



GROUP SINGING & SOCIAL COHESION

amongst students at Danish folk high schools

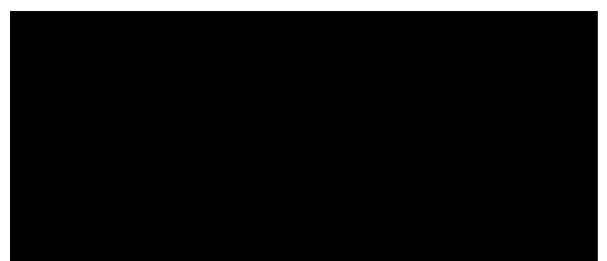
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Abstract

This paper investigates how the act of group singing plays a role in establishing feelings of cohesion amongst students at Danish folk high schools. Firstly, the theoretical foundation for an investigation in this topic is made by examining defining mechanisms of social cognition, communicational aspects oriented around musical interactions, as well as cognitive and health-related aspects related to group singing and social cohesion. Secondly, results from a study consisting of data gathered at four different Danish folk high schools are discussed in relation to the first part of the paper to investigate the aspects of group singing that might have an impact on the students' feeling of cohesion. To conclude, possible new insights into this area of research and hints for further investigation derived from this paper are discussed.

It is shown that group singing significantly establishes an increased feeling of cohesion amongst the students. Social cognitive aspects like affective engagement and shared intentionality together with neural and physio- and psychological changes that enhance social bonding and a feeling of cohesion are discussed to be explanations for this tendency.

Table of contents

PART I

1. INTRODUCTION.....	- 4 -
1.1 DEFINING MECHANISMS OF SOCIAL COGNITION AND INTERACTION	5 -
<i>1.1.1 Theory of Mind</i>	5 -
<i>1.1.2 Joint action</i>	7 -
<i>1.1.3 Social alignment and reciprocity</i>	9 -
<i>1.1.4 Group level social interaction</i>	12 -
1.2 THE ORIGINS OF MUSIC MAKING AND ITS COMMUNICATIONAL ASPECTS	13 -
<i>1.2.1 Affective engagement</i>	14 -
<i>1.2.2 Rhythmic synchronization and entrainment</i>	18 -
<i>1.2.3 Floating intentionality</i>	20 -
<i>1.2.4 Music as coalition signalling</i>	22 -
1.3 COGNITIVE AND HEALTH-RELATED ASPECTS OF (GROUP) SINGING AND SOCIAL COHESION	24 -
<i>1.3.1 Health-related outcomes of singing</i>	25 -
<i>1.3.2 Social cognitive aspects of singing together</i>	27 -
1.4 MUSIC IN THE BRAIN	32 -
<i>1.4.1 PCM-model</i>	33 -
1.5 THE ROLE OF GROUP SINGING IN DANISH CULTURE AND FOLK HIGH SCHOOLS	36 -
<i>1.5.1 The Folk High School Songbook: "Højskolesangbogen"</i>	37 -

PART II

2. INVESTIGATING GROUP SINGING AT DANISH FOLK HIGH SCHOOLS	- 40 -
2.1 THEORETICAL AND ANALYTIC FOUNDATION	40 -
2.2 METHODOLOGY: INCLUSION OF INGROUP IN THE SELF-SCALE	41 -
3. METHODS & MATERIALS.....	- 44 -
3.1 PROCEDURE: MORNING ASSEMBLIES	45 -
3.2 MATERIALS & STIMULI: QUESTIONNAIRES AND THE IIS-SCALE	46 -
3.3 PARTICIPANTS: THE FOLK HIGH SCHOOL STUDENTS	47 -
4. RESULTS	- 48 -
4.1 THE IIS-SCALE	48 -
4.2 PERSONAL STATEMENTS	50 -
5. DISCUSSION	- 52 -

5.1 DISCUSSION OF RESULTS	- 52 -
<i>5.1.1 The sociality of group singing</i>	- 52 -
<i>5.1.2 Possible cognitive, neural, and sociopsychological explanations</i>	- 55 -
5.2 CONFOUNDING FACTORS	- 61 -
5.3 EXPERIMENTAL DESIGN AND METHODOLOGY	- 62 -
6. CONCLUSION	- 64 -
7. REFERENCES.....	- 66 -
8. APPENDICES	- 71 -
8.1 APPENDIX 1: THE FIVE DANISH GROUP SINGING TYPOLOGIES.....	- 71 -
<i>8.1.1 Appendix 1a: Danish original version</i>	- 71 -
<i>8.1.2 Appendix 1b: English translated version</i>	- 72 -
8.2 APPENDIX 2: SONG DESCRIPTIONS	- 73 -
8.3 APPENDIX 3: PRESENTATION-SLIDES OF QUESTIONNAIRES	- 74 -
8.4 APPENDIX 4: QUESTIONNAIRES.....	- 76 -
<i>8.4.1 Appendix 4a: Before singing (Danish and English version)</i>	- 76 -
<i>8.4.2 Appendix 4b: After singing (Danish and English version)</i>	- 79 -

Part I

1. Introduction

Group singing is an important part of the daily life at Danish folk high schools. Every morning students and teachers sing songs together from the folk high school songbook at the morning assembly in the assembly hall. Singing sessions in the evening are also a frequent and beloved activity amongst the students. The uniting of voices creates a seemingly common feeling of joy and cohesion amongst the students.

The present paper searches to explore the phenomenon of group singing at Danish folk high schools and investigates whether singing together has an impact on the feeling of social cohesion amongst the students. During a five-day period, I visited four different folk high schools, hosting and accompanying the singing at a morning assembly, and gathered data from the attending students with two questionnaires filled out immediately before and after the sessions. The present paper presents this study and discusses the findings and puts them in relation to other similar studies in group singing as well as relating it to literature on social cognitive aspects of group singing and music making in general.

Group singing has gained massive attention in Danish society in recent years and the feeling of unity and cohesion that are connected to singing is a commonly known subject in almost any stratum of the Danish society.

The main hypothesis of the study is thus that group singing at morning assemblies generates a stronger feeling of cohesion amongst the students. It is with hopes and expectations for a broader understanding of this phenomenon as well as serving as inspiration for new and fruitful ways to approach the topic that this paper is put out to investigate.

The structure of the paper is in two parts, with the first part functioning as a theoretical framing for the study that is presented and discussed in the second. In the first section mechanisms of social cognition and interaction are covered to establish a theoretical foundation for the paper and study. Hereafter, music-making and singing are investigated as a communicational and inherent social phenomenon and their cognitive aspects are presented and discussed. Next, group singing is investigated more specific in relation to different health-related and cognitive aspects that earlier studies

suggest have an impact on cohesion and bonding. A model of a cognitive predictive coding mechanism that generally lays as the foundation for musical perception in general is then presented. To conclude the first part, a brief description of the sociocultural role of group singing is imposed to illuminate the cultural context of which the singing takes place.

The study is then presented in the second part of the paper with a presentation of the analytic foundation and chosen methodology for the study as well as a walkthrough of the experimental design and the results. Afterwards a discussion of the findings in relation to the earlier presented bodies of work from relevant studies will be unfolded with the purpose of shedding lights on hopefully well-established and fruitful ways of exploring group singing as a cohesion-generating social act. This paper thus aims to function as a theoretical overview for central theories and studies on this topic as well as presenting an experimental approach for inspiration for further investigation in group singing and its effect on social cohesion.

1.1 Defining mechanisms of social cognition and interaction

In the cognitive sciences some theoretical notions have gained footing as the most fruitful when investigating human interaction and perception. In the following sections central basic cognitive mechanisms that lie as the foundation for research on social communication and interaction in general will be examined and function as the theoretical backbone for the present study.

1.1.1 Theory of Mind

Theory of Mind (ToM) is in the cognitive sciences considered as the cognitive ability that allows humans to recognize and report on the minds of other people and living beings. ToM enables us to understand the mental states of others as independent from our own perception and experiences and automatically predict and explain the behaviour of others. ToM is also often referred to as the mentalizing or mind reading ability (Garfield et al., 2001). Furthermore, the cognitive abilities explained here in relation to ToM are to be understood as mechanisms available for cognitively “normal” individuals only. People diagnosed with autism are for example characterized by having a differently working and less versatile ToM. However, it is important to understand this feature as the most important and vital cognitive tool for humans to be and act socially.

The development of ToM is generally regarded as being closely related to language acquisition and thereby does not work as an autonomous form of knowledge that precedes the social and linguistic learning in humans. However, ToM abilities normally begin evolving when around three to four

years of age but keep developing even after acquiring the ability to speak that typically starts a year or two later (Heyes et al., 2014). In other words, ToM is the ability to act socially and is not to be understood as a domain-specific cognitive module driven exclusively by biology and developed on its own terms. On the other hand, this ability is learned in accordance with the cultural and social surroundings of the individual in collaboration with language-acquisition (Garfield et al., 2001).

Santiesteban et al. (2014) have conducted an experiment in which it was investigated how big a role ToM has on both an explicit and implicit level of the human cognition. That is, how ToM works both unconsciously (implicit) and with high effort cognitive control (explicit).

This experiment builds on previous studies where participants were presented dots as visual stimuli on a computer screen while animations of a human figure (avatar) were placed next to the dots. Participants were then asked to verify the number of dots either from the perspective of themselves (self-trial) or the avatar (other-trial). The results from the previous studies show that participants are slower to count the number of dots when an avatar can see a different number of dots from their own point of view. In short, we take the avatars point of view into consideration even when their presence has no purpose for the task, called the “self-consistency effect”. This conclusion has resulted in generally treating ToM, agentive attention, as an important workhorse for implicit cognition establishing the self-consistency effect.

In the Santiesteban et al. (2014) experiment arrows were added as a second condition. Here, both the queues of the avatar *and* arrows were shown to have an underlying implicit working effect on the participants (Santiesteban et al., 2014). This means that the directional features of the stimuli processing are regarded to play an equally important role as the agentive attention in the self-consistency effect of implicit cognition. Santiesteban et al. (2014) therefore conclude that mechanisms mediating the self-consistency effect are domain general.

Domain specific cognition refers to the neural mechanisms dedicated to process specific content like social stimuli (Happé et al., 2017). This experiment thus questions the role of ToM mechanisms in implicit cognition by showing that domain general processes also are sufficient to explain behaviour that seems to involve ToM.

The distinction between explicit and implicit ToM (also referred to as low-level vs. high-level mentalizing) is formulated in the two dominant accounts of ToM: *theory theory* and *simulation theory*. These have been seen as competing approaches. However, it is now widely accepted understanding

them as complementary accounts (Heyes & Frith, 2014). Simulation theory treats the implicit features of ToM and explain these by measuring activity of mirror neurons and motor facilitation in the muscular groups in observers watching and interacting with target agents (Gallese, 1998). In other words, other people's mental states are represented by adopting their perspective and simulating them via mirror neurons and mutual motor muscular facilitation. Theory theory works in the explicit ToM and proposes that through observation and hypothesis testing children learn about explicit mental states in a "scientific-like" approach (Heyes & Frith, 2014).

By having these two approaches complementing each other, ToM is now considered as being shaped by a genetic "start-up kit" as well as the cultural inheritance and surroundings in the development of the infant. Heyes & Frith (2014) compare the explicit mind reading with print reading in terms of its weak dependence on specialized genetically inherited mechanisms and strong dependence on tuition, but also in the shape and size of the cultural legacy. Linguistic communication thus plays a great role in the development of explicit features in the theory of mind by the phenomenon coined as *eavesdropping*: children listen to what expert mind readers, adults with life experience, say in everyday life and when they have no intention of teaching. In this way children culturally inherit mechanisms from their parents and other mind reading experts that are specialized for the representation of mental states (Heyes & Frith, 2014).

