PSYCHO-COGNITIVE EFFECTS OF THE EXPECTANCY OF SCORE-BASED FEEDBACK IN AN ACTIVITY INVOLVING ARTISTIC EMOTIONAL EXPRESSION

ÖZGE DAĞ

BOĞAZİÇİ UNIVERSITY

2020

PSYCHO-COGNITIVE EFFECTS
OF THE EXPECTANCY OF SCORE-BASED FEEDBACK
IN AN ACTIVITY INVOLVING ARTISTIC EMOTIONAL EXPRESSION

Thesis submitted to the

Institute for Graduate Studies in Social Sciences

in partial fulfillment of the requirements for the degree of

Master of Arts

in

Cognitive Science

by

Özge Dağ

Boğaziçi University

2020

DECLARATION OF ORIGINALITY

I, Özge Dağ, certify that

- I am the sole author of this thesis and that I have fully acknowledged and documented in my thesis all sources of ideas and words, including digital resources, which have been produced or published by another person or institution;
- this thesis contains no material that has been submitted or accepted for a degree or diploma in any other educational institution;
- this is a true copy of the thesis approved by my advisor and thesis committee at Boğaziçi University, including final revisions required by them.

Signature.....

Date .....28.02.2020.....

ABSTRACT

Psycho-Cognitive Effects of the Expectancy of Score-Based Feedback

in an Activity Involving Artistic Emotional Expression

Feedback-based control is being used extensively in modern technology with great success to make systems behave in a desired manner. Also for human performers, receiving feedback about their performances provides opportunity to learn from their errors and deficiencies. However, with the wide-spread usage of performance improvement policies with score-based feedback, some adverse psycho-social effects started being reported. The purpose of this thesis is to design and implement an experiment for investigating how the "type" of performance feedback, i.e. whether the information is represented in a qualitative or quantitative manner, affects the human performer. For this study, an original task has been developed that involves artistic expression of emotions. The psychological correlates of the expected effects have been sought for via questionnaire-based methods, while their neural correlates have been investigated via seed-based functional connectivity analysis of fMRI recordings.

ÖZET

Sanatsal İfadeye İlişkin Bir Aktivitede Skora Dayalı Geribildirim Beklentisinin Psiko-Kognitif Etkileri

Geribildirime dayalı kontrol modern teknolojide yaygın bir şekilde kullanılmakta ve sistemlerin istenilen şekilde davranmasını sağlamaktadır. İnsanlara uygulandığında da, geribildirim kişiye hatalarından ve eksikliklerinden ders alıp, kendini ve performansını geliştirme olanağı sağlar. Ancak skora dayalı geribildirimden yararlanan performans geliştirme politikaları yaygınlaştıkça bazı olumsuz psiko-sosyal etkiler bildirilmeye başlanmıştır. Bu tezin amacı, performans geribildiriminin tipinin, yani bilginin nitel olarak mı nicel olarak mı temsil edildiğinin, performans sahibi kişiyi nasıl etkilediğini incelemeye elverişli bir deneyi tasarlamak ve gerçekleştirmektir. Bu çalışma için, sanatsal ifadeye dayalı, özgün bir ödev tasarlanmıştır. Beklenen etkilenimlerin bağlantılı olduğu psikolojik değişiklikler ankete dayalı yöntemlerle, nörolojik değişiklikler ise MRG kayıtlarının fonksiyonel bağlantılılık analizi yardımıyla araştırılmıştır.

ACKNOWLEDGEMENTS

Firstly, I thank my precious professor Yağmur Denizhan. She is the most important and invaluable reason of this thesis being realized. She is an indescribable mentor, advisor, and beyond. I am very happy and proud that I had a chance to work with her and to learned from.

I also thank my teachers and friends at Boğaziçi University; it was a great chance to be part of such an environment. Especially, I am also grateful to the Chaos etc. Seminar; this thesis was born and developed within the inspiring and supporting environment of this seminar which I see as a real school.

I also thank my respectable professors Tamer Demiralp and Hakan Gürvit for their guidance and support.

I am very thankful to my family, for their life long support and love.

Moreover, I also thank the team behind this thesis, with whom this special study was actualized. I warmly thank Zeynep Kocaoğlu for her irreplaceable effort for this study to come true, Özgür Çetimen and Doğan Irmak for their support behind the camera, the participants of the experiment, Çapa Hulusi Behçet Life Sciences Laboratory, and especially Kardelen Eryürek for her supportive and positive attitude during MRI sessions and analyses. I am grateful for the support of the Boğaziçi University Research Fund. This study was supported by Boğaziçi University Research Fund Grant Number 15862.

I thank everyone who has contributed to any part of this thesis, with whom we learned together, and shared the way throughout. I thank Kübra Eren for being there every time I had difficulty to proceed, and her multidisciplinary support. I also thank Serdar Metin who encouraged me at the very beginning, and who always is an

admired adventurer. I also thank the Gülsün family for their support and kindness.

I thank my dearest Umut Gülsün for his indescribable support and love.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Goal-oriented behavior requires the ability to assess the present state and use it as a basis for further action selection. Not only in the functioning of animate agents but also in many technological applications, information about the present system output is used for generating adequate control actions that will lead to a desired behavior. Although such regulatory mechanisms are being used since ancient times in technological systems like water clocks or windmills, the formal description of such mechanisms had to wait until 1920s, when the notion of "feedback" was introduced as a universal abstraction that designates the coupling of the output of a system to its input (Bennett, 1996). Ironically, it was first introduced to describe an undesirable interference of the output of an amplifier with its input resulting in the amplification of parasitic noise in the field of radio engineering. Beside such undesirable artifacts, feedback is being used extensively in modern technology with great success to impose some target behavior upon technical systems. Figure 1 shows the generic block diagram of such a feedback-based control system: the measured system output is fed back to the controller, which determines its deviation from the target behavior and generates a command (the control input to be applied to the system) that will steer the system toward the target behavior.

The notion of feedback, soon after its introduction as a technical term, started being used as a universal abstraction in different disciplines and even in the daily language. In various fields of social sciences, the notion of feedback designates the delivery of information to a person or a group of people about the outcome or some aspects of their performances to be used as a basis for improvement. In Figure 1 we

propose a representation of a feedback-based system involving a human performer and an evaluator, allowing for a comparison to the technical feedback system depicted in Figure 1. As seen in the figure, the measured output fed back to the controller in the technical system provides information about the system performance, which is then used for generating error reducing and performance improving control actions.

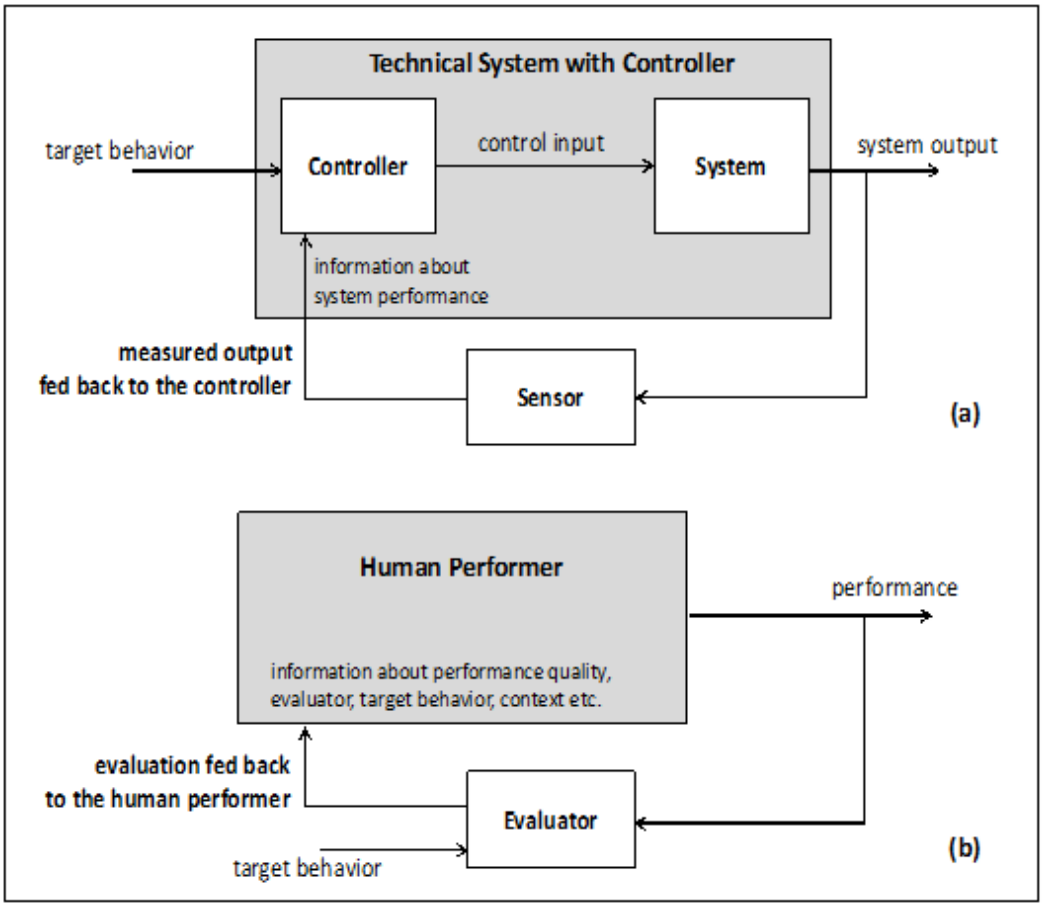


Figure 1. The basic block diagrams of feedback-based systems. a) Technical control system. b) System involving a human performer and an evaluator.

Similarly, the performance evaluation fed back to a human performer in Figure 1 gives him/her the opportunity to "learn from the errors" and improve his/her performance. However, unlike the machine, the human being (like many other higher-level organisms) has the cognitive ability and the tendency to extract

information from the given feedback not only about the performance quality, but also about other important issues. Particularly, information about the social context (such as the presence of competitors, unstated rules of the society, the criteria of the evaluator etc.) is of crucial importance for the performer. For example, if the feedback is delivered verbally, the performer would typically use the intonation and emotional expression of the evaluator as a clue about the social context. Similarly, also other aspects of the feedback, such as its medium of delivery or its form can serve as a clue about the social context, modify the representation of the social context in the mind of the performer, and affect his/her choice of strategies and actions. In short, one can say that also some form-related features of feedback delivery can lead to the cognitive and behavioral changes.

In this thesis, we want to concentrate on how the "type" of performance feedback, i.e. whether the information is represented in a qualitative or quantitative manner, affects the human performer. More specifically, we want to assess whether the mere information that a quantitative type of feedback will be given generates some alterations in the human performer's focus of attention, affective dynamics, and perception of the social environment.

With the wide-spread usage of metric-based performance evaluations in the management of private and public institutions, the large scale and long-lasting psycho-social impacts of that usage started being observed, reported and discussed. Inspired by such reports (Muller, 2018; Beer, 2016), as well as personal observations particularly in the academic environment, a research question emerged whether there exist some empirically detectable and immediate cognitive and behavioral impacts of quantitative type of feedback delivery that can be correlated with the longer-lasting psycho-social symptoms. Toward this end, feedback-related psychology and

neurology literature has been investigated, an fMRI-supported experiment has been designed and conducted, and the experimental results have been analyzed via seed-based functional connectivity analysis, augmented also by questionnaire-based investigations.

CHAPTER 2

LITERATURE REVIEW

In this chapter, first several examples of feedback-based performance improvement systems and reports on their psycho-social impacts are presented. Next, several feedback-related theories and experimental studies from the psychology literature are introduced. Lastly, some fundamental information is summarized about the neural structures that can be relevant for the feedback-related effects hypothesized in this thesis.

2.1 Social impacts of feedback-based performance management policies

Before going into the details of feedback-related theories and laboratory experiments, it is worth having a glance at social policies that aim at improvement via performance feedback. In such policies, predominantly metric-based performance evaluations are used because they allow for large-scale and standardized applications. Once the relevant indices are selected, their assessment can be automatized or delegated to the performers themselves, thus allowing the elimination of human evaluators from the feedback loop. Such practices are typically praised for giving the performers incentive for self-management supported by objective information. However, the advantages of these policies are also accompanied by some adverse psycho-social impacts.

The number of publications that report and analyze such effects keep on increasing, as metric-based efficiency improvement policies become prevalent in all developed and developing countries. We will have a quick glance at the reported complaints and problems in order to gain some inspiration and insight about the

psychological and neural mechanisms that may be involved. For this purpose, we will confine this investigation to two comprehensive reviews: “Metric Power” by David Beer (2016) and “The Tyranny of Metrics” by Jerry Z. Muller (2018).

In his discussion, Beer, departing from various arguments about measurement, points out that “existence, visibility, value and importance are likely to be defined by what can be calculated and what is measurable” (Beer, 2016). In this book, Beer attributes a “power” to the expression of evaluations via metrics (i.e. quantitative expression), according to his conceptualization metrics/measures have the power to prescribe ‘what is valuable’, thus govern human activities in subtle ways by shaping ‘what should be visible’ (Beer, 2016). Beer’s argument about the power of metrics to steer human behavior is directly related to the subject of investigation of this thesis.

On the other hand, Muller, in his book, collects examples from various fields and draws attention to misconducts that typically emerge upon combined usage of quantitative type of feedback and highly set performance targets. This combination seems to generate a tendency in many people to allocate most their time and effort on the measured aspects of the task while neglecting its essence, or even to try to improve the numbers via different manipulative strategies (such as lowering the standards, omitting undesirable data etc.), an attitude that constitutes a serious threat for the healthy functioning of the overall system. Muller gives an example for the typical response generated by the combination of performance-measurement-based policies and higher performance targets: when the salaries, subventions and employment decisions in public education were made strongly dependent on the pupils’ test scores, “teachers and principals in many cities responded by altering students’ answers on the test” (Muller, 2018).

When the target is reduced to the “key performance indices” (KPI) that will be

measured, ignoring the overall quality improvement, the whole logic of performance feedback collapses: when it is known which indices will be measured, people – especially, if they are under highly competitive pressure- invest only in these indices and therefore, these indices cease to be representative for the overall performance quality. This mechanism is known in the field of economy as Goodhart's Law, named after the economist Charles Goodhart, paraphrased by Marilyn Strathern as "When a measure becomes a target, it ceases to be a good measure" (Byrne, 2017).

Reports on such individual and collective symptoms that accompany score-based feedback policies indicate that some other mechanisms can be at work in social systems that go beyond feedback of information about the level of achievement, as known in technical systems. In reference to Figure 1 we suspect that these additional mechanisms may be related to the human ability and need to steadily verify and update their mental representation of the world –especially of the social context- using any interaction as a source of information.

2.2 Theoretical and experimental studies

Usage of the term “feedback” exhibits a large variety in the psychology literature. In earlier times, “feedback” was used to mean something verbal, and it was a tool to convey a qualitative evaluation. Within the last decades, the usage of the term “feedback” shifted towards a quantitative measure, i.e. a score. Since there is no standard convention with regard to the meaning of this term in the literature, in this thesis “feedback” is used to denote any kind of evaluation about a person’s performance. This thesis makes use of two theories that are commonly taken as a basis for cognitive research and interpretations about feedback in our day: Self-Determination Theory and Goal Orientation Theory.

2.2.1 Self-Determination Theory

Self-Determination Theory (SDT) is one of the influential theories that provide an explanatory framework for feedback. The basic premise of this theory is that people are in need of competence, relatedness, and autonomy (Deci & Ryan, 1985). Deci and Ryan state that the first aim of the self-determination theory was to model intrinsic motivation, but later it evolved and turned into a collection of various mini theories regarding motivation (1985). One of these theories accounts for the effects of external events on intrinsic motivation and motivationally relevant processes regarding the effects of intra-personal and inter-personal events. The theory analyzes the effects of events relevant to the initiation and regulation of behavior in terms of their meaning for a person's self-determination and competence (Deci & Ryan, 1985). Ryan and Deci present a large number of studies, and relate the experimental outcomes to their theory. One of the important conclusions of their research is that the effects of any event can be analyzed in terms of the informational, controlling and "amotivating" aspects of the event. According to SDT, the amotivating aspect promotes a mode of functioning, where people feel helpless (Deci & Ryan, 1985). According to Cognitive Evaluation Theory, the informational aspect facilitates an "internal perceived locus of causality" and perceived competence, thus enhancing the intrinsic motivation. The controlling aspect, on the other hand, facilitates an "external perceived locus of causality", thus undermines the intrinsic motivation and promotes extrinsic compliance or defiance. The amotivating aspect facilitates perceived incompetence, thus undermines intrinsic motivation and promotes amotivation. Irrespective of the emotional valance, feedback can undermine or enhance intrinsic motivation if they are perceived as "informational". When an environment allows neither self-determination nor competence for a given behavior,

people become amotivated with respect to that behavior. This may be accompanied by adverse affective and cognitive states such as listlessness, helplessness, depression, and self-disparagement. On the other hand, environments that provide optimal challenge, competence-promoting feedback, and support for autonomous activity, facilitate intrinsic motivation (Deci & Ryan, 1985)

2.2.2 Goal Orientation Theory

The Goal Orientation Theory (GOT, also known under the alternative names Goal Motivation Theory, Achievement Goals Orientations Theory, and Achievement Goal Theory) which is among the most influential theories in feedback-related research, provides a reason for the motivation for achievement. The framework of GOT defines two different kinds of achievement goals: mastery goals and performance goals. Mastery goals refer to tendencies to learn and improve one's own abilities, while performance goals correspond to tendencies to outperform others. According to GOT, depending on their character traits and environmental factors, people exhibit either mastery or performance orientation (Dweck, 1986), and their orientation determines how they perceive feedback. For example, reception of feedback that reports insufficient performance is likely to generate adverse emotional effects on a performance-oriented person, whereas a mastery-oriented person is likely to perceive it as an opportunity for self-improvement.

2.2.3 Experimental studies

Alongside the theoretical concern and curiosity about it, the notion of feedback has also left a mark in educational and professional fields, making it the focus of many studies. Although all of these studies adopt one the two basic theoretical frameworks

conveyed above, they differ in terms of their research questions and research methods, as well as the way they categorize different types of feedback, mostly comparing the effects of slightly different pairs of the categories such as “normative” versus “absolute” feedback, “evaluative” versus “performance” feedback, or “norm-referenced” versus “criterion-referenced” feedback:

For example, Rakoczy et al. discuss the effects of “process-oriented feedback” and “social-comparative feedback” by analyzing their perceived usefulness and perceived competence support (Rakoczy et al., 2013). They report that process-oriented feedback lets students feel supported with regard to their need for competence, and thus improves their interest. Besides, students perceive process-oriented feedback as more useful for subsequent learning than social-comparative feedback. As can be seen, the notion of “process-oriented feedback” and “social-comparative feedback” in this study, share the main features of our notions of “qualitative feedback” and “quantitative feedback”, respectively.

