisation setting that allows members equal participation and smooth exchange of actions gives the perfect conditions for group flow to appear. An elevated level of flow is also observed in highly interdependent team sports, such as football, basketball or hockey (S. A. Jackson & Csikszentmihalyi, 1999). Social context makes the experience of flow more enjoyable, especially if an activity requires a high level of coordination, and interdependency between group members (Walker, 2010).

On the other hand, aligning emotional states seems to be equally as relevant a component of group flow as close coordination of action. Hart & Di Blasi (2013) stress the importance of developing a deep sense of empathy. Sharing the mutual emotional experience, with its highs and lows, seems to be a foundation for deep, mutual understanding within the group, and acting smoothly as a whole. In this context, group flow experience is not only a state of highly coordinated behaviour, but also a state of co-regulated emotional reactions. It might be defined as the optimal collective experience when *everything seems to come naturally*, and group members act in interactional synchrony (coordination) of actions and emotional states (Sawyer, 2003).

The interest in a possible physiological basis of collective experience and social coordination originates from the question as to how people develop complex interpersonal behaviours and, in particular, how (and if) they co-regulate their emotional states. One of the established physiological measures of emotional arousal is heart rate and heart rate variability, as emotional state has an impact on the autonomic nervous system that regulates cardiovascular system (Kreibig, 2010). However, heart rate is also closely connected to activity level and increases with physical effort (Wallot, Fusaroli, Tylén, & Jegindø, 2013) and is weakly influenced by breathing patterns (Schäfer, Rosenblum, Kurths, & Abel, 1998). Therefore, it is expected that social coordination on the behavioural level, as well as co-regulation of emotional states, manifests in aligning physiological states between interacting agents, and particularly in shared pulse patterns.

The phenomenon of collective high emotional arousal has been found in various social contexts. High levels of shared physiological dynamics of heart rate, skin conductance level, and general activity were observed during couple therapy

(Levenson & Gottman, 1983): couples tend to align their pulse, arousal level and behaviour, although it was more typical for distressful episodes of conflict. Similarly, romantic partners were found to coordinate their breathing and heart rate patterns while performing an experimental task together (Helm, Sbarra, & Ferrer, 2012). In the context of group coordination, Müller and Lindenberger (2011) investigated choir singers. They found, relative to a rest condition, that an increase in cardiac and respiratory coupling during singing was moderated by the type of the performance. Predictably, their physiological synchronisation was highest while the choir was singing in unison.

Nevertheless, synchronised movement is not necessary for synchronised arousal. Konvalinka et al. (2011), investigating a collective Spanish ritual of fire walking, showed that shared heart-rate dynamics are present between active participants of the ritual, who actually were walking through the fire, and their closely-related spectators. Interestingly, there was no such relation with other viewers who watched the ritual. Spectators' reactions to a dance theatre piece showed a similar effect (Bachrach et al., 2015): the synchronisation of breath between performers and the spectators. The breathing coupling was related to the attention to one's own or a dancer's physiological state, their breathing and muscular activity. The spectators seemed to spontaneously synchronise with performing dancers. Contrary to the researchers' prediction, the synchronisation of breathing was unrelated to the appreciation of the piece.

The links between shared physiological patterns and group performance in task-oriented settings were investigated by Henning, Boucsein and Gil (2001), where heart-rate and breathing dynamics, combined into a *Social Psychophysiological*

Compliance metric, were predictive for dyads' performance in a collaborative computer gaming task. The teams that showed more shared physiological dynamics solved the task faster and with fewer mistakes. This study was later repeated (Henning & Korbelak, 2005) with the introduction of a disruption: at a random point in the task, player roles were swapped. Shared pulse dynamics positively predicted the reaction time for the unexpected change and post-disruption performance. Based on those findings, it was argued that shared physiological dynamics, especially pulse, reflect increased team awareness and coordination on the behavioural level and team readiness to deal with unexpected challenges.

More recent studies have contradicted these findings: Strang et al. (2014), using a collaborative Tetris-like task, reported a negative relationship between physiological coupling and team performance. They explained their results though the potential complementary coordination (acting in response to the partner rather than in synchrony with the partner) that was facilitated by different team roles. Similarly, Fusaroli et al. (2015a) observed the presence (and increase over time) of interpersonal shared heart-rate dynamics during collective creative Lego construction, but it was found to be unrelated to social rapport and perceived group competence. At the same time, behavioural coordination was a better predictor for both physiological entrainment and collective experience.

The examples above indicate that shared physiological dynamics are present in a variety of social contexts and interpersonal activities, yet the coherent model of connected heart and breathing rates, collective performance and self-reported perception of the experience is still missing. The main limitation of the findings is that they are highly determined by the choice of collaborative task.

Physiological entrainment is commonly discussed in the context of collective experience, in particular, the *collective effervescence* (Bachrach et al., 2015; Fusaroli, Bjørndahl, Roepstorff, & Tylén, 2015b; Henning, Armstead, & Ferris, 2009; Konvalinka et al., 2011). Collective effervescence is the phenomenon first described by Durkheim (1912/2002) in his studies on the consequences of mass collective activities. He argued that certain collective activities, such as mass religious or sport events, create an increase in generated emotional reactions that are experienced by participants in a joint form. It is argued that there are at least two different processes that might lead to joint arousal in a social context and, therefore, to shared physiological dynamics of the participants: *co-ordinated movement* or *empathic projection*.

Many social situations that evoke the collective experience are related to highly coordinated activities, e.g., a team sport, singing or dancing together. It was shown that synchronised behaviour enhances social rapport and cooperation within the groups (Miles, Nind, & Macrae, 2009; Valdesolo, Ouyang, & DeSteno, 2010). Therefore, the 'coordinated movement' hypothesis argues that shared activities, especially synchronised, matching actions, align physiological, cognitive and emotional states of participants, resulting in heightened solidarity (Hove & Risen, 2009; Wiltermuth & Heath, 2009). In social situations, people tend to coordinate their actions automatically: they entrain their postural sway (Shockley, Santana, & Fowler, 2003), align their linguistic forms and complement each other's behaviour (Richardson, Dale, & Shockley, 2008). And indeed, the highest level of cardio and respiratory synchronisation was found while a choir sings in unison (Müller & Lindenberger, 2011), or when dyads perform highly collaborative, and behaviourally constrained tasks (Fusaroli et al., 2015a; Henning et al., 2009; Henning, Boucsein, & Gil, 2001).

However, physiological entrainment does not require synchronous behaviour. People spontaneously and non-consciously tend to mimic each other's facial expression, speech patterns, and postures in everyday interactions (Chartrand & Bargh, 1999), which can lead to alignment of emotional states and therefore to shared physiological arousal. The empathic projection hypothesis argues that during a collective experience or social event, participants align their relevant cognitive and emotional states through an empathic reaction, without any need for motor coordination (P. L. Jackson, Rainville, & Decety, 2006; Singer & Lamm, 2009). In this context, shared physiological dynamics were found in various interactions that were characterised by shared emotional arousal and did not require synchronised behaviour (Henning et al., 2009; Konvalinka et al., 2011; Strang et al., 2014).

Group dance improvisation as a free, unplanned movement practice, has the potential for dancers' physiological entrainment to manifest, both through spontaneous synchronised movement, as well as empathic relations within the group. Both the coordinated movement and the empathic projection processes would predict that the collaborative, group improvisation would lead to dancers' coordination on a physiological level.

6.1 Objectives

This study investigates the physiological entrainment associated with group dance improvisation and the relationship between any entrainment and dancers' shared flow experience:

1. In the first step, this study investigates the phenomenon of physiological entrainment in group dance improvisation. It is predicted that a group task will lead to

higher coordination on a physiological level, measured by heart and breathing rate in the group, in comparison to the solo task (*Hypothesis 1*).

2. To differentiate between the two accounts of the mechanisms behind shared heart-rate and breathing dynamics (empathic facilitation vs. coordinated movement), the effect of dancers' activity levels needs to be taken into account. If coordinated movement facilitates shared physiological dynamics between dancers, the activity patterns will also be more coordinated in group tasks in comparison to the solo task; and activity dynamics measurements will be positive predictors of heart-rate and breathing dynamics. Lack of significant differences in activity dynamics between the tasks will suggest that empathic projection has facilitated the shared heart-rate and breathing dynamics within the group.

3. Further, the group flow experience will be addressed in the context of physiological entrainment. Group flow experience appears in a successful, effortless collaboration where coordination of actions proceeds smoothly in an empathic way. Therefore, it is hypothesised (*Hypothesis 2)* that higher levels of group flow experience during improvisation will be related to a higher level of dancers' coordination on the physiological level (measured by heart-rate and breathing) in comparison with low-flow improvisations. To test this hypothesis, flow experience during improvisations was assessed using the video-recall *Flow* measure described in Chapter 4; and the group index GF, described in Chapter 5, was calculated for each of the shared tasks.

6.2 METHOD

6.2.1 PARTICIPANTS

Eight groups of four dancers were recruited from the second and third year of the BA dance program of Trinity Laban Conservatoire of Music and Dance. The sample

included 28 women and four men; with a mean age of 21.3 years (SD= 1.9 years). Participants received £12 for taking part in a 1.5-hour session. This is the same cohort of dancers as reported in the previous study, 'Shared Flow and Creativity', in Chapter 5.

6.2.2 PROCEDURE

Ethical approval for this study was granted by the University of Plymouth, Faculty of Health and Social Studies. All participants gave written informed consent following a briefing session, in which they were given written and verbal information about the experiment and the purpose of the video-recording.

The testing session was conducted as a dance workshop, and data were collected alongside the movement session. Each group warmed up with a set of exercises, as in the previous studies. After the warm-up, dancers were asked to complete an individual, solo improvisation task that served as a baseline task. All the dancers from a group completed the solo task simultaneously in the same space.

This was followed by two similar group improvisation tasks (here called A and B); with the instruction constructed as a group version of the solo task. The solo task inspired by Franklin's (2013, p. 77) 'Inner Surface' exercise was:

> *'Watch the surface of your body from inside. See how the inner surface changes as you move. What sounds accompany those changes. How does it make you feel? Initially, it may be helpful to imagine yourself as a large balloon in the shape of your body. Place your mind's eye inside this balloon and watch it change shape from your inner vantage point. As you move, certain areas of the balloon extend outward,*

while other areas are pulled inward. Pay special attention to the changes in the inner contours of the balloon.'

The group tasks were the same as those described in Chapter 5 (p.127). Each task lasted 4-5 minutes and was called to an end by the experimenters.

6.2.3 *Flow*

The flow-rating phase was completed as described in Chapter 4. Immediately after completing each task, participants were individually asked to complete the *Flow* task, to annotate flow experience over time in improvisations, on tablet computers. The individual *Flow* ratings were used to compute the group flow experience (GF) over time, defined as the average of co-experience of flow between each of the pairs in the group.

6.2.4 *Physiological data recording and processing*

Physiological data and activity level of dancers were recorded using a Bioharness 3 monitoring device, and processed in the OmniSense Analysis module, both provided by Zephyr™ Technology (2012). The Bioharness system has an elastic chest band worn against the skin carrying a sensor module. It is light (the band with sensors weighs around 85g) and does not limit movement. The module measures five variables simultaneously with time stamps synchronised with the OmniSense Analysis module and across devices, enabling comparison between subjects. Heart-rate data is captured through electrode sensors, and breathing is assessed using a capacitive pressure sensor that detects circumference expansion and contraction of the torso, producing an output as *breaths per minute*. Although it is an indirect method of measuring breathing pattern, it has confirmed validity and reliability through comparison with the highly accurate gas-analysis systems (Hailstone & Kilding, 2011).

Tri-axial accelerometers measure movement using piezo-electronic technology, giving peak acceleration and absolute movement measures of the device (and therefore the wearer). The former is used as an *activity measure* that describes the overall movement/activity of the subject. Additionally, the Bioharness system records data about skin temperature and posture (range of angular degrees from the vertical); however, that information was not relevant for the studies below. Overall, the system reliability has been confirmed in comparison with other established methods of monitoring physiological and movement activity (Johnstone, Ford, Hughes, Watson, & Garrett, 2012).

For the purpose of analysis, the physiological measures of heart rate, breathing rate, and activity level were recorded at a sampling rate of 1 Hz. To align all measures across participants and groups, the data was z-normalised per subject and synchronised among subjects using the timestamps provided by the Bioharness 3 sensors. The data were segmented into the sequences corresponding to each task.

6.2.5 CROSS-RECURRENCE QUANTIFICATION ANALYSIS

Physiological processes such as heart beat and breathing, show wide variation and range, even during rest (Van Orden, Kloos, & Wallot, 2011). For this reason, linear and aggregated data analysis methods, such as correlation, that assume data stationarity (equal distribution over time) are not appropriate to assess the dynamics of shared heart-rate, breathing, or level of activity. Further, the lags of synchronisation for physiological data vary over time (Strang et al., 2014). Therefore, methods that assume constant lags, as in a cross-correlation, are not appropriate for analysing interpersonally shared physiological dynamics, as they might oversimplify the phenomena.

To overcome these aspects of the data, cross-recurrence quantification analysis (CRQA) was used. CRQA is a technique that allows the temporal organisation of the behavioural, cognitive or physiological component of interactions to be examined. In comparison to aggregative approaches that utilise atemporal methods, CRQA identifies and quantifies the shared dynamics of a complex non-linear system (Webber & Zbilut, 1994), taking into account all possible lags of interaction. It measures how, and the extent to which, streams of information come to exhibit similar patterns in time. CRQA compares two time series of data by calculating the degree of their recurrence.

A central feature of CRQA is the cross-recurrence plot, a graph which plots the state of two dynamical systems over time. If the two systems share a similar state at any pair of times (i.e., System 1 is in State X at time A; System 2 is in State X at time B), that point (i.e., A,B) is coloured black; otherwise it is left white. The diagonal shows exact synchronization; points further off the diagonal show increasing temporal lags between the two systems. An example of a cross-recurrence plot is shown in Figure 6.1.

CRQA has been used to qualify the entrainment of coupled oscillators (Shockley, Santana, & Fowler, 2003), and has been shown to be particularly effective in the analysis of interpersonal coordination, which often presents weak, but significant coupling of physiological (Konvalinka et al., 2011; Strang et al., 2014; Webber & Zbilut, 1994) and behavioural systems (Ramenzoni, Riley, Shockley, & Baker, 2012; Richardson, Dale, & Shockley, 2008; Shockley et al., 2003). This method has been validated and found to be more robust than alternative methods (Konvalinka et al., 2011; Strang et al., 2014; Wallot et al., 2013).

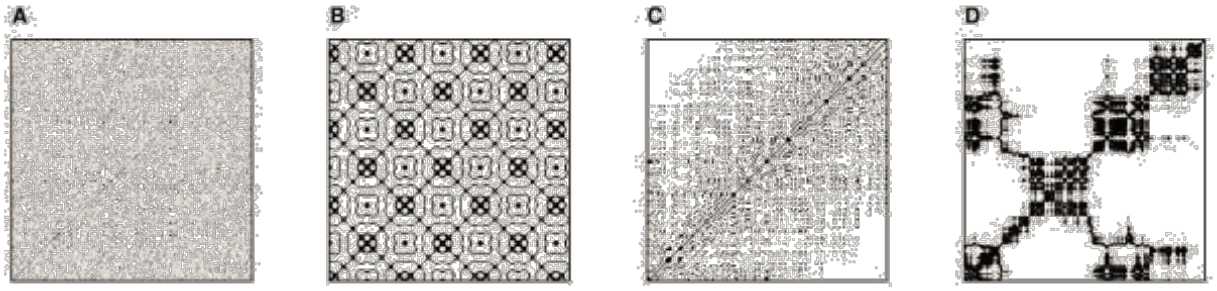


Figure 6.1. Examples of cross-recurrence plots showing A) two unsynchronized, homogenously noisy systems; B) periodic, synchronized systems; C) initially synchronized systems with a linearly increasing drift; D) synchronized systems with random disruptions. From www.recurrence-plot.tk and Marwan, Romano, Thiel, and Kurths, (2007).

CRQA produce several metrics to estimate the similarity between dynamic patterns. They capture many properties of physiological dynamics that would otherwise get lost, due to averaging, with a correlation approach. In this study, the following measures were calculated, following the strategy of Webber and Zbilut (1994):

Coordination measured as the recurrence rate (*RR*) between two time series. It is defined as the percentage of shared states in the phase space, in the range from 0 to 100. The higher the recurrence rate, the more similar the range of basic dynamic patterns displayed by the participants. On a cross-recurrence plot, it is related to the proportion of the plot that is filled with black dots.

Predictability measured by determinism (*DET*) of the system. This measure is based on percentage (0-100) of the points in the recurrence plot that form upward diagonal line segments and reflects the degree to which system dynamics are predictable. The diagonal lines marks periods when the system moves through a series of identical states over time. A plot containing a high rate of diagonal lines would

suggest that participants tend to display prolonged and stable sequences of shared physiological dynamics.

CRQA was calculated using *crqa* package for R (Coco & Coco, 2013). The analysis parameters–*embed*, *delay*, and *radius*–were adjusted following the guidelines of (Coco & Dale, 2014) and the *optimizeParam* algorithm (Coco & Coco, 2013); they were set to the same values across all pairs and groups to allow comparisons. The *delay* was set by determining the dominant value of delay between local minimums of two time series, while the *embed* dimension was estimated by finding the false nearest neighbour function. Finally, the *radius* was adjusted to the 2-5% level of the recurrence rate. This analysis led to the following parameters: *embed* of 3, *delay* of 3 and the radius threshold adjusted for each of measures: r_{HR}=1.1, r_{BR}=0.8, $r_{Activity}$=1.4.

6.2.6 Data Analysis

To assess the presence of interpersonal shared heart-rate and breathing dynamics, CRQA measures were calculated for all possible pairs of members in each group of dancers, both in the individual task and the collaborative, group task. This procedure generated six pairs for each group of eight groups for each of three tasks. For one group, the sensor lost contact repeatedly and the physiological data was not recorded, so their data were excluded from the analysis. In total, seven groups, each with three tasks (one solo task, two group tasks) were included.

To compare the level of coordination and predictability of shared physiological dynamics, a mixed effect linear modelling approach was employed, accounting for groupwise and pairwise variability, as well as experimental conditions. The data are structured into a two-level solution: the pairs (level 1 units) are further clustered within the groups (level 2). Hence, the null model explores the variability in the

complexity of shared physiological dynamics related to pair and group-level random effects:

Null model: Level of coordination ~ (1 | group) + (1| pair).

The experimental models differ for verifying each of the hypotheses, by including relevant fixed factors: the type of task (solo *versus* group), for the hypothesis that group tasks will lead to higher coordination; and flow experience (GF), for the hypothesis that group flow experience will be related to coordination. MLM analyses were performed using the R2MLwiN (Zhang, Parker, Charlton, Leckie, & Browne, 2016) package for R(R Development Core Team, 2008).

For the collected sample of 126 observations (6 pairs per group, 7 groups), the power analyses were estimated by analogy with repeated measures ANOVA, as there are currently no accepted methods for computing the power of hierarchically nested models (Judd et al., 2012), such as the one in this study. For the estimated effect size of f =.20, with alpha of .05, a design with three measurements from 42 pairs would achieve a power of 0.80.

6.3 RESULTS

6.3.1 PHYSIOLOGICAL ENTRAINMENT IN THE GROUP DANCE IMPROVISATION.

The descriptive aggregated statistics for the seven groups for which data was available are presented below in Table 6.1. For brevity, heart-rate is abbreviated as pulse, and breathing-rate as breath. Where necessary, the measures of coordination and predictability are indicated by the suffixes C and P, respectively.