Tomasello (2003) adds to the linguistic importance in ToM development that linguistic communication leads humans to conceptualize things in myriad different, complex, and symbolic ways. How ToM mechanisms play a role in relation to music-making and singing will later be unfolded to investigate how music and singing can be understood as a social practise.

1.1.2 Joint action

Seen in an evolutionary light, a crucial social ability for humans to have developed is the ability to coordinate our actions with those of others. When any form of interaction between multiple participants is involved around a shared scene and goal, we can characterize it as a joint action. More precisely Sebanz et al. (2006) describe a joint action as any form of social interaction where multiple individuals cause a change in the surrounding environment by coordinating their actions in space and time together. A successful joint action is subsequently described to be dependent on the ability to share representations, predict actions, and to integrate predicted effects of own and other's actions (Sebanz et al., 2006).

These three vital coordination mechanisms are treated by Vesper et al. (2017), and they deliver the following table showing how mental representations, sharing of sensorimotor information and general cognitive mechanisms support any joint action.

Coordination mechanism	Example
Mental representations in joint action	
Joint action goal	Relocating a sofa by lifting and moving it together
Task (co-)representation	Carrying a sofa forward or backward
Monitoring	Noticing errors in a co-actor's performance
Sharing sensorimotor information	
Joint attention and shared gaze	Being mutually aware of an obstacle in the way
Sensorimotor prediction	Predicting a co-actor's movement direction
Sensorimotor communication	Pushing a co-actor into a certain direction
Haptic coupling	Feeling a co-actor pushing the sofa
Multisensory processing	Integrating information from different senses
Emotion understanding and expression	Realizing how exhausted a co-actor is
General mechanisms supporting coordination	
Coordination smoothers	Distributing the task of moving forward or backward
Affordances	Being constrained by available space and a co-actor's physical strength
Conventions and culture	Appreciating rules about who carries more weight

Table 1: Coordination mechanisms supporting joint action (Vesper et al., 2017).

Mental representations are explained to occur when interlocutors have a shared goal as a result of their joint actions, for example when carrying a sofa to a mutually agreed location. By monitoring and being aware of the other participant's physical options and obstacles for doing the shared task, mental representations of action possibilities are constructed. When sharing sensorimotor information, the eye gaze is an important feature and well used source for sharing information about internal states and information about potential problems or challenges. The eye movements of interlocutors often reveal information about inner state and by having an awareness of others' eye movement, coordination of sensorimotor actions can more easily be adjusted in accordance with the interlocutors' wishes and, in this way, mutually come closer to the shared action and goal. A successful joint action thus leads to joint perspective taking and the interlocutors' intentions (Vesper et al., 2017).

The notion of joint action can be useful when you want to explore the nature of a social interaction that aims at producing change in the environment. This is, of course, useful when there *is* a form of shared goal and action. However, this is not always the case, and another approach of looking at social interaction in general, is considering the sociality of the situation independent from shared goals and actions. This can be done by drawing on different taxonomy types for social alignment as well as looking at reciprocity and the degree of mutual alignment as the primary requirements for social interaction.

In the next section interactions surrounding joint actions will be mentioned, however the reader must bear in mind that it is not the action itself that is relevant; it is, as mentioned, the sociality of the situation unfolded in the amount of reciprocity and alignment.

1.1.3 Social alignment and reciprocity

Alignment in relation to social interaction concerns the dynamic processes of aligning words, thoughts, bodily postures, and movements that interlocutors do to take each other into account and make use of socially relevant information (Gallotti et al., 2017). When humans interact, we unintentionally and automatically tend to imitate each other which often results in enhancing the communication (Frith & Frith, 2012). When humans have a high degree of alignment in an interaction, it is described to be a highly social interaction, since alignment is a tool for enhancing the communication. Investigating the amount and nature of alignment processes are thus a vital tool for exploring the sociality and nature of social interactions in general.

Konvalinka et al. (2010) have carried out an experiment investigating joint coordinated behavior in synchronized finger tapping on a millisecond timescale. It was found that humans are able to rhythmically align with precision and mutual adjusting with a reaction time down to between one and two milliseconds (Konvalinka et al., 2010). Alignment thus happens on a deeply implicit innate cognitive level and will be further elaborated in section 1.2.2.

Alignment is not only measurable in relation to synchronized behavior when performing a joint action. When communicating and interacting verbally individuals tend to align speech rate, posture, choice of words, and syntactic forms (Garrod & Pickering, 2009). These tendencies are argued to be a result of automatic processes based on imitation happening on many levels other than just the linguistic representation in the mind. Furthermore, alignment is remarked to be in part produced from behavior prediction both for comprehension and production purposes (Garrod & Pickering, 2009).

Social interactions with the highest degree of sociality are defined to be the interactions containing a *bidirectionally* dynamic interaction with a high amount of mutual alignment. This definition delivered by Gallotti et al. (2017) allows us to understand alignment as working on both explicit and implicit levels as well as being either intentional or unintentional. In this light, the interaction *is* the reciprocal information exchange of communicative behavior and not necessarily dependent on a joint action or goal.

Alignment can happen in many ways and with a varying amount of coordination mechanisms involved. But by looking at the different types of alignment we are now able to look at the *nature* of the social interaction. And a fruitful way of doing this, is by taking a further look at the notion of *reciprocity*.

Reciprocity is defined as a social alignment that works mutually and is characterized by cognitive adjustments by every involved interlocutor with the purpose of enhancing the communication (Gallotti et al., 2017). This is also to be characterized as an *online* alignment, where an *offline* is the opposite and characterized by a unidirectional social transmission of information. So, the notion of reciprocity can in this regard be used to explain the nature of the social interactions, and we can conclude that if an exchange of information between two individuals is bidirectional, the interaction is likely to be reciprocal and therefore of a high degree of sociality.

Gallotti et al. (2017) has proposed a figure defining five taxonomy types of interaction between two interlocutors with different levels of reciprocity as the defining factor for the taxonomy types (see Figure 1, page 11). In the figure, the amount of sociality increases from top to bottom, and the first three types can be understood as interactions with unidirectional information transmission, whereas the last two are characterized by a bidirectionally information exchange. Furthermore, the first two are offline with only one part aligning with another, whereas the last three are online and thereby characterized by reciprocity.

Incorporating this taxonomy of interaction types enables us to better grasp and understand social interactions as varying in nature regarding how reciprocal and social they are. Social interactions can now be seen and understood relative to their variety of forms rather than in a more binary social versus antisocial manner. Furthermore, these types are to be understood as dynamically working, where an interaction in the real world will naturally switch between the different types.

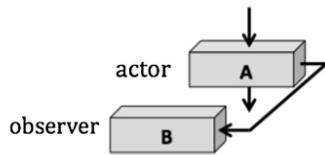


Fig. 1. Off-line social cognition: B observes, but A receives no information from B.

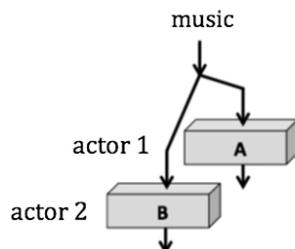


Fig. 2. Coordination without mutual alignment (e.g. Salsa): There is no, or minimal, exchange of information. Both A and B are driven by the same external signal.

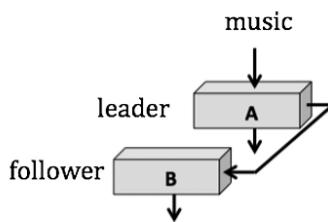


Fig. 3. On-line social cognition without mutual alignment: B aligns to A, but A receives no information from B.

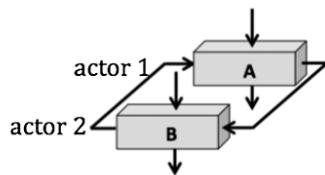


Fig. 4. On-line social cognition with mutual alignment (e.g. Tango): A and B exchange information reciprocally and adapt to each other.

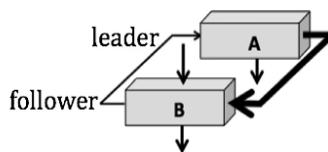


Fig. 5. On-line social cognition with mutual alignment: the follower adapts more than the leader.

Figure 1: Taxonomy of interaction types (Gallotti et al., 2017).

The different interaction types are also useful when looking at a leader-follower relationship. An experiment by Konvalinka et al. (2014) has investigated the difference of neural mechanisms in leader-follower interactions and can therefore be understood in the light of the Figure 1 and the different taxonomy types. By measuring EEG (Electroencephalography) recordings of brain activity during leader-follower finger tapping synchronization interactions between two interlocutors, it was evident that leaders invest more resources in prospective planning and controlling. The leader role

is thus evidently more cognitively demanding, and it is suggested that complementarity and reciprocity is a feature to take into consideration when investigating mutual social interactions in general (Konvalinka et al., 2014).

Social interaction is, of course, happening with more interlocutors than just two individuals. This next section will briefly mention basic cognitive tendencies that can affect general social interaction on group level.

1.1.4 Group level social interaction

Cognitive scientists have long been interested in how decision making and interaction on group level in general can be optimized because a lot of interaction in public spaces and in relation to democratic and western cultural traditions happen on group level. Gallotti et al. (2017) have relevantly remarked that if you pool together individual mental resources, it will exceed the sum of the individual contributions. And as an earlier study has concluded, interactive decision making between two individuals significantly improves when able to communicate freely and exceed the limits of the best individual's contribution, even though both participants have nearly equal visual access to the given stimuli (Bahrami et al., 2010).

We can then conclude that collective decision making has great potential, and as Navajas et al. (2018) point out, aggregating the opinions of many independent and unbiased agents will theoretically end in the group outperforming the best individual judgment. But, as is often the case, reality seems more complex than the theoretical realm of scientific investigation.

Biases are a well-known and common phenomenon in social group interaction and can be related to individual personalities as well as social and identity markers like gender or race. Two common treated biases in cognitive sciences are *optimism bias* and *decision inertia*. The first one is where action outcome is much affected by an unrealistically high expectation for positive outcome resulting in ignoring possibilities for negative outcomes, where the second is a bias related to past experiences attached to individuals that cannot disregard these former experiences in present problem-solving tasks (Bang & Frith, 2017).

A way of dealing with biases on group level is by working with social dynamics and structure within the group. One fruitful way of improving accuracy and social thriving in collective decision making is by dividing larger groups of people into smaller groups allowing face-to-face interaction

that then will be shared in the whole group, thereby exploiting what you could call the wisdom of crowds of crowds (Navajas et al., 2018). In this way a milieu for a freer form of communication is constructed, and the earlier mentioned general social cognitive mechanisms can be exploited in a more fruitful way.

In short, there are cognitive biases and social tendencies that may influence the decision making and interaction on group level. This paper investigates group singing, a cultural and social phenomenon happening on group level, and it is therefore fruitful to have in mind, that there are mechanisms affecting the overall interaction on group level. However, since group singing in Danish folk high schools can be described as having a clear follow-leader role as well as an overall unidirectional interaction form, the group level interaction is not that relevant for the present study, hence this short theoretic introduction to this area of social cognitive research. A more thorough exposition of group singing in Danish folk high schools will be elaborated later in section 1.5.