Zingoni and Byron distinguish between “normative feedback”, which compares the performance of an individual with that of others, and “absolute feedback”, which compares the performance of an individual with an absolute standard (Zingoni & Byron, 2017). They report that normative feedback is perceived as more threatening compared to absolute feedback (Zingoni & Byron, 2017).

A study by Kim et al. compares the brain activations of participants in low-competence and high-competence groups during the processing of “norm-referenced feedback” versus “criterion-referenced feedback” (same as “normative” versus “absolute” feedback as named by Zingoni and Byron). The researchers report that in the low-competence group “norm-referenced feedback” evokes significant activity in the amygdala, which, according to the researchers’ interpretation, is associated with

negative emotions even if the feedback valance is positive (Kim et al., 2010).

A neuroscientific study by Pan et al. compares the neural responses of participants to "evaluative feedback" (containing task-related information, as well as subjective appraisal of the specific abilities and personality characteristics of the participant) and "performance feedback" (providing objective results related to the outcome of the task) (Pan et al., 2009). They conclude that receiving evaluative feedback activates self-related brain areas, while performance feedback does not.

In a study by Choi et al. brain activation patterns in adolescents' brains are compared under four different conditions: "performance feedback" (objective feedback reporting either success or failure), "evaluative feedback/social reward" (evaluative statement about the subject's capacity such as "you are stupid" or "you are clever"), "monetary reward", and "no feedback" (Choi et al., 2013). It is reported that the right postcentral gyrus, which is mostly associated with self-related processing, is activated only under "evaluative feedback" and "no feedback" conditions.

Another neuroscientific study analyzes the fMRI recordings of participants who are given quantitative feedback that shows whether their test result is above or below the average (Hoefler et al., 2015). This study reports correlations between perception of self-threat and activation in midline cortical areas, including the ACC and the thalamus (Hoefler et al., 2015).

There are also many feedback-related studies that are directly related to Goal Orientation Theory. For example, a study by Kamarova et al. investigates the relation between mastery-orientation and perceived competence (Kamarova et al., 2017). The researchers show that performance-oriented students report higher perceptions of competence compared to mastery-oriented students when they receive positive

feedback (in terms of valence), while mastery-oriented students report higher perceptions of competence when they receive negative feedback (in terms of valence). Furthermore, performance-oriented people are found to be more sensitive to the valence of feedback (negative or positive psychological value) as compared to mastery-oriented people.

In a neuro-scientific study by Mangels et al., which investigates the effects of the achievement goals of a subject, it is stated that such goals function similar to other types of top-down effects in that they enhance the attention on goal-relevant information (Mangels et al., 2017). The researchers report that achievement goals, which promote interest and learning, engage neural regions associated with error correction, which are also putatively associated with conceptual processing. On the contrary, goals, which promote outperforming others, engage regions associated more with perceptual processing.

Another neuro-scientific study focuses on how achievement goals and expectations affect striatal processing during reception of feedback (Swanson & Tricomi, 2014). It is found that subjects with normative goals are more sensitive to the valence of feedback, which can be particularly well-observed in the caudate and putamen.

In a further neuro-scientific study Satterthwaite et al. investigate the effect of enhanced motivation on feedback processing. They emphasize that intrinsic motivation is a modulator for the striatal processing of performance-related feedback, and state that more motivated participants exhibit higher sensitivity to the valence of feedback. Their study also shows that feedback-related responses in the striatum very much resemble the responses due to extrinsic rewards such as food or money (Satterthwaite et al., 2012).

Some studies related to social anxiety disorder show that fear of scrutiny enhances apprehension, arousal, and panic in a performance context (Cauette & Guyer, 2013). According to a research about hypersensitivity related to fear of failure, striatal sensitivity is associated with incentive anticipation (Guyer et al., 2012). Bar-Haim et al. also show that activations due to quantity-related incentives (which can be interpreted as "quantitative feedback") may give rise to psychological states such as performance monitoring or sensitivity to feedback that are common to behavioral inhibition and social phobia (Helfinstein et al., 2011). In another study by Guyer et al. on anticipation of social evaluation reports positive functional connectivity between the vlPFC and the amygdala in socially anxious adolescents when anticipating evaluation from negatively perceived peers. This suggests that vlPFC may have a role in the modulation of avoiding stimuli associated with a threat of social retaliation (Guyer et al., 2008).

There exist various studies in the literature investigating the behavioral and neural differences generated by normative and evaluative feedback, the relationship between social anxieties and feedback-related processing, and the determining role of goal orientation and intrinsic motivation in feedback-related processing. These studies provide partial evidence that support the hypotheses in this thesis, as well as clues about brain areas where activities relevant to the subject matter of this thesis can be expected.

2.3 Feedback-related neural structures

Certain brain areas and network structures, which are related to the studies and theories explained in 2.2 and 2.3, and the functionalities of which have constituted the basis of our hypotheses are summarized below. Because the effects of

quantitative and qualitative feedback are expected to differ with regards to emotional processing, social perception, and focus of attention of the subject, structures related to emotional processing, social processing and attention are considered in this study.

2.3.1 Amygdala

The amygdalae are two small, almond-shaped structures in the brain which are located anterior to the hippocampi near the temporal poles. The amygdala has an essential part in the processing of fearful and rewarding environmental stimuli, and it has been associated with emotion and motivation (Janak and Tye, 2015). In other words, the amygdala detects and learns emotionally significant stimuli in the environment. Moreover, the amygdala also has a contribution in the association of stimulus and reward. However, a distinction should be made between reward processing and emotional reaction: the amygdala has a conditional role in reward processing, while it has a crucial role in emotional reactions (Murray, 2007). It should be noted that the amygdala is not solely responsible for reward processing. Murray (2007) states that, "the amygdala is essential for processing emotional aspects of reward, including its valence (positive or negative) and its relative value (e.g. good versus superb), many other aspects of reward processing are effected outside the amygdala." To add, amygdala activation also occurs during the perception of a potential threat where related past memories are used as a basis for judgement (Breiter et al. 1996).

2.3.2 Ventral striatum

The ventral striatum (or nucleus accumbens) is a group of subcortical structures which are thought to play a crucial role in emotion and behavior. Part of these

subcortical structures are thought to be involved in experiencing pleasure (Berridge & Kringelbach, 2015). Moreover, subregions of the nucleus accumbens are shown to have dissociated functions. To be more specific, the core of the nucleus accumbens seems to have a greater role regarding stimuli associated with reward and safety, while the shell "aids in inhibiting the emergence of behaviors that may interfere with goal seeking" (Floresco, 2015). Moreover, the activity of the dopaminergic (DA) neurons in the nucleus accumbens is associated with reward prediction: unexpected rewards increase firing in these neurons, while the activity of these neurons is suppressed when expected rewards are not delivered (Floresco, 2015). Likewise, Gu et al. (2019) suggest that the activity of the ventral striatum is evoked with the anticipation of social and monetary reward. To add, increased activity is observed in the nucleus accumbens in people who encounter their objects of addiction (Kringelbach and Berridge, 2016).

2.3.3 Anterior cingulate cortex

The anterior cingulate cortex (ACC) has connections to the limbic system and the prefrontal cortex, which puts it in a very unique position. Hence, most probably, the ACC has a crucial role in integrating the neuronal circuitry for affect regulation (Stevens, Hurley & Taber, 2011). Moreover, it has often been posited that the ACC has a central role in the processing of rewards and decision making. The ACC also takes part in the processing of information about other agents. For example, the ACC is engaged during economic games in which people interact with one another. In such economic games, the participants make decisions that affect their own payoffs together with that of other players' (Apps, Rushworth & Chang, 2016). Furthermore, the anterior cingulate cortex and the anterior insula are engaged in situations, where a

social error or a defect in the social network is involved. These areas are also activated with resentment, deception, embarrassment, guilt, and “empathy for the suffering of others” (Allman et al., 2011).

2.3.4 Default mode network

In brain imaging studies, it is commonly observed that a set of brain regions constituting the so-called default mode network (DMN) is at work when individuals are “left to think to themselves undisturbed” (Buckner, Andrews-Hanna & Schacter, 2008). Moreover, the DMN is also engaged during self-referenced mental activities like “remembering, considering hypothetical social interactions, and thinking about one's own future” (Buckner, Andrews-Hanna & Schacter, 2008). In doing so, the DMN constructs mental simulations based on personal past experiences. DMN also facilitates situations where an understanding of others’ mental and physical states is required. Here, DMN contributes in self-other mappings which are crucial for embodiment and mentalizing (Raichle, 2015).

2.3.5 Cingulo-opercular network

The cingulo-opercular network is an attentional control network which is composed of the left and right anterior insula, the dorsal anterior cingulate extending into the middle superior frontal cortex and thalamus (Dosenbach et al., 2008). As pointed out by Sadaghiani & D'Esposito, its function has been particularly difficult to characterize because it exhibits pervasive activity and is often co-activated together with other control-related networks. Nevertheless, research results support the general view that its fundamental function is the intrinsic maintenance of tonic alertness (Sadaghiani & D'Esposito, 2015).

The set of brain regions constituting the cingulo-opercular network is called the salience network by other researchers who focus on its functionality of detecting behaviorally relevant stimuli, and coordinating neural resources (Uddin, 2015). In other words, the naming of this set of brain regions varies according to the functionality of interest: those who focus on tonic alertness and top-down attention call it cingulo-opercular network, while those interested in bottom-up attention call it salience network. In this thesis, we decided to employ the term cingulo-opercular network because the designed experiment is likely to generate a top-down effect.

2.3.6 Temporoparietal junction

The temporoparietal junction (TPJ) encompasses the supramarginal gyrus, caudal parts of the superior temporal gyrus, and dorsal-rostral parts of the occipital gyri. Furthermore, functional neuro-imaging studies indicate that the TPJ is associated with social cognitive tasks such as perspective taking, empathy, and theory of mind (Decety & Lamm, 2007). The TPJ also plays an important role in various mechanisms related to attention and social cognition, such as mentalizing, distinguishing the self from the "other", social norm compliance, and empathy, among others. The substrates of attentional reorientation in TPJ are involved in reorienting attention between the self and the "other". Likewise, these substrates may also be involved in "attributing attention between social agents" (Kubit & Jack, 2013). With regard to the lateralization of TPJ, Igelström and Graziano (2017) state that attentional functions have right-dominancy, while memory and language processing have left-dominancy. TPJ is also reported to engage with social reward anticipation (Gu et al., 2019).

CHAPTER 3

METHODOLOGY

Although there exist theoretical models in the feedback-related literature providing some useful clues related to the research questions of this thesis, no experimental study has been encountered that sufficiently isolates the effects of the type of feedback (i.e. qualitative or quantitative). As a matter of fact, experiments reported in the literature fail to do so due to two main reasons:

i) For the sake of controllability, repeatability, and ease of objective measurement, almost all studies that investigate the effects of feedback rely on experiments that are based on tasks, where the performance quality can be naturally quantified in terms of its similarity to an externally specified optimal reference. However, such tasks, where the performance is reducible to successful imitation of an external reference, are likely to generate neither genuine task-related intrinsic motivation, nor sufficient emotional attachment to the content of the performance in the performer. Consequently, they are not particularly suitable for detecting the difference between qualitative and quantitative types of feedback in terms of their effects on the emotional and mental state of the performer.

ii) Although the main question of the studies largely varies in feedback related literature, some of studies indirectly investigate the effect of quantitative feedback. Those studies are mostly based on the comparison of the (neural and/or behavioral) responses of performers, who have and have not received such feedback. The response of a performer who has received some feedback depends not only on the type of the feedback (quantitative or qualitative) but also on its valence (i.e. on whether it is better or worse than the expectation); hence, such experiment designs

are not suitable for isolating the effect of the type.

Because in this thesis the aim is to investigate the research question whether the expectation of score-based evaluation causes any significant alteration in the performer's emotional and mental state, special attention has been paid to avoid the above-mentioned pitfalls while designing the experiment. Hence, an experiment has been designed that focuses on the effects of the expectancy of quantitative feedback delivery, rather than the content of the delivery. The experiment involves fMRI and self-report based assessments in order to test the hypotheses summarized in Table 1.

Table 1. Research Hypotheses

Related faculty	Hypothesis and null-hypothesis
Attention	H_1^1: Expectancy of quantitative feedback induce some alteration in the subject's attention.
	H_0^1: Expectancy of quantitative feedback does not induce any alteration in the subject's attention.
Emotion	H_1^2: Expectancy of quantitative feedback induce some alteration in the subject's affective dynamics.
	H_0^2: Expectancy of quantitative feedback does not induce any alteration in the subject's affective dynamics.
Social perception	H_1^3: Expectancy of quantitative feedback induce some alteration in the subject's perception of the social environment.
	H_0^3: Expectancy of quantitative feedback does not induce any alteration in the subject's perception of the social environment.

To create suitable conditions for testing the research hypotheses, it is desired that all participants are as mastery-oriented as possible (at least in relation with the given task) prior to the manipulation stage, where the control and experiment group are differentiated. Toward this end several measures have been taken

(i) by composing the call for participants in a way that is likely to attract mastery-oriented people,

(ii) by choosing of a task involving artistic expression of emotions, which is likely to attract people who are driven by an orientation toward self-realization and mastery,

(iii) by providing a coaching service that promotes mastery-orientation such that even (generally) performance-oriented people can develop mastery-orientation in relation with this specific task, and

(iv) by excluding professional artists, who are likely to have integrated mastery and performance goals in an inseparable manner, and developed special strategies to cope with quantitative feedback.

3.1 The task

The expectancy of quantitative feedback may not evoke the hypothesized effects if the given task is based on the achievement of an externally set target, in which case a quantitative evaluation of the performance in terms of its closeness to the external target would be rather natural. On the contrary, a task that is inherently based on an internal reference is better suitable to test the above hypotheses. Therefore, in this thesis a task has been designed that involves artistic expression of emotions: each participant is asked to prepare a choreographic composition to a piece of music of his/her choice and to perform it.

3.2 The experiment design

The general procedure of the experiment designed in this thesis is presented in Table 2, while the detailed explanation of each step is given in the following subsections.

Table 2. Experiment Procedure and Timing

#	Activity	Duration
1	Call for and selection of the participants	2-3 weeks
2	Briefing and personal profile assessment of the participants	1 hour
~ 5 days later		
3	Participants' first personal meeting with the coach and the researcher	1 hour
~ one week later		
4	Participants' second personal meeting with the coach and the researcher	1 hour
~ one week later		
5	Video recording of the individual dance performances	~ 15 min
6	Audio recording of the coach's evaluations of the dance videos	~ 10 min per video
~ one week later		
7	fMRI scanning	~ 25 min
8	Surveys based on self-report	~ 20 min

3.2.1 Call for and selection of the participants

Formulation of the call for participants is part of the experiment design because it is expected to serve as a filter that increases the likelihood of working with subjects who are driven by internal motivation rather than expectation of external rewards. Therefore, volunteer recruitment strategies based on offering payment or course credit have been deliberately avoided.

The call for participation was made in Turkish (see Appendix A), shared in mail groups and social media platforms, and put up in various places. The volunteers who responded to this call by e-mail or phone were interviewed according to the following procedure, in order to check their suitability:

i. A detailed briefing about the flow of the experiment, the involved risks and the duties of the participant was given.

ii. Suitability for MRI was assessed according to the form (see Appendix B) provided by the MR laboratory, and those who are unsuitable for MRI were

rejected.

iii. Professional dancers and performance artists were excluded from the experiment.

iv. Accepted candidates were requested to fill the Informed Consent Form (Katılımcı Bilgi ve Onam Formu, see Appendix C).

As a result, 20 participants were admitted to the experiment, 10 female and 10 male, with ages varying between 18 and 38 and a mean of 25. All of them were right-handed. Two participants could not finish the experiment due to personal reasons.

3.2.2 Briefing and personal profile assessment of the participants

A detailed briefing about the general schedule of the experiment was given to each participant, the task was explained, and their questions were answered. Participants were assured about the privacy of their recordings; i.e. their video and fMRI recordings will only be seen by the team directly involved in the conduction and evaluation of the experiment. They were also told that their recordings and a functional image of their brains will be given to them at the end of the study.

The personal features of each participant (age, profession, past experience with dance and/or performing arts) was assessed, and a Turkish version of the Trait Anxiety Inventory was given (see Appendix D). The Trait Anxiety Inventory is a self-report based multiple-choice instrument for measuring the trait anxiety which represents a predisposition to react with anxiety in stressful situations.

3.2.3 Meetings with the coach and the researcher

During the preparation of their composition, the participants had two personal meetings of 30 minutes with a professional coach, who is an expert psychologist

specialized in dance and movement therapy, and were given support, evaluation and guidance. Meetings were held in a classroom prepared to provide a comfortable dancing space and a comfortable meeting environment. The room was equipped with a sound system for playing the pieces of music.

During these meetings, the objective of the coach was to enhance the internal motivation of the participants to express their emotions artistically, to provide artistic and psychological coaching during the preparation of the artistic composition. Toward this end, she interviewed the participants to assess their motivation for choosing the specific piece of music and the content they want to express in their composition, observed their dance performances, gave feedback about the expression conveyed, as well as some general tips about choreographic elements. She paid attention to supply feedback in an emotionally neutral, supportive, and informative manner. Detailed information about the methodology of the coach can be found in Appendix E.

After the first meeting with the coach, each participant is asked to respond to the following questions:

i. What were your expectations about the meeting and have they been satisfied?

ii. What are your opinions about the coach? Do you trust her expertise?

iii. How would you describe your meeting with the coach?

Approximately one week after the first meeting, the participants had a second personal meeting with the coach, showed their improved work, and got her final suggestions. During both meetings, part of the conversation between the coach and the participant and the coach's feedback to participant were recorded for archival purposes.

At the end of the second meeting, the following questions were asked to the

participants:

i. How would you describe your meeting with the coach?

ii. How was your communication with the coach? Did you feel supported or controlled by her?

iii. Did you make any preparation for your performance since the first meeting with the coach? If you did, what was important for you during this preparation?

iv. Are you ready for the video recording of your performance?

3.2.4 Video recording of the participants' dance performances and audio recording of the evaluations of the coach

Nearly one week after the second personal meeting each participant appeared in front of the camera, explained the concept of their work for a few minutes and then performed the dance. Before their camera sessions, the participants were given the following reminder:

"The camera recording that you will watch in the next phase of the experiment will not be seen by or shared with anyone other than the experiment team. At the end of the experiment the recording will be given to you as a memento of your efforts. When you are ready for the recording, please explain in front of the camera why you have chosen this piece of music, and the meaning of your dance performance, if there is any. Then, you can start your performance accompanied by the music of your choice."