Table 6.1. Descriptive statistics of aggregated CRQA metrics: coordination and predictability for solo and two group tasks (n=7).

		Pulse		Breath		Activity	
		Mean	*(SD)*	*Mean*	*(SD)*	*Mean*	*(SD)*
Coordination	Solo task	21.21	(3.24)	22.17	(1.68)	26.99	(4.02)
	Group task A	27.60	(7.39)	25.75	(2.38)	23.64	(2.79)
	Group task B	25.97	(2.43)	23.58	(1.62)	23.52	(2.99)
Predictability	Solo task	93.93	(3.23)	99.43	(0.33)	69.04	(8.72)
	Group task A	96.67	(2.97)	99.73	(0.09)	57.27	(7.56)
	Group task B	97.09	(1.36)	99.61	(0.12)	61.66	(5.76)

The significance of the difference between solo and group tasks was assessed by adjusting the model where task condition, solo *versus* group, was introduced as the fixed effect:

Model 1: shared dynamics ~ task+ (1|group) + (1|pair).

Table 6.2 presents summary statistics of model exploration for the level of coordination and predictability metrics between the groups. $Pulse_C$ improved the null model, with change in log likelihood χ^2 $Pulse_C$ (1)=6.05, p=.013, and there was a positive effect of the group character of task on $Pulse_C$ patterns: *B* =.92, z=2.65, p=.008 (Figure 6.2). Adding the task as a fixed effect to the model explained 28% of variability at the group level. Similarly, model $Pulse_P$ was better than the corresponding null model (change in log likelihood χ^2 $Pulse_P$ (1)=6.75, p=.009) with the analogical effect of type of task: *B* =.92, z=2.82, p=.005. The character of task explained 32% of the variability in the $Pulse_P$ within the groups. Both results indicate that a group

improvisational task leads to the higher entrainment of heart-rate patterns between dancers.

Table 6.2. Multi-level modelling analysis shows that adding a contrast between the solo and group improvisational task as a fixed effect, improves the modelling of the level of heart-rate coordination ($Pulse_C$) and predictability ($Pulse_P$) within the groups (Model 1 v Null Model).

	$Pulse_C$				$Pulse_P$			
	Null Model		Model 1		Null Model		Model 1	
Parameter	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Fixed:								
Intercept	0	.190	-.62*	.284	0	.181	-.61*	.267
Task_group			.92**	.348			.92**	.326
Random:								
Group	.71	.233	.51	.175	.63	.212	.43	.154
Pair	.28	.039	.28	.039	.37	.051	.37	.051
Deviance	257.1		251.0		282.2		275.4	

*Note. **p<.01, *p<.05.*

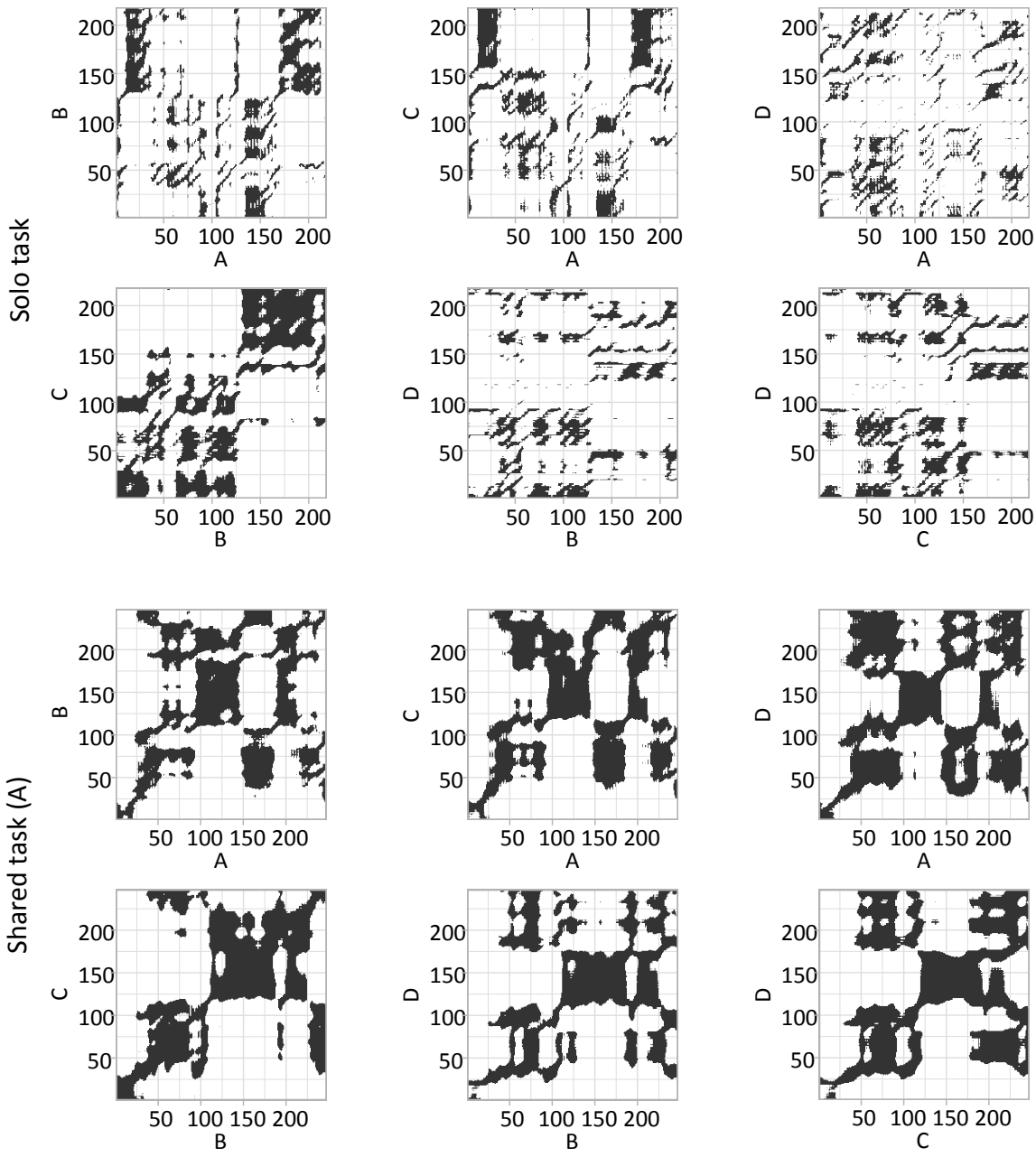


Figure 6.2. Cross-recurrence plots of shared pulse (HR) dynamics in solo and group task (Group 3). Each graph represents a combination of two of the four dancers (A to D) in a group, so there are six graphs per task. The higher the proportion of black dots in the graph, the higher the coordination (*RR*) between the dancers; a higher rate of diagonal lines indicates higher predictability (*DET*), the prolonged and stable sequences of shared physiological dynamics. The cross-recurrence graphs for all groups, tasks and physiological variables (heart-rate, breathing and activity) are presented in Appendix 3 (p. 203).

A corresponding analysis was performed for breathing patterns and is summarised in Table 6.3. Model 1, for $Breath_C$, was better than the null model (change in log likelihood $\chi 2$ $Breath_C$ (1)=6.30, p=.01). Including the effect of task in the model predicted the difference of *B*=.63 (z=2.71, p=.007) of $Breath_C$ between solo and group tasks; and explained 43% of variability on the group level. Similarly, model $Breath_P$ was better than the corresponding null model (change in log likelihood: $\chi 2$ $Breath_P$ (1)=6.02, p=.014), showing significance of the fixed effect of task on the $Breath_P$: *B* =.81, z=2.64, p=.008 which explained 30% of the group-level variance.

Table 6.3. Multi-level modelling analysis shows that adding a contrast between the solo and group improvisational task as a fixed effect improves the modelling of the level of coordination ($Breath_C$) and predictability ($Breath_P$) of dancers' breathing patterns within the groups (Model 1 v Null Model).

	$Breath_C$				$Breath_P$			
	Null		Model 1		Null		Model 1	
Parameter	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Fixed:								
Intercept	0	.127	-.42*	.189	0	.166	-.54*	.250
Task			.63**	.231			.81**	.306
Random:								
Group	.21	.105	.12	.079	.50	.180	.35	.135
Pair	.79	.109	.79	.109	.49	.068	.49	.068
Deviance	347.1		340.8		309.4		303.4	

*Note. **p<.01, *p<.05.*

These results demonstrate that as predicted by *Hypothesis 1*, a group task in improvisation leads to higher coordination and predictability of heart-rate and breathing patterns between dancers within the group. This analysis is inconclusive regarding the mechanism of such entrainment, which will be investigated in the next section.

6.3.2 THE MECHANISM OF SHARED PHYSIOLOGICAL DYNAMICS

To examine the underlying mechanism of physiological entrainment between dancers (*coordinated movement* or *empathic projection*), the effect of movement entrainment, measured by shared dynamics in activity level was assessed. First, the influence of task on shared patterns in the level of activity was tested using an MLM approach (Table 6.4). In the second step, models for heart-rate and breathing shared dynamics were analysed with activity level as the predictor (Model 3).

An effect of the task on the level of coordination and predictability of shared activity patterns was found. However, the direction of relation was contrary to the previous findings for heart-rate and breathing patterns. The coordination metric was higher for the individual task, $Activity_C$ =-.84; z=-2.40, p=.016 (a significant change in log likelihood in comparison to null model: $\chi 2$ $Activity_C$ (1)=5.10, p=.024). This dependency, in comparison with heart-rate and breathing shared dynamics is presented in Figure 6.3.

Table 6.4. Multi-level modelling analysis shows that adding a contrast between the solo and group improvisational tasks as a fixed effect improves the modelling of the level of coordination ($Activity_C$) and predictability ($Activity_P$) of dancers' Activity patterns within the groups, but with a negative weight, contrary to the modelling of heart-rate and breathing.

	$Activity_C$				$Activity_P$			
	Null		Model 1		Null		Model 1	
Parameter	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Fixed:								
Intercept	0	.185	.56*	.284	0	.192	.67*	.281
Task_group			-.84*	.348			-1.0**	.345
Random:								
Group	.66	.222	.51	.174	.73	.240	.51	.171
Pair	.33	.045	.33	.045	.26	.036	.26	.036
Deviance	271.0		265.9		247.5		240.4	

*Note. **p<.01, *p<.05.*

Similarly, the predictability of shared activity dynamics was higher in the solo than in group tasks: $Activity_P$ =-1.0; z=-2.90, p=.004 (change in likelihood $\chi 2$ $Activity_P$ (1)=7.09, p=.008). It is worth noting that while coordination metrics are in the same range between the different physiological measures (pulse, breathing and activity), predictability of shared patterns of activity is much lower than that of heart-rate and breathing (Table 6.1).

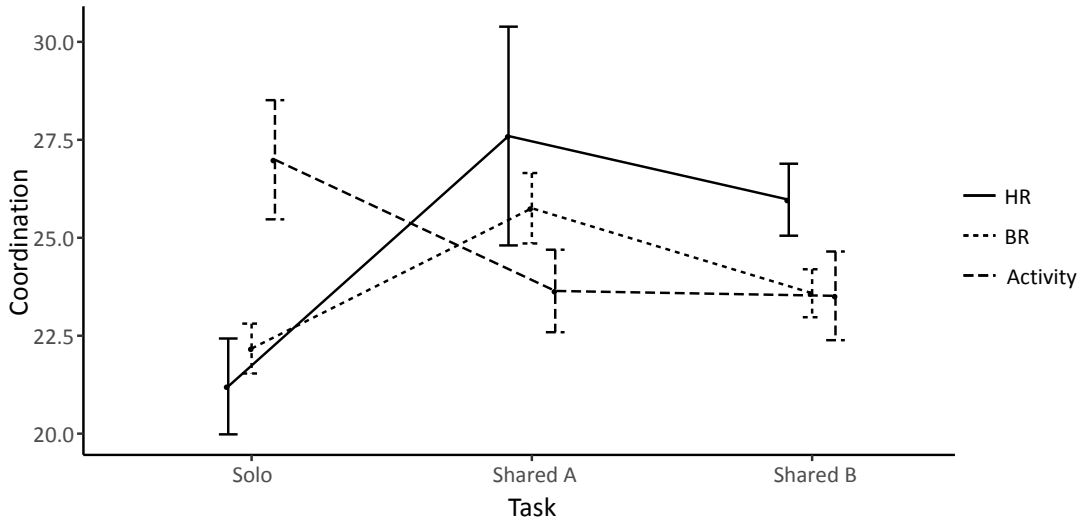


Figure 6.3 Level of coordination between heart-rate, breathing and activity level patterns of dancers within solo and shared improvisation tasks. Coordination of heart- and breathing rate measures increases in shared tasks, while activity decreases.

To summarise, the group improvisational task led to lower coordination and predictability of activity level across the groups, in comparison with the individual task. It is important to remember that the individual task, where dancers were asked to improvise alone, was performed simultaneously in the same space. The results indicate that in the individual task, dancers within the group did quite similar things, organising similarly their improvisation over time in terms of activity level. In group task, dancers seemed to structure their improvisation differently. Lower coordination and predictability of activity indicates the greater variability of activity: Therefore, dancers were more likely to structure their group improvisation in a complementary way (responding to each other's actions, taking turns, acting in opposition) than dancing in synchronisation.

In the next step, the relationships between shared activity patterns and shared physiological (heart-rate, breathing) dynamics were examined by including $Activity_C$

and $Activity_P$ as fixed factors into the corresponding models of heart-rate and breathing shared dynamics:

Model 2: shared dynamics ~ Activity + (1 | Group) + (1 | Pair)

Detailed results of the analyses are reported in the tables: Table 6.5 for the shared heart-rate dynamics and Table 6.6 for shared breathing dynamics. The tested model $Pulse_C$ ~ $Activity_C$ showed no linkage between coordination of dancers' activity level and heart-rate (change in log likelihood in comparison to null model: χ^2 (1)=2.23, p=.135). However, there was a relationship between predictability measures: the increase of $Activity_P$ results in the decrease of $Pulse_P$ (*B* =-.23; z=-2.34, p=.019; change in model's likelihood: χ^2 (1)=5.05, p=.025). Including $Activity_P$ as a fixed factor into the model explained 21% of variability at the group level. An analogous analysis for activity and breathing patterns dependencies did not find any statistically significant relationships (Table 6.6.).

This exploration of coordinated patterns of activity, in relationship to type of task and shared physiological patterns of heart-rate and breathing, indicates that the mechanism underlying the shared heart-rate and breathing dynamics in dance improvisation was not related to synchronised movement. Both the level of coordination and the predictability of activity coordination were lower in group tasks than in solo tasks, presenting the opposite relationship to heart-rate and breathing co-ordination. Further exploration showed that level of coordination in activity had no significant relationship with heart-rate or breathing coordination metrics.

Table 6.5. Multi-level modelling analysis shows no relationship between coordination (*RR*) of shared heart-rate and activity level patterns (Model 2: $Pulse_C$ ~ $Activity_C$); but a relationship between the predictability (*DET*) of dancers' shared heart-rate and activity patterns (Model 2: $Pulse_P$ ~ $Activity_P$).

	$Pulse_C$ ~ $Activity_C$				$Pulse_P$ ~ $Activity_P$			
	Null		Model 2		Null		Model 2	
Parameter	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Fixed:								
Intercept	0	.190	0	.182	0	.181	0	.164
Activity			-.13	.084			-.23*	.098
Random								
Group	.71	.233	.65	.215	.63	.212	.50	.175
Pair	.28	.039	.28	.039	.37	.051	.36	.050
Deviance	257.1		254.8		282.2		277.1	

*Note. *p<.05.*

Moreover, there was the negative relationship between predictability of coordinated activity and heart-rate, but no significant relationship with the predictability of coordinated breathing patterns. This indicates that the coordination of heart-rate and breathing dynamics in dance improvisation was facilitated through empathic reaction and co-regulation of emotional states between dancers within the improvising group, rather than by coordinated movement.

Table 6.6. Multi-level modelling analysis shows no relationships between coordination (*RR*) of shared breathing and activity level patterns (Model 2: $Breath_C$ ~ $Activity_C$); nor the predictability (*DET*) of dancers' shared breathing and activity patterns (Model 2: $Breath_P$ ~ $Activity_P$).

	$Breath_C$ ~ $Activity_C$				$Breath_P$ ~ $Activity_P$			
	Null		Model 2		Null		Model 2	
Parameter	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Fixed:								
Intercept	0	.127	.	.117	0	.166	0	.160
Activity			-.139	.103			-.09	.109
Random:								
Group	.21	.105	.17	.091	.50	.180	.46	.168
Pair	.79	.109	.80	.110	.49	.068	.50	.069
Deviance	347.1		345.6		309.4		308.8	

6.3.3 PHYSIOLOGICAL ENTRAINMENT AND GROUP FLOW EXPERIENCE

The last part of this analysis investigates whether group flow experience is related to group entrainment at a physiological level. It was verified using the MLM approach by fitting Model 3, with a fixed effect of group flow experience, as measured by GF index.

Model 3: shared dynamics ~ flow + (1 | group) + (1 | pair)

Only group improvisation tasks (seven groups, two tasks performed by each group) were included in this analysis, as group flow is a group activity phenomenon. The average flow GF index for a group was .16 (SD= .105), with a minimum of .02 and maximum of .37. The group flow moments, when three or more dancers within the

group were sharing flow simultaneously, were rather rare and did not last more than 30-50 seconds. One of the groups had almost no group-flow moments at all.

The results of fitting Model 3 with heart-rate dynamics are summarized in Table 6.7, and for breathing dynamics in Table 6.8. None of the tested models were significantly better than the null model. The exploration of MLM for shared patterns of activity and flow had similar results. Overall, group flow experience does not affect the level of coordination or predictability of physiological changes in group dance improvisation. Therefore, *Hypothesis 2* was not confirmed.

Table 6.7. Multi-level modelling analysis shows no relationship between high and low group flow improvisations and level of coordination ($Pulse_C$) and predictability ($Pulse_P$) of dancers' heart-rate patterns within the groups (Model 3).

	$Pulse_C$ ~ GF				$Pulse_P$ ~ GF			
	Null		Model 3		Null		Model 3	
Parameter	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Fixed:								
Intercept	0	.228	0	.209	0	.235	0	.227
Flow (GF)			-.34	.211			-.24	.228
Random:								
Group	.67	.276	.56	.232	.73	.293	.68	.272
Pair	.31	.053	.31	.053	.26	.043	.26	.043
Deviance	177.3		174.9		164.8		163.8	

Table 6.8. Multi-level modelling analysis shows no relationship between high and low group flow improvisations and level of coordination ($Breath_C$) and predictability ($Beath_P$) of dancers' breathing patterns within the groups (Model 3.).

	$Breath_C$~ GF				$Breath_P$~ GF			
	Null		Model 3		Null		Model 3	
Parameter	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Fixed:								
Intercept	0	.144	0	.134	0	.163	0	.152
Flow (GF)			-.19	.135			-.22	.153
Random:								
Group	.149	.112	.11	.098	.25	.142	.20	.124
Pair	.84	.142	.84	.142	.74	.125	.74	.125
Deviance	233.8		231.9		228.4		226.4	

6.4 DISCUSSION

6.4.1 SHARED PHYSIOLOGICAL DYNAMICS IN GROUP DANCE IMPROVISATION

As predicted, a group improvisational task led to physiological shared dynamics of heart-rate and breathing between dancers. Further investigation into the coordination of activity level showed that shared activity patterns do not cause this physiological entrainment. Dancers were not in movement (activity level) synchrony in the group tasks. In conclusion, those findings suggest that *empathic projection* facilitated the shared heart-rate and breathing dynamics in the group dance improvisation.