This paper is rather targeting the individual cognitive and social benefits of group singing and therefore the next sections will walk the reader through some central cognitive and communicational aspects of singing and music making.

1.2 The origins of music making and its communicational aspects

Singing is a very common way of expressing and making music. This section will cover important communicational aspects of music-making in general by reviewing different studies on music and its cognitive effects and origins and how musical communication differs from for example linguistic based interactions. Afterwards, a more thorough examination of singing, more specifically group singing, will be covered.

A neuroscientific experiment has investigated whether music can transfer specific semantic concepts and meaning in a similar manner as words and sentences can (Koelsch et al., 2004). This was done by measuring activity of dipoles in the posterior portion of the middle temporal gyrus in the close vicinity of the superior temporal sulcus. It is here, the activity of semantic processing derived from language-based interacting can be traced. In the experiment semantic meaning in language and music was compared by investigating the semantic priming effect as indexed by the behavioural measures when subjects with no musical training were presented with visual target words after hearing a spoken sentence or a piece of music. The words and sentences consisted of half of them being abstract and the other half concrete in meaning. One third of the descriptions were based on

descriptions made by the composers of the music themselves, and the rest was descriptive words chosen by musicologists, for example the word *staircase* was chosen to establish semantic meaning similar to ascending pitch steps.

The results of the study showed similar brain activity when hearing music compared to listening to words and sentences. The results thus indicate that music as well as language can prime the meaning of a word, and that both music and language work similarly when determining physiological indices of semantic processing. In other words, the semantic processing related to language-based interactions resembles music-based interactions. However, music and language does not share the same semantics, but the present data show that music can prime representations of meaningful concepts, both abstract and concrete, just as words and language can (Koelsch et al., 2004).

1.2.1 Affective engagement

It is now fair to assume that just as ToM functions as a vital workhorse for requiring linguistic abilities, it is an important tool as well for achieving musical abilities and acting socially in a musical setting.

This is exactly what Livingstone & Thompson (2009) suggest in their article “The emergence of music from the Theory of Mind”. Here, they argue that ToM lies at the foundation of the emergence of music. More specifically, it is the ability of *affective engagement*, deriving from ToM, which is underpinned by the mirror neuron system of empathy and imitation.

It is argued that music generates a multimodal emotional experience through an activation of channels that are being emphatically matched by the audio-visual mirror neuron system. What this means is that the emotional experience generated by music permits a safe learning environment for affective engagement (Livingstone & Thompson, 2009).

But what is the connection between emotion and music, and how is emotional experiences in relation to music derived in the listener?

Balkwill & Thompson (1999) have in a study investigated aspects of music perception that enable humans to identify musically expressed emotions, and if these aspects are working in a cross-cultural manner. That is, if people from a given culture can perceive the same emotional qualities as people from a completely different country and culture in a piece of music characterized by musical qualities specific to the foreign culture and tradition with an unfamiliar tonal system.

An experiment was conducted where listeners enculturated to Western tonal music judged emotional content of music based on an unfamiliar tonal system and instrumentalization from Hindustani Ragas, as well as provided judgments of several psychophysical dimensions in the same musical stimuli. The following five dimensions were investigated in the study: tempo, melodic complexity, rhythmic complexity, pitch range, and timbre.

It was evident from the results that the naïve listeners perceived similar assessments of intended emotions in the music compared to expert listeners with musical and cultural knowledge about Hindustani Ragas. For example, the tempo of a piece of music evidently tells a lot about whether it is to be perceived as sad or joyful. Many other characteristics connected to psychophysical cues reveal emotional content, but the main point from the study is that humans thus seem to be able to identify emotions based on psychophysical cues in music in general.

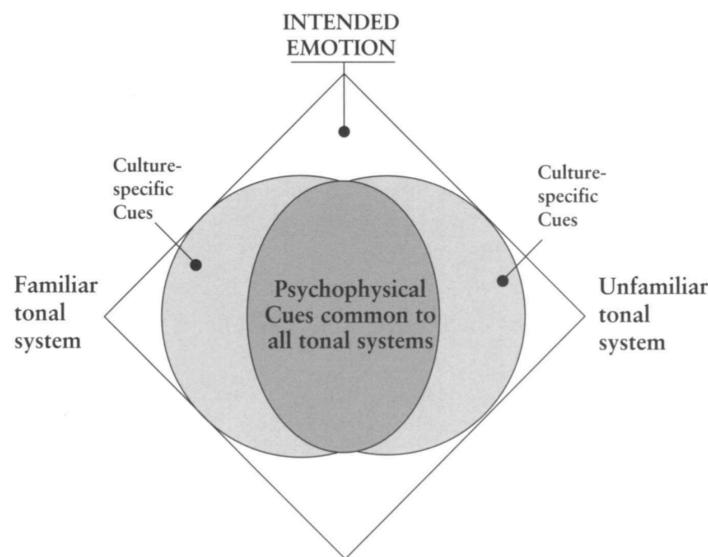


Figure 2: Psychophysical Cues causes emotion in music (Balkwill & Thompson, 1999).

Based on their study, Balkwill & Thompson (1999) propose the figure above, which is used to explain how music inherently elicits emotions in the listener in an evident cross-cultural manner, but also how it carries culturally distinct cues as well.

Affective engagement seems also to be created through the endorphin system while making music. In an experiment, Dunbar et al. (2012) used pain threshold as an assay for beta-endorphin release comparing music performance activities versus listening activities. Beta-endorphin release is generally recognised to be associated with social bonding being specifically linked to the pain control

system and the reward system in the brain (Dunbar et al., 2012). The results were clear that singing, dancing, and drumming trigger endorphin release, where the listening activities did not. It is thus concluded in the study that it is the performance of music that generates endorphin, not the music itself.

The release of dopamine has been shown to play a role in emotional arousal responses in relation to listening to music. Dopamine is a neurotransmitter connected to the increase of, amongst other things, reward feeling, motivation and arousal. Salimpoor et al. (2011) have in a study measured the release of dopamine in participants listening to either pleasurable or neutral music. Pleasure being a highly subjective phenomenon makes it difficult to measure objectively. However, physiological changes occurring during moments of extreme pleasure like chill and frisson responses are well-established physiological aspects for measurement since these responses involve a clear pattern of autonomic nervous system (ANS) arousal.

Ligand-based positron emission tomography (PET) scanning was used to estimate dopamine release in striatum. Furthermore, fMRI scans were done on the same participants with the same stimuli to examine the temporal profile of blood oxygenation level (BOLD)-response in those regions that showed dopamine release in the PET-scans. BOLD-responses and dopamine releases measured in PET-scans are usually correlated in order to reveal temporally mediated distinctions in dopamine releases together with the anticipatory and consummatory responses in respectively the dorsal and ventral striatum.

The results from the study show that intense pleasure in the participants' responses to music leads to dopamine release. Also, and notably, the anticipation of an abstract reward (music being the abstract phenomenon) were shown to result in dopamine release distinct from those associated with the peak pleasure itself. In other words, the act of listening to pleasurable music as well as the anticipation inherent in the act of listening (this will be further elaborated in section 1.4) itself are shown to have the effect of releasing dopamine (Salimpoor et al., 2011).

Returning to the article about ToM in relation to music-based communication, Livingstone & Thompson (2009) argue that the two perspectives on ToM, *Theory Theory* and *Simulation Theory* offer alternative explanations for the emergence of music through the pre-existing cognitive faculties. *Theory Theory* suggests that in order to predict and explain actions of conspecifics this model of mental states (ToM) has been developed in the human brain. The other, *Simulation Theory*, is

instead suggesting that it is the mirror neuron system that is engaged in the hypothetical state of mind, providing the *basis* for empathy, and therefore lays the foundation for the music communication. In other words, whether you subscribe to the *Theory Theory* or *Simulation Theory* account of mind-reading, it will also depend on whether you are able to describe music as working mostly in the implicit low-level mind reading (*Simulation Theory*) or in the explicit high-level mind reading (*Theory Theory*). However, it is importantly noted that both viewpoints are compatible with understanding music as an instance of affective engagement that allows the construction of mental models of emotional states of others in the communication situation (Livingstone & Thompson, 2009). Music thus generates emotional experience that lays the foundation for a safe learning environment for affective engagement; the exchange of psychological states for developing higher-order models of emotion in other humans.

Other accounts on the origins of music in relation to language evolution propose that music has evolved from a pre-linguistic precursor called “Contagious heterophony” that is also seen in animals (Brown, 2007). Contagious heterophony is defined as “a group vocalization in which each individual produces a variation on a similar kind of call but in which the members of the group call asynchronously; group-wide vocalizing emerges through a sequential process of spreading or contagion” (Brown, 2007). It is a phenomenon occurring in the howling of wolves, and other animals, where the howling of a first wolf is contagious to the rest of the group resulting in creating an asynchronous heterophony of howling wolves. It is then argued that we see a similar occurrence among humans at for example concerts with standing ovations, at recitation of political slogans at rallies or singing songs at sports stadiums and that it plays an important role in group function and identity, territory maintenance and group cohesion both amongst animals and humans (Brown, 2007). The main point with contagious heterophony is in this regard that it is derived from a pre-linguistic precursor not depended on the acquiring of ToM. In short, it is argued that the human vocal system is based on contagious heterophony and provides a precursor for systems that will *later* become both song and speech in humans (Brown, 2007)

This paper does not seek to investigate further into the role of ToM in music, but as it will be evident in section 1.2.4, rhythmic synchronization plays a great role in establishing social cohesion and music-based interaction on group level. In this way, we clash a little with Brown’s view on

synchronicity, but we will bear the importance of vocalizing and the power of contagious heterophony in relation to group cohesion in our minds for deriving points later.

1.2.2 Rhythmic synchronization and entrainment

Synchronization and rhythmic perception and coordination have in other studies also been shown to play a big role in the evolutionary function of signalling social relationships and that the ability to rhythmically coordinate actions develop early in infants and reliably across cultures. Music and especially rhythm can be seen as an extra-verbal communication signalling system evoking emotional reactions in other individuals (Bryant, 2013). Interpersonal rhythmic synchrony has been shown to promote prosocial behaviour in cross-cultural studies done on 4-year-old children and down to as young as 14-month-old toddlers showing more helpful and prosocial behaviour (Richter & Ostovar, 2016).

One important mechanism that has been described to function as the backbone for the rhythmic nature of humans is *entrainment*. It is defined as spatiotemporal coordination resulting from rhythmic responsiveness, where organisms synchronize their own biological rhythms to external cyclical processes. This phenomenon is likely to have evolved because it provides an evolutionary advantage for organisms to “tune in” to ecological rhythms and respond symmetrically to these (Phillips-Silver et al., 2010). Entrainment can also be seen as working socially and occurs when an individual responds to outputs from another individual or entity as the incoming signal for rhythmic processing. The degree of mutuality can of course vary and can happen in dyadic relationships as well as on group level. Just like alignment with advantage can be seen in degrees of sociality, it is also the case with entrainment, and Phillips-Silver et al. (2010) have produced following figure (Figure 3) for overview of the different social entrainment systems.