Afterwards, the coach watched each participant's dance video, and audio-recorded her qualitative evaluations to be fed back to the respective participant.

3.2.5 Formation of the control and experiment groups

The participants were randomly assigned into two groups of equal size, but 2 participants in the control group had to leave the experiment due to personal reasons at a late stage such that the group sizes could not be equated. The experiment and control groups were counterbalanced according to the participants' age, gender and general anxiety scores (Table 3).

Table 3. Experiment and Control Groups

	Experiment group	Control group
Size	10	8
Age	(18-32), mean: 24	(18-33), mean: 23
Gender	5 female, 5 male	4 female, 4 male
Trait anxiety score	(30-64), mean: 41	(31-53), mean: 40

3.3 Measurements

3.3.1 fMRI measurements

Magnetic resonance imaging (MRG) is based on the acquisition of images by stimulating the protons in the hydrogen atom nuclei of water molecules in and between tissues by magnetic field (Gore 2003). In order to obtain a functional MRI, temporal changes of the Blood Oxygen Level Dependent (BOLD) signals of the brain is processed (Ogawa et al. 1993). During the resting state fMRI, BOLD signals are recorded while the brain is in a state of spontaneous resting, without receiving any warning or being engaged in any specific task. Neurons produce both low and high frequency fluctuations. Resting-state fMRI imagining utilized spontaneous low-frequency fluctuations (< 0.1 Hz) which enables constant communication between spatially separated but functionally connected neural networks (van den Heuvel & Hulshoff Pol, 2010). Functional connectivity analysis derived from observed high correlation between resting-state BOLD oscillations of different cortical/subcortical

areas associated with cognitive/sensory-motor functions (Biswal et al., 2010). It is also possible to make a functional connectivity analysis in task-based fMRI, by selecting activation regions as a region of interest (ROI). (Biswal et al. 1995).

Each participant was given an appointment for an MR scan. During the fMRI sessions, the participant was given a summary of the previous phases of the experiment, as well as technical information about fMRI. The participant also signed a form of consent for the MR scan. The following explanation about the sequence of events in the MR device was delivered verbally:

"We will start the experimental process when you are ready. The MR scan will start after a loud noise. Then, you will watch the video of your dance performance. Once again, there will be a loud noise, and the scan will proceed. Then, you will receive the final evaluations of the coach."

Later, the questions of the participant were answered, if any. Next, in order to make sure that everything is correctly perceived, the participant was asked to describe the upcoming sequence of events in the MR device. Then, participants signed the instructions for MRI scan (see Appendix F), and the experiment procedure summarized in Table 4 was conducted.

Table 4. Experiment Procedure in the MR Device

Experiment Group	Control Group
Anatomical T1-weighted MRI recording	
First resting state fMRI recording	
Announcement: "Now you will watch your video recording and then receive the final evaluations of the coach. Finally, your scores will be given!"	Announcement: "Now you will watch your video recording and then receive the final evaluations of the coach."
Dance video	
Announcement: "Soon you will receive the final evaluations of the coach, and finally your scores will be given!"	Announcement: "Soon you will receive the final evaluations of the coach."
Second resting state fMRI recording	

The MRI protocol was carried out with 3 T Phillips Achieva scanner (Philips Achieva, Best, Holland) equipped with a 32 channel SENSE head coil, installed at the Hulusi Behçet Life Sciences Research Laboratory, in the Faculty of Medicine of the Istanbul University.

Anatomical recordings were obtained collecting T1 weighted high resolution images with 3D (Turbo Field Echo) sequence, while resting state functional MRI recordings were obtained collecting T2 weighted fMRI images with an echo-planar imaging (EPI) sequence. The parameter values related to these recordings are given in Table 5.

Table 5. Parameter Values Related to T1 and T2 Weighted fMRI Scans

	T1 weighted anatomical scan	T2 weighted functional scan
Type of sequence	3D (Turbo Field Echo)	echo-planar imaging (EPI)
Time of repetition / Time of echo	8.4 msec/ 3.9 msec	2000 msec/ 30 msec
Flip angle	8°	77°
Slice # and type	180 axial slices	36 transverse slices
Slice thickness	1 mm (isotropic without gap)	4 mm (without gap)
Voxel size	1 mm^3	2 mm × 2 mm × 4 mm
Field of view	250 mm × 250 mm	221 mm × 240 mm × 144 mm
Matrix size	252 × 227	112 × 117
Scan duration	05:55 min	10:24 min (10 dummy + 300 dynamic scans)

3.3.2 Surveys based on self-report

After leaving the MR scanner, the participants were given some questionnaires before and after listening to the pre-recorded qualitative evaluations of the coach on their dance videos. The stages of the procedure after leaving the MR scanner are summarized in Table 6 both for experiment and control group members.

Table 6. The Procedure After Leaving the MR Scanner

Stage #	Experiment Group	Control Group
1	Announcement: "Soon you will hear the final evaluations of the coach, and finally your scores will be given!"	Announcement: "Soon you will hear the final evaluations of the coach."
2	First questionnaire (Q_I)	
3	State anxiety test (ST-X_I)	
4	Motivation Survey (MS)	
5	Participants listen to the qualitative evaluations of the coach	
6	Second questionnaire (Q_{II})	

3.3.2.1 The first and second questionnaire

After leaving the MR scanner, the participants were asked to respond to two sets of survey questions (Q_I and Q_{II}) designed for this experiment in order to collect additional information about their thoughts and preferences. Some of the questions in these surveys demand free-format answers, while others are of multiple-choice type. (See Appendix G)

In order to assess retrospectively, how the participants felt while watching their dance videos, the Affect Valuation Index (AVI) has been adapted according to the conditions of the present experiment. Originally, AVI has been developed as a measure of the difference between ideal and actual affective states (Tsai, Knutson & Fung, 2006). In the present experiment, this measurement was made as part of Q_I by asking the participants to rate the applicability of 30 different affective descriptions on a scale of 1 to 5 to describe how they felt while watching their dance videos. These ratings were used to compute the scores of four different categories with the following valence and arousal combinations: low arousal positive score (LAP: calm,

relaxed, peaceful etc.), high arousal positive score (HAP: enthusiastic, excited, elated etc.), low arousal negative score (LAN: dull, sleepy, sluggish etc.) and high arousal negative score (HAN: fearful, hostile, nervous etc.). The Turkish version of the index was taken from Namer's PhD dissertation (Namer, 2014).

3.3.2.2 State-Trait Anxiety Inventory

State-Trait Anxiety Inventory (STAI) is a self-report based instrument, which is designed to assess levels of state anxiety and trait anxiety. The STAI includes separate tests for state and trait anxiety, twenty items each (see Appendix H and D, respectively). The Trait Anxiety Inventory ($ST\text{-}X_{II}$) measures the subject's predisposition to react with anxiety in stressful situations, while the State Anxiety Inventory ($ST\text{-}X_{I}$) measures a transient momentary emotional status related to situational stress. The Turkish version of the inventory used in this thesis was checked for consistency and reliability by Öner and LeCompte, and was found to have high item homogeneity and consistency (Öner & LeCompte, 1983).

The Trait Anxiety Inventory was given at the beginning of the experiment (section 3.2.2) was used in the formation of the control and experiment groups for counterbalancing the trait anxiety. The State Anxiety Inventory was given after the MRI session to be used for testing the hypothesis related to affective dynamics.

3.3.2.3 The Motivation Survey

In order to valuate the participants' goal orientation, those sections of the MSLQ questionnaire were applied, which are related to intrinsic and extrinsic motivation.

The Motivated Strategies for Learning Questionnaire (MSLQ) was designed as a self-report instrument in order to assess the motivational orientations of college

students, and their learning strategies in a college course. Normally, goal orientation refers to how a student perceives the reasons why s/he engages in a learning task. For MSLQ, goal orientation refers to the general goals of the student, and his/her orientation to the course (Pintrich et al., 1991).

While adopting the MSLQ to the present study, the expression "this course" was replaced by "participating in an activity". Moreover, the questions from the values section of MSLQ related to intrinsic and extrinsic motivation have been utilized to compose the test dubbed the Motivation Survey. In the manual of the original MSLQ, intrinsic goal orientation is defined as the measure of how much the student perceives him/herself as part of the task, the reasons for participation being challenge, curiosity, or mastery. The developers of this questionnaire note that, "having an intrinsic goal orientation towards an academic task indicates that the student's participation in the task is an end all to itself, rather than participation being a means to an end" (Pintrich et al., 1991).

When it comes to extrinsic goal orientation, it can be said to complement intrinsic goal orientation, as it refers again to the extent how much the student perceives him/herself participating in the task, but this time with reasons such as grades, rewards, performance, competition, and evaluation by others. Here, "when one is high in extrinsic goal orientation, engaging in a learning task is the means to an end" (Pintrich et al., 1991). In other words, students with high extrinsic goal orientation are mainly concerned with issues that are not directly related to the essence of the task (issues like grades, rewards, comparison to competitors).

In the questionnaire, where four items from the intrinsic motivation section, and three items from the extrinsic motivation section of MSLQ have been included, the participants were asked to rate the validity of the given assertions using a five

point Likert scale (1 “not true for me” - 5 “completely true for me”). The scores for intrinsic and extrinsic motivation are obtained separately. The motivation survey is given in Appendix I.

3.4 The pilot study

As part of the design process of the experiment, a pilot study was conducted with the aim of testing the applicability of the design ideas, and determine the necessary modifications and adjustments.

The participants of the pilot study were chosen among those who responded via e-mail or phone to the call for participation described in Section 3.2.1. Detailed information was given to them about the procedure they would go through, and their personal profiles were assessed (among other questions also a goal orientation test and a trait anxiety test were given).

The pilot study was conducted with 10 participants whose ages range between 20 and 31, with equal number of women and men. One of the participants decided not to complete the experiment because she did not want her dance performance to be recorded.

Only the first six steps of the experiment procedure (see Table 2) were applied in the pilot study, thus excluding the MRI scanning. Each participant had two personal meetings with the coach during the preparation of their dance compositions, and their final performances were video-recorded. Participants were given a self-report based survey (Pilot-Questionnaire I) before the recording. Next, the coach watched the recordings of the participants, and recorded her final comments. Finally, participants were assigned to experiment and control groups, which were counterbalanced according to age, gender, and trait anxiety test results. However,

because of one drop-out the number of remaining participants was odd, and thus the experiment and control groups could not be of equal size (experiment group: five, control group: four).

Instead of the MRI scanning part (seventh step in Table 2) of the main experiment, a modified procedure was applied as summarized in Table 7. All self-report based surveys used in the pilot study (Pilot-Questionnaire I, II, III and IV) have been developed for the specific task in this thesis, and are given in Appendix J.

Table 7. The Final Steps of the Pilot Study (replacing step 7 and 8 in the original experiment procedure given in Table 2)

Experiment Group	Control Group
Watching the dance video	
Pilot-Questionnaire II	
Announcement: "Soon you will hear the final evaluations of the coach, and finally your scores will be given."	Announcement: "Soon you will hear the final evaluations of the coach."
Pilot-Questionnaire III	
Listening to the qualitative evaluations of the coach	
Announcement: "Soon you will receive a score."	-
Pilot-Questionnaire IV	

3.4.1 Results of the pilot study

As the number of participants in the pilot study was small, no group analysis was conducted, but the responses of the individual participants were used to form a general opinion about the tendencies of control and experiment group members. Table 8 summarizes the results of the various surveys for each participant in the pilot study.

Table 8. Results of the Pilot Study

Participants	Con_1	Con_2	Con_3	Exp_1	Exp_2	Exp_3	Exp_4
Trait Anxiety	34	47	49	36	50	38	50
Goal Motivation	35	13	25	25	26	35	23
Intrinsic mot. (range: 4-20)	17	9	13	16	18	20	15
Extrinsic mot. (range: 3-15)	8	4	12	9	8	15	8
Self-evaluation: *pleasant *adequate *not so good	pleasant	pleasant	adequate	pleasant	not so good	adequate	pleasant
Announcement about imminent score delivery: differentiation between groups							
Would you like to share your video with the other partcp.s or on the social media?	yes	with partcp.s: yes; on the social media: no	does not matter	yes	no	yes	no
Would you like to get a score?	yes	yes	yes	no	yes	no	yes

The results in Table 8, as well as some statements of participants allow for several observations that might be relevant for the research question of this thesis:

i. The experiment group results exhibits a systematic inverse correlation between willingness to share one's dance recording with others and willingness to receive quantitative feedback (score) about one's performance: all participants who declared their unwillingness to show their dance videos to others have also stated that they would like to receive scores; and conversely, all participants who declared their willingness to show their videos to others, stated that they do not prefer to receive a score. Furthermore, the former had high Trait Anxiety scores, while the latter had low Trait Anxiety scores. The validity of this seemingly very strong correlation observed in a very small sample needs to be checked in the main experiment with a larger sample size.

ii. One of the experiment group members has retrospectively declared that she has not noticed or taken serious the announcement about the imminent delivery of a score. Due to the small group size (five) it is not possible to evaluate the statistical significance of this observation; nevertheless, it clearly constitutes an obstruction of the experiment condition. In face of this observation, it was decided to include in the main experiment the verification that experiment group members have noticed the announcement about an imminent score delivery, and have taken it serious.

iii. Some participants turned out not to have clearly understood from the announcement and briefing that they were supposed to compose/design their own dance performances. For example, three of the seven participants reported that they initially expected that they were going to learn and perform a choreography that would be taught by the coach, while some of them reported that they were expecting to be evaluated on basis of some pre-set external criteria. Five out of seven participants, even though they comprehended the task, reported that they still had some expectation of being evaluated or judged by the coach, yet their opinions changed after the first meeting with the coach. Some examples of their statements are given in Appendix K.

iv. All of the participants declared that they trusted the coach, and enjoyed working with her. All of them said that receiving feedback from the coach was beneficial and informative, and has enabled them to notice aspects that they could not notice by themselves. Most participants also said that the comments of the coach served as a mirror.

v. Some participants seemed to have the default expectation to be confronted with an environment that requires a performance-oriented attitude, yet the approach

of the coach has encouraged them to be more mastery-oriented with regard to this specific task within the realm of the experiment. Many participants expressed their surprise about and contentment with this approach of the coach. Nevertheless, participants with relatively high performance-orientation declared that they steadily had to remind themselves of the mastery-oriented nature of the experiment: “This time I performed my dance with higher awareness. I often reminded myself that ‘there is no test result associated with this, it is not a matter of right or wrong.”

3.5 Analysis methods

All measurements made in the main experiment are summarized in Table 9 in chronological order.

Table 9. Measurements in Chronological Order

Name	Explanation
$ST\text{-}X_{II}$	Trait anxiety test
Entering MR device	
S_{PRE}	First resting state MR scanning
Generation of a difference between control and experiment groups via announcement	
Watching the dance video	
S_{POST}	Second resting state MR scanning
Leaving the MR device	
Q_I	First questionnaire
$ST\text{-}X_I$	State anxiety test
MS	Motivation survey
Listening to the qualitative evaluations of the coach	
Q_{II}	Second questionnaire

The fMRI and survey based measurements have been analyzed separately.

3.5.1 Functional connectivity analysis of fMRI recordings

The analysis of the fMRI recordings was carried out under the supervision and with the help of the research team at the Hulusi Behçet Life Sciences Research Laboratory, Istanbul Faculty of Medicine, Istanbul University. Preprocessing and functional analyses of the functional images were performed with the SPM12 software package and CONN toolbox working under MATLAB. Firstly, to correct for head motion related artifacts, functional images were realigned to the first image and unwrapped. Additional processing was carried out with realigned functional images using the ART (artifact detection tools) toolbox to detect the outlier volumes on the basis of realignment parameters. T1-weighted anatomic images were registered to the mean functional image, then segmented into gray matter, white matter and cerebrospinal fluid, and were normalized to Montreal Neurological Institute (MNI152) standard template. Functional images were normalized to MNI 152 template, resampled to 2 mm^3 voxels and spatially smoothed with Gaussian kernel (full width half maximum = 8 mm).

Seed-based functional connectivity analysis was performed with CONN toolbox (Whitfield-Gabrieli and Nieto-Castanon, 2012). Firstly, functional data were band-pass filtered between (0.01 and 0.1 Hz) in order to remove noise. Additionally, signal from white matter, cerebrospinal fluid and head motion parameters were used as confounds. Seeds were selected from three different atlas files provided in CONN toolbox. Detailed information about the selected seeds and the related atlas files are given in the Appendix L. Selected seeds and the hypotheses associated with their selection are given in Table 10.

Table 10. Selected Seeds, Associated Neural Structures, their Functionalities and Related Hypotheses

Seeds	Associated Structure	Functionalities and related hypotheses
Medial prefrontal cortex (1, 55, -3)	Default Mode Network	attention - H_1^1 & social processing - H_1^3
Lateral parietal-left (LP-l) (-39, -77, 33)		
Lateral parietal-right (LP-r) (47, -67, 29)		
Posterior Cingulate Cortex (PCC) (1, -61, 38)		
Anterior Cingulate Cortex (0, 22, 35)	Cingulo-opercular Network	attention - H_1^1
Anterior Insula-left (-44, 13, 1)		
Anterior Insula-right (47, 14, 0)		
Rostral prefrontal cortex-left (-32, 45, 27)		
Rostral prefrontal cortex-right (32, 46, 27)		
Supramarginal gyrus-left (-60, -39, 31)		
Supramarginal gyrus-right (62, -35, 32)		
Supramarginal Gyrus, posterior division-right	Temporo-parietal Junction (TPJ)	social processing - H_1^3
Supramarginal Gyrus, posterior division-left		
Angular Gyrus-right		
Angular Gyrus-left		
Superior Temporal Gyrus, posterior division-right		
Superior Temporal Gyrus, posterior division-left		
Middle Temporal Gyrus, temporo-occipital part-right		
Middle Temporal Gyrus, temporo-occipital part-left		
Amygdala-right	Amygdalae	emotional processing - H_1^2
Amygdala-left		
Accumbens-right	Nuclei accumbens	
Accumbens-left		
BA.24-l, Ventral Anterior Cingulate Cortex	ventralACC	emotional processing - H_1^3 & social processing - H_1^2
BA.24-r, Ventral Anterior Cingulate Cortex		
BA.32-l, Dorsal Anterior Cingulate Cortex	dorsalACC	
BA.32-r, Dorsal Anterior Cingulate Cortex		

Seed-to-voxel functional connectivity analysis was performed for all selected seeds. The functional connectivity maps were created for each participant's each recording, representing their correlation coefficients of the connectivity maps in terms of Z scores obtained via Fisher transformation.

The cluster forming threshold (upper bound of the probability that a cluster of voxels connected to a given seed is formed "by chance") was chosen as 0.001 and the family-wise error corrected (FWE-corrected) threshold for cluster level analysis was chosen as 0.05. After the application of the Bon-Ferroni correction (i.e. division by the number of seeds) the new threshold was obtained as 0.05/27 = 0.001852.