Previously, Ribeiro and Fonseca (2011) suggested that collaboration and communication in dance improvisation are mediated by *choreographic (kinaesthetic)*

empathy. Choreographic empathy is defined as the ability to understand others' actions and emotions through embodied feelings that matches others' states. It allows dancers to anticipate the intentions of other dancers and to make decisions based on shared structures. Ribeiro and Fonseca (2011) stated that *mirror neurones* (Gallese, Keysers, & Rizzolatti, 2004) might be a possible neuronal structure that enables awareness of other dancers' emotional states and movement intentions. Further, they argued that the movement choices in improvisation, based on a silent agreement between improvisation partners, are only possible due to empathy, and affective motor decision-making. The current study supported Ribeiro and Fonseca's (2011) theory. Higher coordination and predictability of shared physiological dynamics in group improvisation tasks are consistent with the hypothesis of kinaesthetic empathy as the mechanism that allows dancers to share the collective aim of improvisation.

The differing shared dynamics of activity level suggested that the group task would lead to higher variability of behaviour compared to the solo improvisation. First, it is interesting to notice that while dancers were completing the solo task simultaneously, they were more alike than when they were improvising a common task as a group. Dancers were explicitly instructed that the first task (the base line for further investigation) should be performed as a solo. However, they were sharing the same space and performing at the same time. Such setting of the solo task could lead to movement entrainment in several ways. First, as noticed in the introduction, dance has a natural potential for spontaneous synchronised movement (Maduell & Wing, 2007; Naveda & Leman, 2010; Waterhouse et al., 2014). Dancers, even when engaged in the solo task, might spontaneously synchronise their movement and dynamic in an unconscious way. Additionally, as they see other people dance, they might get

inspired or simply copy appealing movement solutions. The interviews with dancers from the first and second study of this thesis (Chapter 3, Chapter 4) supported such a possibility, as dancers commonly commented that they use other dancers' ideas in their creation.

Waterhouse, Watts and Bläsing (2014) differentiated four possible modes of coupling possible between the dancers: *unison* – when the dancers move together, performing identical movement; *complimentary* – when they move together but performing different movement at the same time; *turn-taking* – one dancer moves and the other pauses; and *breaks* – when dancers collectively pause or rest. Although this classification was created for choreographic work, it describes well the possible modes in improvisation too. The results of the current study suggest that group improvisation, when dancers actively collaborate and create a dance together, is characterised by the combination of all mentioned modes, but unison was rather rare. The complexity of movement dialogue and group decision-making is possible through choreographic, kinaesthetic emphatic relations between dancers (Ribeiro & Fonseca, 2011). It might lead to higher variability of movement, as dancers act in a complementary way to each other, and therefore it results in lower coordination and predictability of shared patterns of activity between dancers in comparison to a solo task.

This study used shared dynamics of the general level of activity (measured by tri-axial accelerometers placed on chest band) as an indicator for shared dynamics of movement. Such an approximation has several limitations. First, the accelerometer placement does not capture the full variety of movement vocabulary in dance (e.g., hand or leg gesture). It only gives general information about dancers' momentum, so all conclusions based on this measure should be considered carefully. Other methods,

such as motion capture, are highly useful for tracing individual or duet movement (Kimmel & Preuschl, 2016; Mündermann, Corazza, & Andriacchi, 2006), but the group activity, due to overlapping of bodies, is more challenging to track.

Similarly, there are some limitations of using the chest band sensor for detecting breathing patterns. This method of measuring breathing activity relies on chest movement (expansion and contraction). In dance, several movements, such as torso tilts, arches or twists, might lead to similar chest activity that is unrelated to breathing, causing high noise in collected data. The gold standard in physiological studies for measuring breathing is breath-by-breath gas analyser (Redding & Wyon, 2003), but again because of size, weight and covering the face, it was found to be too disruptive to use in the study of group dance improvisation.

The current investigation used the specific practice of dance improvisation in response to solo or group improvisational tasks. In should be noted that although tasks were chosen to prompt the specific type of creative research (based on imagery and senses awareness) and asked dancers to engage in a solo or collaborative process of improvisation, these tasks did not limit the dancers' movement expression or way of engaging with each other. Therefore, the current finding might be generalised on the wider scale, while discussing the underlying mechanism of social coordination in dance, and collaborative improvised practices in other domains: e.g., music, theatre, and problem-solving.

6.4.2 GROUP FLOW EXPERIENCE

The investigation of group flow experience and shared physiological dynamics did not show any significant links and *Hypothesis 2* was not confirmed. This result is inconsistent with the prediction that group flow is highly reliant on good

communication skills and mutual empathic connections within the group (Hart & Di Blasi, 2013; Sawyer, 2007; Waddington, 2013). However, group flow (GF index) in the current study was rather low (M= 16.25, SD=10.47); and the group flow moments, when three or more dancers within the group were sharing flow simultaneously, were rare and did not last more than 30-50 seconds in 4-5 minutes tasks. The lack of expected relationship between group flow and shared physiological dynamics might be caused by lack of representation of high-flow groups. Chapter 4 suggested that group flow develops over time and groups were more likely to achieve a high-flow state in the third and fourth group task. In this study, tasks were carefully chosen to facilitate group experience–through the combination of sense awareness, attention towards the group and imagery cues. However, due to the time limitation of the experimental session and the inclusion of a solo task, groups had only enough time to perform two group tasks. This was perhaps not sufficient time to observe stable and extended group flow.

6.4.3 CONCLUSIONS

This study gives a new perspective on the complex nature of group improvisation. It showed that group improvisation leads to shared physiological dynamics between dancers, however they are not related to shared movement patterns. It suggests that dancers develop an empathic relationship in the group task, which might facilitate a shared creative process and group decision-making in dance. These finding supports previous theoretical statement on the nature of group creativity and communication in dance improvisation (Ribeiro & Fonseca, 2011). In future studies, the development of more precise methods to track movement patterns

would be beneficial, as use of single-point accelerometer gives quite limited information about overall movement in dance.

The investigation did not show any linkage between group flow experience and shared movement or physiological patterns within the group. It was noticed that group flow experience in improvising tasks was rather rare and did not last for longer periods than 40-50 seconds. Therefore, future investigation with a larger number of group tasks within the group would be beneficial for capturing high-flow improvisations.

7 Conclusions and Future work

This thesis explored the role of flow experience in dance, focusing on group improvisation as a creative process that is fundamentally collaborative and relatively easy to observe. The initial questions of the links between flow and creativity, the role of the task or group focus for building flow experience and its physiological basis were addressed using a mixed methods approach. This thesis has demonstrated that dancers held a strong belief that flow was linked to creativity – that being in the flow enabled them to find more interesting and novel movement solutions. Moreover, they commonly emphasised the social aspect of the experience, pointing out that being in a group facilitated flow. This thesis has shown that flow experience could be reliably measured using retrospective methods that allow investigation of the dynamics of the experience over time and its group character. A video-recall method indicated that flow was not invariant over a creative task but rather was experienced in the burst of total involvement. Such an approach to assessing flow could be used to derive a group flow measure reflecting group members' simultaneous flow. In general, group flow experience was rather a rare phenomenon. However, being in the group supported individual flow. Further, group flow was a highly creative process – both dancers' self-reports and experts' judgments showed that high-flow groups were rated higher in terms of creative outcomes of improvisation. The final study of this thesis indicated that group improvisation led to detectable physiological entrainment, which was not due to synchronous movement but rather based on the empathic relationships between the dancers. However, there was no link between shared physiological dynamics and group flow experience. In conclusion, the results pointed towards the

idea that being in a group and, in particular, a focus upon collaboration, did enhance flow experience and in consequence made a group flow more likely. Furthermore, the highly focused state of the group, when all group members experience flow simultaneously, did enhance creativity and creative outcomes of the process. The findings of this thesis will be discussed in more detail below, addressing four essential aspects: the nature and role of flow (and group flow), experience in creative dance practice, its connection to creativity, and the factors that influence and enhance flow (and creativity) in a shared creative process. Additionally, a novel, retrospective method of assessing group flow is reviewed.

7.1 Flow experience in creative dance practice

Flow is associated with a psychological state of simultaneous cognitive efficiency, intrinsic motivation and positive emotions (Moneta & Csikszentmihalyi, 1996). Dancers, describing flow in their practice (Chapter 3), pointed to similar aspects. The major themes that emerged from their reports were: effortless attention, the phenomenon of attention-awareness merging that results in full concentration and lack of self-critique during the process, and the enjoyment of pursuing the creative process. Similarly, the investigation in Chapter 4 revealed that in group improvisation practice, *Flow* (measured by video-stimulated recall method) was related to *fluency of performance* (FSS; Engeser & Rheinberg, 2008), the aspect of flow associated with the sense of control and presence in the moment, as well as the merging of action and awareness, but not with *absorption by activity* (loss of awareness, skill/challenge balance, the feeling of being lost in thoughts) nor its *perceived importance*.

Interestingly, dancers reported that the group supported their flow experience, especially if they were working among trusted collaborators (Chapter 3). This is

consistent with the previous research of Walker (2010), which showed that social activities might result in experiencing flow more intensively and with greater enjoyment. The analysis of interviews revealed that, as in previous studies (Hart & Di Blasi, 2013; Sawyer, 2003), group flow required high interpersonal skills, like communication and listening, the ability to build on others' ideas, and getting inspired by others. Group members shared the experience of becoming one with the group, emphasizing complete, shared concentration on the task and a feeling of mutual connection (Chapter 3). These qualities of a shared creative process were further reflected in the comparison of low and high-flow collaboration in Chapter 4: The video-recall reports from dancers revealed that in high-flow collaboration dancers held a feeling of deeply supportive, mutual connections with the group; they engaged with each other in a complex way, sharing ideas and supporting each other actions through the largely embodied process of co-creation. The feelings of joy and amusement were common, creating a positive climate for collaboration. The collaborative aspect of high-flow group creativity was also noticed by external observers (Chapter 5). As while assessing low and high-flow improvisation both experts and non-experts rated high-flow tasks as more coherent and collaborative.

7.2 CAPTURING GROUP FLOW

The studies presented in this thesis had incorporated novel methods of tracing group activity and evaluating internal states. The key advantage of applying video-recall protocol using handheld tablets was that it allowed dancers' reports of improvisation process and flow experience to be collected simultaneously, immediately after finishing the task.

Compared with other methods, like reflective diaries, retrospective reports or classic interviews, this method led to better recollection, did not require good writing skills or high commitment from a participant, and was time efficient (Rowe, 2009), which was especially important while carrying out research in an internationally renowned institution within a limited time frame. Moreover, the procedure offered a multi-perspective view on the collaborative process, as it engaged all participants equally and at the same time, so final reports included a holistic description of the group dynamic and group creative process.

Similar benefits were visible in assessing flow with the video-recall protocol. Previously flow experience was measured by questionnaire-based recollections or sampling methods (Engeser & Rheinberg, 2008; Jackson & Eklund, 2002; Larson & Csikszentmihalyi, 2014). Examining group flow raised additional challenges due to a complexity of the social situation. Hence, group flow studies often had qualitative character based on observation or interviews (Hart & Di Blasi, 2013; Sawyer, 2003). The few attempts to quantify the group experience, used aggregated individual sampling measures of flow (MacDonald, Byrne, & Carlton, 2006) or developed a scale of collective experience (Salanova, Rodríguez-Sánchez, Schaufeli, & Cifre, 2014). The two main advantages of using the video-stimulated recall method of measuring flow over the previous approaches, were that it allowed the investigation of the nature and dynamic of experiencing flow over the creative process and shed light on the shared character of flow in the group activity.

The validity of the video-recall measure *Flow* was confirmed by comparison with a previously established, sampling method of measuring flow, Flow Short Scale (FSS, Engeser & Rheinberg, 2008). *Flow* correlated with *the fluency of performance*

aspect of the experience, that addressed such characteristics as the merging of action and awareness, the sense of control, and the presence in the moment of activity. But there was no link between *Flow* and FSS *absorption by activity*. This might be explained by the specific characteristics of dance and, in particular, group improvisation. As interviews with dancers revealed, flow in dance was mostly related to effortless attention and enjoyment, while other aspects such as skill/challenge balance or transformation of time were not directly present in dancers' descriptions of flow (Chapter 3); and these are the elements of flow experience included in the 'absorption by activity' scale of FSS.

The group flow factor (GF) was computed from the individual *Flow* reports by counting the proportion of pairs within the group simultaneously reporting flow experience. This approach captured simultaneous, shared experience rather than averaged individual flow, as was proposed in the previous studies (MacDonald et al., 2006; Salanova et al., 2014). The relevance of GF was confirmed by qualitative comparison of low and high-flow group tasks in Chapter 4, confirming that high GF groups displayed group flow characteristics described in previous research (Hart & Di Blasi, 2013; Sawyer, 2007), which were not present in low-flow groups. Additionally, the evidence of some inhibitors for flow, like negative emotions (Csikszentmihalyi, 1997), was found only in low-flow groups' reports.

The key advantage of using the video-stimulated recall method of assessing flow was the additional information about the dynamics of experience over time. The previous approaches, questionnaires and sampling methods give only overall or momentary measure of experience (Engeser & Rheinberg, 2008; Jackson & Eklund, 2002; Larson & Csikszentmihalyi, 2014; Salanova et al., 2014), hardly answering such

questions as how stable over time, or simultaneously experienced in the group was flow. The video-stimulated recall method showed that in dance improvisation, flow was experienced in bursts of total involvement that rarely last over the entire task. During each five-minute improvisation, dancers experienced up to five intense moments of being in the flow, which might last between a few seconds and the whole task's duration (Chapter 4, Chapter 6).

However, complete group flow, understood as the shared simultaneous experience of flow in the group, was very rare (Chapter 4, Chapter 6). According to Sawyer (2003, 2007), group flow emerged from the interactions occurring within the group and it was a peak experience of the group. Therefore, it could not be reduced to the mental states or individual experiences of the group members (Sawyer, 2003, p.46). Despite this, a close comparison of the phenomenology of Sawyer's (2003) group flow concept, and of individual flow phenomenon (Csikszentmihalyi, 1975), showed many similarities (Chapter 2.6). The only difference lies in the emphasis on the quality of group collaboration for group flow, which is naturally absent in the individual model of flow. In Salanova's et al. (2014) view, collective flow originates in emotional contagion among the group members: The flow experience can spread from one member of the group to 'infect' the others, so the flow becomes a group phenomenon in highly interdependent, interactive situations. This thesis showed that the quality of collaboration and climate of the group, facilitated or inhibits individual flow. As noted in Chapter 3, trust and good communication in a group supported flow, while bad relationships reduced the experience. However, experiments in Chapter 4 and Chapter 6 showed that flow experience in group tasks was experienced mostly independently, while simultaneous, group flow was only occasional. While discussing flow experience

in group collaboration (Chapter 3, Chapter 4.3), dancers referred both to their individual preferences for particular tasks and the group climate, as indicators for being in the flow. In light of these findings, flow might be seen rather as an individual phenomenon that is enhanced by being in a group, as was suggested by Walker (2010), who argued that social setting and, in particular, social interdependence in a task would enhance enjoyment and flow experience in an activity; rather than it being a collective state of the group (Salanova at al., 2014; Sawyer, 2003, 2007).

In conclusion, flow in a group context is an individual mental state of total involvement in the task, which might be supported or inhibited by the social processes in the collaborative task. Thus, group flow is a complex phenomenon, which requires a group to develop collaboration skills and a climate of trust that allows each of the group members to use their potential fully and, in consequence, enables them individually to enter a state of flow.

7.3 FLOW AND CREATIVITY

In Csikszentmihalyi's (1988c) view, flow plays a vital role in innovation and creativity, as all such processes require high intrinsic motivation to break through to a new level of complexity of thoughts and ideas, while the social environment rarely provides sufficient extrinsic rewards to motivate people to extensive creative work. This argument was reflected in interviews with dancers (Chapter 3) when they stated that flow helped them to maintain creative exploration for longer. Moreover, they claimed that in the flow they tended to produce highly novel, 'organic and natural' movement and phrases. The flow link to creativity was confirmed by the latter studies: From the first-person perspective, dancers rated as more creative, outcomes from the tasks where they were individually experiencing more flow (Chapter 4). Similarly, high

group-flow tasks were evaluated as more creative by experts (Chapter 5). These findings supported the previous results on the positive influence of flow on creativity from other domains (Cseh, Phillips, & Pearson, 2016; MacDonald et al., 2006). High group flow improvisations were rated not only as more creative, but also as technically better, aesthetically appealing, coherent and meaningful (Chapter 5). Taken together, these results would suggest that group flow is connected with peak performance, when an assembly perform at the highest level of their abilities, as also suggested by Sawyer (2003).

7.4 Enhancing Flow and Creativity

The previous research (Hart & Di Blasi, 2013; MacDonald et al., 2006; Sawyer, 2003), as well as the findings of this thesis (Chapter 3, Chapter 4), established that flow was a component of highly creative collaboration, and group flow originated from social aspects of a task, in particular from the quality of communication, mutual support and trust in group. This thesis additionally focused on investigating whether some creative approaches or settings might be more beneficial for inducing group flow experience than others. In chapter 4, two different improvisational tasks aimed to manipulate dancers' mental focus. The external focus task, based on sense awareness and mindful collaboration with others, was found to be more likely to elicit group flow; however, only in the latter tasks. This result highlighted again the social aspect of group flow and creativity–a group needed enough time for familiarisation with the task and each other to actually enter flow. Previously, Sawyer (2003) emphasised the importance of shared warm-up or even group rituals that would allow an ensemble to synchronise with each other. In the light of those findings, the small number of high-

flow improvisations in the last study (Chapter 6) seems to be caused by the smaller number of tasks in the session.

Interestingly, group improvisation led to the dancers' coordination on a physiological level, regardless of the quality of collaboration (Chapter 6). The previous study suggested that group activity might lead to shared physiological dynamics, through synchronised movement (Fusaroli, Bjørndahl, Roepstorff, & Tylén, 2015; Henning, Boucsein, & Claudia Gil, 2001; Müller & Lindenberger, 2011) or 'emphatic projection' (Bachrach, Jola, & Pallier, 2016; Konvalinka et al., 2011; Strang et al., 2014). This thesis had found that the coordination of dancers' physiological dynamics in improvisation was based on empathic relations, and not on synchronised movement. As a consequence, it was expected that there would be a positive relationship between physiological coordination and group flow experience. However, the results did not support such a link. This was in contradiction to the theoretical statement that group flow might be described as a collective state of mind when a group acts, feels and experiences as a one (Sawyer, 2003, 2007).

In conclusion, group flow experience develops over time; the familiarity and high level of trust within a group is beneficial for building flow. Moreover, the creative task–which promotes the collaboration with, and attention to, others–reinforces group flow, simultaneously supporting the highly creative process of the group.

7.5 LIMITATIONS

This thesis presented interesting findings on the role of flow experience in dance creative practice, its shared, social character and its positive links to the creative outcome. However, the current approach had some limitations. First, this thesis explored the role of flow experience in improvised practised of students from only two

higher education institutions in the UK. Due to the educational system, the creative practice of students was always highly influenced by their teachers and institutional values. Therefore, the extrapolation of current findings onto different creative practices might be limited. On the other hand, the chosen methodological approach– the investigation of dance improvisation–gave participants a relatively open frame for their creative process, not limiting their movement expression or aesthetic choices.