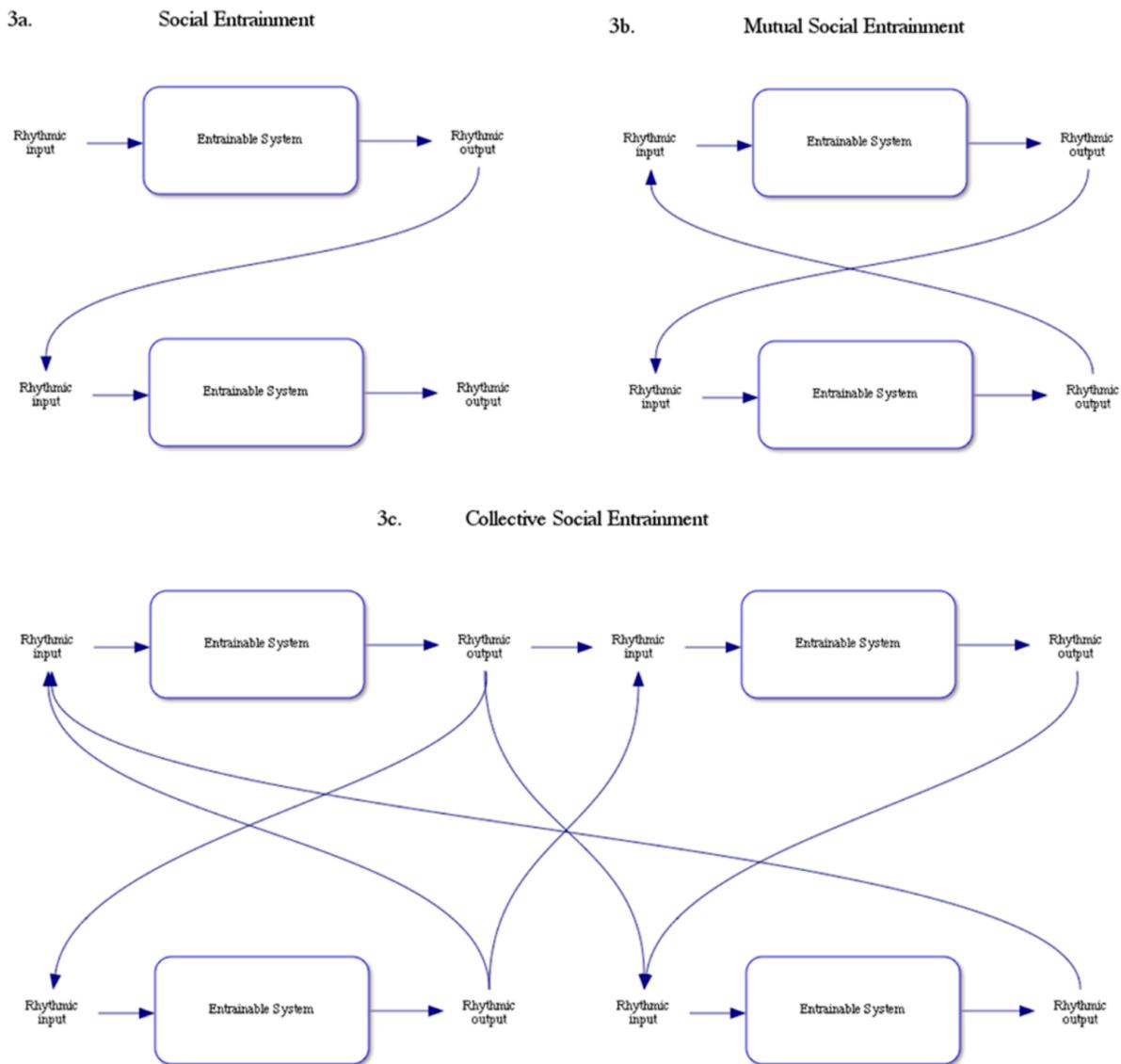


Figure 3: Social entrainment systems (Phillips-Silver et al., 2010).

Rhythmic understanding and perception are by Richter & Ostovar (2016) seen as likely to have paved the way for the evolution of language, since it is argued that linguistic coordination requires an underlying embodied communication based on rhythmic and gestural understanding. It is the rhythmic perception that simply enables humans to discern words and is a necessary feature for codifying and decoding language (Richter & Ostovar, 2016).

To conclude, and importantly for this paper, Bryant (2013) notes that this unique rhythmic ability to coordinate our actions with others is reliable across cultures. Furthermore, group performances of music and dance are described to be a universal phenomenon across all known human cultures, and they are almost always inextricably tied to the central cultural traditions of a given group of socially

and culturally unified humans (Bryant, 2013). Since this paper investigates a musical phenomenon that is a part of the Danish culture and tradition it is important to understand its cultural role and meaning. This will be unfolded in section 1.5, but the point to be made here is that there are universal cognitive mechanisms regarding rhythm perception that lays the foundation for musical, cultural, and social cohesion.

1.2.3 Floating intentionality

An important aspect of human social interaction is, as discussed earlier, the orientation around a joint and shared action or goal in an interaction. When we play or sing music together, this is of course a piece of joint action. Music-based interaction of any kind relies on the use of instruments or use of the body in alternate ways than speaking like singing or percussive use of the body. By performing music musicians create both sounds and rhythms, but also physically show that music is being made. When you play an instrument, you cause a spatiotemporal change in the shared scene, and this, in turn, creates a mutual attention towards the produced sounds and rhythms in the spatio-temporal condition. The musician produces an instrumental and communicational action intention, which then initiates a sensorimotor communication that other musicians engage with. The spatio-temporal social interaction is thus initiated by the joint action of making music.

A study investigating individual and joint action outcomes in duet music performances has shown, that musicians are able to monitor both their own and their partner's actions and the combined outcome of their coordinated actions. It is further shown that action outcomes which affect the shared goal affects the musicians more than action outcomes which only affect individual actions of the musicians (Loehr et al., 2013). When musicians play together, it is thus shown that they can distinguish between both their own and others' actions as well as the individual and joint outcomes.

The complex nature of communicating through music is harder to grasp and explain compared to linguistic interaction that follows an already given set of rules because of the non-negotiable semantic meanings of words. Words and language carry an inherent intentionality and prospective specificity of meaning. Auditory interaction in the form of music does not carry this inherent intentionality and specificity, and the British musicologist, Ian Cross, has coined the notion of *floating intentionality* to capture this (Cross, 2005).

A music-based interaction is characterized by its semantic open-ness and multiple possibilities of meaning and intentional interpretation. In other words, individual difference in interpretation of the

communication does not have a say in whether the communication is successful or not when making music together. Music delivers a temporal regulatory framework which allows participants to interpret the flow of music on individual terms while at the same time coordinating behaviour and attentional foci. This semantic openness creates conditions for minimization of conflict, while simultaneously enabling joint sense of shared goals and actions oriented around the temporal regulatory framework (Cross, 2005). In short, the notion of floating intentionality tells us that music is a way of communicating centred around the joint action, while having a not fixed inherent semantics which allows for rich possibilities regarding individual differences in expressing a mutual understanding of the shared scene.

Returning to the notion of affective engagement, Livingstone & Thompson (2006) propose that the previous mentioned capacity for affective engagement coupled with the mentalizing ability (ToM) enable a host of symbolic systems, including music. By stating this, it is stressed how affect posits a central role in musical origins and thereby in a communicational setting characterized by floating intentionality. Affect is a strong working mechanism in caregiver-infant interaction, and by coupling ToM with affective engagement they conclude that infants are provided with early exposure to music-like structures via the affect-driven floating intentionality in the caregiver-infant interaction (Livingstone & Thompson, 2006). In other words, the floating intentionality of communication through music is connected to the deeply social cognitive mechanisms in humans.

It is now fair to conclude that music is an inherently social phenomenon. How music is practised and what role it plays in the lives of humans are very much dependent on the complex cultural structures in which it is engaged and formed, since social interaction in general is culturally dependent.

Humans are particularly skilled compared to any other animal in coordinating actions in a rhythmic manner. This ability is developed in early infants and group performances of music and dance and is also a visible communicative factor and phenomenon across every known culture (Bryant, 2013).

How emotional aspects of music play a role in group performances does not have a clear-cut answer, but emotional experiences related to music are necessarily tied up with the complexities of social interactions and therefore also the culturally dependent musical behaviour in a group. So, since music is characterized by its social nature and prominent role culturally, it is suggested that

music has had an evolutionary role and function in signalling social relationships across groups (Bryant, 2013).

1.2.4 Music as coalition signalling

One distinctive social feature that, among others, make humans unique compared to all other mammals, is the ability to form close and highly cooperative coalitions and alliances between groups even without any consanguineal relation (Hagen & Bryant, 2003). So, the questions are here then why do we do this and what cognitive forces drive this tendency? Hagen & Bryant (2003) suggest that by looking at the possible roles of music and dance on an ethnographical and cognitive evolutionary level it can help us understand the driving forces behind this social feature. One of their main contributions is the notion of the *coalition signalling system* with music and dance playing a central role.

Firstly, a closer definition of a “group” is needed. Hagen & Bryant (2003) describe it as “a large number of individuals that are willing as well as able to coordinate actions to achieve mutually beneficial goals”. It is not a coalition of people in their physical presence alone that in this regard describes a group, it is the *possibility* and *willingness* of shared actions and goals that are the key features. This description of a group will be applied in the present paper, and it will later be put in relation to the social dynamics that are characteristic for the Danish folk high schools.

Hagen & Bryant (2003) conducted an experiment investigating, firstly, if people infer coalition quality from the quality of a given piece of music. And, secondly, if quality of the given piece of music is in part dependent on the synchronization in the music. For the experiment a song with acoustic drums, electric bass, acoustic and electric guitar were composed, all recorded on their own digital tracks. Three one-minute versions of the song were then created. The difference of the versions consisted in how much in-sync they were. The first version was completely in sync with all instruments, the second version had delayed each instrumental track with 60ms, and the third was a “scrambled” version with timing mistakes consisting of small tempo alterations on each track at different times. 159 participants (undergraduate anthropology students, mean age 21, 68 males, 91 females) were then given a brief questionnaire after listening to each version answering questions related to the quality of the music and personal qualities attributed to the musicians “playing” the different instruments. It was evident from the results that synchrony in the music affected perceived

music quality, which further affected the participants' perceived coalition quality amongst the "musicians" (Hagen & Bryant, 2003). The point to take from this is simply that a strong rhythmical connection, for example implemented in high quality synchronized music, is equivalent to the apparent quality or robustness of the cohesion of the group of people performing together.

Hagen & Bryant (2003) further argue that in groups characterized by the above-mentioned features of possibility and willingness of shared actions and goals, the individual interactions inside the group must be of a rich and highly social nature characterized by a high amount of alignment and sociality between the interlocutors. Because of this, interactions and performances at group level can be derived as credible signals of collective interests. Hagen & Bryant (2003) then make the important point that music can function as the group-level analogue of the signals associated with the emotional states of the individuals *in* the group. And as noted earlier, music is an excellent tool for transferring and expressing emotions through the acquisition of affective engagement and ToM.

The *coalition signalling system* is thus used to explain how music and dance can function as a communicative phenomenon signalling coalition based on the dominating common emotional state and spirit from one group to another. In other words, music has the ability to communicate emotional states to listeners even though they are not culturally familiar with the tonal system.

Music may in this regard be seen as not just an inward-pointing mechanism concerning the relations and emotions happening inside a group, but also as a group-level communication device that outwardly signals the emotions and connectedness of the given coalition or social group. And this connectedness is dependent on the quality and synchronization of the music. The more quality and synchronization inherent in the musical performance, the stronger the group cohesion tends to appear.