In order to explain the statistical analyses, let us introduce the following symbolic notations:

R_{PRE} : Representation of the pre-announcement connectivity map of a participant.

R_{POST} : Representation of the post-announcement connectivity map of a participant.

$\{R_{PRE}\}_E$: Set of R_{PRE} of all participants within the experiment group

$\{R_{POST}\}_E$: Set of R_{POST} of all participants within the experiment group

$\{R_{PRE}\}_C$: Set of R_{PRE} of all participants within the control group

$\{R_{POST}\}_C$: Set of R_{POST} of all participants within the control group

ΔR : Difference between R_{POST} and R_{PRE} of a participant

$\{\Delta R\}_E$: Set of ΔR of all participants within the experiment group

$\{\Delta R\}_C$: Set of ΔR of all participants within the control group

In this experiment, the aim was to assess whether the presence of score expectancy generates a significant alteration in the functional connectivity of some relevant seeds. For this purpose, both between-group and within-group analyses were conducted. In the between-group analysis, the comparison was conducted between $\{\Delta R\}_E$ and $\{\Delta R\}_C$ rather than between $\{R_{POST}\}_E$ and $\{R_{POST}\}_C$, in order to have a stronger statistical analysis that is more robust against the effects of uncontrolled variables such as the emotional valence of the chosen piece of music, its significance for the individual etc.. In the within-group analyses,$\{R_{PRE}\}_E$ & $\{R_{POST}\}_E$, and $\{R_{PRE}\}_C$ & $\{R_{POST}\}_C$ were compared separately.

3.5.2 Analysis of surveys

The analysis of the surveys was conducted for each test (e.g. goal orientation, or state anxiety) independently. All statistical testing was made using IBM SPSS Statistics.

3.5.2.1 Analysis of the State Anxiety Test

The State Anxiety Test results were obtained as a weighted sum of the answers to the different items. Each of the 20 items were scored between one and four, such that the overall test score varies between 20 and 80. In the analysis, state anxiety test score was calculated for each participant, applying the procedure described in the State-Trait Anxiety manual (Öner & Le Compte, 1983). The control and experiment groups were compared in terms of the overall state anxiety scores using independent t-test via IBM SPSS Statistics. According to the hypotheses of this study, the mean state anxiety score of the experiment group was expected to be higher than that of the control group.

3.5.2.2 Analysis of the Motivation Survey

The Motivation Survey scores were obtained as a weighted sum of the answers to the different items. For each participant, the intrinsic and extrinsic motivation scores were calculated separately. The control and experiment groups were compared in terms of these two scores using independent t-test via IBM SPSS Statistics.

3.5.2.3 Analysis of the questionnaires

The answers to free-format or multiple-choice type of questions in the first and second questionnaires were used to trace the participants' comments, thoughts, and emotional states. They are not suitable for numerical analysis, but can be used as a

source of information for more differentiated analysis in future studies.

For the analysis of the Affect Valuation Index, composite scores were generated for the four main categories, using each participant's numeric response (one to five) for the emotions in the test. The score between one and five was calculated for each category (HAP, LAP, HAN, LAN) as a weighted average of the ratings given to the related expression. The control and experiment groups were compared in terms of the composite scores of the four categories using independent t-test via IBM SPSS Statistics.

CHAPTER 4

ANALYSIS RESULTS

In this thesis, data obtained by different methods are analyzed separately. The results of these analyses are reported below.

4.1 Results of the seed-based connectivity analyses

Seed-based functional connectivity analyses of the fMRI scans were conducted in the form of between-group and within-group comparisons.

4.1.1 Between-group analysis

Between-group analysis consists of the comparison of $\{\Delta R\}_E$ and $\{\Delta R\}_C$, the post-pre differences of the connectivity maps representations of the experiment and control group members, respectively (see 3.5.1). A statistically significant difference between the control and experiment groups was found in the functional connectivity of the Right Middle Superior Frontal Cortex (MSFC-r) which is one of the cortical hubs of the cingulo-opercular network (referred to as the right rostral prefrontal cortex in the CONN atlas) to a 753 voxel-sized cluster belonging to the Intracalcarine Cortex in the experiment group as compared to control group (Table 11, Fig. 2). More specifically, for this seed the mean of $\{\Delta R\}_E$ turned out to be positive, and that of $\{\Delta R\}_C$ negative (Fig. 3). This finding indicates that receiving the announcement about the imminent delivery of scores and watching the dance video was succeeded by an increased connectivity between the cingulo-opercular network and occipital areas, whereas just watching the dance video was succeeded by a decrease in the connectivity of the same regions.

Table 11. Results of the Statistical Comparison of $\{\Delta R\}_E$ and $\{\Delta R\}_C$

Seed / Related Neural Structure	Connected Areas			P value (FWE-corrected)
	Voxel size	Peak coordinate	Labels	
Middle Superior Frontal Cortex – right (CONN label: RPFC-r) / Cingulo-opercular Network	753	(8, -76, 26)	131 voxels covering 20% of Intracalcarine Cortex Left	< 0.0001
			120 voxels covering 16% of Intracalcarine Cortex Right	

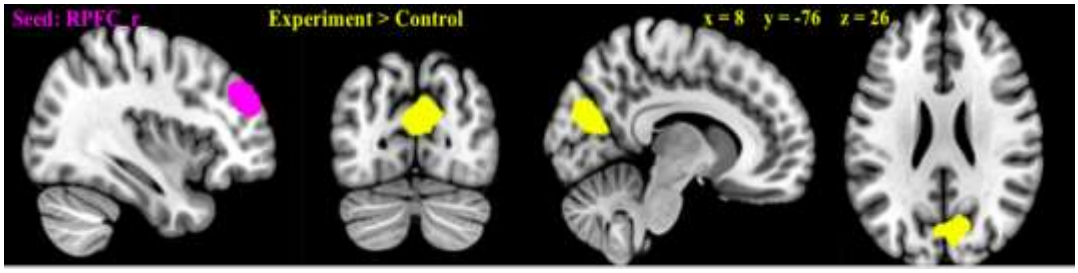


Figure 2. Results of between-group comparison: the seed at the right middle superior frontal cortex and connected areas

Figure 2 shows the seed at the right middle superior frontal cortex (magenta) and the connected areas (yellow) where a statistically significant difference is observed between the control and experiment groups in terms of ΔRs. ($t(16) = 5.30$, $p = 0.000004$).

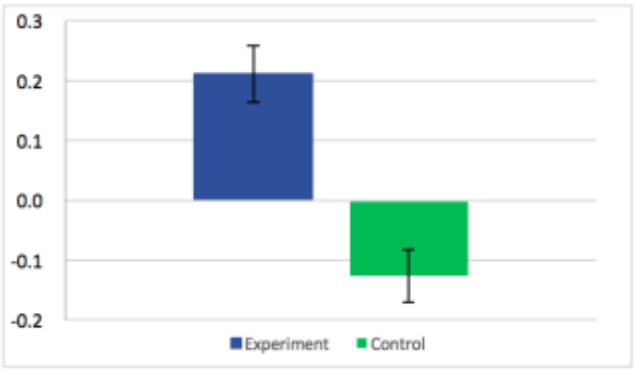


Figure 3. Group mean of ΔRs for the experiment and control groups corresponding to the areas given in Table 11

4.1.2 Within-group analyses

In the within-group analysis of the control group results, where $\{R_{PRE}\}_C$ and $\{R_{POST}\}_C$ have been compared, no significant change was observed.

On the other hand, in the within-group analysis of the experiment group results, the comparison of $\{R_{PRE}\}_E$ and $\{R_{POST}\}_E$ revealed an increase in the functional connectivity for six different seeds summarized in Table 12. The connected regions with the different seeds are depicted in Figures 4 to 10.

Table 12. Results of the Statistical Comparison of $\{R_{PRE}\}_E$ and $\{R_{POST}\}_E$

Seed / Related Neural Structure	Connected Areas				P value (FWE-corrected)
	Peak coordinate	Vox. size	Vox. size	Label	
Middle Superior Frontal Cortex – right (CONN label: RPFC-r) / Cingulo-opercular Network	(10, -78, 8)	1814	457	26% of Lingual Gyrus-r	< 0.0001
			235	16% of Lingual Gyrus-l	
			193	7% of Occipital Pole-l	
			150	23% of Cuneal Cortex-r	
			131	20% of Intracalcarine Cortex-l	
			120	16% of Intracalcarine Cortex-r	
Left Supramarginal Gyrus / Cingulo-opercular Network	(8, -76, -8)	475	408	24% of Lingual Gyrus-r	< 0.0001
			37	2% of Lingual Gyrus-l	
Supramarginal Gyrus, posterior division Right (pSMG-r) / TPJ	(0, -34, 66)	298	175	4% of Precentral Gyrus-r	0.0003
			34	1% of Precentral Gyrus-l	
			27	1% of Postcentral Gyrus-r	
Supramarginal Gyrus, posterior division Left (pSMG-l) / TPJ	(-10, -6, 72)	341	99	2% of Precentral Gyrus-l	< 0.0001
			78	12% of Juxtapositional Lobule Cortex-l	
			60	2% of Superior Frontal Gyrus-l	
			47	7% of Juxtapositional Lobule Cortex-r	
Supramarginal Gyrus, posterior division Left (pSMG-l) / TPJ	(-66, -38, 8)	228	82	21% of Superior Temporal Gyrus, posterior division-l	0.0009
			33	3% of Supramarginal Gyrus, posterior division-l	
			22	2% of Middle Temporal Gyrus, posterior division-l	
Angular Gyrus Left (AG-l) /TPJ	(-34, 30, 4)	384	90	25% of Frontal Operculum Cortex-l	< 0.0001
			42	3% of Thalamus l	
			42	Putamen l	
			26	Caudate l	
			20	Pallidum l	
Middle Temporal Gyrus, temporo-occipital part Right (toMTG-r) / TPJ	(0, -80, 0)	618	150	10% of Lingual Gyrus-l	< 0.0001
			104	16% of Intracalcarine Cortex-l	
			98	13% of Intracalcarine Cortex-r	
			70	49% of Supracalcarine Cortex-r	
			43	2% of Lingual Gyrus-r	

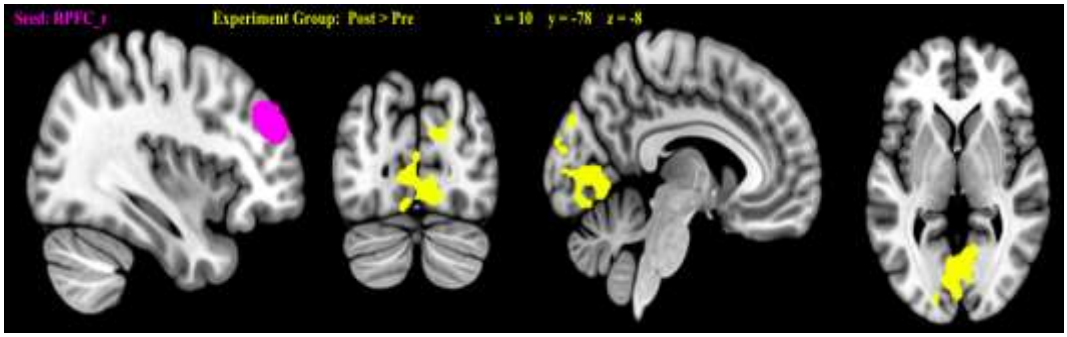


Figure 4. Results of within-group comparison: the seed at the right middle superior frontal cortex and connected areas

Figure 4 shows the seed at the right middle superior frontal cortex (magenta) and connected areas (yellow) where a statistically significant difference is observed in terms of R_{POST} and R_{PRE} in the experiment group ($t(16) = 7.96$, $p < 0.0001$).

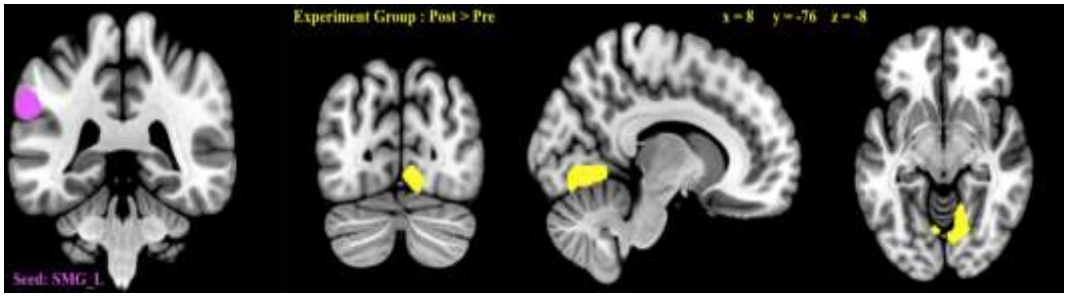


Figure 5. Results of within-group comparison: the seed at the left supra marginal gyrus and connected areas

Figure 5 shows the seed at the left supra marginal gyrus (magenta) and connected areas (yellow) where a statistically significant difference is observed in terms of R_{POST} and R_{PRE} in the experiment group ($t(16) = 6.84$, $p < 0.0001$).

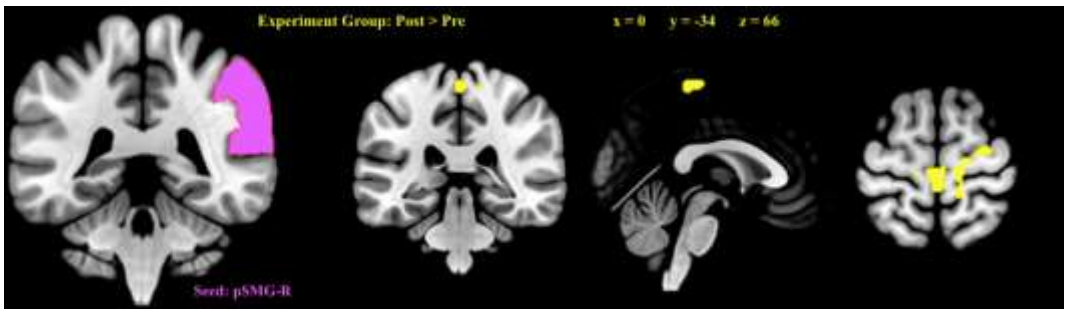


Figure 6. Results of within-group comparison: the right posterior supra marginal gyrus and connected areas

Figure 6 shows the seed at the right posterior supra marginal gyrus (magenta)

and connected areas (yellow) where a statistically significant difference is observed in terms of R_{POST} and R_{PRE} in the experiment group ($t(16) = 8.16$, $p = 0.0003$).

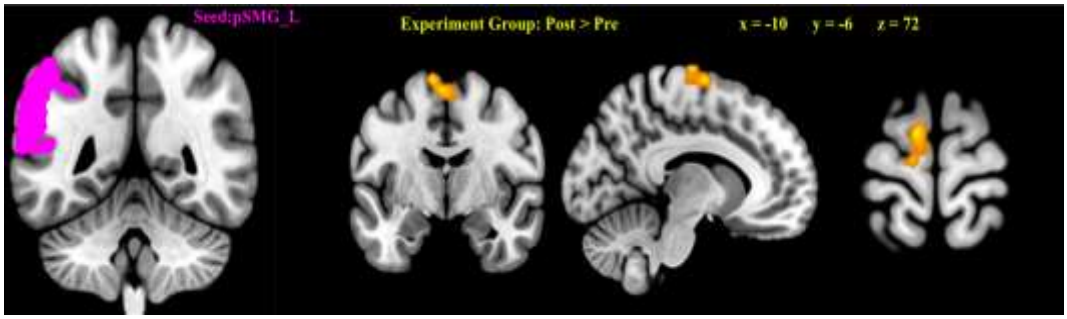


Figure 7. Results of within-group comparison: the seed at the left posterior supra marginal gyrus and connected areas

Figure 7 shows the seed at the left posterior supra marginal gyrus (magenta) and connected areas (yellow) where a statistically significant difference is observed in terms of R_{POST} and R_{PRE} in the experiment group ($t(16) = 9.80$, $p < 0.0001$).

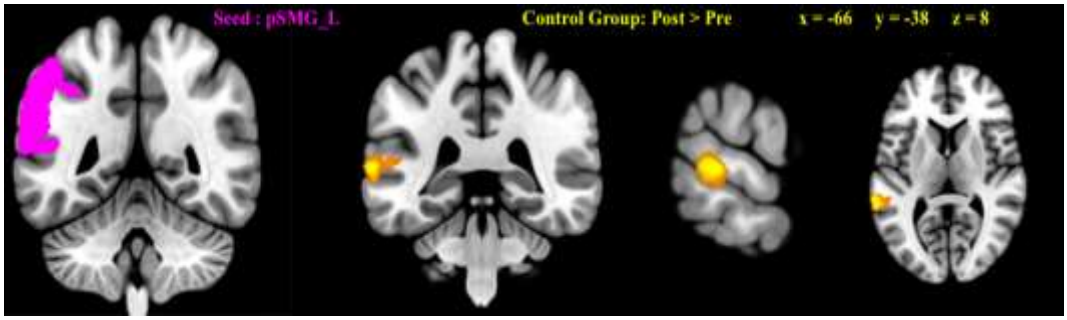


Figure 8. Results of within-group comparison: the seed at the left posterior supra marginal gyrus and connected areas (second cluster)

Figure 8 shows the seed at the left posterior supra marginal gyrus (magenta) and connected areas (yellow) where a statistically significant difference is observed in terms of R_{POST} and R_{PRE} in the experiment group ($t(16) = 19.30$, $p = 0.0009$).

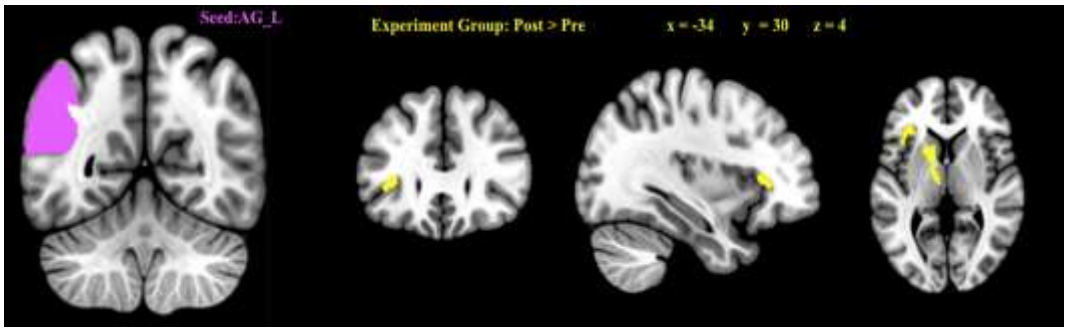


Figure 9. Results of within-group comparison: the seed at the left angular gyrus and connected areas

Figure 9 shows the seed at the left angular gyrus (magenta) and connected areas (yellow) where a statistically significant difference is observed in terms of R_{POST} and R_{PRE} in the experiment group ($t(16) = 9.14$, $p < 0.0001$).