Moreover, given the small samples size (4-8 groups per experiment), caution must be taken with generalising the results. The sample size in the current thesis was dictated by the availability of dancers and organisational possibilities. Typically, each session with dancers would last around 1.5 hours engaging only 4 to 6 dancers. Fitting the experimental sessions into the full-time schedule of a conservatoire institution was highly challenging. At the same time, it was preferable to investigate a coherent cohort of dancers and being able to make some within-group comparisons rather than extending the sample for multiple groups with varied backgrounds. In the first experimental study (Chapter 4), due to fundamental differences in approach to the tasks, one of the groups had to be removed from the sample. . Therefore, in the subsequent studies, the sessions were carefully prepared in accordance with the practice in the hosting institution and all the participants originated from the same HE programme (Chapter 5, Chapter 6).

Another shortcoming comes from the way that creativity was assessed in the current studies. The consensual assessment technique (CAT, Amabile, 1982), is a commonly used approach to assess creativity. However, the main challenge of this method is finding appropriate judges. In this thesis, CAT was used for first-person assessments (Chapter 4), as well as third-person ratings (Chapter 5). As discussed in

Chapter 4, the first person judgements of creativity might be highly inaccurate due, rather, to a personal liking for the task than a more general comparison of what was creative or not. The third-person perspective in Chapter 5 raised different challenges: First, experts were defined as people with higher-education or active performance/research practice in the field of dance. Yet, the current thesis addresses, as the focus of research, dance improvisation, within contemporary dance practice. The familiarity with this particular genre of dance practice was high, but still 30% of experts declared that they were not generally watching dance improvisation, and almost 20% never practised it. This lack of experience could influence the creative outcomes perception, as the analysis of nonexperts ratings revealed quite different patterns of data than that of the experts. An alternative approach would include the choice of a small sample of highly experienced experts from the field – improvisation teachers, performers or critics (Kaufman, Baer, & Cole, 2009; Kaufman, Baer, Cole, & Sexton, 2008; Lee, Lee, & Youn, 2005). Nonetheless, the approach used in this thesis, based on a bigger sample (n=77) of *quasi-experts* (Kaufman & Baer, 2012), allowed for some interesting insights about the structure of creativity ratings, revealing high dependence on other dimensions of the assessed product, like aesthetic appeal, technical demands or coherence of collaboration (Chapter 5).

7.6 Future Implications

The novel methodology developed in this thesis–the video-stimulated recall reports of group activity and subjective experience–might find wide use in future studies, not only in research of group creativity in dance, but applied to any collaborative processes. It allows the experience and internal states of the group members to be captured in a relatively straightforward, time-efficient way. In

particular, it would be interesting to apply this method to study group creativity in domains such as music and music improvisation, improvised theatre or even problem-solving groups. Any practice where the creative process is entangled with momentary group dynamics, would benefit from such multi-layer analysis.

To advance the understanding of shared, embodied creativity in dance, future studies should extend the research towards other dance practices and dance genres. Many practices, especially traditional dances, possess an improvisational character; for example, flamenco (Heffner Hayes, 2003), but use a very precise, limited movement vocabulary and are highly dependent on music. It would be interesting to extend the research into such practices, where, due to more formalised movement, the objective measures of performance and creativity might be easier to develop.

Finally, promising possibilities of a deeper understanding of group dynamics in dance (and group collaboration) are given by using physiological measures. The study in Chapter 6 provides empirical evidence for the theoretical statement that group communication and creativity in dance improvisation is facilitated by kinaesthetic empathy that develops between dancers (Ribeiro & Fonseca, 2011). The current analysis uses a simple comparison of dancers' shared physiological dynamics of heart-rate, breathing and activity in solo and group improvisation tasks, controlling only for the effect of flow experience. The future investigation of this link, the influence of task, group structure, and so on, could advance understanding of shared group processes and non-verbal communication.

APPENDICES

APPENDIX 1. SECONDMENT REPORT FROM RESEARCH FELLOW INTERNSHIP AT TRINITY LABAN CONSERVATOIRE OF MUSIC & DANCE

INSTITUTION: TRINITY LABAN CONSERVATOIRE OF MUSIC & DANCE

As the UK's only conservatoire of music and contemporary dance, Trinity Laban represents unequalled expertise in contemporary dance, with one of the largest teams of specialist dance artist teachers in the world, working from world class facilities.

The Faculty of Dance is one of Europe's leading centres for the training of professional contemporary dance artists. Trinity Laban is a creative and cosmopolitan community of performers, choreographers, teachers, designers and researchers, and is acknowledged internationally as a leader in the contemporary arts. Innovative and ground-breaking education combines with community and social inclusion work to make Trinity Laban a leader in the advancement of creative artistic practice.

Trinity Laban is known internationally as a leader in Dance Science and was the first institution in the world to offer an MSc in Dance Science in 2001. The main aims of the Dance Science Department, leaded by Emma Redding (a supervisor of this research project), are to investigate ways of enhancing dance training, optimising dancer performance and exploring the physiological and psychological effect of dance as a form of physical activity. The department also has a strong connection with the International Association for Dance Medicine and Science (IADMS).

In 2011, Trinity Laban Conservatoire of Music and Dance established a partnership with Wayne McGregor | Random Dance R-Research Department to investigate the creative process within dance, and a number of experimental pilot studies have already taken place. This has led to their collaboration with Plymouth University School of Psychology on the Leverhulme Trust funded project, 'In the

Dancer's Mind', led by my Director of Studies Professor Jon May, which is evaluating the effectiveness of training dance students in metacognitive imagery skills.

AIMS

The secondment was planned for up to 6 months, starting at the end of September 2015. The major aim was to carry out experimental studies into physiology of shared flow experience in dance improvisation. The specific aims were grouped in following areas:

Knowledge: extend my knowledge of biomechanics and physiology of dance practice and dance science research methods.

Skills: familiarize myself with physiology lab equipment, testing procedures and analysing physiological data in practice

Research: plan and carry out a study into physiology of shared flow experience in dance improvisation.

Networking: create new collaboration and participate in exchange of knowledge. Involvement in the research life of Trinity Laban, in particular, in the Dance Science Department.

Dissemination: share the research methodology and outcomes though seminars or workshops.

The institution agreed to provide access to the facilities, professional support and as training centre for contemporary dance, participants for studies. Moreover, The Dance Science Department in TL had the necessary support for physiological studies of dance practice.

ACTIONS

7.6.1.1 Skills

I joined the Dance Science master programme taking Performance Enhancement: Physiology, Biomechanics, Psychology and Lab Skills modules. I focused on physiological demands of dance practice and performance in relation to workload, training principles and physical fitness, as well as the biomechanical analysis of human movement pertinent to dance. I had an opportunity to familiarise myself with testing equipment (e.g., movement analysis software, gas analysers, heart rate monitors) in order to capture and analyse data through a variety of methods. Lab Skills sessions served to test the theory in practice and interact with different equipment and testing protocols.

At the same time, I completed a literature review on the physiology of flow experience as well as the physiology of shared experience as a preparation for an experimental study into the physiology of flow in dance. As a result, I decided to focus on such measures as heart rate, breathing rate and movement tracking (using accelerators), focusing on shared experience rather than physiology of flow as personal optimal experience. I excluded some physiological measures of flow, like electrodermal activity or cortisol level as being too hard to control in movement situations. Subsequently, I chose and collected suitable testing equipment.

7.6.1.2 Research

To obtain practical skills, I joined a research team during the screening programme for TL dance undergraduate students [1]. The aim of this programme is to identify those students who are most 'at risk' of sustaining an injury while undertaking full time dance training in order that they can be supported during the early stages of

their training with supplementary conditioning programmes and advice about how to work in class. As an assistant, I had an opportunity to observe the wide range of dance science lab equipment in use and to familiarise myself with testing and data collecting procedures.

Also, I was involved with the research project, 'In the Dancer's Mind' [2], that investigates the capacity of mental imagery to inspire the creation of original movement material. I took a part in preparing and carrying out testing sessions with students, as well as gathering feedback from staff members, as a part of the project was an intervention lead by teachers. That experience prepared me for organising my own research project within the institution.

My fourth study, into the physiology of shared flow experience, was prepared and carried out as a part of this secondment. The main challenge of this project was to collect appropriate, wearable wireless equipment to capture the physiological responses of dancers (HR, breathing rate, movement) during free improvisation without limiting participants' movement or distracting them from improvisation. The equipment and procedure were tested in series of pilot exercises and trials before the final version of procedure engaging the Dance Science Department. The testing sessions took place in TL facilities and undergraduate dance students participated in this study. The study is described in detail in the relevant chapter.

7.6.1.3 Networking

I attended a variety of staff development events at the Dance Department. Some of them focussed on teaching practices in Arts higher education, e.g., a Research Informed Teaching session; some were very informative, such as nutrition or injuries in dance practice. Some had a very practical character, like the whole day session with

Candoco Company on inclusive dance practice. I took part in several seminars and sharing research events, including the Research Seminar series with invited speakers. A *Celebration of Research at Trinity Laban* session focused on past and ongoing research projects at TL and *Research Degree Programme Week*, where MPhil and PhD students had an opportunity to present their work. I also attended the *Foundations for Excellence Conference* (2015, hosted at TL), that challenged existing pedagogical practices and proposed innovative methods of nurturing excellence among young dancers and musicians [3].

In exchange, I organized a workshop with a choreographer Teoma Naccarato and a composer John MacCallum. Their research, *Choreography and Composition of Internal Time* is an ongoing practice-based research and creation project, in which they are investigating temporal relationships between physiology, such as heart-rate and breathing, with rhythms in movement, music, and mediated environments [4]. The workshop had an interactive character, as they shared their research results and plans as well as their methodology and tools. Although the meeting was primarily intended for the Dance Science Department, it was open to other staff members and graduate students. Their expertise had a great impact on preparing the equipment for my study. Also, we decided to continue our collaboration, engaging together in the forthcoming *CogNovo Summer School* and *Off The Lip 2* conference, both held at Plymouth University the following year.

I also had a few chances to chances to present and discuss my research. In the beginning of the secondment I organized a seminar for the Dance Science Department where I presented my first and second studies and discussed methodology and research plans with staff members and MSc students, gathering feedback and ideas. I

had an inspiring tutorial with TL members of staff, discussing my research in detail. Besides my supervisor, Emma Redding, I received meaningful insights from Edel Quin, Brenton Surgenor and Tony Thatcher that allowed me to further shape my research plans. Finally, in March 2016 I presented my research again to the wider forum, as a guest on annual *Research Degree Programme Week* event dedicated to MPhil and PhD students of Trinity Laban.

EVALUATION

I benefitted from the secondment at Trinity Laban in many ways. Firstly, I was exposed to dance science, a discipline new to me, and found many connections with my interdisciplinary research approach. By attending the MSc programme I learnt the basics of physiology and physiological experimental methods that allowed me to further my research in this direction. By assisting in ongoing studies I familiarised myself with new equipment and became confident in carrying out physiological studies. This will allow me to include such methods in future studies and be open to more interdisciplinary perspectives. Also, I had a chance to interact with a professional network of dance science researchers, that has created new collaboration opportunities, such as with the International Association for Dance Medicine and Science.

I had the chance to observe contemporary dance practice, look into the work and research of practitioners, and discuss with them my research interests as well as to look for common understanding between different ways of gathering knowledge. Such dialogues made my research more relevant for artistic practice and taught me how to present my mostly psychological work to the wider community.

Finally, living in London expanded my contacts with other institutions, such as London Contemporary Dance School, The Place, Goldsmith University of London and Independent Dance through participation in open events and personal connections.

The main challenge of completing part of my PhD in a partner institution was related to organisational issues. It required additional time to be introduced to local policies, university structures and for building new research collaboration. As a guest researcher, I wasn't following the same induction path as local postgraduate students. I arrived at Trinity-Laban in the second year of my project, prepared to focus on my experimental studies, but I hadn't had the chance to naturally build connections with the local research community. It slowed the process of preparing studies and probably made it more difficult. I often did not know how organise things, what was possible or who was the right person to ask. I was introduced to my department and institution in general, but this could not replace experience and personal connections.

Another challenge regarded meeting the different standards of two very different institutions: especially when they represent very different disciplines. Trinity Laban is mainly a conservatoire of dance where experimental studies are rather rare and students have limited experience in participation, while psychology faculties of a university engage their students in research and experimental studies in every stage of education. Taking into account both perspectives–especially regarding ethical standards, participant recruiting policies and setting up the study–demanded careful planning of actions.

SUMMARY

Completing my secondment in Trinity Laban was beneficial in various ways for my personal development and completing this PhD project. I had a chance for the first

time to engage with Dance Science. I extended my knowledge and understanding of physiology and biomechanics of dance practice and developed some laboratory skills. I enlarged my professional network, achieving new collaborations and presenting my research on new forums. Furthermore, I completed a challenging study with participants recruited from Trinity Laban and obtained the video material for another one. Without access to the Trinity Laban facilities I wouldn't have been able to engage in such an interdisciplinary approach to my research topic.

Most of my aims relating to knowledge, skills and research were achieved. However, networking and dissemination could have been more fruitful. Being a guest researcher, outside of the usual doctoral pathway, limited my interaction with other researchers and involvement in the research life of the institution. Additionally, during this period, I frequently came back to visit my home institution, Plymouth University, as I had become involved in significant events there (more than in previous years). For instance, the collaboration with Teoma Naccarato started during the *Practice Research Symposium* held at Plymouth University [5]. That might indicate that more fruitful effects of networking will appear in the near future, rather than immediately.

A successful secondment experience requires careful planning and prior, detailed agreement with the hosting institution regarding aims, sources and actions. However, not all of these may be apparent before the secondment has begun. At the start of the secondment, additional time and attention needs to be dedicated to induction to facilities, policies and resources, to allow the research project to fit into a local schedule and planning of the secondment around ongoing programmes at the secondment host. Finally, having a mentor, a supervisor from inside the institution,

helps to include a researcher into local activities and effectively organise a research project within local frameworks.

LINKS:

[1] http://www.trinitylaban.ac.uk/student-experience/student-support/health-injury-support/dance/screening-for-dancers

[2] www.dancersmind.org.uk

[3] http://foundations-for-excellence.org

[4] https://ccinternaltime.wordpress.com

[5] http://blogs.plymouth.ac.uk/artsinstitute/2016/03/17/talking-about-practice-as-research/

APPENDIX 2. A PILOT STUDY OF VIDEO-STIMULATED RECALL METHOD OF FLOW EXPERIENCE.

Chapter 4 – Individual or shared flow experience

Table 1. Statistics of Video-Stimulated Recall of Flow Experience in Improvisation from the pilot study.

	Dancer	**A**	**B**	**C**	**D**	**E**	**F**	*Mean*
	no of burst	3	5	4	4	3	5	4
	min (s)	4	3	13	7	13	5	7.5
Task 1	max (s)	34	23	21	232	58	66	72.3
	M(s)	19.3	12.3	17	65	30.3	22.4	27.7
	% of task	18%	12%	21%	81%	28%	35%	33%
	no of burst	4	4	4	0	5	3	3.3
	min (s)	10	23	5	0	13	34	14.2
Task 2	Max (s)	48	61	16	0	69	94	48
	M (s)	23.75	41.75	10	0	34.8	72	30.4
	% of task	35%	62%	15%	0%	64%	80%	43%
	no of burst	4	2	1	2	1	2	2
	min (s)	5	6	20	66	56	26	29.8
Task 3	Max (s)	52	8	20	192	56	211	89.8
	M (s)	31	7	20	129	56	118.5	60.3
	% of task	47%	5%	8%	97%	21%	89%	45%

Above are presented descriptive statistics of flow experience captured by video-stimulated recall method of measuring flow from the pilot study. The Table 1

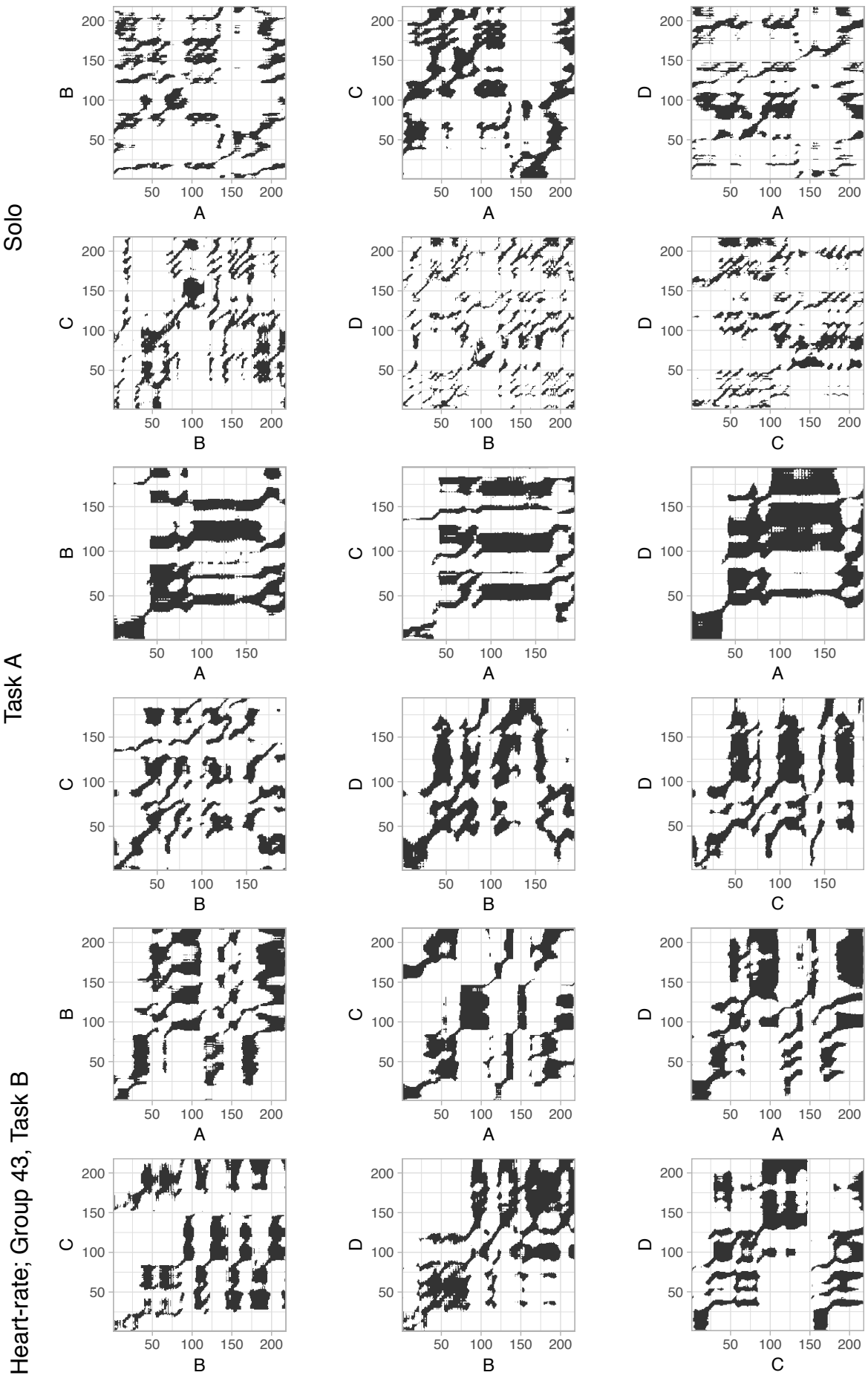
describes characteristics of flow for each of dancers in each of task, as well as summarized data.