For a moment let us return to the notion of floating intentionality. By buying in on the idea of floating intentionality we interpret and understand music as a communicative media on its own terms. And as it has been shown, music can provoke emotion and meaning-making on deep personal levels. This means that music can be thought of as a medium suited to manage social situations that are characterized by uncertainty, and enhancing a mutual sense of affiliation between participants, because the floating intentionality allows them to experience the significance of a joint action as both idiosyncratically individual, deeply personal, and yet shared (Cross, 2014).

Cross (2014) further argues that music has the advantage over language to integrate simultaneous experience of multiple participants into a collective communicative interaction. However, speech and language are not to be thought as separative communicative mediums. Music can overlap into speech-dominant interaction, just like the other way round is possible (Cross, 2014).

Music is thus a communicative medium that gives rise for not just only individual communicational well-being, it also has positive outcome for the communication on group-level (Cross, 2014).

In the beginning of this section the social cognitive notions of Theory of Mind, joint action and social alignment and reciprocity as well as a brief mentioning of group level interaction dynamics have been described to give the reader a fundamental understanding of the social cognitive mechanisms that form the basis for complex human social development and interaction. Hereafter the origins of music making and communicational aspects of making music have been introduced. The notion of affective engagement has shown how musical interactions can elicit and communicate emotional states and experiences. Another central communicative aspect of music is how rhythmic synchronization and entrainment can coordinate actions and even signalling social relationships in groups of individuals. Furthermore, the notion of *floating intentionality* has described how the abstract nature and many different forms of music making still carry inherent meaning and intention for humans even though it is different from the more fixed semantic meaning in linguistic based communication. Lastly, the notion of the *coalition signalling system* has described how the communicational aspects of music can play together in a social group setting and create a feeling of cohesiveness and at the same time explain how music evolutionarily have been used to signal coalitions. In the next session the scope will be narrowed down to focus on the specific act of singing. First health-related outcomes of singing will be explored while the social cognitive and cohesive-related dynamics will be elaborated afterwards.

1.3 Cognitive and health-related aspects of (group) singing and social cohesion

It has been shown that music performances in groups have a coalition signalling effect to the outside as well as creating a sense of mutual affiliation between participants. But how have these coalition mechanisms inside the group been investigated in the cognitive sciences? And are there specific health-related or cognitive attributions connected to the act of group singing rather than just talking about making music in general?

1.3.1 Health-related outcomes of singing

An experiment conducted by Kreutz et al. (2003) investigated neurohumoral and emotional effects of group singing in a German amateur choir with 31 members (23 females, 29 to 74 years of age with a mean of 56.9). This was done by measuring the amount of secretory immunoglobulin A (sIgA) and cortisol in the participants before and after two weekly practice sessions with either a singing or listening condition lasting 60 minutes. sIgA is considered the first line of defence against infections in the upper respiratory system, and both sIgA and cortisol levels are specifically related to physiological arousal (Kreutz et al., 2003).

The first practice session consisted of the participants learning parts of Mozart's *Requiem* by singing, whereas the second practice session only consisted of auditory learning by listening and no singing. Also, the emotional states of the participants were measured before and after each practice condition using a standard psychometric scale with the purpose of determining any correlations between physiological and subjective measures.

The findings from the study suggest that singing leads to significant positive increases of sIgA as well as cortisol and that it is, in contrast, not the case with the listening condition. On the contrary, significant negative changes of mean cortisol levels were elicited in the listening condition. The findings related to the emotional states showed that positive affect increased as well as negative affect decreased after singing, and informal interviews confirm these findings (Kreutz et al., 2003). This study suggests, like previous similar studies, that both singing and listening to music have positive outcome for listeners and practitioners. However, neurohumoral effects are only visible in the singing condition, therefore suggesting that there is a difference between listening and singing. It is the *doing* of singing that creates the effect in terms of physiological outcomes.

Unwin et al. (2002) indicate that it is a different dubious picture regarding group singing and its effect on mood change. In an experiment with a healthy adult community sample of volunteers (quantity not stated) randomly assigned to either singing together for one hour in a group or listening to the singing group, it was shown that both groups had a positive outcome of mood change after the session. A significant difference in mood change between the two group conditions was not found. These two studies thus tell us that the difference between listening and singing in groups seems to lie in the physiological aspects of singing, but that listening can have a similar effect as group singing when it comes to mood change.

Neurochemical effects in relation to singing also appear when speaking of health-related outcomes of singing. Dunbar et al. (2012) claim with their earlier mentioned findings on beta-endorphins related to music activities (including singing) that the release of beta-endorphins also plays a significant role in humans bonding in larger social groups, since endorphins seem to underpin primate social relationships.

Another health-related hormone, Oxytocin, is also associated with the act of singing. In daily speech it is called “the love hormone” and is associated with intimate relationships and with the ability of buffering stress in humans (Kreutz, 2014). Gunter Kreutz (2014) revealed in a study how concentrations of salivary oxytocin only increased in the same group of individuals when singing, in opposition to when only chatting. Before this study, oxytocin had been connected to the act of singing, however, this study is the first to replicate it with a control condition. A mixed group of 21 novice and experienced singers filled out brief questionnaires of psychological well-being and gave samples of saliva for measuring levels of salivary oxytocin, cortisol and dehydroepiandrosterone. This was done at the beginning of two rehearsal sessions and 30 minutes after. There were two conditions: a singing condition with warm-up vocal exercises and a chatting condition with the participants talking about recent positive life experiences. When comparing the mean scores from the two conditions it was evident that patterns of change favoured singing over chatting. The results from this study thus suggest that singing both enhances psychological well-being, but also induces a socio-biological bonding response that is connected to the oxytocin hormone (Kreutz, 2014).

The clear connection between singing and well-being is generally used in healthcare to promote both physically and psychological well-being. In a study by Keeler et al. (2015) four singers from a jazz vocal ensemble had their concentrations of plasma oxytocin and adrenocorticotropic hormone (ACTH) measured before and after two group singing sessions in order to measure levels of social affiliation, engagement and arousal. The experimental design operated with two different conditions: singing respectively pre-composed music and improvised music. In both conditions the singers’ ACTH concentrations decreased, whereas the oxytocin levels increased in the improvised conditions. These results indicate that group singing can reduce stress and arousal as indicated by the decrease in ACTH, which leads to enhanced social flow in the participants. Furthermore, the higher levels of oxytocin in the improvised condition are attributed to the stronger social awareness linked to the act of improvising versus singing pre-composed music.

Neurochemical as well as psychological and physiological factors are clearly an important factor when speaking of health-related outcomes of singing. This leaves us to dig further into the cohesive power of singing in groups and which social cognitive aspects lay as the foundation for this tendency. Also, as Unwin et al. (2002) point out, changes in the pattern of breathing are regarded as being an interconnected part of most emotional reactions. This breathing and respiratory aspect of singing seems to be a focus for more recent studies on group singing and its relation to physiological and psychological well-being.

1.3.2 Social cognitive aspects of singing together

Vickhoff et al. (2013) investigated how choir singing promote wellbeing by measuring the heart rate variability (HRV) and Respiratory sinus arrhythmia (RSA) of 11 healthy 18-year-olds of mixed gender. The participants had to perform under three conditions: 1) humming a single tone and breathing when needed to, 2) singing a hymn with unguided breathing, and 3) singing a slow mantra with common pauses for breathing. The differences in the conditions are thus in the breathing structure of the singing with the humming having no structure, the hymn an uncoordinated structure, and the mantra a coordinated structure for breathing. The heart rate (HR) was measured throughout every condition, and by doing this it was possible to examine if song structure affected the HR-patterns. It was found that the three different song structures caused three different respiration patterns and that unison singing of regular song structures makes the hearts accelerate and decelerate simultaneously across participants. It was thus concluded that song structure, respiration and HR are connected.

This conclusion resonates with the first article to describe inter-individual synchronization of respiratory and cardiac patterns caused by singing done by Müller and Lindenberger (2011) a few years earlier. Müller and Lindenberger (2011) found that respiration and HRV synchronization (entrainment) increased significantly between subjects when singing in unison and canon. What Vickhoff et al. (2013) then provide with their study, is an explanation of the reason for this HRV entrainment: unison singing (the hymn and especially the mantra conditions) coordinates respiration with consecutive RSA effects. In other words, the guided common breathing facilitated by unison structured singing enhances the entrainment between singers. What we can conclude is then that there is a connection between vocal phrase length and HRV frequencies, and that HRV is coupled to respiration (RSA).

The following figure (Figure 4) graphically explains the aligning tendency of the participants' HRV-frequencies especially in the hymn and mantra conditions. Each panel depicts the participants' spectral densities with the grey curves and the black line represents the mean spectral densities across participants.

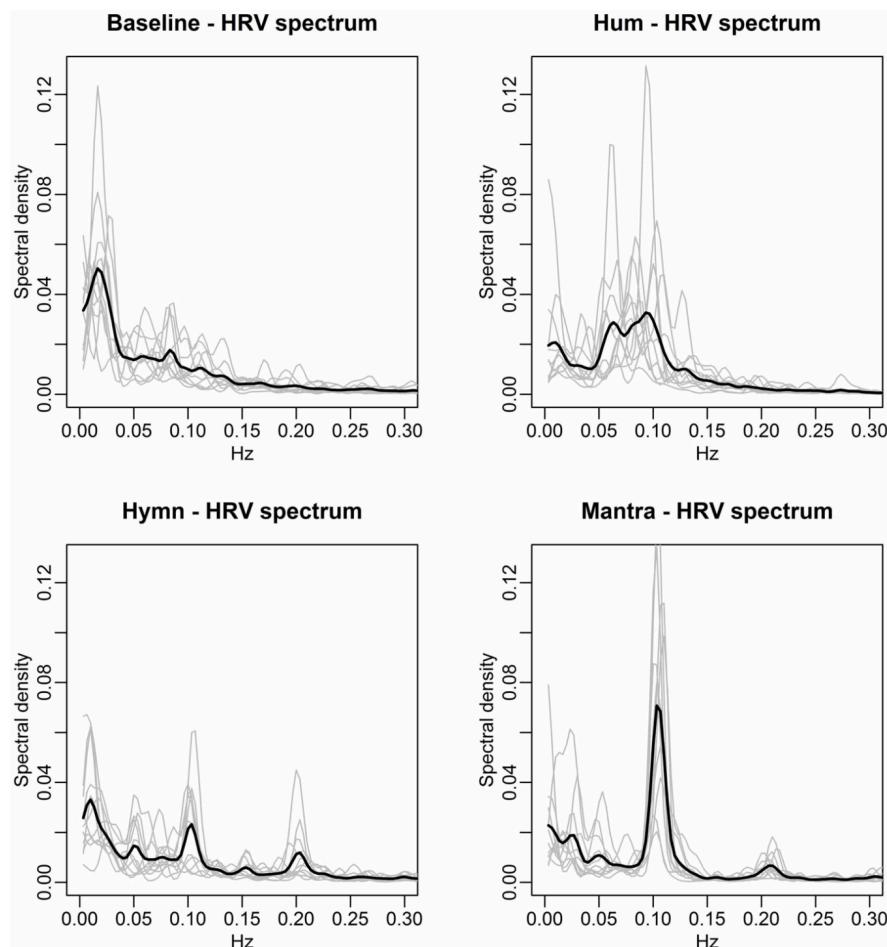


Figure 4: HRV-frequencies induced by the four different conditions (Vickhoff et al., 2013).