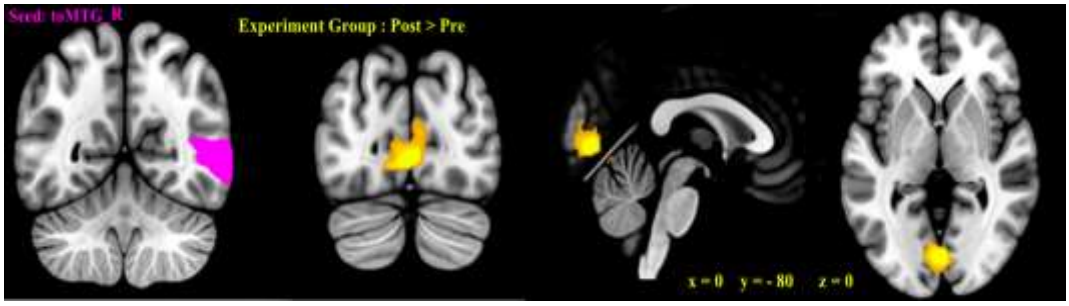


Figure 10. Results of within-group comparison: the right temporpoccipital parts of middle temporal gyrus and connected areas

Figure 10 shows the seed at the right temporpoccipital parts of middle temporal gyrus (magenta) and connected areas (yellow) where a statistically significant difference is observed in terms of R_{POST} and R_{PRE} in the experiment group ($t(16) = 14.73$, $p < 0.0001$).

4.2 Results of survey analyses

The analysis of self-report based surveys was conducted via SPSS. The results presented in Table 13 and summarized in Figure 11 exhibit no statistically significant difference between the control and experiment groups. Nevertheless, a statistically insignificant difference exists between the means of the control and experiment groups in terms all test items in the direction suggested by the research hypotheses in this thesis. In any case, the sample size (control: eight, experiment: ten) is insufficient especially for this type of assessment methods.

Table 13. Analysis Results of Self-Report Based Surveys

Survey Component		Group Statistics				t-test for equality of means	
		Group	Mean	Std. Dev.	Std. Error	Significance (2-tailed)	Exp. mean - Con. mean
State Anxiety Test		Exp.	34.9	9.25	2.92	.091	7.27
		Con.	27.63	7.52	2.65		
Motivation Survey	Intrinsic Goal Orientation	Exp.	16.2	2.7	.854	.582	-.67
		Con.	16.88	2.29	.811		
	Extrinsic Goal Orientation	Exp.	8.7	2.94	.932	.666	.70
		Con.	8	3.81	1.350		
Affect Valuation	High Arousal Positive	Exp.	3.28	.84	.26	.037	-.87
		Con.	4.15	.74	.26		
	High Arousal Negative	Exp.	1.45	.87	.27	.256	.37
		Con.	1.07	.21	.07		
	Low Arousal Positive	Exp.	2.54	.83	.26	.046	-.83
		Con.	3.37	.78	.27		
	Low Arousal Negative	Exp.	1.7	.82	.26	.375	.35
		Con.	1.4	.78	.27		

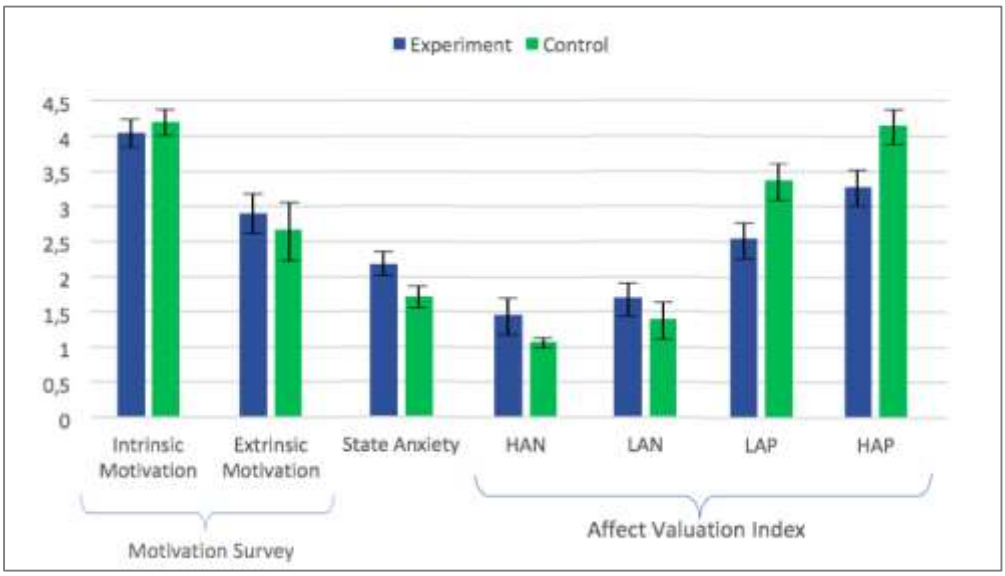


Figure 11. Statistical comparison of the group means obtained from self-report based surveys: Motivation Survey (Intrinsic and Extrinsic Motivation), State Anxiety Test, and four subcategories of Affect Valuation Index (HAP: high arousal positive, HAN: high arousal negative, LAN: low arousal negative, LAP: low arousal positive)). All results are given on basis of 5.

The strong correlation between subjects with high trait anxiety and wish to receive score-based performance evaluation observed in the pilot study was not present in the main experiment.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

In this thesis, the research hypotheses have been tested on the basis of data obtained from fMRI scans and self-report based surveys. Data obtained via different methodologies have been separately analyzed. Below, these analysis results are discussed, and some conclusions are drawn from the findings.

5.1 Discussion of the fMRI results

As described in detail in Section 3.6.1, two analyses have been carried out on the functional connectivity maps of the participants:

5.1.1 Discussion of the between-group analysis results

The outcomes of the between-group analysis demonstrate the presence of a statistically significant difference between the experiment and control group in relation to the middle superior frontal cortex - right (MSFC-r). More specifically, the results indicate that in the experiment group the average connectivity of MSFC-r to some visual processing areas (right cuneal cortex and right intracalcerin cortex) has increased between the two fMRI scans, whereas in the control group it has decreased. It should be noted that the participants watched their dance videos between the two fMRI scans, where those in the control group did so with the expectancy of receiving some qualitative evaluations after leaving the scanner, and those in the experiment group did so with the additional expectation of receiving scores (i.e. quantitative feedback). Keeping in mind that MSFC is one of the cortical hubs of the cingulo-opercular network, which is associated with top-down attentional

control, and more specifically with the intrinsic maintenance of tonic alertness, the above finding can be interpreted as follows: the presence of score expectancy while watching the performance video puts the subjects into a state of alertness, which is then captured in the subsequent resting state fMRI recording. In case of the absence of score expectancy, having watched the video with the expectation of only qualitative evaluation seems to have had an effect of reducing the alertness. This asymmetry between the expectancy of qualitative and quantitative feedback supports the general research idea that the form of the feedback may make a difference independent of the content that is fed back.

It is not surprising that in his finding the brain regions, to which MSFC is connected, include some areas associated with visual processing because at that stage of the experiment all communication is conducted via a visual interface, which the participants are requested to fixate during the MR recordings.

On the other hand, the above interpretation would not change much if we would adopt the bottom up approach of attention and designate the associated network as the salience network. According to that approach one can say that quantitative type of feedback is perceived as more salient than qualitative feedback, i.e. it demands more attention.

In any case, this finding related to a modification of the connectivity of MSFC not only supports the hypothesis that the expectancy of quantitative feedback delivery may induce some alteration in the subject's attention (H_1^1, Table 1), but also indicates the direction of this change.

5.1.2 Discussion of the within-group analysis results

No significant connectivity difference was found in the statistical comparison of the

first and second fMRI scans within the control group, whereas the same comparison conducted within the experiment group revealed a significant connectivity difference of various hubs of the cingulo-opercular network, as well as of the middle superior frontal cortex - right (MSFC-r) and left supramarginal gyrus (SMG-l) to a larger range of occipital/visual areas (Table 11) than found in the between group analysis. Noting that within the control group the conditions differ between the two fMRI scans only in terms of having watched the dance video, the lack of a significant connectivity difference between the two scans at the regions of interest allows the conclusion that watching one's performance video does not generate any significant change in the connectivity of the considered brain regions. This conclusion, when applied to the experiment group findings, allows us to attribute the connectivity change observed in the experiment group to the presence of score expectancy, rather than to the effect of having watched the performance video. As a matter of fact, it is likely that receiving the information that soon a performance score will be delivered alters the participant's experience of watching the video.

The brain regions associated with statistically significant connectivity changes in the experiment group can be used to gain further information about the effects of score expectancy: these findings, when compared with those from between-group analysis, indicate (i) a larger cluster of visual areas connected to one of the seeds (MSFC-r) in the cingulo-opercular network, (ii) one additional seed (SMG-l) in the cingulo-opercular network connected to visual areas, and (iii) some seeds in the TPJ with statistically significant connectivity increase to some areas associated with visual and somato-motor processing, after the generation of score expectancy. The first two findings can be viewed as a consolidation of the between-group analysis, while the third finding related to the TPJ provides some new

information. Noting the generally accepted involvement of TPJ in other-related social processing such as mentalizing, this finding can be considered as a support to our hypothesis that expectancy of quantitative feedback may induce some significant alteration in the subject's perception of the social environment (H_1^3, Table 1). The increased connectivity of seeds in TPJ to some somatomotor regions can be explained in relation to the subjects' having watched their dance videos very recently, such that they are likely to be still imagining some motion.

5.2 Discussion of the self-report based survey results

Although the experiment and control group differences obtained from the State Anxiety Test and the Affect Valuation Index were not statistically significant, the group averages of all measurement components (Figure 11) exhibit a consistent trend that can be summarized as follows: participants, who have watched their performance videos with the expectancy of imminent score delivery, reported having experienced more negative and less positive emotions while watching their dance videos as compared to those who watched their videos with the expectancy of qualitative feedback delivery only. Similarly, on average, experiment group reported higher anxiety levels than the control group after leaving the MR device, i.e. when they were expecting the feedback delivery. In other words, the differences between the experiment and control group averages obtained for all numeric survey components were in the direction in accordance with the theoretical expectations.

These statistically insignificant but consistent differences between the experiment and control groups obtained from a rather small sample (a total of 18 participants, too small for this type of survey) cannot be used for validating the hypothesis related to the affective effects (H_1^2, Table 1), but serves as a preliminary

clue that encourages the conduction of the experiment with a larger sample.

5.3 Limitations and needs for improvement

In this thesis, one of the research hypotheses was that score expectancy alters subject's affective dynamics (H_1^2, Table 1). However, the fact that the pieces of music chosen by the participants, as well as their dance compositions involved very personal and diverse emotions, makes it very difficult to isolate the effects of the manipulation (announcement of imminent delivery of quantitative feedback) on the connectivity of areas related to emotional processing. So, we conclude that this experiment design is not suitable for testing hypothesis H_1^2 based-on fMRI analysis.

Beside possible improvements in the experiment design, the present data set has still a high potential for further analysis. Particularly creation of subgroups according to personal traits conducting a joint statistical analysis of all numerical components of self-report based surveys.

As stated before, the major shortcoming of this study is the rather small sample size, which makes the usage of statistical methods in self-report based surveys difficult.

5.4 Challenges

The aim of this thesis is to investigate whether the type of performance feedback, in the sense of being presented in a qualitative or quantitative manner, generates any cognitive difference in the receiver of feedback. However, there exist some inherent challenges involved in an experimental investigation of this question.

First of all, delivery of feedback to a human performer arouses dynamics at different time scales and with different scopes, usually investigated separately by different disciplines including neurology, psychology, sociology, educational

science, just to name a few. The long-term and macro-scale effects of quantitative feedback delivery detected and reported by behavioral, educational or social sciences correspond to the cumulative effects of routine and repeated feedback delivery conditions. What is considered in this thesis is, however, not even the effect of a single iteration of feedback delivery, but the effect of only the expectancy of a certain type of feedback. So, an important challenge involved in the present experiment was the difficulty of detecting a possibly rather minor difference generated at the preliminary stage of a single iteration.

Moreover, this small difference due to quantitative feedback expectancy was generated during a very short time interval (at the scale of few minutes) –relative to the duration of the initial stages of the experiment (at the scale of several weeks)-, such that it was not certain whether the generated difference would be detectable.

5.5 Conclusion

The contribution of this thesis includes the design and conduction of an experiment that can assess the short-term neural and emotional changes induced by quantitative feedback expectancy. On the basis of the outcomes of this experiment, we can conclude that expectancy of quantitative feedback –as opposed to qualitative feedback- generates alertness in the subject, and induces pre-occupation with the mental states of others. Thus, the mere type of feedback (qualitative or quantitative), even prior to its delivery (which would have given information about the performance), creates a change in the subject's cognition and possibly creates a "prejudice" about the evaluation system, the evaluator and the social context.

The above conclusion about the effects of quantitative feedback expectancy is of course applicable only to subjects who already have a representation of the social

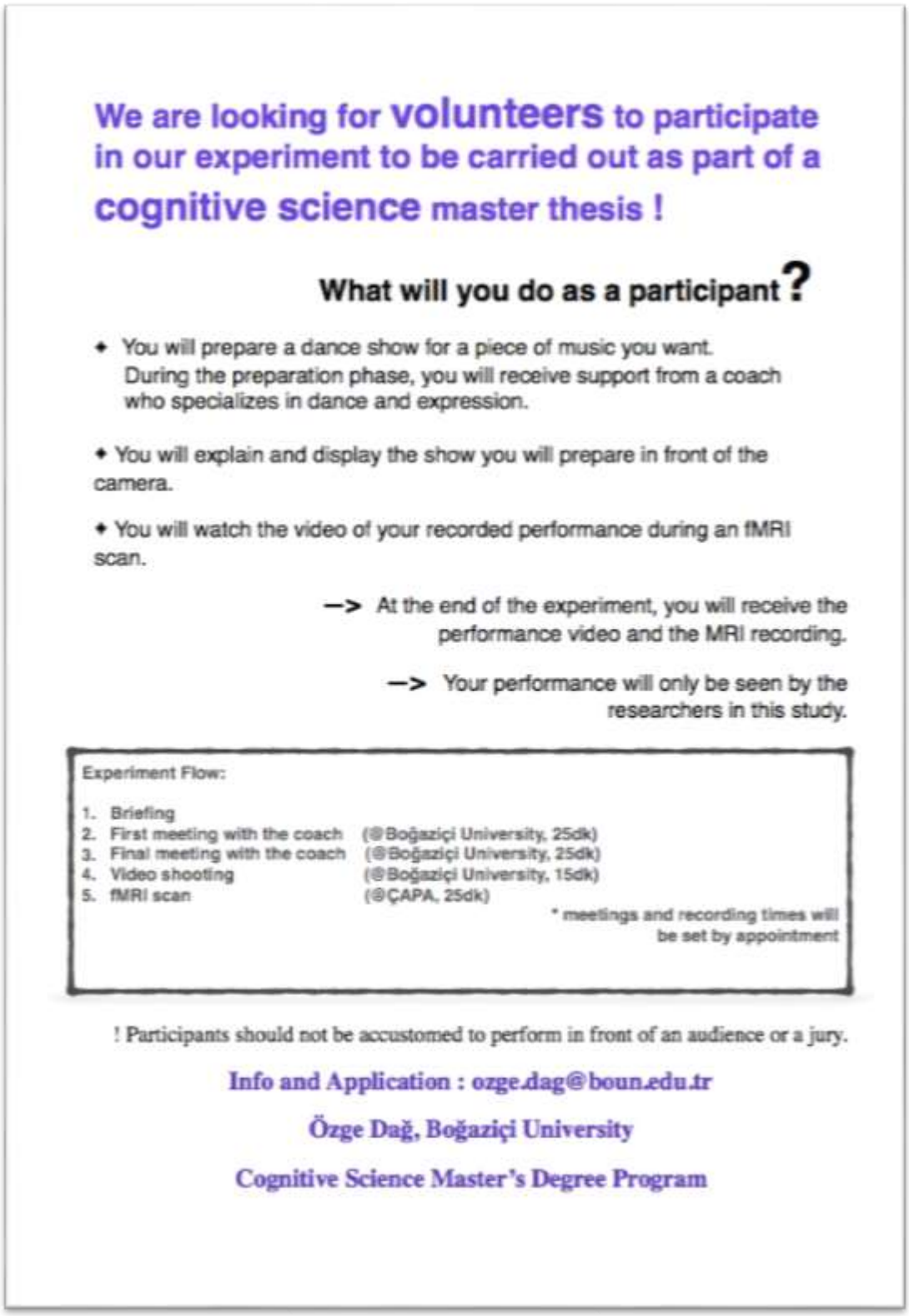
context as one where score-based incentivizing prevails. Such a representation is the cumulative result of a life-long learning process that involves widespread and repeated exposure to quantitative feedback delivery.

The relatively small and incremental difference generated by quantitative feedback expectancy on the subject's attention can be regarded as a low-level cognitive factor that can create a bias in resource allocation during later performances in favor of those aspects of the performance that are measured and fed back quantitatively. Such a bias in resource allocation is extensively reported in the literature on social consequences of metric-based performance evaluation (Section 2.1). Moreover, the finding related to mentalizing in subjects with quantitative feedback expectancy indicates that quantitative type of feedback induces engagement with the representation of the social context, which was not observed in subjects with qualitative feedback expectancy, alone.

These results suggest that human subjects tend to extract from the formal features of the delivered feedback information about the environment. What makes feedback in human systems different that the technological ones, is perhaps exactly this tendency and ability of human beings to extract from the various aspects of feedback, additional information other than the mere information about performance quality. Therefore, when designing systems for improving human performance utilizing the principle of "learning from the errors", this tendency and ability should be taken into account, if we want to avoid "treatments that are worse than the disease".

APPENDIX A

THE CALL FOR PARTICIPANTS



We are looking for volunteers to participate in our experiment to be carried out as part of a cognitive science master thesis !

What will you do as a participant?

- You will prepare a dance show for a piece of music you want. During the preparation phase, you will receive support from a coach who specializes in dance and expression.
- You will explain and display the show you will prepare in front of the camera.
- You will watch the video of your recorded performance during an fMRI scan.

—> At the end of the experiment, you will receive the performance video and the MRI recording.

—> Your performance will only be seen by the researchers in this study.