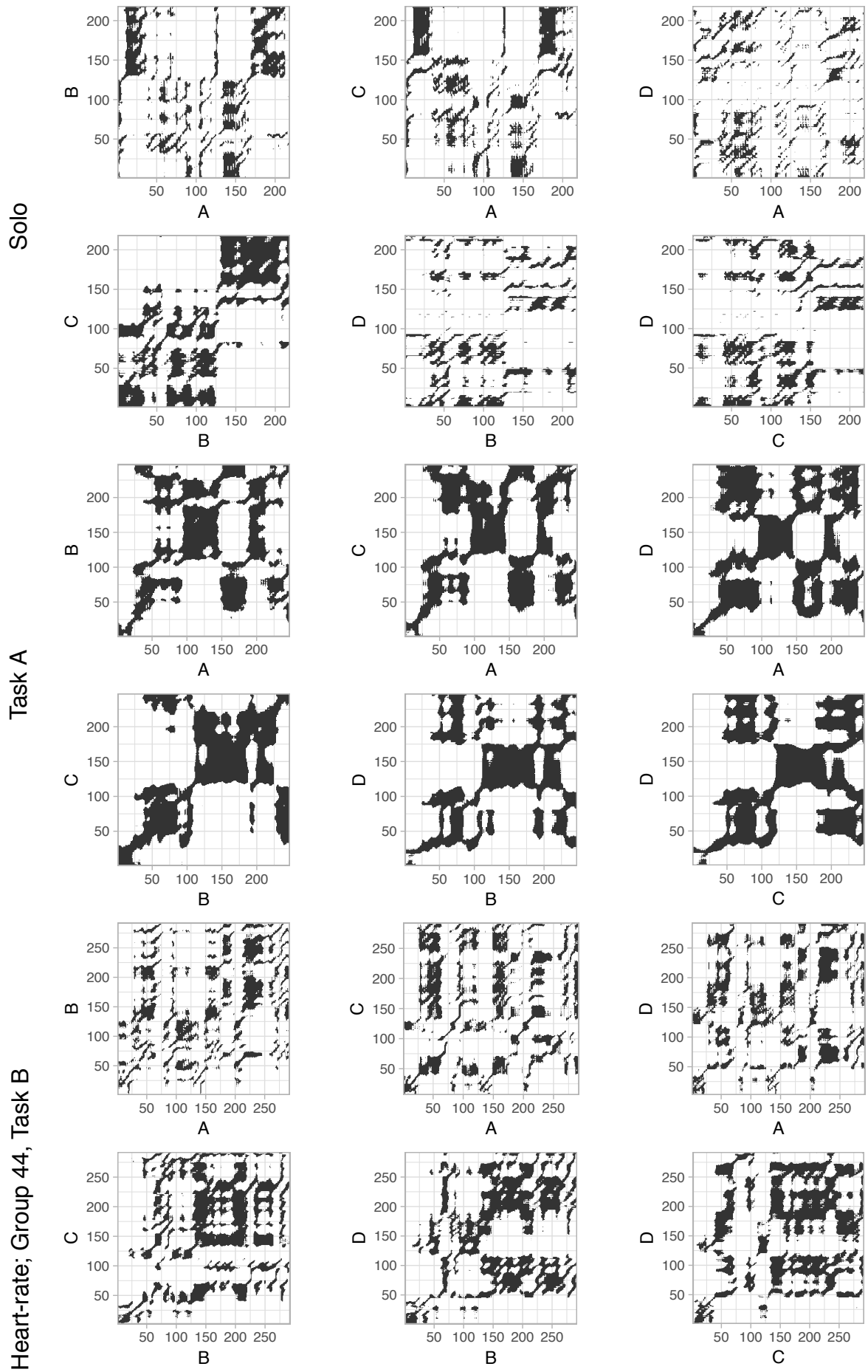
APPENDIX 3 CROSS-RECURRENCE PLOTS OF SHARED PHYSIOLOGICAL DYNAMICS (PULSE, BREATHING AND ACTIVITY) IN SOLO AND GROUP TASKS.

Chapter 6 – Physiology of shared flow experience

The next pages illustrate cross-recurrence plots of shared physiological dynamics in solo and group tasks. Each page reports a set of plots representing changes over shared dynamics of one variable (heart-rate, breathing, activity) in three tasks: solo and two group tasks A and B of one group. The graphs are ordered by variables and groups; therefore, the first seven pages report shared dynamics of heart-rate in each of seven group, followed by shared patterns of breathing and activity.

Each graph represents a combination of two of the four dancers (A to D) in a group, so there are six graphs (two lines) per task. The higher the proportion of black dots in the graph, the higher the coordination (*RR*) between the dancers; a higher rate of diagonal lines indicates higher predictability (*DET*), the prolonged and stable sequences of shared physiological dynamics.


Solo
Task A
Heart-rate; Group 43, Task B
A
B
C
D
50
100
150
200


Solo
Task A
Heart-rate; Group 44, Task B
A
B
C
D
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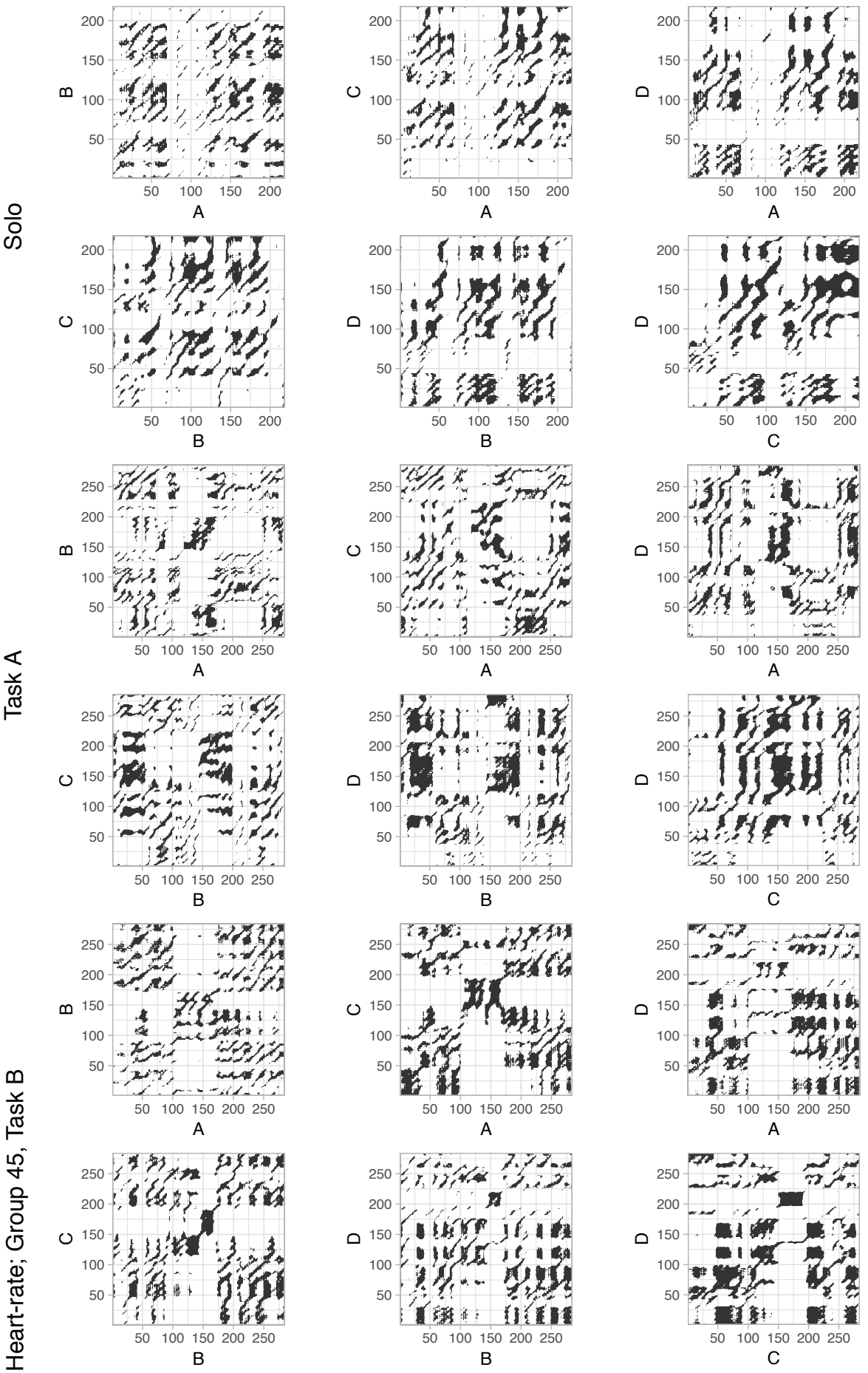
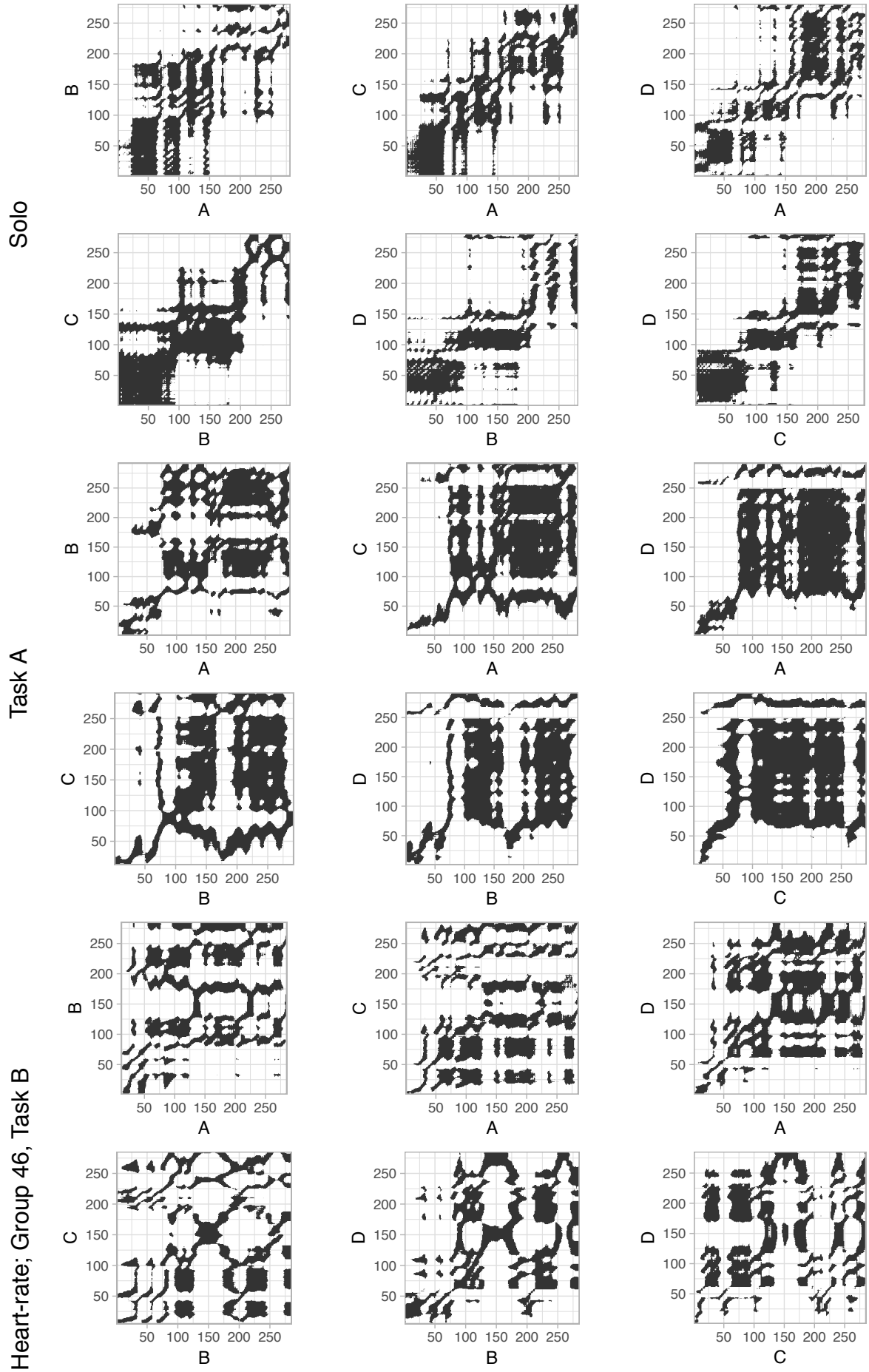
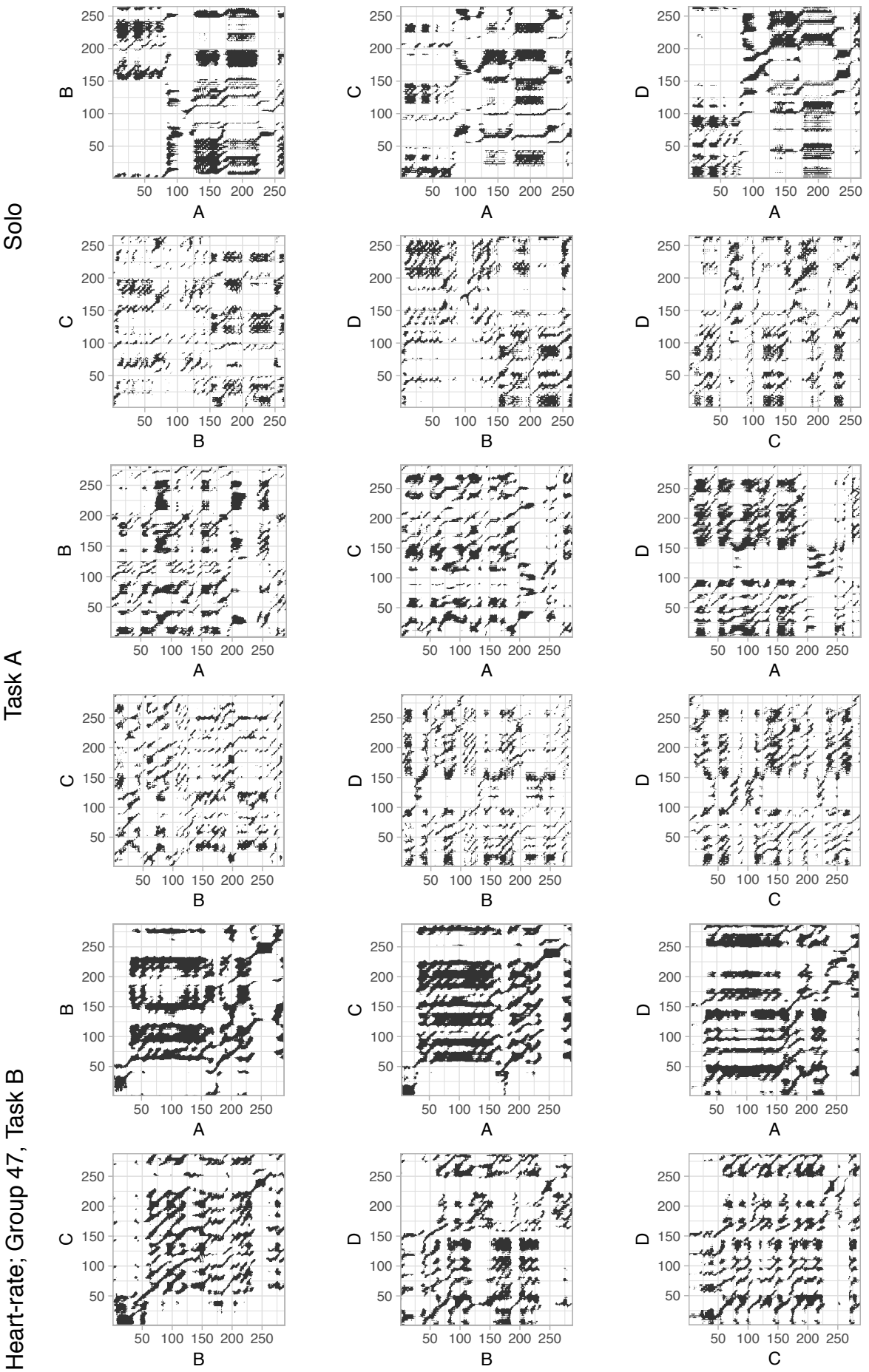
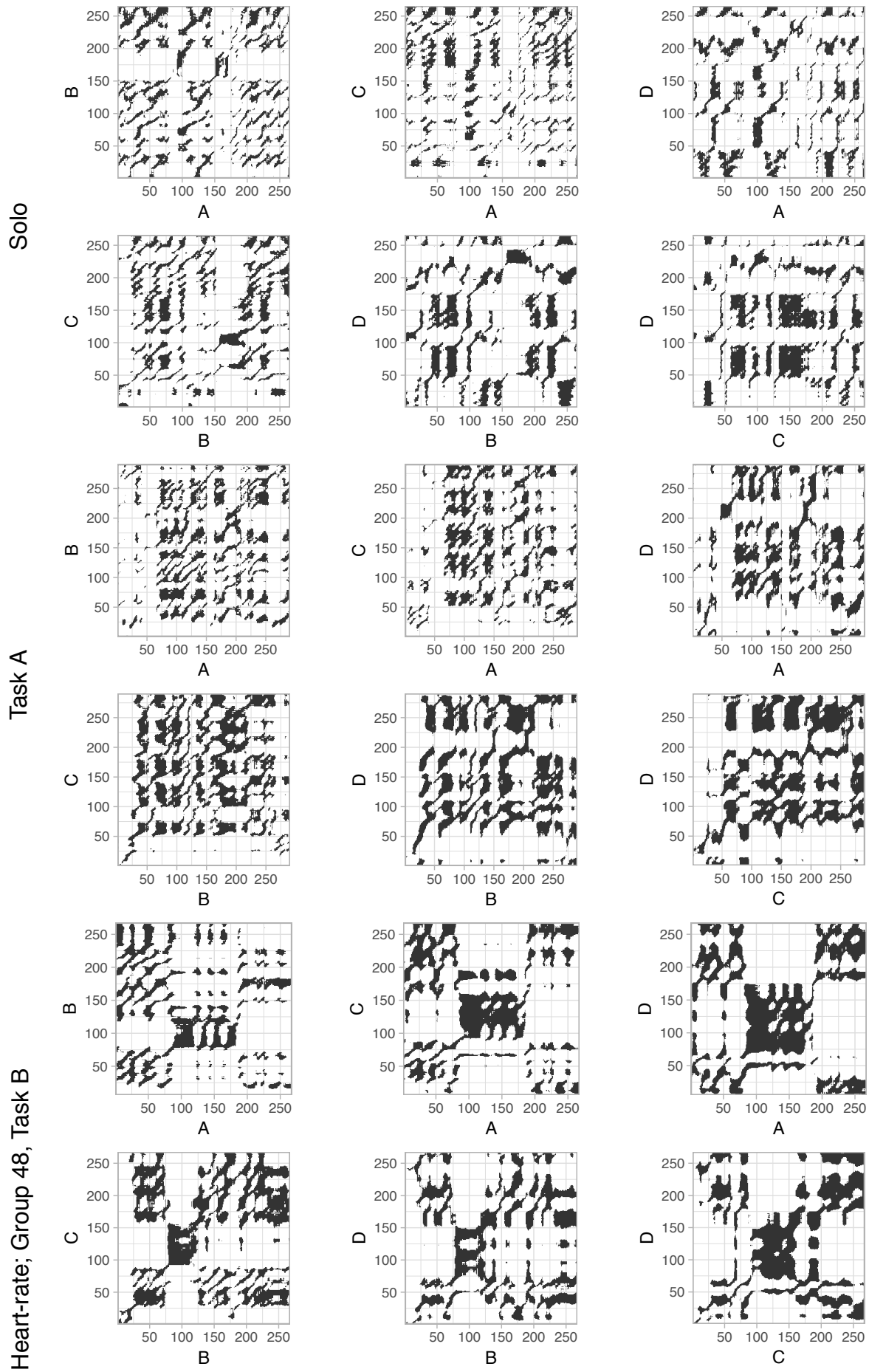
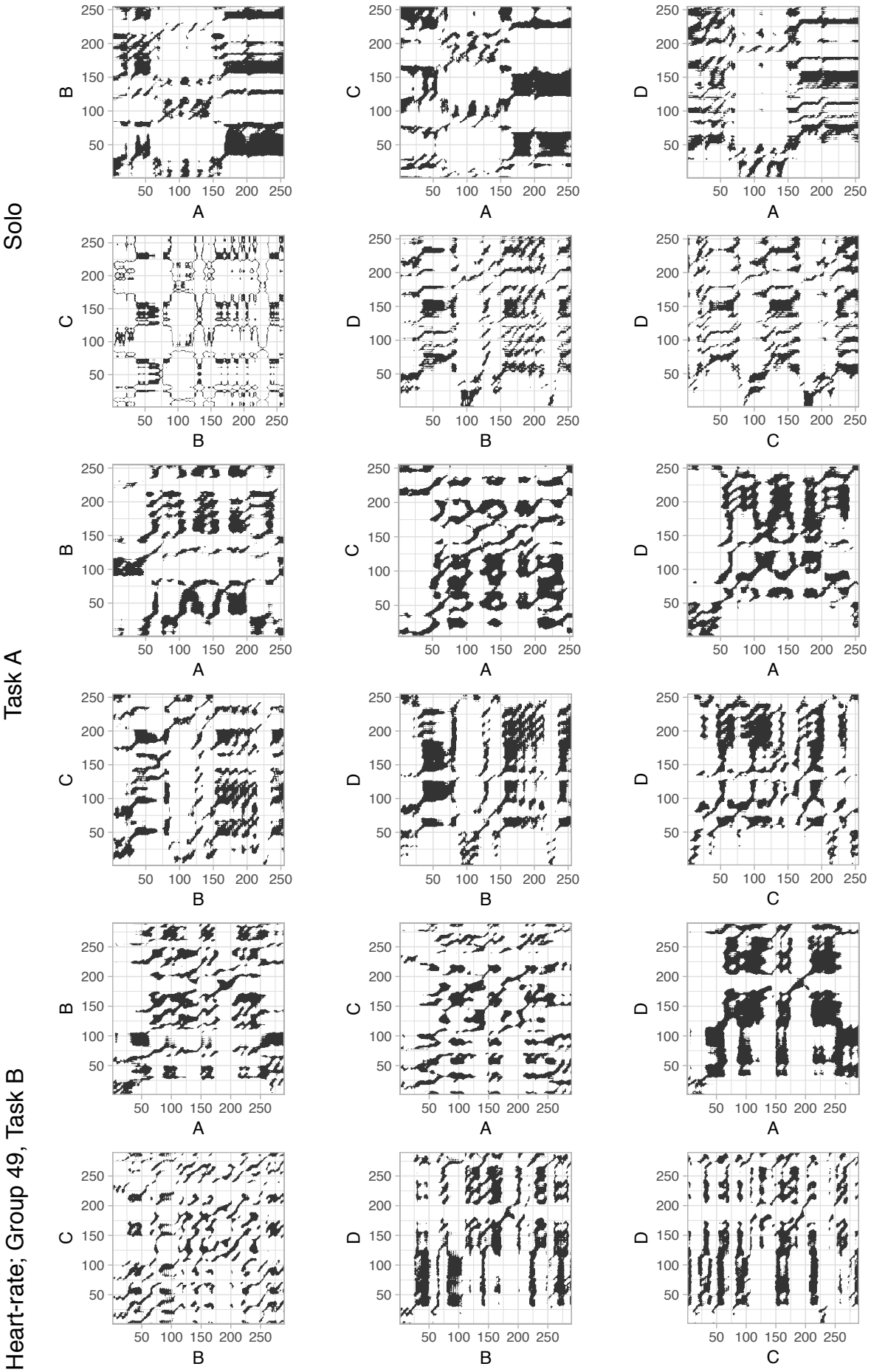
100
150
200
250