Furthermore, it is pointed out how the vagal effect of breathing is universal and works similarly across cultures because it is related to the autonomic nervous system. This can thus be used to explain why coordinated respiratory activity, like singing and praying, is a common practice across cultures even with strong variation in beliefs and way of living (Vickhoff et al., 2013).

Vickhoff et al. (2013) interpret their results in the context of Porges' polyvagal theory of communication and how the guided respiration enhances a calm, unthreatened mental state creating motivation for social communication. For the present paper this path will not be taken further into account,

but the results from their study can be seen from the perspective of the earlier described notions of joint action and entrainment.

When thinking of the nature of joint action as described earlier, it can be claimed that external and visible joint action corresponds to the inner and biological joint action mechanisms in the interlocutors. Reversing this logic will guide us to consider how the synchronized internal events, entrainment, can affect the external actions (see Table 1, page 8 and Figure 3, page 19). When singing together the neurophysiological activity for motor production of words and melody, timing as well as respiration and HRV are coordinated across individuals. A fair guess for the social cognitive outcomes caused by this jointness is that singers should now be more inclined to change their egocentric perspective to a more social *we*-perspective, causing them to perceive the world from a more reciprocal point of view, thus establishing and defining a stronger *we*.

This feeling of a stronger *we* is by Tomasello & Carpenter (2007) described as a *shared intentionality* (also referred to as *we-intentionality*). Shared intentionality refers to collaborative social interactions in which interlocutors share psychological states with one another. And this sharing of psychological states is believed to be what distinguishes humans from other primates: the ability to learn through other persons and to collaborate with others in collective activities. In other words, this feeling of a stronger *we*, a shared intentionality, is serving as a psychological foundation for all things cultural. Sharing psychological states is a necessity for social behaviour and skills and motivations for shared intentionality are seen as direct expressions of the biological adaptation that enables children to participate in the social and cultural practices surrounding them (Tomasello & Carpenter, 2007).

But is it the group singing *per se* that creates this feeling of cohesion and shared intentionality or is it the cooperative nature of the jointness of singing that is the workhorse for this feeling of cohesion? Wolf et al. (2015) have shown how participants having coordinated movements and joint attention alone can feel cohesion and closeness with an interacting partner. Two participants (63 in total) were sat in front of their own individual computer screens and had to respond by clicking with the mouse whether there was a consonant or vowel letter on the screen. The participants did not directly interact with each other but knew that the other participant was doing the same task and that they were cooperating on a shared task. After the session participants had to respond whether they felt closer to the other participant by answering a social bonding scale as well as the IOS-scale (Inclusion of Other in the Self) – this scale will be elaborated further in section 2.2 in part II. Overall,

the results showed that participants felt connected to their given partners even though the nature of the interactions had a minimum of jointness. Wolf et al. (2015) suggest with their findings that it is possible that social bonding in joint actions is merely the product of a series of repeated low-level implicit cognitive processes. In short, feeling a cooperative urge regardless of the interaction itself can have factors that promote feelings of social bonding and cohesion.

Group singing has furthermore shown to have a potential for creating a shared social identity amongst people with post-stroke aphasia. People with post-stroke aphasia have, beyond difficulties in language functions, generally reported more experiences of social exclusion and reduced levels of social activity because of their disorder (Tarrant et al., 2021).

In a recent experiment 21 British people with post-stroke aphasia was assigned to a singing group with the amount of six or seven in each. Ten weekly singing sessions lasting 90 minutes were video-recorded and analysed later by independent coders on the basis of the Harvard Community Health Plan Group Cohesion (HCHP-GCS) scale. Each session was then rated on the degree to which the group *as a whole* appeared cohesive versus fragmented. The results indicate a reliable difference between cohesion scores at the beginning and the end of the singing interventions. No signs of fragmentation were observed, and this study thus suggests the feeling of cohesion to be a parameter to take into account when dealing with a shared social identity (Tarrant et al., 2021).

The studies I have mentioned hitherto have either been focused on the physio- and psychological and neurohormonal and -chemical well-being irrespective of the social cohesive aspects of group singing. A series of studies (Pearce et al., 2015; Pearce et al., 2016a; Pearce et al., 2016b; Weinstein et al., 2015) connect these features and has investigated whether health and well-being improvements are mediated by the social bonds in a choir, both as a group (collective bonding) and on an individual level (relational bonding).

Over the course of 7 months, Pearce et al. (2015) explored in a longitudinal study whether weekly community-based group singing classes could create greater impact on health and well-being compared to other weekly activities such as creative writing and crafts. Four of the classes (with a total of 84 participants) were singing classes and the last three were creative writing or crafts classes (with a total of 51 participants). It was then investigated if these potential health and well-being benefits were mediated by singers having stronger social bonds compared to participants in the other classes. After the first, third and seventh week (when finished) data from the participants

divided into seven newly formed community-based adult education classes were collected. The data consisted of Proxy measures of endorphin levels by measuring pain threshold in the participants as well as the participants self-reporting on the IOS-scale.

The results from the study showed that the singing groups reached similar levels of closeness to their classmates by the end of the study compared to the non-singer. However, the singers evidently seemed to bond much quicker than the non-singers as reported in timeslot 1 and 2, indicating that singing together has a kind of “ice-breaker effect” which indicates that singing together furthers faster social bonding than other social activities like creative writing or craft workshops (Pearce et al., 2015).

Another longitudinal group singing study with a similar design was conducted to further investigate the social bonding mechanisms of group singing. Four of the classes (with a total of 81 participants) were again singing classes and the last three were creative writing or crafts classes (with a total of 51 participants). This time the data consisted of only self-report questionnaires on mental and physical health, well-being, and social bonding. The results were a bit surprising and showed no significant difference in improving health and well-being in the singing classes versus the other creative writing or craft classes. An improvement in physical and mental health as well as increasing collective bonding and social cohesion was found, which was in line with similar earlier studies.

However, this study nonetheless ends asking whether group singing is special, and if these improvements in relation to cohesiveness and physical and mental health are caused simply by just being together and interacting socially in a group (Pearce et al., 2016a)? This will be discussed later in relation to the results from the study presented in the second part of the paper.

Another study investigated whether singing in groups has an impact on the bonding processes. The amount of social bonding between two conditions of singing groups was measured and compared between groups with respectively competitive and cooperative singing (Pearce et al., 2016b). Sub-groups of the total amount of participants, 88 European students from the same university Fraternity, were made and given different names. The groups then had to either sing cooperatively or competitively (trying to be louder than the other group), and the feeling of cohesiveness among the groups were then compared. The results clearly showed that participants felt significantly closer to groups after singing cooperatively compared to when singing competitively. This indicates that group singing can increase cohesiveness, but a shared common motivation must be a common

factor for all interlocutors in the singing group. Singing *per se* does not enhance this feeling of cohesion and closeness alone (Pearce et al., 2016b).

The abovementioned studies of group singing have been with relatively small choirs, but a study by Weinstein et al. (2015) intends to investigate if group size has any impact on cohesion and social bonding between participating singers. Sub-choirs consisting of 20-80 singers were put together to create a “mega choir” consisting of a total of 232 singers and like in previously mentioned studies, self-report measures of social bonding as well as endorphin release (pain thresholds as proxies) were done before and after 90 minutes of singing. The sub-choirs also did the answering with a 90-minute singing session on their own, so that the results from the mega choir could be compared with results from the sub-choirs. Overall, group singing in both cases was shown to increase positive affect and feelings of inclusion and social connection. But more importantly, the social bonding effects of singing were more substantial in the mega choir compared to the smaller choirs. The social closeness was not as pronounced in the mega choir, probably because of the great amount of people not knowing each other. Every sub choir knew each other beforehand and did not have the same motivation for doing social bonding from scratch. This study thus shows that group singing has a potential for creating fast bonding dynamics for people in greater choirs where people do not know each other beforehand (Weinstein et al., 2015). This goes well in hand with the previously mentioned “ice breaker-effect”.

1.4 Music in the brain

Center for Music in the Brain (MIB) at Aarhus University with the Danish bassist and neuroscientist Peter Vuust in front is one of the leading research centres for neuroscientific and interdisciplinary research in music perception, action, emotion, and learning. In a recent article, “Music in the brain”, Vuust et al. (2022) have gathered what they consider the most important and epoch-making experiments of music processing in the brain over the past 40 years and deliver an overview of the most important cognitive mechanisms. The focus of the paper is the basic neural mechanisms of music processing in the brain and requisite prediction-based brain mechanisms. The link between music and language, which has been examined in this paper, is not an area of interest in their regard.

Since this paper focuses on the social cognitive aspects of singing together, the in-depth and thorough investigations of basic neural mechanisms of music perception in the brain delivered by Vuust

et al. (2022) will not be covered in detail here. However, the notion of the predictive coding of music (the PCM-model) that is central to the research of MIB, will be covered since it can be used to explain and understand general perception mechanisms that lay the ground for musical interaction and communication in interpersonal relationships in groups (Vuust et al., 2022).

1.4.1 PCM-model

Prediction is considered as a fundamental principle of brain processing. And investigating theories of predictive processing therefore offers explanations of how we can identify and recognize causes of sensory inputs and integration of information and stimuli.

When investigating music perception in the light of predictive coding, it has been clear that generally musical expectations are elicited by auditory bottom-up sensations on the one hand, and also depend on top-down predictions, on the other. The neuronal mechanisms underlying musical expectation are shaped by culture, personal listening history, musical training, and biology. In music these characteristics are formed in long-term learning, familiarity with a particular piece or genre, short-term memory for the immediate musical past, as well as deliberate listening strategies (Vuust et al., 2022).

The PCM-model (see Figure 5, page 34) is a predictive coding-based model developed by Vuust et al. (2022) and delivers a theory of brain functions for music with an explicit focus on biological, cultural, and contextual factors influencing the cognitive predictive coding of music perception.

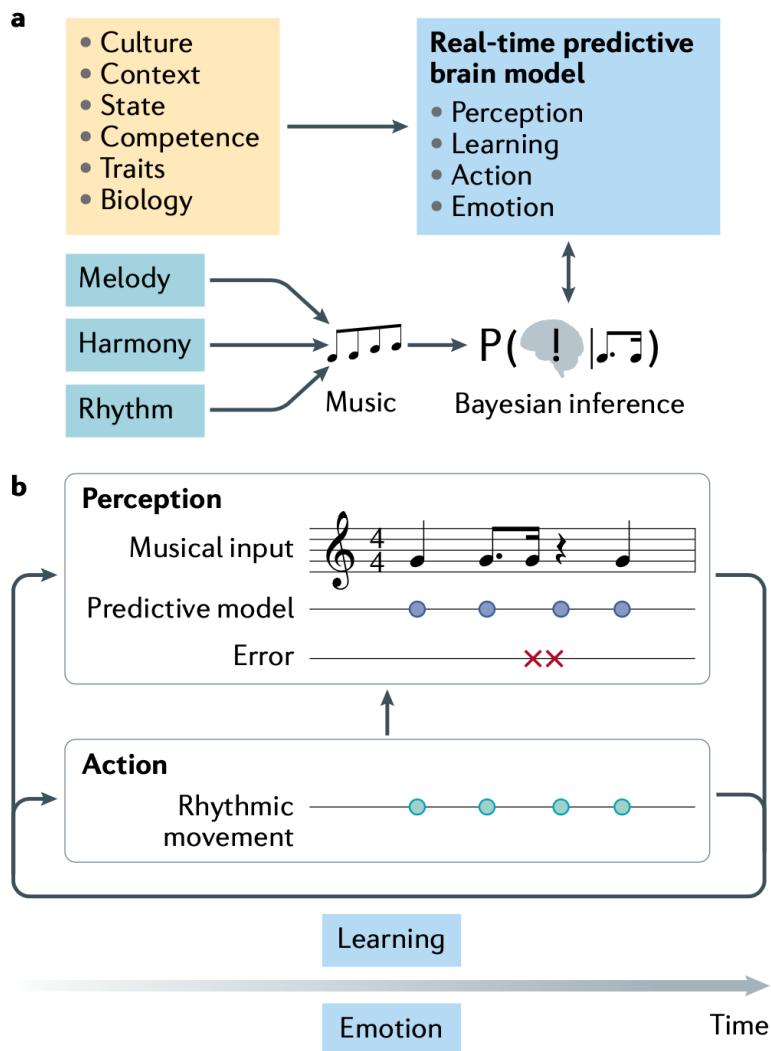


Figure 5: Predictive coding of music (Vuust et al., 2022).