Experiment Flow:

1. Briefing
2. First meeting with the coach (@Boğaziçi University, 25dk)
3. Final meeting with the coach (@Boğaziçi University, 25dk)
4. Video shooting (@Boğaziçi University, 15dk)
5. fMRI scan (@ÇAPA, 25dk)

* meetings and recording times will be set by appointment

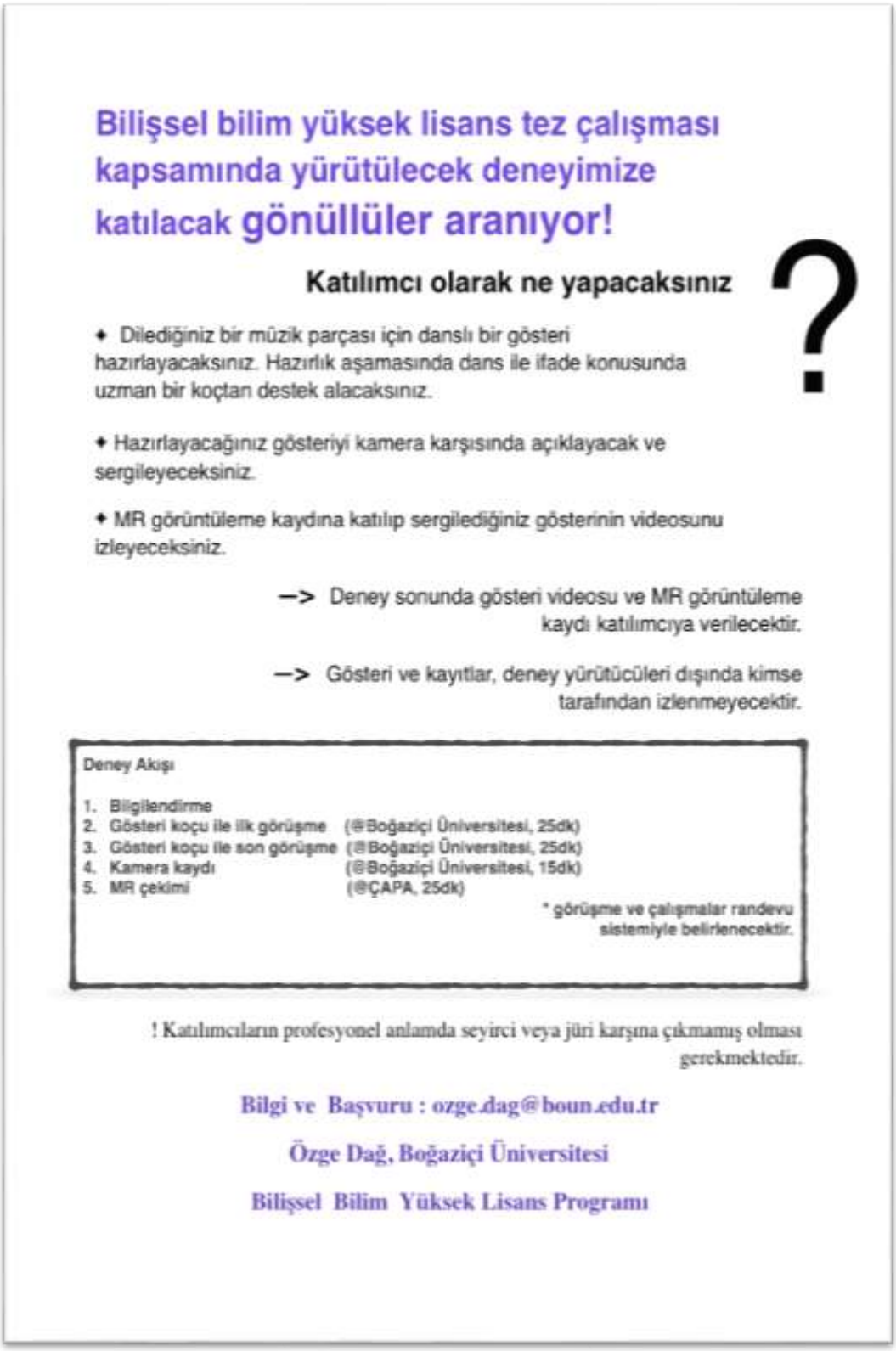
! Participants should not be accustomed to perform in front of an audience or a jury.

Info and Application : ozge.dag@boun.edu.tr

Özge Dağ, Boğaziçi University

Cognitive Science Master's Degree Program

THE CALL FOR PARTICIPANTS (TURKISH)



Bilişsel bilim yüksek lisans tez çalışması kapsamında yürütülecek deneyimize katılacak gönüllüler aranıyor!

Katılımcı olarak ne yapacaksınız ?

- Dilediğiniz bir müzik parçası için danslı bir gösteri hazırlayacaksınız. Hazırlık aşamasında dans ile ifade konusunda uzman bir koçtan destek alacaksınız.
- Hazırlayacağınız gösteriyi kamera karşısında açıklayacak ve sergileyeceksiniz.
- MR görüntüleme kaydına katılıp sergilediğiniz gösterinin videosunu izleyeceksiniz.

—> Deney sonunda gösteri videosu ve MR görüntüleme kaydı katılımcıya verilecektir.

—> Gösteri ve kayıtlar, deney yürütücüleri dışında kimse tarafından izlenmeyecektir.

Deney Akışı

1. Bilgilendirme
2. Gösteri koçu ile ilk görüşme (@Boğaziçi Üniversitesi, 25dk)
3. Gösteri koçu ile son görüşme (@Boğaziçi Üniversitesi, 25dk)
4. Kamera kaydı (@Boğaziçi Üniversitesi, 15dk)
5. MR çekimi (@ÇAPA, 25dk)

* görüşme ve çalışmalar randevu sistemiyle belirlenecektir.

! Katılımcıların profesyonel anlamda seyirci veya jüri karşına çıkmamış olması gerekmektedir.

Bilgi ve Başvuru : ozge.dag@boun.edu.tr

Özge Dağ, Boğaziçi Üniversitesi

Bilişsel Bilim Yüksek Lisans Programı

APPENDIX B

MRI SCAN BRIEFING FORM (TURKISH)

Hulusi Behçet Yaşam Bilimleri Araştırma Laboratuarı

PROTOKOL NO :
ETİK KURUL NO :
DOĞUM TARİHİ :
HASTA ADI SOYADI :
YER :
TARİH :

MRG İNCELEMESİ

MRG incelemesi öncesinde size birtakım sorular sorulacaktır. MRG cihazındaki kuvvetli manyetik alan, vücudunuzun içindeki veya üzerindeki herhangi bir metalde yanmaya, yerinden oynamaya ya da elektrik akımına neden olabilir. **UYARI: Vücudunuzun içinde ya da üzerinde metal bir obje varsa bu sizin için ÇOK TEHLİKELİ olabilir!** Lütfen bu formu dikkatlice ve doğru bir biçimde doldurunuz. Lütfen size uygun olan yanıtı (Evet veya Hayır) yuvarlak içine alınız.

	Evet	Hayır
1. Vücudunuzda metal ya da metal içermesi olası objeler var mı? Varsa aşağıdaki kutucukları işaretleyin ve ayrıntısını verin.		
[ ] Anevrizma klipsi [ ] Kardiak pacemaker (kalp pili) [ ] İmplante kardiyoverter defibrilatör (şok cihazı) [ ] Elektronik implant ya da cihaz [ ] Manyetik stent, filtre ya da bobin [ ] Nörostimulatör, derin beyin stimülatörü [ ] Omur ilik stimülatörü [ ] İnternal elektrod ya da teller [ ] Kemik büyüme /kemik füzyon stimülatörü [ ] Koklear, otolojik ya da diğer kulak implantları [ ] İnsülin ya da diğer infuzyon pompaları [ ] İmplante ilaç infüzyon cihazı [ ] Herhangi bir çeşit protez (göz, penil, vb.) [ ] Kalp kapakçığı protezleri [ ] Yapay ya da prostetik uzuv [ ] Programlanabilir / [ ] programlanamayan şant [ ] Civa uçlu beslenme sondası	[ ] Radyasyon tohumları ya da implantları [ ] Medikasyon yamaları (patch) [ ] Herhangi bir metalik parça ya da yabancı cisim [ ] Meme dokusu ekspanderi (balon, genişletici) [ ] Cerrahi zımbalar, klipsler [ ] Kemik ya da eklemlerde pim, vida, çivi, tel, plak [ ] Rahim içi cihaz, vajinal diyafram ya da vajinal pesari [ ] Takma dişler, kısmi damak ya da diş teli [ ] Kalıcı makyaj ya da göz kalemi (eyeliner) [ ] Vücut piercing takısı [ ] Göz kapağı yayı ya da teli [ ] Sıcaklık probu [ ] İşitme cihazı (girişten önce çıkartınız)		
2. Daha önce gözünüzden metal bir obje ya da parçayla yaralandınız mı?	Evet	Hayır
3. Metal bir obje ya da yabancı bir cisimle yaralandığınız oldu mu (örneğin; saçma, mermi, şarapnel) ?	Evet	Hayır
4. Daha önce herhangi bir ameliyat olduysanız aşağıya yazınız. _____ Tarihi _____ Boy_____ Kilo_____		
KADINLAR İÇİN: Gebe olma olasılığınız var mı? _____ Evet Hayır Emzirme döneminde misiniz? _____ Evet Hayır	Evet	Hayır

MRG taraması ile ilgili sıkça sorulan sorular formunu okuyup anladığınızı onaylıyorsanız lütfen aşağıya imzanızı atınız. Herhangi başka bir sorunuz olursa hekimimize danışabilirsiniz.

	DUR	DEVAM
Formu dolduran kişinin adı soyadı, imzası :		
Hastanın/ebeveynin/vekilinin imzası :	Sorumlu kişi ile görüş	Protokole göre devam et
MRG çekimini yapan kişinin adı soyadı, imzası :		
Araştırmacının adı soyadı, imzası :		
Tarih ve Saat : _____		

APPENDIX C

INFORMED CONSENT FORM

Research institution: Boğaziçi University
Title of the research: An MRI-supported research on the dependence of artistic expression on the type of feedback.
Project Manager: Yağmur Denizhan
E-mail address: denizhan@gmail.com
Phone: 0 212 3596850
Name of the researcher: Özge Dağ
E-mail address: ozge.dag@boun.edu.tr
Phone: 0 530 6902086

Dear Participant,

This research, which is carried out within the scope of a Boğaziçi University Cognitive Science Master's Thesis, is aimed at investigating psychological and neural influences related to feedback.

If you agree to participate in the research, you will be expected to participate in the dance show preparation process that will be supported by an expert coach, and then come to the MRI recording.

The show to be prepared will be for a 1.5-2 minute part of a song you will determine. During the preparation process, you will meet with your coach twice to work on your demonstration draft. After a period of 3-7 days after the second meeting, you will meet with the cameraman and perform the show. All meetings will be arranged by appointment and the research director will be with you during the meetings.

After performing your show, you will need to come to ÇAPA Basic Sciences Department for MRI recording at your appointment time. Please read the information which will be sent to you before coming to the MRI recording. Finally, you will need to answer the questionnaires which will be given to you on the day you arrive at ÇAPA.

We ask that you understand and fulfill your responsibilities during the research, and also check that you meet the requirements for the MRI recording. During the study, your name and the information you provided will be kept strictly confidential and will not be used for any other purposes other than this thesis.

Your participation in the study is completely voluntary. No fee will be paid for participation in the study. After the end of the study, you will be given the video of your dance performance and your MRI record.

Before you sign this form, please ask if you have any questions about the study. If you have any questions later, you can ask the project manager. You can also consult your local ethics committees about your rights related to the research.

You can leave the study at any time without providing any reason; in such a case, the data you have shared will not be used and will be destroyed.

If your address and phone number change, please notify us.

I, (participant's name) ..... I read the above text and fully understood the scope and purpose of the study that I was asked to participate in, and my responsibilities as a volunteer. I had the opportunity to ask questions about the study. I understood that I could quit this study whenever I wanted without providing any reason, and that I would not encounter any negativity if I quit.

I have / do not want to get a copy of this form (in this case, the researcher will keep this copy). I agree to participate in the study.

Participant Name-Surname: ……	Researcher's Name-Surname: ……
Signature: ……	Signature: ……
Date (day / month / year): ..... / ..... /	Date (day / month /year): ..... /..... /.....

INFORMED CONSENT FORM (TURKISH)

KATILIMCI BİLGİ ve ONAM FORMU

Araştırmayı destekleyen kurum: Boğaziçi Üniversitesi
Araştırmanın adı: Sanatsal ifadenin geribildirim tipine bağımlılığına ilişkin MRG destekli bir araştırma.
Proje Yürütücüsü: Yağmur Denizhan
E-mail adresi: denizhan@gmail.com
Telefonu: 0 212 3596850
Araştırmacının adı: Özge Dağ
E-mail adresi: ozge.dag@boun.edu.tr
Telefonu: 0 530 6902086

Sayın Katılımcı,

Boğaziçi Üniversitesi Bilişsel Bilim Yüksek Lisans Tez Çalışması kapsamında yapılan bu araştırma, geribildirime bağlı psikolojik ve nöral etkilenimi araştırmaya yöneliktir.

Araştırmaya katılmayı kabul ettiğiniz takdirde uzman bir koç tarafından desteklenecek danslı bir gösteri hazırlama sürecine katılmanız ve ardından MRG kaydına gelmeniz beklenecektir.

Hazırlanacak gösteri kendi belirleyeceğiniz bir şarkının 1.5-2 dklık bir bölümü için olacaktır. Hazırlık süreci boyunca gösteri taslağınız üzerinde çalışmak için iki kez koçunuz ile buluşacaksınız. İkinci buluşmadan 3-7 günlük bir süre geçtikten sonra ise gösteriyi sergilemek için kameraman ile buluşacaksınız. Tüm buluşmalar randevu ile ayarlanacak ve buluşmalar sırasında araştırma yürütücüsü yanınızda olacaktır.

Gösterinizi sergiledikten sonra yine randevu saatinizde MR görüntüleme kaydı için ÇAPA Temel Bilimler Bölümüne gelmeniz gerekicektir. MRG kaydına gelmeden önce tarafınıza gönderilecek bilgilendirmeyi mutlaka okuyunuz.
Son olarak size ÇAPA ya geldiğiniz gün verilecek anketleri cevaplamanız gerekecek.

Deney sürecinde üzerinize düşen sorumlulukları anlayıp yerine getirmenizi ve ayrıca MRG kaydı için istenen tarafınıza bildirilecek şartları sağladığınızı kontrol etmenizi rica ediyoruz. Çalışma sırasında isminiz ve verdiğiniz bilgiler tamamen gizli tutulacaktır ve tez çalışması dışında başka bir amaçla kullanılmayacaktır..

Çalışmaya katılmanız tamamen isteğe bağlıdır. Çalışmaya katılımın karşılığında herhangi bir ücret verilmeyecektir. Çalışmanın bittikten sonra hazırlayacağınız gösterinin videosu ve MR görüntüleme kaydınız size verilecektir.

Bu formu imzalamadan önce, çalışmayla ilgili sorularınız varsa lütfen sorun. Daha sonra sorunuz olursa, proje yürütücüsüne sorabilirsiniz. Araştırmayla ilgili haklarınız konusunda yerel etik kurullarına da danışabilirsiniz.

Çalışmayı istediğiniz zaman ve herhangi bir neden belirtmek zorunda kalmadan bırakabilirsiniz, böyle bir durumda paylaştığınız veriler kullanılmayacak ve imha edilecektir.

Adres ve telefon numaranız değişirse, bize haber vermenizi rica ederiz.

Ben, (katılımcının adı) ....., yukarıdaki metni okudum ve katılmam istenen çalışmanın kapsamını ve amacını, gönüllü olarak üzerime düşen sorumlulukları tamamen anladım. Çalışma hakkında soru sorma imkânı buldum. Bu çalışmayı istediğim zaman ve herhangi bir neden belirtmek zorunda kalmadan bırakabileceğimi ve bıraktığım takdirde herhangi bir olumsuzluk ile karşılaşmayacağımı anladım.

Bu formun bir örneğini aldım / almak istemiyorum (bu durumda araştırmacı bu kopyayı saklar).

Çalışmaya katılmayı kabul ediyorum.

Katılımcı Adı-Soyadı:……	Araştırmacının Adı-Soyadı:……
İmzası: ……	İmzası: ……
Tarih (gün/ay/yıl):...../...../.....	Tarih (gün/ay/yıl):...../...../.....

APPENDIX D

TRAIT ANXIETY TEST

Anket I ("Survey2")

İsim ("Name") **Yaş ("Age")** **Meslek ("Profession")**

YÖNERGE: Aşağıda kişilerin kendilerine ait duygularını anlatmada kullandıkları bir takım ifadeler verilmiştir. Her ifadeyi okuyun, sonra da **genel** olarak nasıl hissettiğinizi ifadelerin sağ tarafındaki parantezlerden uygun olanı karalamak suretiyle belirtin. Doğru ya da yanlış cevap yoktur. Herhangi bir ifadenin üzerinde fazla zaman sarf etmeksizin **genel** olarak nasıl hissettiğinizi gösteren cevabı işaretleyin.

("**INSTRUCTION:** Below there are some expressions that people use to express their own feelings. Read each statement, and then indicate how you feel in general by scribbling the appropriate parenthesis on the right side of the statements. There are no right or wrong answers. Mark the answer that shows how you feel in general without spending too much time on any expression.")