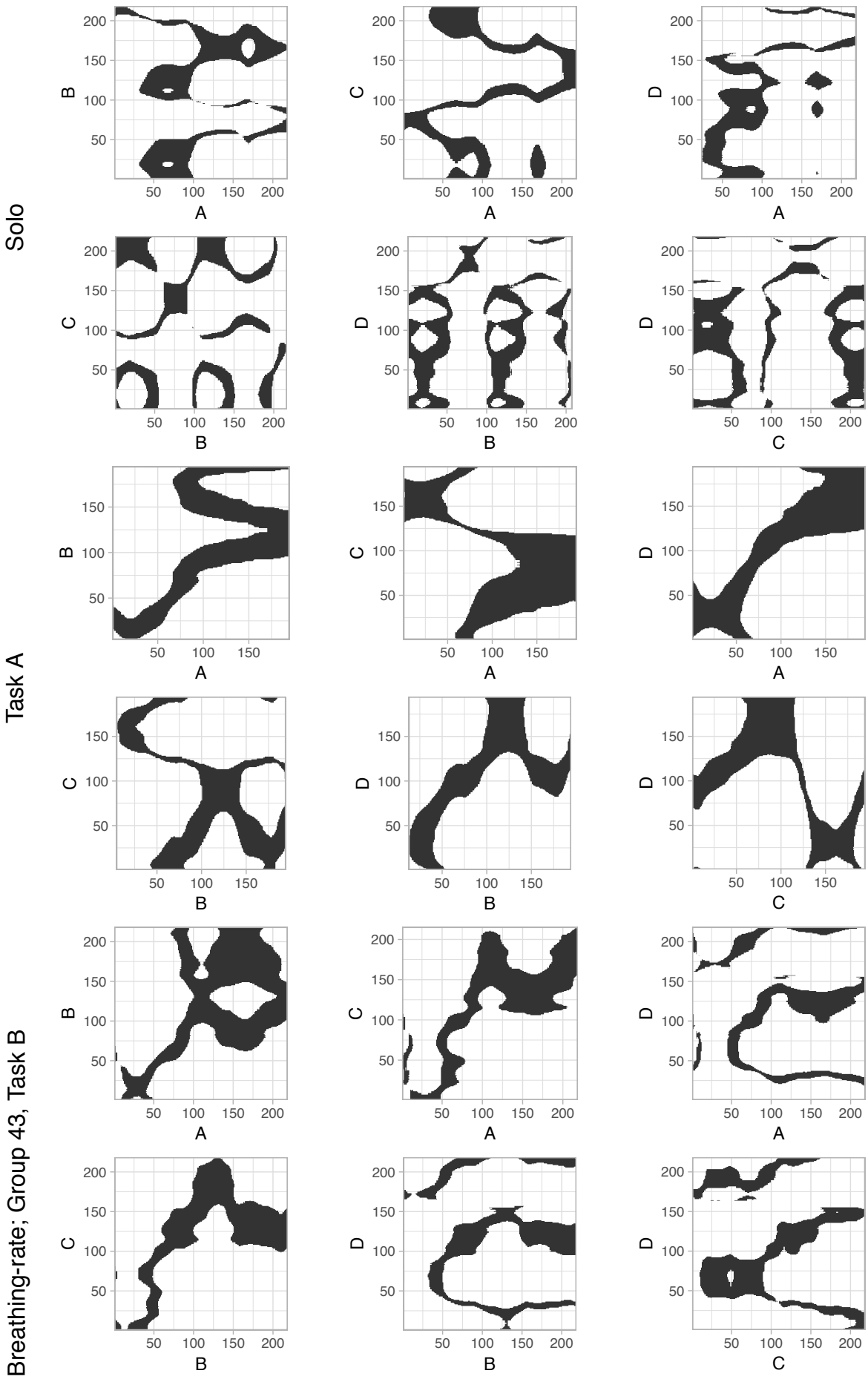

Solo
Task A
Heart-rate; Group 45, Task B
A
B
C
D
50 100 150 200
50 100 150 200 250


Solo
Task A
Heart-rate; Group 46, Task B
A
B
C
D
50 100 150 200 250


Heart-rate; Group 47, Task B
Task A
Solo
A
B
C
D
50 100 150 200 250


Solo
Task A
Heart-rate; Group 48, Task B
A
B
C
D
50 100 150 200 250


Solo
Task A
Heart-rate; Group 49, Task B
A
B
C
D
50 100 150 200 250


Solo
Task A
Breathing-rate; Group 43, Task B
A
B
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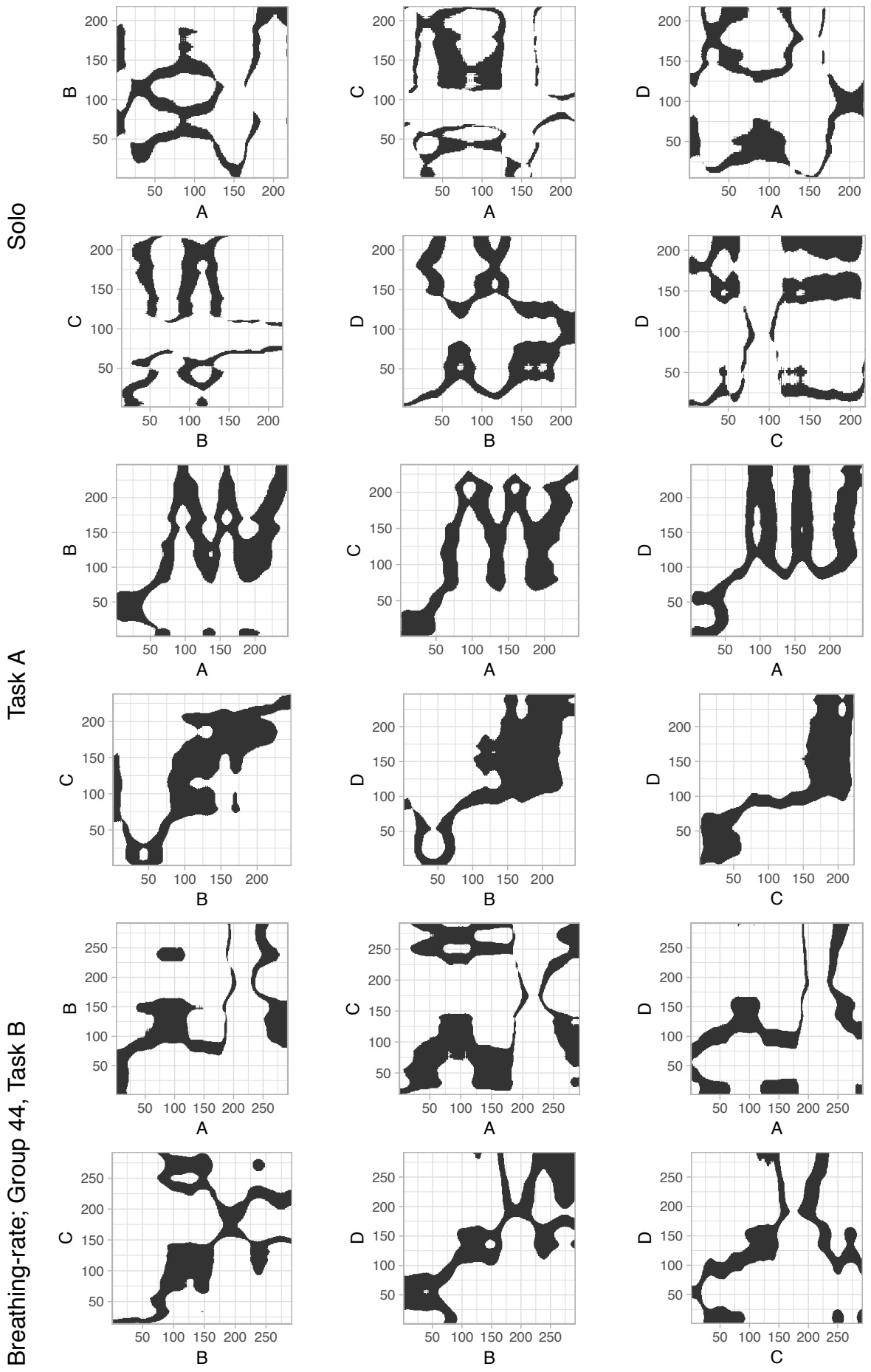
Solo
Task A
Breathing-rate; Group 44, Task B
A
B
C
D
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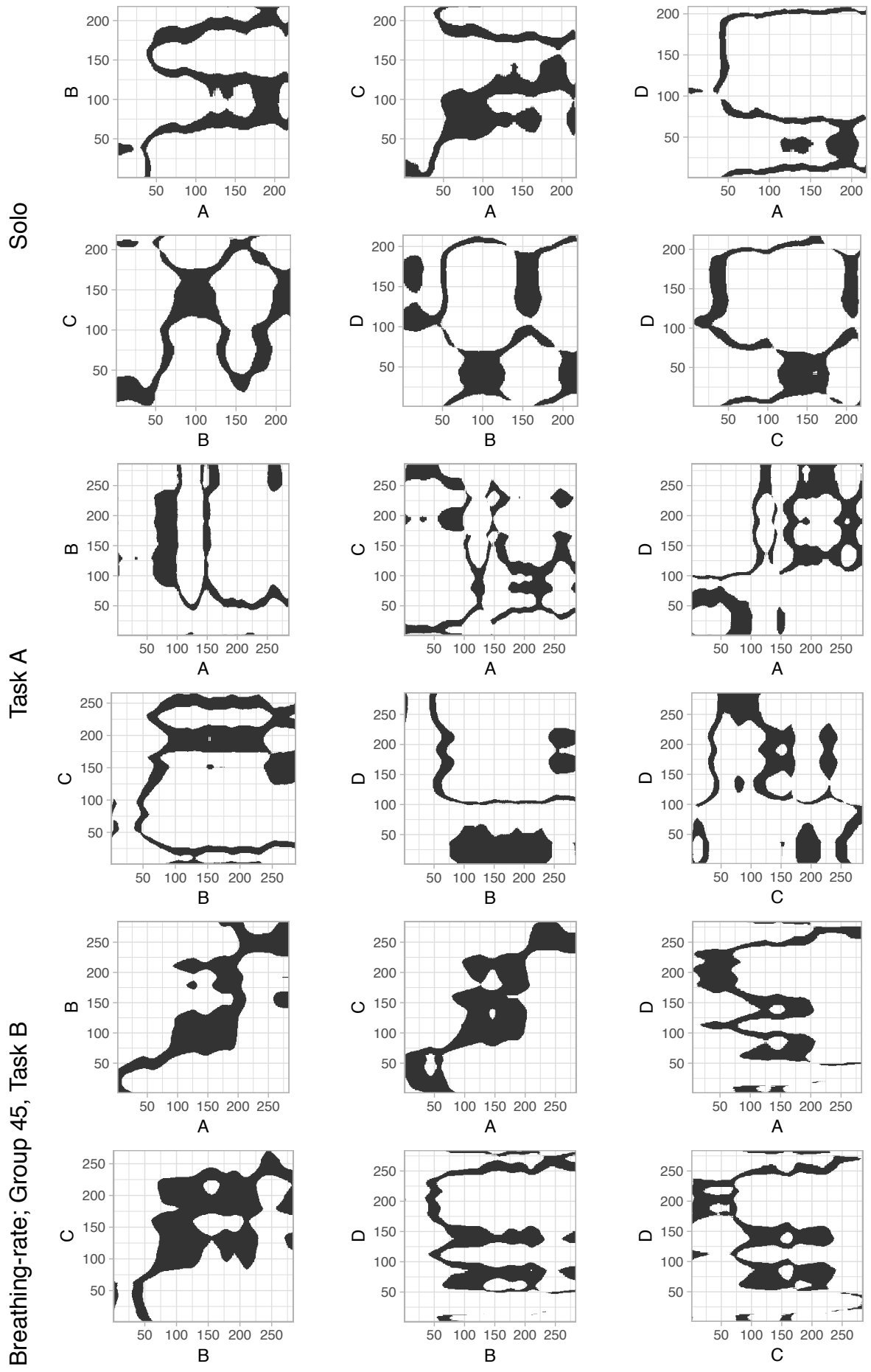
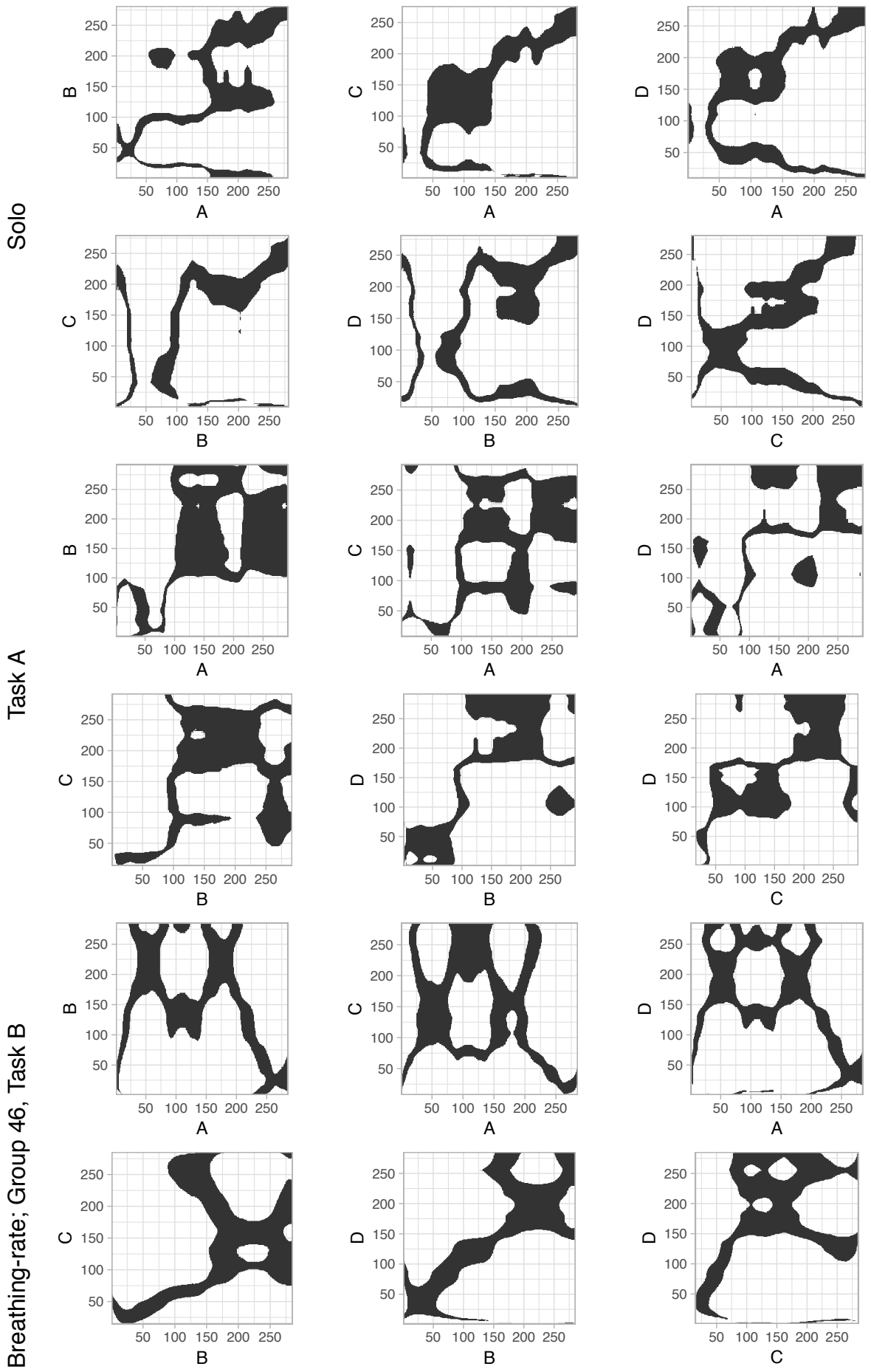
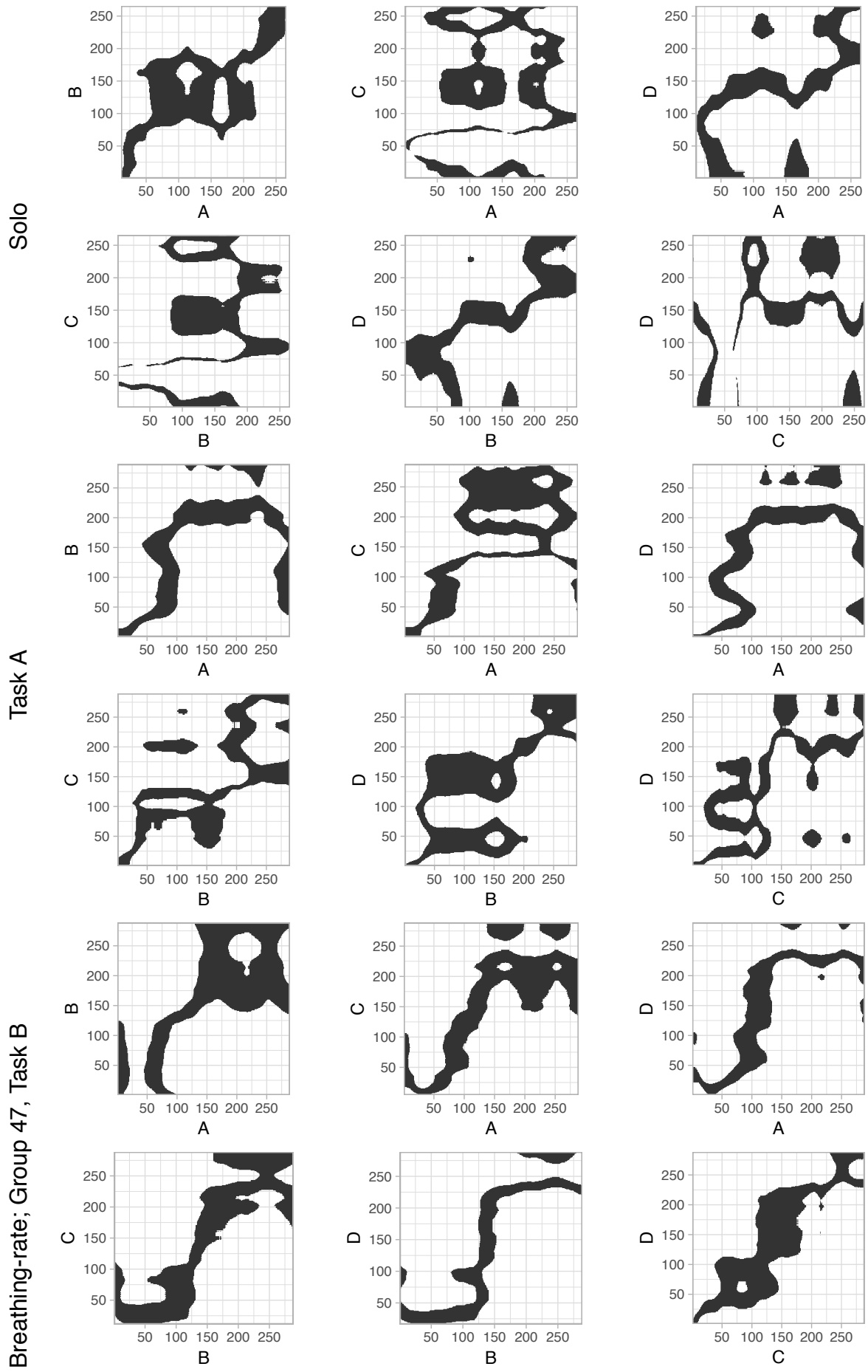
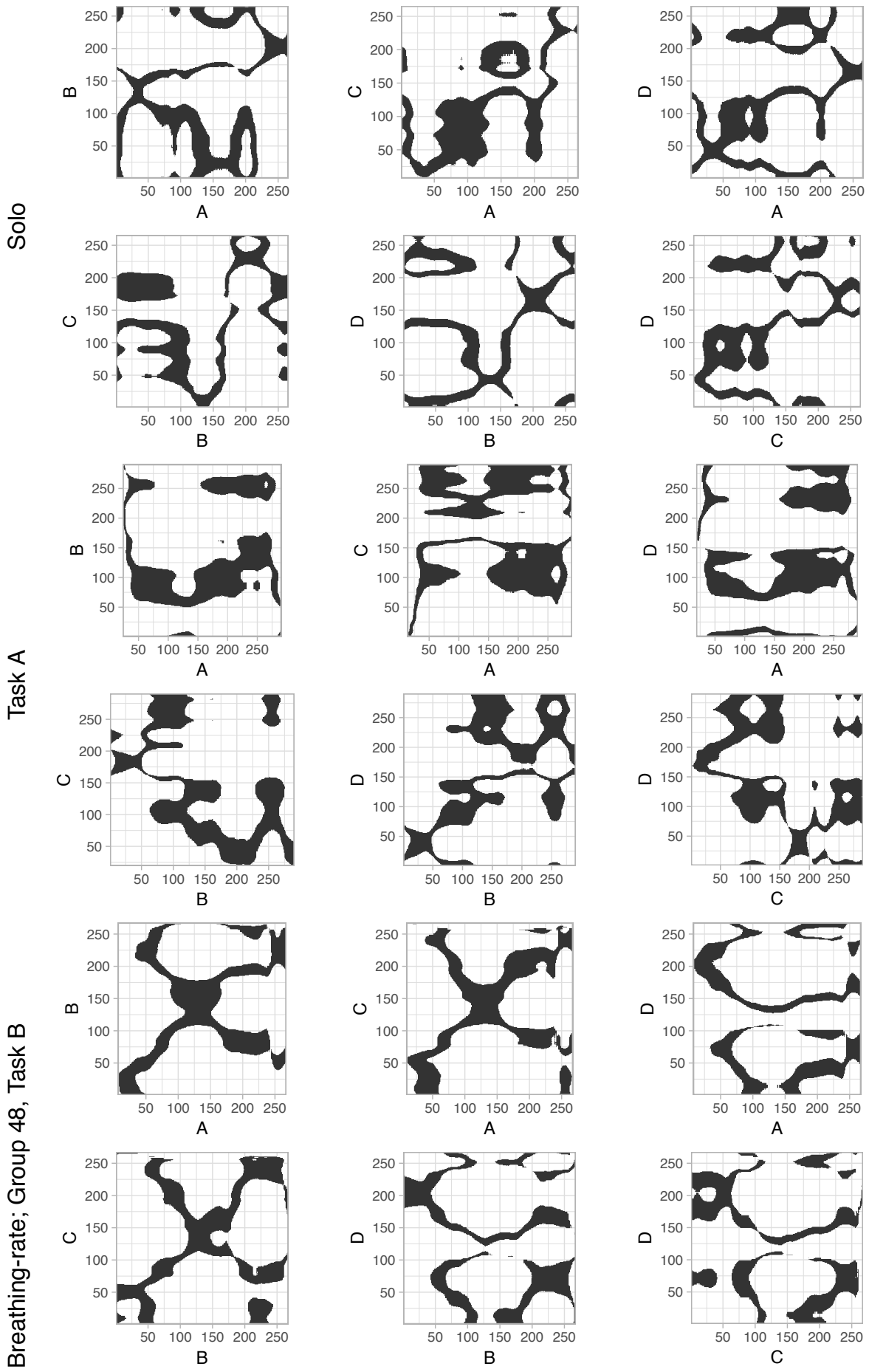
250