The main engine for the PCM-model is that music perception, action, emotion, and learning are proposed to be recursive Bayesian processes, where the brain attempts to minimize prediction error. The processes underlying music perception and action are coupled so that perception minimizes prediction error by updating the predictions, while action then reduces prediction error by generating predicted sensory signals. Emotion, attention, and motivation then contextualize prediction and guide behaviour, action, and learning, thus acting as Bayes optimal biases. The brain can therefore be seen as a hierarchical prediction machine where sensory input is constantly held up against the brain's beliefs about the causes of this input.

The PCM-model then propose that the predictive coding rests on top-down processes related to three structural aspects of music: melody, harmony, and rhythm. Music perception is then guided by real-time prediction based on prior experience that is shaped by the cultural background, musical

competence, current context, attentional and emotional states, individual traits, as well as innate biological factors. In Figure 5 (previous page) the syncopated rhythm (marked as “musical input” at the b-part) is an unexpected rhythm provoking prediction error between the sensory input and the top-down predictions. This process then leads to an impulse for action, for example in the form of rhythmic movement like foot-tapping, producing proprioceptive sensations that serve to conform to the predictive model. The recursive arrows symbolize the iteration every time the rhythm repeats, and over time this forms the basis of learning and evolving music-related emotions, which shape and modify future actions and music perception.

The PCM-model is used to explain the perception and predictive coding of music in the individual brain. However, it is proposed that this predictive coding framework provides a powerful model for describing musical communication since musical interactions, and not just perception, rely heavily on prediction. While playing or singing we continuously predict the sensory consequences of our actions and amplify those of others. Music is a fine-tuned instance of coordinated human interaction involving interpersonal synchronization, social entrainment, and communication, where predictive processing takes a central role. When playing music together, we share the same generative model where our neuronal dynamics can harmonize and thus enable an elemental theory of mind enabling us to infer what the other person sings or plays (Vuust et al., 2022).

In other words, musical interaction is guided by mutual reduction of prediction errors. The PCM-model can thus serve as a model for investigating how competence, social context, and interactions depend on predictive brain processing in general, and how musical meaning is distributed between individuals. Vuust et al. (2022) end their paper by underlining how this neuroscientific research paves the way for investigation into the way in which music becomes meaningful by attenuating the importance of shared musical expectations and how it undergirds music perception, action, emotion, and learning. It is concludingly remarked how the future research in this area should be dedicated to understanding the way music shapes social interactions and the role of predictive coding in creating shared meaning through music.

This paper is a humble contribution to the field, and an effort in investigating social cohesive creating forces in group singing. Before presenting the actual study and the second part of the paper, the sociocultural context framing for the group singing at Danish folk high schools is presented.

1.5 The role of group singing in Danish culture and folk high schools

When dealing with social cohesion in groups that sing together, it is fair to conclude that a lot of different factors like group size, culture, location, and social contexts have a say in how the feeling of cohesion is both constructed and experienced by the interlocutors.

The present paper investigates social cohesion in relation to group singing at Danish folk high schools, and before presenting the actual study and its results, a sociocultural exposition of Danish folk high schools' institutional role in the Danish society must be accounted for. To create better understanding of the mental states and feeling of cohesion in the students we must first know in which cultural and traditional context the group singing takes place.

Bryant (2013) concludes in his article "Animal signals and emotion in music: coordinating affect across groups" that it is the social nature of playing music together with the complex cultural processes of human lives that conveys to music as having an evolutionary function of signalling social relationships. The importance of group performances in dance and music is universal and existent in every known human culture, and therefore it must be inextricably tied to the central traditions of a given culture (Bryant, 2013). In other words, music exists in countless forms and expressions across cultures, and to investigate a given musical form we must also understand the culture and context in which it unfolds.

Group singing in Danish society is strongly connected to the historian, priest, poet, and politician Nicolai Frederik Severin Grundtvig (1783-1872) and the development of Free Schools and Folk High Schools (*friskoler og folkehøjskoler*). In the beginning of the 19th century N.F.S. Grundtvig had a plan: to create a feeling of cohesion among the Danish lower and middle working class in the, at that time, large agricultural society. Grundtvig felt a strong lack of national identity and communitarian feeling and believed that the way to achieve this was by enlightening and educating ordinary people (in particular the peasants) in Danish societal, religious, and cultural history. A way of doing this was by giving public talks and lectures across the country. Grundtvig had a very animated and engaged way of telling and engaging his audience, which quickly granted him a role as a popular public figure amongst the Danish workers and peasants (Korsgaard, 2019).

The first historically confirmed observed act of group singing in connection to Grundtvig's ideological endeavour was one of his enlightenment-talks at the Borchs Dormitory in Copenhagen the 17th of October 1838. Grundtvig talked about the Battle of Copenhagen in 1801 and the heroic acts

performed by the Danish naval hero and his late friend Peter Willemoes (1783-1808). The crowd got so excited that they spontaneously jumped off their seats and jointly sang the song “Kommer hid, I piger små”. The lyrics had been written by Grundtvig in 1810 as a tribute to Willemoes a few years after his death in 1808, and the composer C.E.F. Weyse (1774-1842) had just recently composed the melody in 1837 (Korsgaard, 2019).

The establishing of the first folk high schools, starting with Rødding Højskole in 1833, was, and is still, centred around Grundtvig's educational principles: the interrelation of national, social, and religious issues with the personal and cultural development. The best way of doing this is through the mother tongue, thus violating the at that time dominating view on enlightenment, that knowledge was mainly gained through Latin in grammar or Latin schools (Korsgaard, 2019). The aim of the schools was not to consolidate the Danish people itself. The main goals of the folk high schools were thus to nurture a common humanity through the intrinsically edifying nature of the school's educational principles. The roles of the Danish folk high schools have been and are, briefly explained, to fuel the urge for learning through the pure feeling of delight. The way this has been done has naturally evolved through the schools' over 175-year history. However, many of the first schools established still exist, and the founding Grundtvigian ideas of education through delight still persist. Today there are around 80 folk high schools in Denmark, and they can be classified in seven different types of schools: Regular “Grundtvigian”, craft specialized, sports & athletics, Christian or spiritual, lifestyle oriented, for seniors (60+), and for youth (15–17-year-olds).

Common for all schools is the role of group singing at for example the obligatory daily morning assemblies and evening singing sessions. Singing together is a central and important aspect of being a student at a folk high school, and the official Folk High School Songbook (*Højskolesangbogen*) is a cultural-historical artefact and permanent equipment at all folk high schools.

1.5.1 The Folk High School Songbook: “Højskolesangbogen”

Singing together as a practice has existed in the Danish society since the Reformation (1534) where hymn-singing or congregational singing developed from the church traditions. However, songs made for group singing in connection to the folk high schools have existed just as long as the schools themselves. The first edition of the Folk High School Songbook came out in 1894, 50 years after the first folk school, Røddinge, was founded. It was made on the basis of three independent song books created at the three folk schools in Askov, Vallekilde and Testrup (Plambeck, 2019). In

November 2020 the 19th edition of the book was published, thus being the most recent edition in use all over the Danish folk schools.

The 19th edition of the songbook contains 601 different songs. The songs are classified in different themes such as morning or evening songs, a certain time of the year or just celebrating life and/or love; they each have their unique number and are published with sheet music.

For the latest editions of the book, an editorial board consisting of six culturally prominent and acknowledged Danes with relation to the Folk School movement, have been chosen to renew the repertoire of the book. For the 19th edition 122 songs were removed from the 18th edition while 151 new songs were added. In recent times the editions have been renewed every 10-17th year. The reason for renewing the repertoire in this quite comprehensive manner, is that the book should have culturally and traditionally strong roots but at the same time carry an ability of feeling relevant for the present time. The editorial board are thus in a form of limbo where they must be true to the history and letting the most relevant and generally used songs remain in the book while being aware of the newest cultural and societal trends and currents. Because of the book's cemented culturally important status, a lot of people have an opinion every time a new edition is published.

In a questionnaire done by the Danish newspaper Kristeligt Dagblad from 2014 the songbook was convincingly voted as the most Danish thing. And this was in competition with the Danish national dish Fried Pork Belly with parsley sauce, rye bread, the popular Lego brand, and even the Danish national Flag (Rahbek, 2019)!

The book is being used daily as a part of the obligatory morning assemblies at the folk schools and are often connected thematically or historically to the given topic of the assembly. Also, talks and lectures with edifying purposes for the students are typically accompanied with a song or two from the book to contextualize and actualize the given topic. In other words, the book contains a rich variety of songs that can put something into perspective with almost any given topic or idea to a song. The songs are usually presented by a pianist and a teacher that accompany and actualize the songs for the students. The songbook and the songs themselves are therefore strongly dependent on the teachers who should give the songs personal relevance for each student.

The Danish musician and research scientist in medical science, Lasse Skovgaard, divides the group singing traditions of Danish culture into five typologies. One of them is group singing at folk high schools (*Højskolesang*), and what characterizes this form of singing and distinguishes it from the

other types, is the pronounced goal of creating a common reflection and “tuning of the mind” in the students (Skovgaard, 2020).¹

Group singing and the Folk High School Songbook must therefore be characterized as being a central artefact connected strongly to Danish society and culture. What makes group singing unique at Danish folk high schools is how it has a firm institutionalised role which leads to the songs being loaded with cultural, existential, and political meaning. And, as described by Skovgaard, the singing together with this cultural meaning searches to create a united reflection and mind set in the students unique for this kind of group singing that are a part of the subject of investigation in the study being presented in the second part of this paper.

¹ See Appendix 1a for an overview of the five Danish group singing typologies (1b for an English translation).

Part II

2. Investigating group singing at Danish folk high schools

It is now time to present the study central for the present paper. Over a period of five days in the spring 2022, I visited four different Danish folk high schools and facilitated a morning assembly each lasting 30 minutes. At the assemblies I presented and accompanied on piano the singing of different songs from the folk high school songbook. I brought two questionnaires to be answered just before and after the sessions, which had the purpose of measuring the feeling of cohesion amongst the students before and after each session.

A precise description of the study will be presented later, however a brief contextualization and positioning of the theoretical and analytic foundation for the study as well as the methodological basis are needed first.

2.1 Theoretical and analytic foundation

The present study seeks to investigate whether group singing has a socially unifying effect for students at folk high schools by measuring if they feel more connected to people around them after 30 minutes of singing at a morning assembly.