	Hiç ("Never")	Biraz ("A little")	Çok ("A lot")	Tamamiyle ("Always")
1. Genellikle keyfim yerindedir ("I am generally in a good mood")	( )	( )	( )	( )
2. Genellikle çabuk yorulurum ("I usually get tired quickly")	( )	( )	( )	( )
3. Genellikle kolay ağlarım ("I usually cry easily")	( )	( )	( )	( )
4. Başkaları kadar mutlu olmak isterim ("I want to be as happy as others")	( )	( )	( )	( )
5. Çabuk karar veremediğim için fırsatları kaçırırım ("I miss opportunities because I can't decide quickly")	( )	( )	( )	( )
6. Kendimi dinlenmiş hissederim ("I feel rested")	( )	( )	( )	( )
7. Genellikle sakin, kendime hakim ve soğukkanlıyım ("I am generally self-conscious and calm")	( )	( )	( )	( )
8. Güçlüklerin yenemeyeceğim kadar biriktiğini hissederim ("I feel that difficulties are so much that I can't beat them")	( )	( )	( )	( )
9. Önemsiz şeyler hakkında endişelenirim ("I worry about trivial things")	( )	( )	( )	( )
10. Genellikle mutluyum ("I am usually happy")	( )	( )	( )	( )
11. Her şeyi ciddiye alır ve etkilenirim ("I take everything seriously and get affected")	( )	( )	( )	( )
12. Genellikle kendime güvenim yoktur ("I usually don't have self-confidence")	( )	( )	( )	( )
13. Genellikle kendimi emniyette hissederim ("I usually feel safe")	( )	( )	( )	( )
14. Sıkıntılı ve güç durumlarla karşılaşmaktan kaçınırım ("I avoid being faced with troublesome and difficult situations")	( )	( )	( )	( )
15. Genellikle kendimi hüzünlü hissederim ("I usually feel sad")	( )	( )	( )	( )
16. Genellikle hayatımdan memnunum ("I am generally satisfied with my life")	( )	( )	( )	( )
17. Olur olmaz düşünceler beni rahatsız eder ("Unnecessary thoughts bother me")	( )	( )	( )	( )
18. Hayal kırıklıklarını öylesine ciddiye alırım ki hiç unutamam ("I take disappointments so seriously that I can never forget them")	( )	( )	( )	( )
19. Aklı başında ve kararlı bir insanım ("I am a sane and determined person")	( )	( )	( )	( )
20. Son zamanlarda kafama takılan konular beni tedirgin eder ("Issues that have been on my mind recently make me nervous")	( )	( )	( )	( )

APPENDIX E

METHOD OF COACHING

The feedback sessions of the coach are based on the studies of Rudolph von Laban and on Mcniff's concept of aesthetic response. Laban has created a systematic approach for analyzing movement. He has identified the 'movement qualities' that occur during action. These qualities express the sensations and the effects of the movement on the self, as well as others. He has categorized these qualities into the so-called effort elements: space, weight and time (Laban & Lawrence, 1947).

The coach uses these elements to identify the existing efforts and qualities in the participants' movement, and offers the information on the efforts to expand their knowledge on putting a dance piece together.

While watching a dance performance, the coach observes how a participant uses the space, the kind of time and speed of movement, and whether the participant is using her body weight and suddenness of movement in the presentation. During the meetings, the coach explains these elements and suggests the participant to think about both opposites of elements for their next performance. The main objective of this stage of the meeting is to offer information and knowledge to the participant about elements of dance. The coach abstains from expressing her own personal preferences and leaves the creative decision of using the given information to the participant.

As far as the space element is concerned, the coach explains how one can use different parts of the space, such as the outer periphery or the middle.

The time element is explained as the possibility of slowing down or speeding up the movement, which can be used as a tool of expression independent of the

rhythm of the music.

The weight element is explained as the choice between using very floating and light movements versus using the body weight to make larger and stronger movements and thus offer presence in the dance.

The next stage of the meetings is related to emotions, sensations and thoughts evoked in and experienced by the coach while watching the dance performance. In this section, the coach feeds back relatively more subjective experiences. Here, the coach has to use her capacity to open herself and receive what is being presented from an aesthetic perspective. As the coach watches the dances, she also observes the facial gestures of the participants for emotion expressions. While watching the performance, the coach asks herself the following questions: 'What emotions does this dance evoke in me? What is my experience to this dance? What are the sensations I feel in my body? What non-judgmental thoughts are going through my head? How does this piece of dance touch me?' (McNiff, 1998)

This type of inquiry into one's feelings, sensations and thoughts by experiencing an art form is referred as an 'aesthetic response' (McNiff, 1981). It goes both ways for the viewer's response to the art presented as well as the presenter's response to the work itself. The coach provides insight into her artistic and aesthetic experience by using phrases like 'when watching the dance, I felt like…' or 'this dance made me feel …', 'as I was watching I felt like I was in a crowd watching and cheering this dance …'. For an opportunity of further development, the coach then makes suggestions based on her experience, and authentic and genuine curiosity of what else she would like to have experienced. For example: 'I was genuinely curious to watch this feeling of … more deepened.' Or 'I was thinking you (the participant) could have given this message a bit clearer?'

APPENDIX F

INSTRUCTIONS FOR PARTICIPANTS

Hulusi Behçet Life Sciences Research Laboratory

Things you need to do before entering the MR shooting room are listed below. Not complying to the instructions can lead to **VERY DANGEROUS** results for you and the researcher because of the strong magnetic field inside the room!

If any, **REMOVE** your jewelery (e.g. necklace, imprint, earring, bracelet, ring).

REMOVE the piercings from your body!

REMOVE all kinds of hairpins (wire buckle, hairpin, metal buckles, snap buckle etc.) and accessories (crown, wig, welding hair, hairpiece etc.)

If you have any denture teeth, dentures and artificial palates, **REMOVE THEM!**

If any, **REMOVE** your hearing aids!

If you have, **TAKE OFF** your glasses!

REMOVE watches, pagers, cell phones, credit and debit cards, and all other cards with a magnetic stripe!

REMOVE your clothes and underwear with metal buckles, metal straps or zippers!

If there are metals such as pins, tweezers, nail clippers, coins, pens, etc. on you, you **MUST REMOVE** them!

During MRI recording, some patients may find the noise disturbing, or this may affect their hearing. So, you can use ear plugs or headphones if you want.

I read this form, understood all its contents and did what I needed. I had the opportunity to ask questions about the information in this form.

Name and Surname of the Participant / Patient: _____
Signature: _____
Name and Surname of the Researcher: _____
Date: _____ Signature: _____

INSTRUCTIONS FOR PARTICIPANTS (TURKISH)

Hulusi Behçet Yaşam Bilimleri Araştırma Laboratuarı

MR çekim odasına girmeden önce yapmanız gerekenler aşağıda sıralanmıştır. Söylenenleri yapmamanız oda içindeki kuvvetli manyetik alan nedeniyle çekim yapacak kişi ve sizin için **ÇOK TEHLİKELİ** sonuçlara neden olabilir!

Varsa takılarınızı (örneğin; kolye, künye, küpe, bileklik, yüzük) **MUTLAKA çıkartınız!**

Vücudunuzdaki piercingleri **MUTLAKA çıkartınız!**

Her türlü saç tokası (tel toka, firkete, metal tokalar, çıtçıtlı toka vb.) ve aksesuvarlarını (taç, peruk, kaynak saç, postiş vb.) **MUTLAKA çıkartınız!**

Varsa protez diş, takma diş ve yapay damaklarınızı **MUTLAKA çıkartınız!**

Varsa işitme cihazlarınızı **MUTLAKA çıkartınız!**

Varsa gözlüğünüzü **MUTLAKA çıkartınız!**

Saat, çağrı cihazı, cep telefonu, kredi ve banka kartları ile manyetik şeritli diğer tüm kartlarızı **MUTLAKA çıkartınız!**

Metal kopçalı, metal askılı ya da fermuarlı kıyafet ve iç çamaşırlarınızı **MUTLAKA çıkartınız!**

Üzerinizde toplu iğne, çengelli iğne, cımbız, tırnak makası, bozuk para, kalem vb. metaller varsa **MUTLAKA çıkartınız!**

MRG çekimi sırasında, bazı hastalar gürültüyü rahatsız edici bulabilirler veya bu gürültü işitmelerini etkileyebilir. Dolayısıyla isterseniz kulak tıkacı ya da kulaklık kullanabilirsiniz.

Bu formu okudum, tüm içeriğini anladım ve gerekenleri yaptım. Bu formdaki bilgilerle ilgili olarak soru sorma fırsatım oldu.

Katılımcının/Hastanın Adı Soyadı: _____

İmzası: _____

Araştırmacının Adı Soyadı: _____

Tarih: _____ İmzası: _____

APPENDIX G

QUESTIONNAIRES

Anket 1 (“Survey 1”) **İsim: (“Name:”)**

1. Hazırlayıp kaydettiğiniz dans gösterisi sizin için ne kadar anlam taşıyor?
(“How much does the dance show you have prepared and recorded mean to you?”)

( ) çok özel bir anlamı var (“It has a very special meaning”)

( ) biraz anlamlı (“It has some meaning”)

( ) çok özel bir anlamı yok (“It does not have sny special meaning”)

2. Hazırlayıp kaydettiğiniz dans gösterisi dış gözlemcilerin belirlediği kriterlere göre puanlandırılmaya elverişli midir?
(“Is the dance show you prepared and recorded suitable for scoring according to the criteria determined by external observers?”)

kesinlikle hayır (“absoulutely no”) ( ) ( ) ( ) ( ) ( ) kesinlikle evet(“absolutely yes”)

3. Deneyde, size duygu ve düşüncelerinizi ifade etmeye yönelik bir dans kompozisyonu hazırlamak için elverişli bir ortam sunulduğunu düşünüyor musunuz?
(“Do you think that in the experiment, you are provided with a convenient environment for preparing a dance composition to express your feelings and thoughts?”)

kesinlikle hayır (“absoulutely no”) ( ) ( ) ( ) ( ) ( ) kesinlikle evet(“absolutely yes”)

4. Çalışmaya katılım sebebinizi aşağıdaki ifadeler ne ölçüde anlatabilir?
(“To what extent can the following statements explain your reason for participation in the study?”)

Duygularımı sanatsal ve özellikle de bedensel bir şekilde ifade etmeyi sevdiğim için katıldım.
(“I joined because I like to express my feelings in an artistic and especially with my mody.”)

( ) kesinlikle (“absoulutely”) ( ) biraz (“some”) ( ) hiç (“none”)

Bir uzman desteği ile geliştireceğim bir dans performansı kaydımı hatıra olarak saklama fikri çekici göründüğü için katıldım.
(“I attended because the idea of keeping a dance performance record that I will develop with the support of an expert as a souvenir seems attractive.”)

( ) kesinlikle (“absoulutely”) ( ) biraz (“some”) ( ) hiç (“none”)

Bilimsel bir araştırmaya detsek olmak için katıldım.
(“I attended in order to be a part of a scientific research and support it.”)

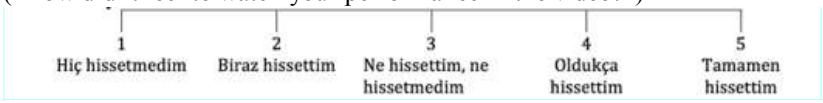
( ) kesinlikle (“absoulutely”) ( ) biraz (“some”) ( ) hiç (“none”)

Yeni bir deneyim yaşamak için katıldım.
(“I joined in order to have a new experience.”)

( ) kesinlikle (“absoulutely”) ( ) biraz (“some”) ( ) hiç (“none”)

Diğer, açıklayınız:
(“Other, please explain:”)

5. Videodaki performansınızı izlemek size nasıl hissettirdi?
("How did it feel to watch your performance in the video?")



("none") ("some") ("neither, nor") ("a lot") ("fully")

hevesli ("enthusiastic")_____	cansız ("listless") _____	heyecanlı("excited") _____
kuvvetli ("powerful") _____	uyuşuk ("lazy")_____	pasif ("passive") _____
kıpır kıpır ("restless") ____	dinlenmiş ("relaxed")____	afallamış ("stunned") ____
şaşkın ("confused") _____	durgun ("settled") _____	çok neşeli ("exuberant") _____
korkulu ("fearful")_____	sakin ("calm") _____	rahat ("at ease") _____
asabi ("irritable") _____	âtıl ("idle") _____	coşkulu ("vigorous")_____
hareketsiz ("still") ___	üzgün ("upset") _____	mutlu ("happy") _____
mutsuz ("unhappy")_____	tatmin olmuş satisfied __	uykulu ("sleepy")_____
memnun ("contented")_____	sessiz ("quiet")_____	düşmanca ("hostile")_____
huzurlu ("peaceful")____	yalnız ("alone") _____	dingin ("quiet")_____

6. Videodaki performansınızı nasıl değerlendirirsiniz?
("How would you evaluate your performance in the video?")

7. İzlediğiniz gösterinizde dikkatinizi en çok çeken şey neydi?
("What captured your attention the most in your performance video?")

Anket 4 (“Survey 4”)

1. Çalışmanın değişik kısımlarını aşağıda belirtilen açılardan kendinize göre çoktan aza doğru sıralayınız.
(“Sort the different parts of the study regarding the aspects listed below, according to yourself.”)

1. müziğimi seçme ve kafamda tasarlama
   (“chosing the music and designing the show”)
2. kendi kendime yaptığım hazırlık
   (“preparing for the show by myself”)
3. gösteri koçu ile yapılan çalışmalar
   (“meetings with the coach”)
4. videoyu kaydetme
   (“ recording the performance”)
5. videoyu izleme
   (“watching the video”)

Benim için en heyecan verici kısım : (“the most exciting part”)

…… > …….. > ……..> ……> …….

Benim en çok keyif aldığım kısım : (“the most joyful part”)

…… > …….. > ……..> ……> …….
Benim için en zorlayıcı kısım : (“the most challenging part”)

…… > …….. > ……..> ……> …….

2.Videodaki performansımın puanlandırılmasını (isterdim / istemezdim) . (“I prefer / do not prefer my performance to be scored.”)

—> Neden (“Why”)

APPENDIX H

STATE ANXIETY TEST

Anket 2 ("Survey 2")

İsim: ("Name:") **Tarih: ("Date:")**

YÖNERGE: Aşağıda kişilerin kendilerine ait duygularını anlatmada kullandıkları bir takım ifadeler verilmiştir. Her ifadeyi okuyun, sonra da o **anda** nasıl hissettiğinizi ifadelerin sağ tarafındaki parantezlerden uygun olanı karalamak suretiyle belirtin. Doğru ya da yanlış cevap yoktur. Herhangi bir ifadenin üzerinde fazla zaman sarfetmeksizin **anında** nasıl hissettiğinizi gösteren cevabı işaretleyin.

("**INSTRUCTION:** Below there are some expressions that people use to express their feelings. Read each statement, and then indicate how you feel **at the moment** by scribbling the appropriate parenthesis on the right side of the statements. There are no right or wrong answers. Mark the answer that shows **how you feel instantly**, without wasting much time on any expression.")

	Hiç ("Never")	Biraz ("A little")	Çok ("A lot")	Tamamiyle ("Always")
1. Şu anda sakinim ("I'm calm right now")	( )	( )	( )	( )
2. Kendimi emniyette hissediyorum ("I feel safe")	( )	( )	( )	( )
3. Şu anda sinirlerim gergin ("I am nervous right now")	( )	( )	( )	( )
4. Pişmanlık duygusu içindeyim ("I am feeling regret")	( )	( )	( )	( )
5. Şu anda huzur içindeyim ("I am at peace right now")	( )	( )	( )	( )
6. Şu anda hiç keyfim yok ("I am in a bad mood right now")	( )	( )	( )	( )
7. Başıma geleceklerden endişe ediyorum ("I am concerned about what will happen to me")	( )	( )	( )	( )
8. Kendimi dinlenmiş hissediyorum ("I feel rested")	( )	( )	( )	( )
9. Şu anda kaygılıyım ("I am anxious right now")	( )	( )	( )	( )
10. Kendimi rahat hissediyorum ("I feel comfortable")	( )	( )	( )	( )
11. Kendime güvenim var ("I have self-confidence")	( )	( )	( )	( )
12. Şu anda asabım bozuk ("I am upset right now")	( )	( )	( )	( )
13. Çok sinirliyim ("I am very angry")	( )	( )	( )	( )
14. Sinirlerimin çok gergin olduğunu hissediyorum ("I feel very nervous")	( )	( )	( )	( )
15. Kendimi rahatlamış hissediyorum ("I feel relieved")	( )	( )	( )	( )
16. Şu anda halimden memnunum ("I am satisfied with my situation right now")	( )	( )	( )	( )
17. Şu anda endişeliyim ("I am worried now")	( )	( )	( )	( )
18. Heyecandan kendimi şaşkına dönmüş hissediyorum ("I feel stunned by excitement")	( )	( )	( )	( )
19. Şu anda sevinçliyim ("I am happy")	( )	( )	( )	( )
20. Şu anda keyfim yerinde ("I am in a good mood right now")	( )	( )	( )	( )

APPENDIX I

MOTIVATION SURVEY

Anket 3 (“Survey 3”) **İsim: (“Name:”)**

Herhangi bir aktiviteye katılıp katılmamaya karar verirkenki tutumunuzu, aşağıdaki ifadeler ne ölçüde yansıtmaktadır?

(“To what extent do the following statements reflect your attitude when deciding whether or not to participate in any activity?”)

Lütfen aşağıda verilen ifadeleri dikkatle okuyarak yanıtınızı, sizin için en uygun olan seçeneği işaretleyerek belirtiniz. Doğru ya da yanlış bir yanıt yoktur.
(“Please read the statements given below carefully and indicate your answer by marking the most appropriate option for you. There is no right or wrong answer.”)

1. Ne tür bir aktiviteye katılacağımı seçerken, beni gerçekten zorlayacağını düşündüğüm aktiviteleri tercih ederim, bu sayede yeni şeyler öğrenebilirim.
(“I prefer activities that really challenge me so I can learn new things.”)

benim için kesinlikle yanlış ( ) ( ) ( ) ( ) ( ) benim için kesinlikle doğru
(“absolutely wrong for me”) (“absolutely right for me”)

2. Zor olsalar bile, bende merak uyandıran aktiviteleri tercih ederim.
(“I prefer activities that arouses my curiosity, even if it is difficult.”)

benim için kesinlikle yanlış ( ) ( ) ( ) ( ) ( ) benim için kesinlikle doğru
(“absolutely wrong for me”) (“absolutely right for me”)

3. Herhangi bir aktivitede benim için en tatmin edici şey, o aktivitenin özünü mümkün olduğunca çok keşfedip gerçekleştirmektir.
(“The most satisfying thing for me in an acitivity is trying to understand the essence of the activity as thoroughly as possible.”)

benim için kesinlikle yanlış ( ) ( ) ( ) ( ) ( ) benim için kesinlikle doğru
(“absolutely wrong for me”) (“absolutely right for me”)

4. Yüksek bir puan almamı sağlayacak türden olmasa bile özünü en iyi şekilde gerçekleştirebileceğimi düşündüğüm bir aktiviteyi tercih ederim.
(“I choose activities that I can understand the essence of even if they don't guarantee high scores.”)

benim için kesinlikle yanlış ( ) ( ) ( ) ( ) ( ) benim için kesinlikle doğru
(“absolutely wrong for me”) (“absolutely right for me”)

5. Benim için en tatmin edici şey o aktivite sonucunda yüksek bir puan almaktır.
(“Getting a high score in an activity is the most satisfying thing for me right now.”)

benim için kesinlikle yanlış ( ) ( ) ( ) ( ) ( ) benim için kesinlikle doğru
(“absolutely wrong for me”) (“absolutely right for me”)

6. Eğer yapabilirsem, herkesten daha yüksek bir puan almak isterim.
(“If I can, I want to get better scores in an activity than most of the others.”)

benim için kesinlikle yanlış ( ) ( ) ( ) ( ) ( ) benim için kesinlikle doğru
(“absolutely wrong for me”) (“absolutely right for me”)

7. Herhangi bir aktivitede başarılı olmak isterim çünkü yeteneğimi aileme, arkadaşlarıma, üstlerime ve diğerlerine göstermek benim için önemlidir.
(“I want to do well in an activity because it is important to show my ability to my family, friends, or others.”)

benim için kesinlikle yanlış ( ) ( ) ( ) ( ) ( ) benim için kesinlikle doğru
(“absolutely wrong for me”) (x“absolutely right for me”)

APPENDIX J

QUESTIONNAIRES FOR THE PILOT STUDY

Anket I ("Survey I")

Ad Soyad: ("Name:")
Tarih: ("Date:")

1.Gösteri koçu ile görüşmeleriniz, gösteri hazırlamanızda yararlı oldu mu?
("Did your meetings with the coach help you in preparing your performance?")