Solo
Task A
Breathing-rate; Group 45, Task B
A
B
C
D


Solo
Task A
Breathing-rate; Group 46, Task B
A
B
C
D
50 100 150 200 250


Solo
Task A
Breathing-rate; Group 47, Task B
A
B
C
D
50 100 150 200 250


Solo
Task A
Breathing-rate; Group 48, Task B
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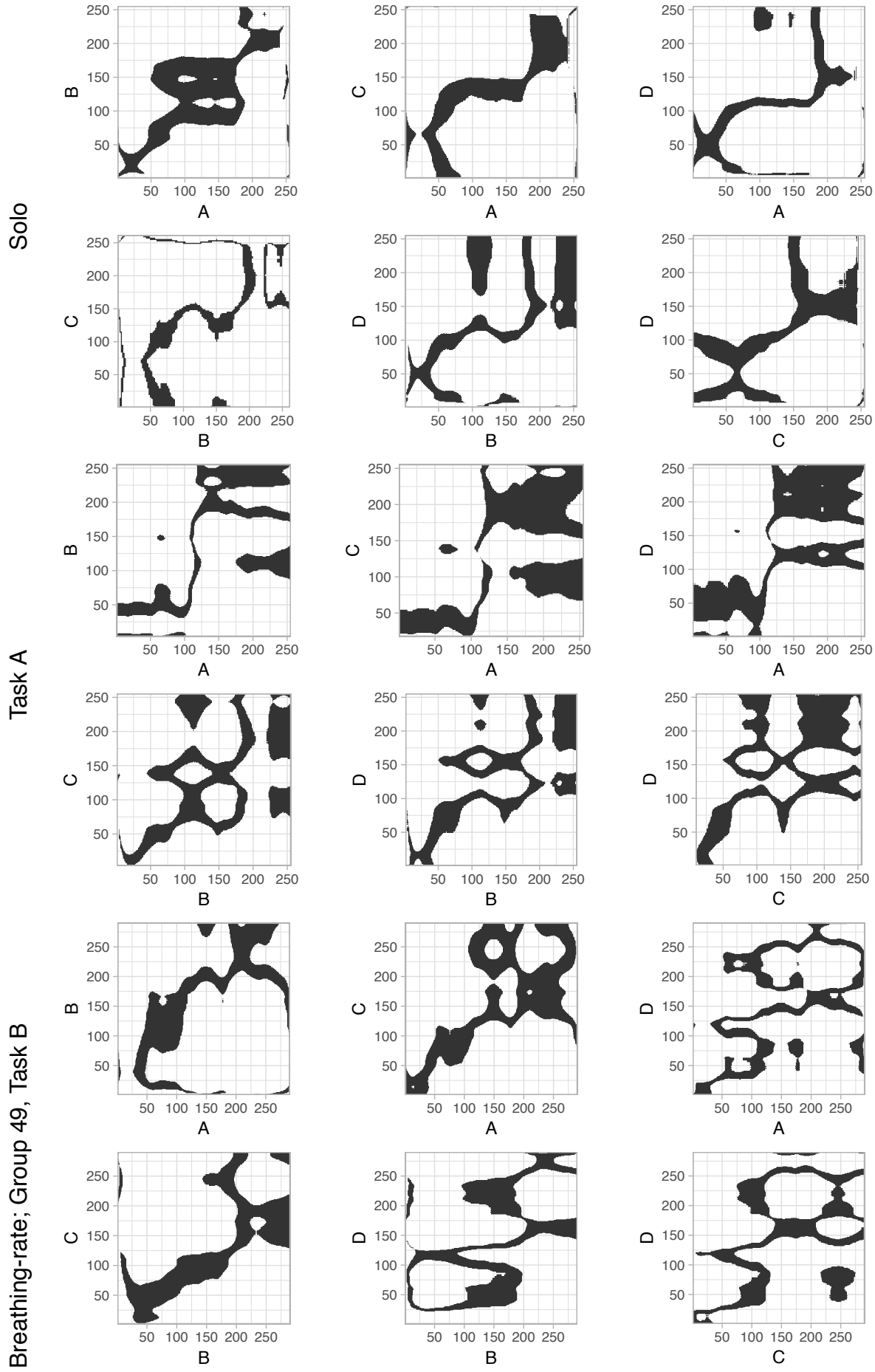
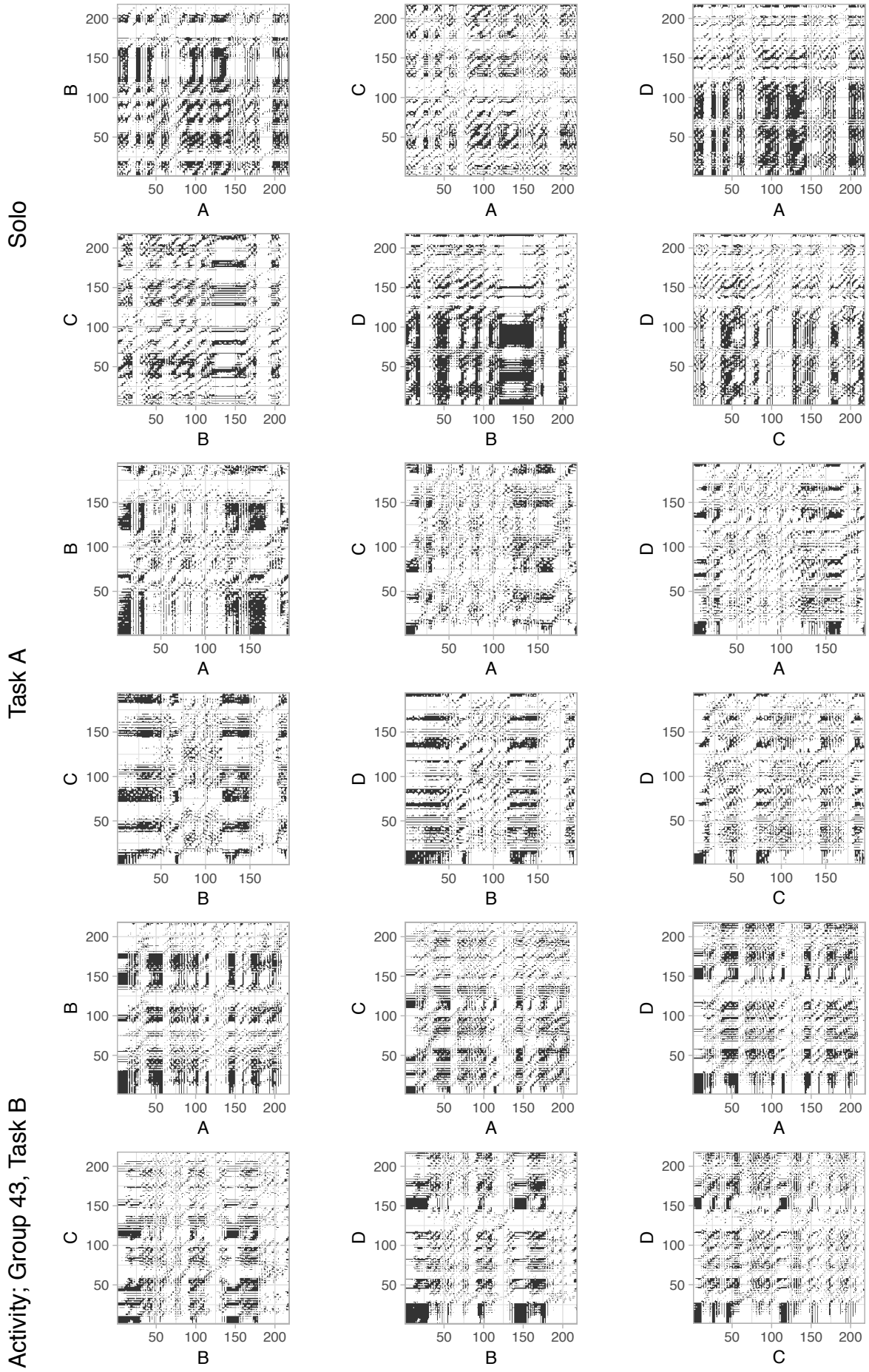

Solo
Task A
Breathing-rate; Group 49, Task B
50 100 150 200 250
A
B
C
D


Solo
Task A
Activity; Group 43, Task B
A
B
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D
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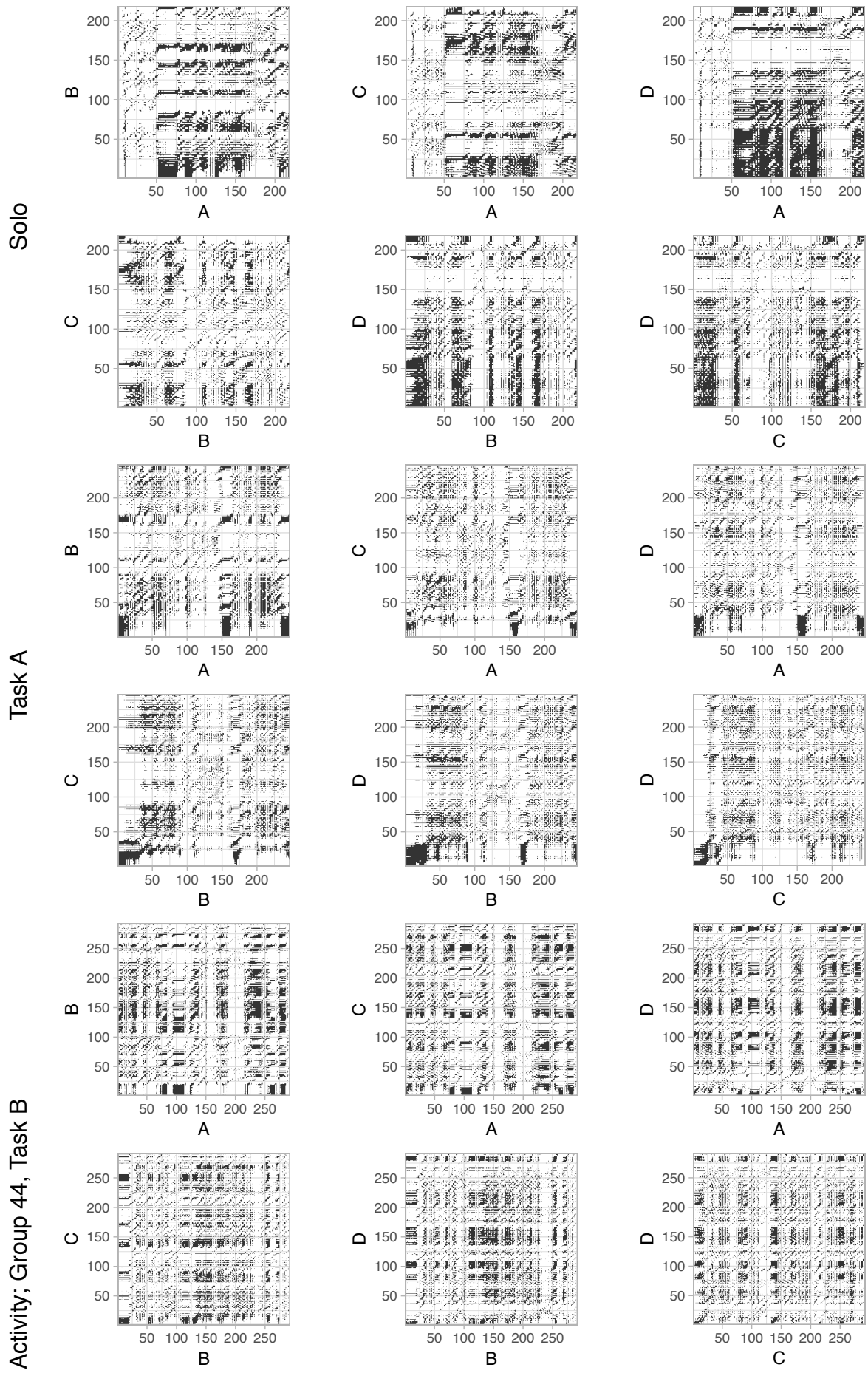
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Task A
Activity; Group 44, Task B
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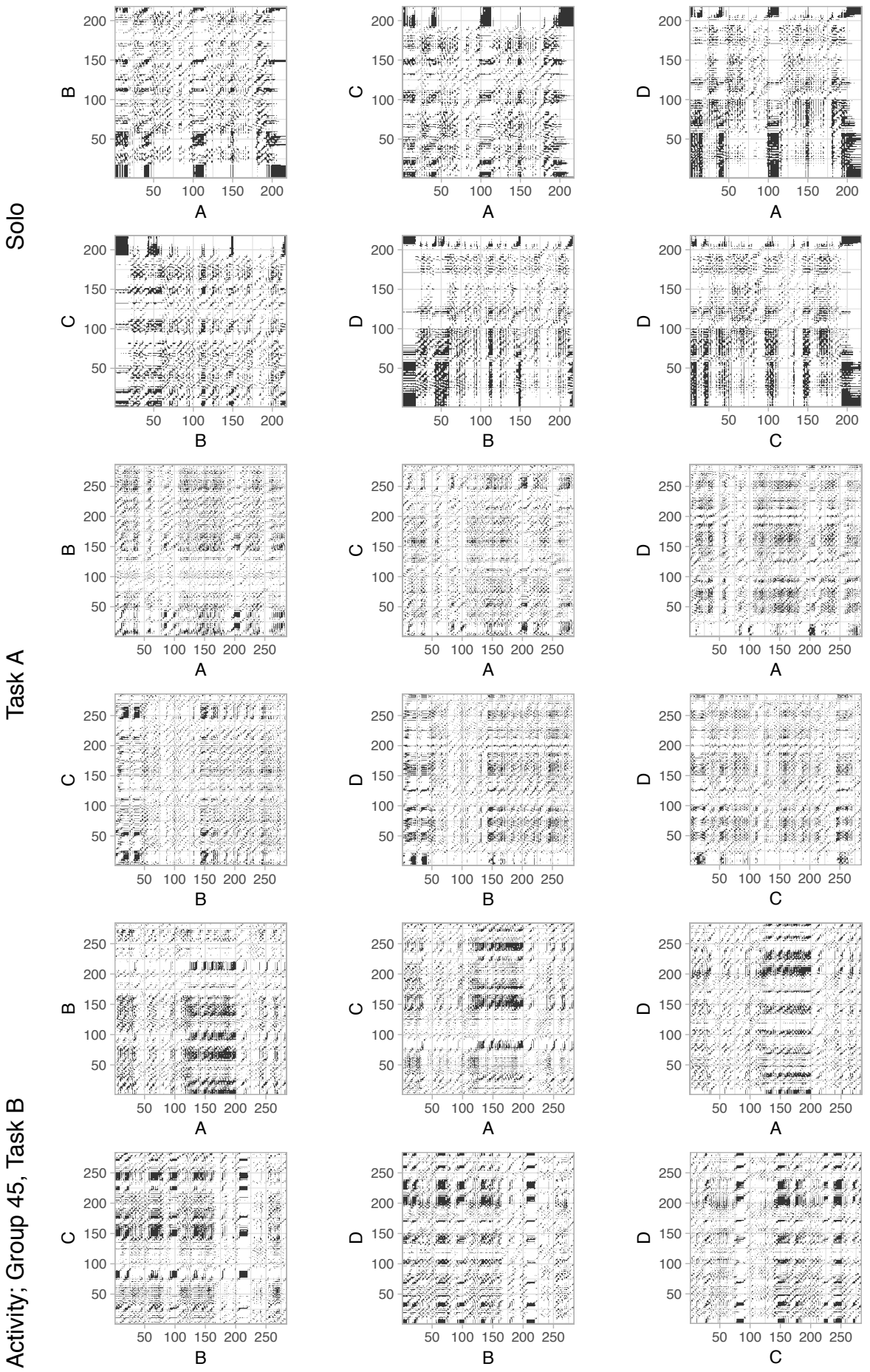
Solo
Task A
Activity; Group 45, Task B
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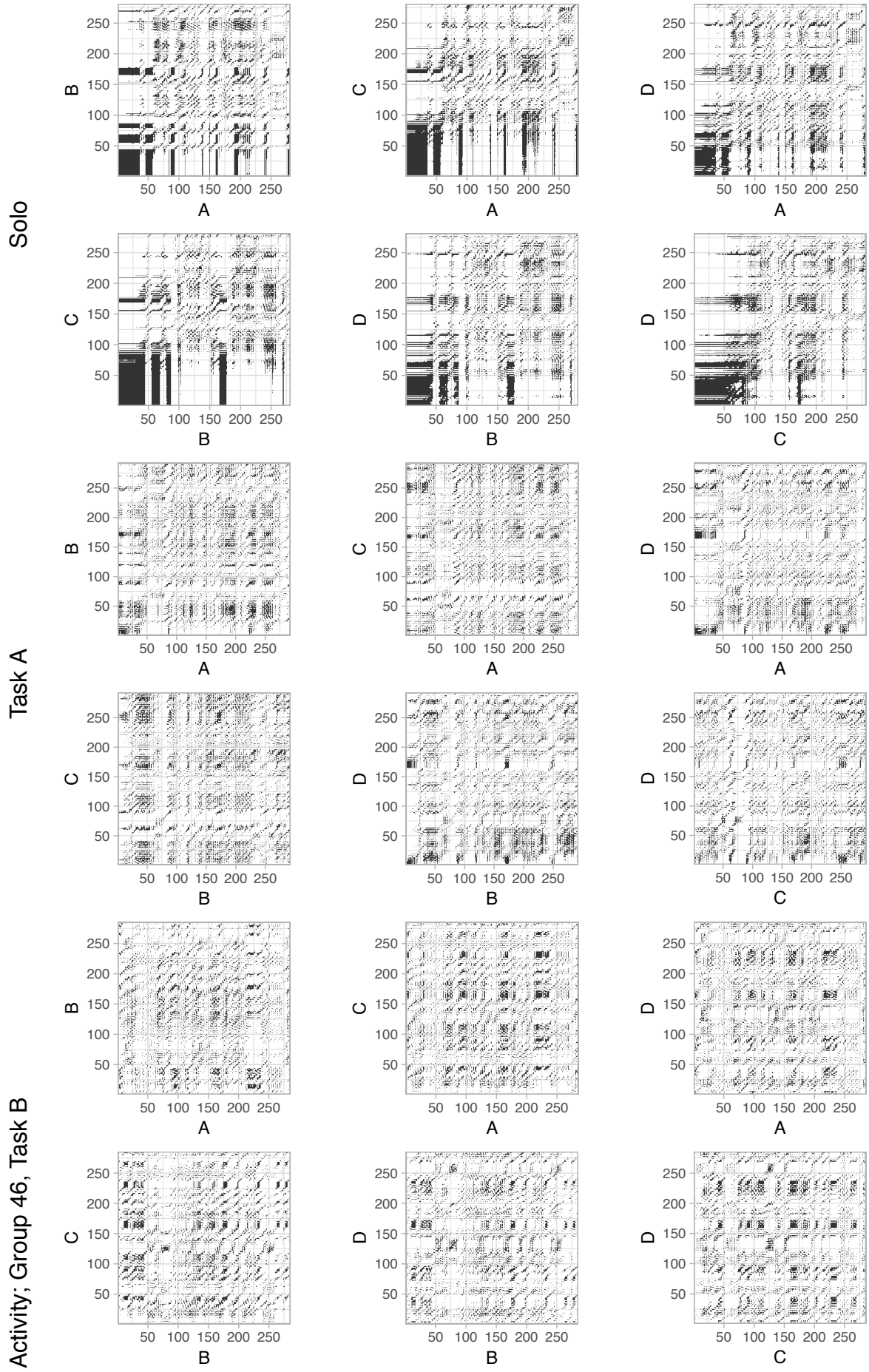
Solo
Task A
Activity; Group 46, Task B
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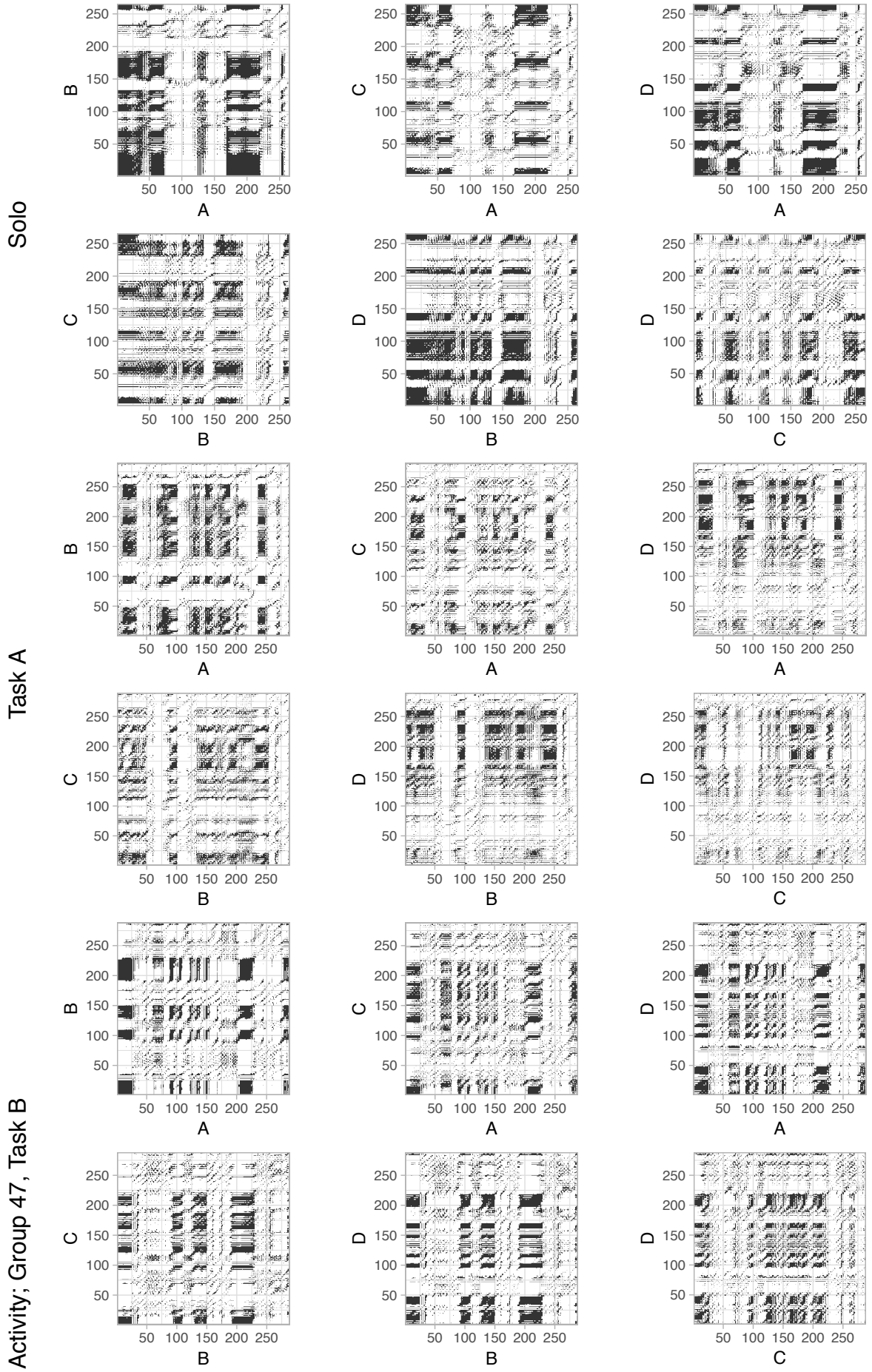
Solo
Task A
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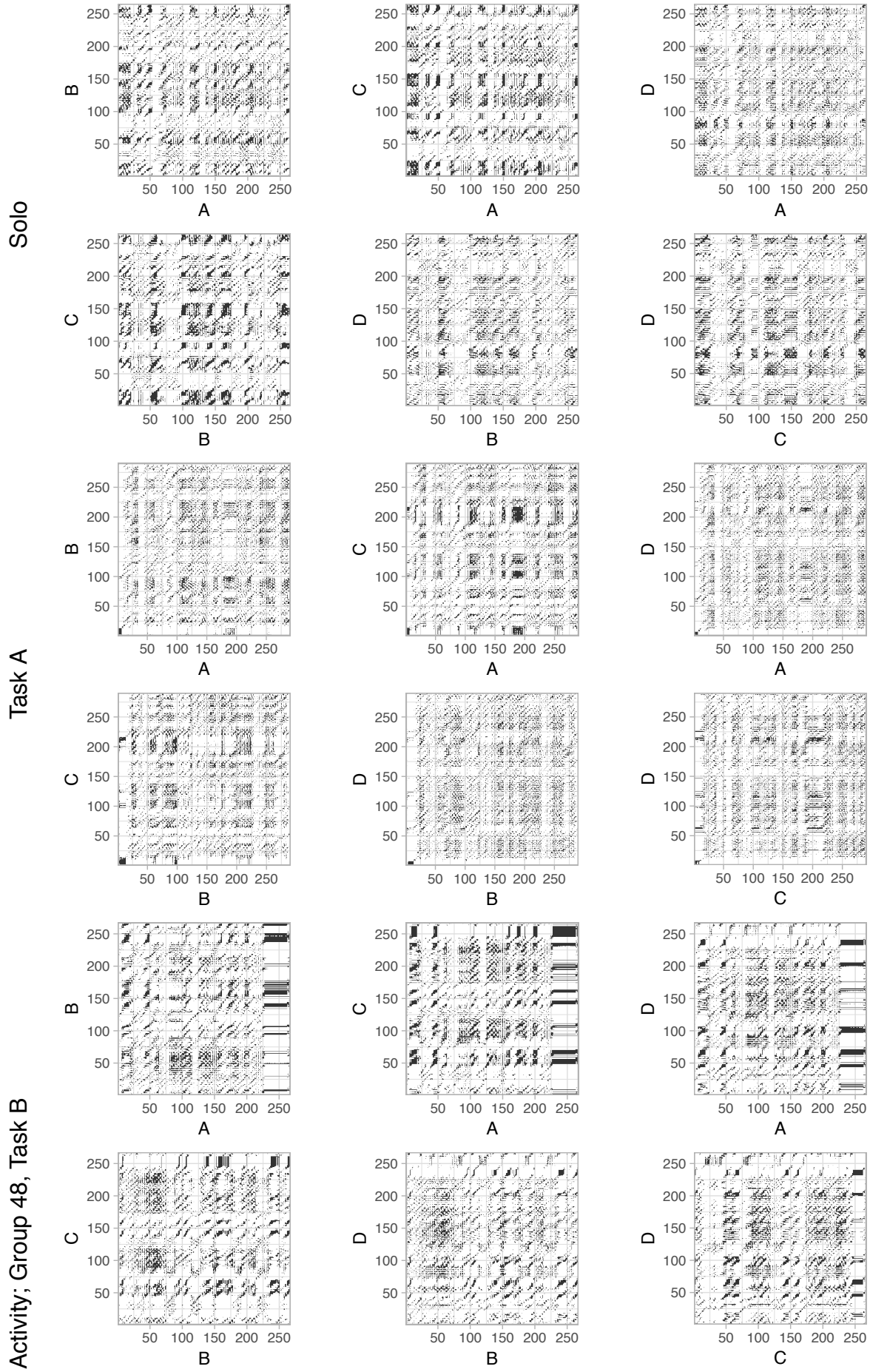
Solo
Task A
Activity; Group 48, Task B
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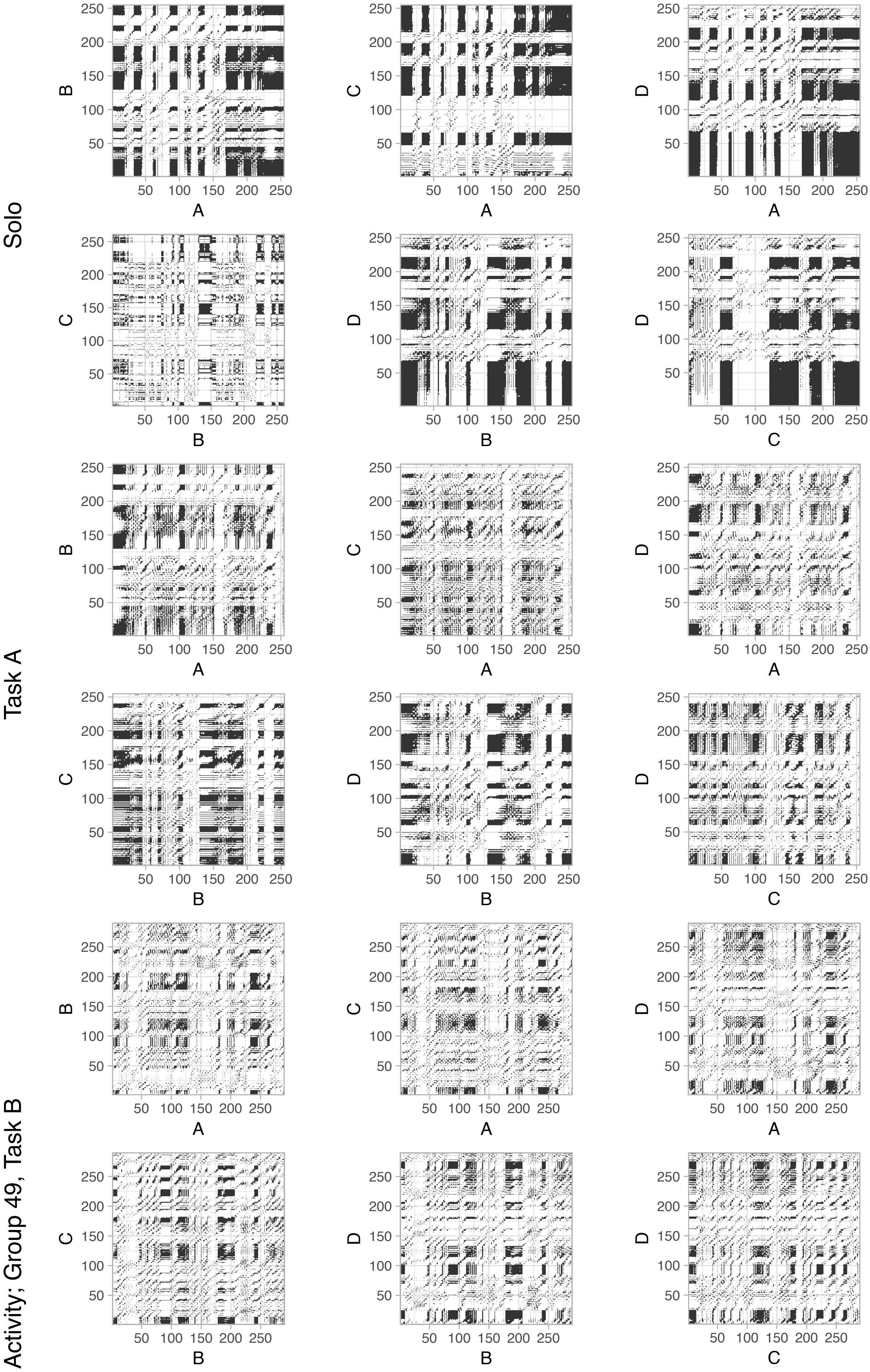

Solo
Task A
Activity; Group 49, Task B
A
B
C
D

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