2. Gösteri koçunun bilgisine güveniyor musunuz?
("Do you trust the coach's knowledge?")

3. Seçtiğiniz şarkı sizin için ne ifade ediyor?
("What doest the song you have chosen mean to you?")

4. Gösteri konseptiniz ve koreografinizin sizin için kişisel bir anlamı var mı?
("Does your choreography or its theme have a personal meaning to you?")

5. Gösteri koçunuzun geribildirimlerini aldıktan sonra gösteri tasarımınızda ne kadar değişiklik yaptınız?
("To what extent did you modify your performance after you received feedback from the coach?")

* hiç ("none")
* küçük değişiklikler ("minor changes")
*büyük değişiklikler ("major changes")
* tamamen değişti ("complete change")

6. Gösteriye hazırlanmak için toplam kaç saat çalıştınız?
("How many hours did you work to prepare your performance?")

7. Şu ana kadar olan hazırlık aşamasında özellikle zorlandığınız bir husus oldu mu?
("Was there a specific phase of preparation that challenged you?")

8. Gösteri için verilen mekanı amaca uygun buluyor musunuz?
("Do you think that the room that was used in the experiment was fit for purpose?")

Anket II ("Survey II")

Ad Soyad: ("Name:")
Tarih: ("Date:")

1.Deney süresince neler öğrendiniz?
("What did you learn during the experiment?")

2. Performansınızı izlemenin sizde yarattığı duyguları aşağıdaki ifadeler ne ölçüde yansıtmaktadır?
("To what extent do the following expressions reflect the emotions that you had during watching your performance?")

%100_____%75_____%50_____%25_____%0

heyecan ("excitement")_____

şaşkınlık ("surprise")_____

kaygı ("worry")_____

mutluluk ("happiness")_____

gurur ("pride")_____

utanç ("shame")_____

öfke ("anger")_____

……. _____

3. Performansınızı nasıl değerlendirirsiniz?
("How would you evaluate your performance?")

4. Videoda dikkatinizi en çok çeken şey neydi?
("What captured your attention the most in your performance video?")

5. Performansınızda memnun kalmadığınız bir kısım var mıydı?
("Was there any part in your performance that you were not satisfied with?")

6. Videonuzun diğer katılımcılar tarafından görülmesini ister miydiniz?
("Would you prefer your video to be watched by other participants?")

. evet ("yes") . hayır ("no")

7. Video kaydınızın sosyal medyada yayınlanmasını ister miydiniz?
(“Would you prefer your video to be shared in social media platforms?”)

***Cevabınız ne olursa olsun, videonuz ve kişisel bilgileriniz yalnızca bu çalışma bağlamında kullanılacak ve kesinlikle deney yöneticileri dışında kimseyle paylaşılmayacaktır*

***(“Whatever your answer, your video and personal information will only be used in the context of this study and will never be shared with anyone other than experiment managers.”)*

. evet (“yes”) . hayır (“no”)

8. İzlediğiniz videodaki performansınıza ilişkin geri bildirimleri öğrenmek yerine, yeni bir kayıt yapıp sadece ona dair geri bildirimleri öğrenmek ister miydiniz?
(“Would you like to make a new recording and take feedback about it only, instead of receiving feedback on your performance in the video you watched?”)

. kesinlikle evet (“absolutaly yes”)
. fena olmazdı (“okay”)
. farketmez (“does not matter”)
. hayır (“no”)
. asla (“never”)

Anket III ("Survey III")

Birazdan performansınıza ilişkin geri bildirimleri dinleyeceksiniz.
("You will receive feedback on your performance soon.")

1. Geri bildirimleri dinlemeden hemen önceki ruh halinizi aşağıdaki ifadeler ne ölçüde yansıtmaktadır?
("To what extent do the following expressions reflect your mood just before receiving the feedback?")

%100_____%75_____%50_____%25_____%0

heyecanlı ("excited")_____

kaygılı ("worried")_____

meraklı ("curious") _____

ümitli ("hopeful") _____

mutlu ("happy") _____

sıkılmış ("bored") _____

……. _____

……. _____

……. _____

2. Eklemek istedikleriniz?
("Anything you want to add?")

Anket IV ("Survey IV")

1. Gösteri koçunun performansınıza ilişkin değerlendirmesine güveniyor musunuz?
("Do you trust the coach's evaluations of your performance?")

3. Koçun geri bildirimlerine ilişkin aşağıdaki ifadeler ne ölçüde doğrudur?
("To what extent are the following statements regarding the coach's feedback true?")

%100_____%75_____%50_____%25_____%0

haksız değerlendirme ("unfair evaluation") _____

ne yaptığımı anlamamış ("she did not understand what I did") _____

doğru gözlemlemiş ("correct observation") _____

şaşırtıcı ("surprising")_____

gurur verici ("elating")_____

geliştirici yorum ("improving comment") _____

……. _____

……. _____

……. _____

4. Gösterinizde görülmemiş kısımlar olduğunu düşünüyor musunuz?
("Do you think that the coach has missed any part of your performance?")

5. Geri bildirimler yeni bir şey öğrenmenizi sağladı mı?
("Did the feedback make you learn anything new?")

6. Sizce geribildirimler objektif miydi?
("Do you think that the feedback was objective?")

7. Deney sürecini nasıl buldunuz?
("How would you evaluate the experiment?")

8. Bu tür bir deneye tekrar katılmak ister miydiniz?
("Would you like to participate in a similar experiment?")

9. Bu gösteriyi bir yarışma için hazırladığınızı düşünüyor olsaydınız neleri farklı yapardınız?
("What would you do differently if you thought you were preparing this performance for a competition?")

10. Çalışmanızın bir uzman tarafından notlandırılmasını ister miydiniz?
("Would you like your performance to be scored by an expert?")

. evet ("yes") . hayır ("no")

-> Neden? ("Why?")

APPENDIX K

EXAMPLES OF PARTICIPANTS' STATEMENTS

NOTED DURING THE PILOT STUDY

a. "I realized that there is no "right or wrong" about doing this task."

b. "I expected formal and robot-like comments, but they were comfortable and personal."

c. "It turned out that it was not a matter of whether I should or shouldn't do it this way."

d. "I experienced stage anxiety but it turned out to be baseless. I was expecting a judgmental observer, but it was not the case. I was also judging myself but it turned out to be unnecessary."

e. "Comments were not like technical warnings, instead they were personal and dance-oriented."

f. Based on these observations in the pilot study, special effort has been given to guarantee a clear understanding of the task and experimental circumstances in the main experiment.

APPENDIX L

SEEDS AND ATLAS FILES IN CONN TOOLBOX

Atlas File in CONN	Seeds
Networks Atlas: Default Mode Network	MPFC (1,55,-3)
	LP-l (-39,-77,33)
	LP-r (47,-67,29)
	PCC (1,-61,38)
Networks Atlas: Cingulo-opercular Network	Anterior Cingulate Cortex (0,22,35)
	Anterior Insula-l (-44,13,1)
	Anterior Insula-r (47,14,0)
	RPFC-l (-32,45,27)
	RPFC-r (32,46,27)
	SMG-l (-60,-39,31)
	SMG-r (62,-35,32)
FSL Harward-Oxford Atlas	Supramarginal Gyrus, posterior division Right (pSMG-r)
	Supramarginal Gyrus, posterior division Left (pSMG-l)
	Angular Gyrus Right (AG-r)
	Angular Gyrus Left (AG-l)
	Amygdala-r
	Amygdala-l
	Accumbens-r
	Accumbens-l
	Superior Temporal Gyrus, posterior division Right (pSTG-r)
	Superior Temporal Gyrus, posterior division Left (pSTG l)
	Middle Temporal Gyrus, temporooccipital part Right (toMTG-r)
	Middle Temporal Gyrus, temporooccipital part Left (toMTG-l)
Broadman Atlas	Ventral Anterior Cingulate Cortex (BA.24-l)
	Ventral Anterior Cingulate Cortex (BA.24-r)
	Dorsal Anterior Cingulate Cortex (BA.32-l)
	Dorsal Anterior Cingulate Cortex (BA.32-r)

Note: CONN uses ‘Cingulo-Opercular Network’ and ‘Salience Network’ interchangeably.

REFERENCES

Allman, J., Tetreault, N., Hakeem, A., Manaye, K., Semendeferi, K., & Erwin, J. et al. (2011). The von Economo neurons in the frontoinsular and anterior cingulate cortex. *Annals of The New York Academy of Sciences*, *1225*(1), 59-71.

Apps, M., Rushworth, M., & Chang, S. (2016). The anterior cingulate gyrus and social cognition: tracking the motivation of others. *Neuron*, *90*(4), 692-707.

Beer, D. (2016). *Metric power*. London: Palgrave Macmillan.

Bennett, S. (1996). A brief history of automatic control. *IEEE Control Systems*, *16*(3), 17-25.

Berridge, K., & Kringelbach, M. (2015). Pleasure systems in the brain. *Neuron*, *86*(3), 646-664. doi: 10.1016/j.neuron.2015.02.018

Biswal, B., Mennes, M., Zuo, X., Gohel, S., Kelly, C., & Smith, S. et al. (2010). Toward discovery science of human brain function. *Proceedings of the National Academy of Sciences*, *107*(10), 4734-4739.

Biswal, B., Zerrin Yetkin, F., Haughton, V., & Hyde, J. (1995). Functional connectivity in the motor cortex of resting human brain using echo-planar mri. *Magnetic Resonance in Medicine*, *34*(4), 537-541.

Breiter, H., Etcoff, N., Whalen, P., Kennedy, W., Rauch, S., Buckner, R., Strauss, M., Hyman, S. and Rosen, B. (1996). Response and habituation of the human amygdala during visual processing of facial expression. *Neuron*, *17*(5), 875-887.

Byrne, A. (2017). Comment: Measure for measure. *Nature*, *548*(7666), 22.

Caouette, Justin & Guyer, Amanda. (2013). Gaining insight into adolescent vulnerability for social anxiety from developmental cognitive neuroscience. *Developmental Cognitive Neuroscience, 8,* 65-76.

Choi, W., Son, J., Kim, Y., Oh, J., Lee, S., Shin, C., Kim, S., Ju, G., Lee, S., Jo, S. and Ha, T. (2013). An fMRI study investigating adolescent brain activation by rewards and feedback. *Psychiatry Investigation*, *10*(1), 47.

Decety, J., & Lamm, C. (2007). The role of the right temporoparietal junction in social interaction: How low-level computational processes contribute to meta-cognition. *The Neuroscientist*, *13*, 580-593.

Deci, Edward & Ryan, Richard. (1985). Intrinsic motivation and self-determination in human behavior. New York: Springer.

DePasque, Samantha & Tricomi, Elizabeth. (2015). Effects of intrinsic motivation on feedback processing during learning. *NeuroImage, 119,* 175-186.

DePasque Swanson, S., & Tricomi, E. (2014). Goals and task difficulty expectations modulate striatal responses to feedback. *Cognitive, affective & behavioral neuroscience, 14*(2), 610–620.

Dosenbach, N. U., Fair, D. A., Cohen, A. L., Schlaggar, B. L., & Petersen, S. E. (2008). A dual-networks architecture of top-down control. *Trends in cognitive sciences, 12*(3), 99–105.

Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist, 41*(10), 1040-1048.

Floresco, S. (2015). The nucleus accumbens: an interface between cognition, emotion, and action. *Annual Review of Psychology, 66*(1), 25-52.

Gore, J. (2003). Principles and practice of functional MRI of the human brain. *Journal of Clinical Investigation, 112*(1), 4-9.

Gu, R., Huang, W., Camilleri, J., Xu, P., Wei, P., Eickhoff, S., & Feng, C. (2019). Love is analogous to money in human brain: Coordinate-based and functional connectivity meta-analyses of social and monetary reward anticipation. *Neuroscience & Biobehavioral Reviews, 100*, 108-128.

Guyer, A., Choate, V., Detloff, A., Benson, B., Nelson, E., Perez-Edgar, K., Fox, N., Pine, D. and Ernst, M. (2012). Striatal functional alteration during incentive anticipation in pediatric anxiety disorders. *American Journal of Psychiatry, 169*(2), 205-212.

Guyer, A., Lau, J., McClure-Tone, E., Parrish, J., Shiffrin, N., Reynolds . . . and Nelson, E. (2008). Amygdala and ventrolateral prefrontal cortex function during anticipated peer evaluation in pediatric social anxiety. *Archives of General Psychiatry, 65*(11), 1303.

Helfinstein, S., Benson, B., Perez-Edgar, K., Bar-Haim, Y., Detloff, A., Pine, D., Fox, N. and Ernst, M. (2011). Striatal responses to negative monetary outcomes differ between temperamentally inhibited and non-inhibited adolescents. *Neuropsychologia, 49*(3), 479-485.

Hoefler A, Athenstaedt U, Corcoran K, Ebner F, Ischebeck A (2015) Coping with self-threat and the evaluation of self-related traits: An fMRI study. *PLoS ONE 10*(9): e0136027.

Igelström, K., & Graziano, M. (2017). The inferior parietal lobule and temporoparietal junction: A network perspective. *Neuropsychologia, 105,* 70-83.

Janak, P. and Tye, K. (2015). From circuits to behaviour in the amygdala. *Nature*, 517(7534), 284-292.

Kamarova, Sviatlana & Chatzisarantis, Nikos & Hagger, Martin & Lintunen, Taru & Hassandra, Mary & Papaioannou, Athanasios. (2017). Effects of achievement goals on perceptions of competence in conditions of unfavourable social comparisons: The mastery goal advantage effect. *The British journal of educational psychology*, *87*(4), 630-646.

Kim, Sung-il & Lee, Myung-Jin & Chung, Yoonkyung & Bong, Mimi. (2010). Comparison of brain activation during norm-referenced versus criterion-referenced feedback: The role of perceived competence and performance-approach goals. *Contemporary Educational Psychology*. 141-152

Kubit, B., & Jack, A. (2013). Rethinking the role of the rTPJ in attention and social cognition in light of the opposing domains hypothesis: Findings from an ALE-based meta-analysis and resting-state functional connectivity. *Frontiers in Human Neuroscience*, *7*, 323.

Laban, Rudolf, and Lawrence, F. C. Effort. (1947). London: MacDonald and Evans.

Mangels, J. A., Rodriguez, S., Ochakovskaya, Y., & Guerra-Carrillo, B. (2017). Achievement goal task framing and fit with personal goals modulate the neurocognitive response to corrective feedback. *AERA Open*, 3(3), doi: 10.3389/fnhum.2013.00323.

McNiff, S. (1981) The arts and psychotherapy, Springfield, IL: Charles C. Thomas Publisher.

McNiff, S. (1998). Art-based research. London: Jessica Kingsley.

McNiff, S. (1998). Art opens to the world. In Ellen G. Levine and Stephen K Levine, eds. Art in action: Expressive arts therapy and social change. London: Jessica Kingsley Publishers.

McNiff, S. (2011). Artistic expressions as primary modes of inquiry. *British Journal of Guidance & Counselling*, *39*(5), 385-396.

Muller, J. (2018). *The tyranny of metrics*. New Jersey: Princeton University Press.

Murray, E. (2007). The amygdala, reward and emotion. *Trends in Cognitive Sciences*, 11(11), 489-497.

Namer, Y. (2014). Affect with other: self- and affect-discrepancy in personal and impersonal contexts. (PhD thesis). Bogazici University, İstanbul, Turkey.

Oner, N. and Le Compte, A. (1983) Durumluk sürekli kaygı envanteri el kitabı. İstanbul: Bogazici Universitesi Yayinlari.

Pan, Xiaohong & Hu, Yang & Li, Lei & Li, Jianqi. (2009). Evaluative-feedback stimuli selectively activate the self-related brain area: An fMRI study. *Neuroscience letters, 465,* 90-4.

Pintrich, P & Smith, D. & Duncan, Teresa & Mckeachie, Wilbert. (1991). A manual for the use of the motivated strategies for learning questionnaire (MSLQ). Michigan: Ann Arbor.

Raichle, M. (2015). The brain's default mode network. *Annual Review of Neuroscience, 38*(1), 433-447.

Rakoczy, Katrin & Schütze, Birgit & Klieme, Eckhard & Blum, Werner & Hochweber, Jan. (2013). Written feedback in mathematics: Mediated by students' perception, moderated by goal orientation. *Learning and Instruction, 27,* 63–73.

Satterthwaite, T., Ruparel, K., Loughead, J., Elliott, M., Gerraty, R., Calkins, M., Hakonarson, H., Gur, R., Gur, R. and Wolf, D. (2012). Being right is its own reward: Load and performance related ventral striatum activation to correct responses during a working memory task in youth. *NeuroImage,* 61(3), 723-729.

Sadaghiani S., D'Esposito M. (2015). Functional characterization of the cingulo-opercular network in the maintenance of tonic alertness. *Cerebral Cortex, 25*(9), 2763–2773.

Stevens, F., Hurley, R., & Taber, K. (2011). Anterior cingulate cortex: Unique role in cognition and emotion. *The Journal of Neuropsychiatry and Clinical Neurosciences, 23*(2), 121-125.

Tsai, J. L. Knutson, B., & Fung, H. H. (2006). Cultural variation in affect valuation. *Journal of Personality and Social Psychology, 90,* 288-307.

Uddin, L. (2014). Salience processing and insular cortical function and dysfunction. *Nature Reviews Neuroscience, 16*(1), 55-61.

van den Heuvel, M., & Hulshoff Pol, H. (2010). Exploring the brain network: A review on resting-state fMRI functional connectivity. *European Neuropsychopharmacology, 20*(8), 519-534.

Whitfield-Gabrieli, S. & Nieto-Castanon, A. (2012). Conn: A functional connectivity toolbox for correlated and anticorrelated brain networks. *Brain Connectivity, 2*(3), 125–141.

Zingoni, Matt & Byron, Kris. (2017). How beliefs about the self-influence perceptions of negative feedback and subsequent effort and learning. *Organizational Behavior and Human Decision Processes,* 139, 50-62.