It has been argued how music and singing can be seen as a highly social communicative phenomenon that, amongst many other things, has the ability of creating feeling of cohesion, mutual feelings, joint attention, and shared identity in the interlocutors that are part of groups singing together. All reviewed literature in this paper thus lie as the theoretical bedrock and provide the analytical scope for the present paper to be discussed later in connection with the results from the study.

Not all presented theory points in the same direction, and studies like the Pearce et al. (2015, 2016a) that questions the effect of singing will be involved in later discussions to challenge the results from the study the most fruitful way. However, most of the mentioned studies in the first part suggest group singing to play an essential role when creating cohesion amongst singers. Because of this, the main hypothesis of the study is that 30 minutes of group singing at morning assemblies increases the feeling of cohesion amongst the students at Danish folk high schools.

What makes this study different from other similar and earlier mentioned experiments is the influential presence of the songbook. As mentioned, the folk high school songbook is deeply rooted in

Danish culture and society, giving the act of singing a meaning and a cultural dimension that goes beyond the act of “just” singing. How, and if, this plays a role will be discussed later together with the chosen methodology that forms the basis for this study.

But what is the methodology you may ask? As showed in the studies by Wolf et al. (2015) and Pearce et al. (2015; 2016a) the IOS-scale (Inclusion of Others in the Self) was used in self-reporting by the participants. In the present study a later variant of the IOS-scale, the IIS-scale (Inclusion of Ingroup in the Self), has been used. Since the two scales are almost identical, I have chosen to use the IOS-scale as the methodological basis for the present study. It will be presented in more detail in the next section together with an explanation of the difference between the two scales.

2.2 Methodology: Inclusion of Ingroup in the Self-scale

The IOS-scale is a single-item pictorial scale made for measuring the feeling of closeness in an individual in relation to her relevant others. The notion of closeness is in the IOS-scale interpreted as an overlap of selves and builds on other psychological measurements and general approaches from social psychology. More specifically, I think of the Relationship Closeness Inventory (RCI) and Sternberg Intimacy Scale (Aron et al., 1992).

The overlapping selves are clearly represented in the scale with 7 degrees of how interconnected the self feels in relation to the other(s). These are depicted in two equal-sized circles which are increasingly overlapping. The left circle representing the Self and the right the Other(s) and respondents must choose the one degree that in the moment of answering feels most accurate for their sense of cohesion with the other(s).

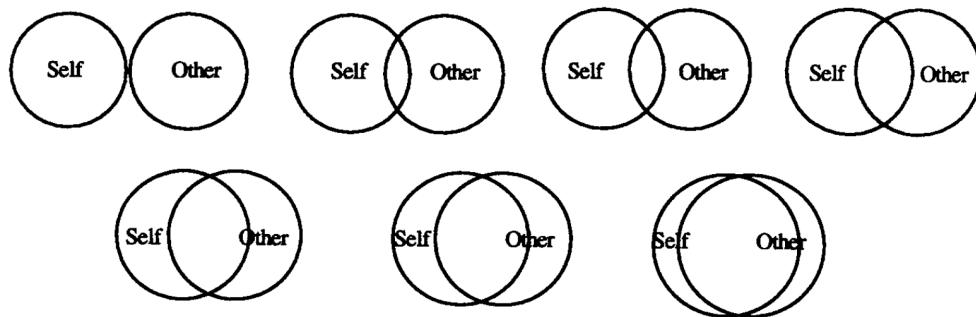


Figure 6: The Inclusion of Other in the Self (IOS) scale (Aron et al., 1992).

When Aron et al. (1992) presented this scale, they conducted a series of studies examining the utility of the IOS-scale with a view to find out whether this approach of measuring closeness was in

line with previously investigated and established psychological theories on closeness (especially the RCI). A partial recreation of a study by Berscheid et al. (1989) functioned as the primary study to explore the utility of the IOS-scale. In the Berscheid et al. (1989) study, a group of undergraduates had to answer questionnaires about their closest other, and Aron et al. (1992) then replicated this questionnaire while including the IOS-scale as an adjunct measure to cross-validate key findings from their own study and compare them to Berscheid et al. (1989). They did five different studies varying in population and situations in order to broaden and explore the measure of closeness in different constellations. Finally, three studies were conducted to explore how subjects interpret the IOS scale and how these interpretations relate to the actual responses.

Aron et al. (1992) argue that the IOS-scale captures an unusually broad index of closeness in the respondent. The scale taps into people's sense of being interconnected with other people, and this sense arises from both conscious and unconscious processes. Aron et al. (1992) conclude that the presented data from their series of studies support the utility of the IOS-scale, a single-item pictorial measure of closeness, and that it can capture something in the respondent's perception of a relationship that is consistent with many theoretical orientations. The influence and presence of the IOS-scale in later studies measuring interpersonal closeness in the field of social psychology support this claim.

In a more recent paper, the reliability of the IOS-scale has been re-investigated as well as adapted and changed a little for online user-purposes (Gächter et al., 2015). In their version of the IOS-scale the term "other" is exchanged with "X" to broaden the clarification of the other part as well as each step of interconnectedness is given a number from 1 to 7. Their purpose of re-investigating the IOS-scale was to report whether the psychometric properties of the scale extend to non-students, and to see if it is suitable for internet-based survey tools. Gächter et al. (2015) compare their findings to other psychological measures like the one in the Aron et al. (1992) study, but the point made by Gächter et al. (2015) is that other measurement methods for closeness are typically administered through questionnaires done in classrooms and with students. In this re-evaluative study, the use of the scale was therefore administered through Mechanical Turk (MTurk) by Amazon.com and reached many kinds of people in different ages and sex as well as both students and non-students. The findings by Gächter et al. (2015) strongly suggest that the IOS-scale is again highly significant and correlated with several scales measuring dimensions of relationship closeness (RCI, the Loving and Liking Scales, and the Personal Acquaintance Measure (PAM) and Subjective Closeness Index

(SCI)). It is concluded, like in the Aron et al. (1992) paper, that the IOS-scale measures important aspects of relationship closeness in compact and highly reliable ways. Despite the other scales having different conceptual foundations, the same latent construct in individuals feeling of closeness is concluded to be obtained using the IOS-scale. Furthermore, it is noted how the scale is very much capable of being used as an online tool based on its simplicity and portability. The IOS-scale is concluded by Gächter et al. (2015) to be a good predictor of the closeness of relationship within a class of relationships.

As already said, the present study investigates group singing. And as described earlier, the present paper's definition of a group is built on the description delivered by Hagen & Bryant (2003) where a group is understood as "a large number of individuals that are willing as well as able to coordinate actions to achieve mutually beneficial goals". The IOS-scale has mostly been explained so far in relation to individual relations, so the question is if this measurement of closeness can even be used to measure the feeling of closeness between an individual and a group of several people? To tackle this question another variety of the IOS-scale will be recruited: the Ingroup of Inclusion in the Self (IIS) scale.

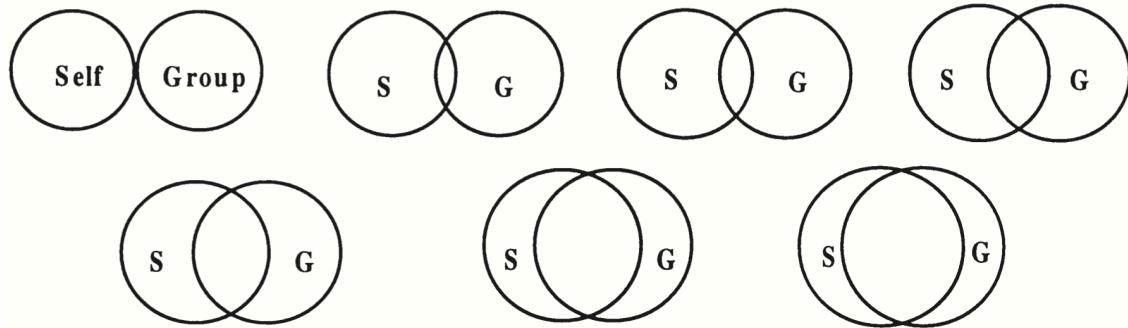


Figure 7: The Inclusion of Ingroup in the Self (IIS) scale (Tropp & Wright, 2001).

The IIS-scale has been elaborated by Tropp & Wright (2001) and draws obvious inspiration from the IOS-scale. Here, the only difference is the term "other" being replaced with "group". The main point for doing this is to incorporate the aspect of ingroup identification in the individual's feeling of cohesion with its social surroundings. Ingroup identification is here meant as the degree to which the ingroup is included in the self and has also been used earlier by Aron and his colleagues, the inventors of the IOS-scale, when emphasizing the overlap between self and ingroup (Tropp & Wright,

2001). So, by replacing “other” with “group” it is now possible to measure the interconnectedness of the ingroup with the individual self.

Tropp & Wright (2001) point out the big difference between and variability in how and to which degree people feel a subjective sense of interconnectedness with their given groups. However, this individual difference is not a problem if the feeling of interconnectedness with the ingroup is more or less constant across groups. And this is exactly what will be accounted for when focusing on in-group identification rather than feeling closeness with an “other”. Furthermore, and important for the present paper, when investigating the degree to which the ingroup is included in the self, the social environment framing the situation is taken much more into account (Tropp & Wright, 2001). In other words, it is a scale that couples the feeling of closeness to the context surrounding and creating it. And as mentioned, the social context of a group singing session at a Danish folk high school is multi-faceted in both the cultural meaning in the songbook as well in its sociality unfolding in the actual situation.

Other than the IIS-scale being a theoretically well-founded tool it is also beneficial in its simplicity and handiness. The overlapping circles capture the essence of inclusion of ingroup in the self without using many different wordings or items. It is simple, easy to comprehend, and difficult to misinterpret. The IIS-scale is as mentioned a single-item measurement and can thus be administered more quickly than multi-item measures. Responding to the scale takes very little time and it is therefore also useful for studies that have limited time for respondents. Using the IIS-scale therefore renders a high amount of freedom and opportunities for the experimental design when managing respondents. Concludingly it is also, as mentioned earlier, suitable for online-based survey tools.

The present study builds on the theoretical foundation of the IOS-scale by using the IIS-scale as the main measurement tool for the feelings of cohesion amongst students before and after group singing sessions. In short, the IIS-scale is the methodological foundation for this paper.

3. Methods & materials

In this section the methods and materials used for gathering data for the present study will be presented. The experimental design of this study is inspired by the earlier mentioned and explained studies on group singing by Pearce et al. (2015, 2016a) where the IOS-scale were used to gather

data before and after singing sessions. However, this study is different because it is a cross-sectional study instead of being longitudinal and uses the IIS-scale instead of the IOS-scale. Also, this study stands out from the others by investigating only folk high school students. At folk high schools, students live, eat, and sleep together at the school, creating a different context for the environment surrounding the participants compared to other similar studies where participants are living a more “normal” daily life in their community.

3.1 Procedure: morning assemblies

Morning assemblies are a regular part of the everyday life at the folk high schools after breakfast every weekday and are obligatory for all students. Singing songs together from the songbook is an important ritual for the assemblies as well as teachers or students presenting or telling something with common cultural, social, existential, or political relevance for everyone attending.

From the 14th to the 18th of March 2022, I visited four different Danish folk high schools (Bornholms Højskole, Engelholm Højskole, Ry Højskole, and Silkeborg Højskole) to facilitate a morning assembly each lasting 30 minutes. All students had attended the schools for roughly two months at that time meaning they already were acquainted with singing from the folk high school songbook. Every visit was coordinated in accordance with the principal of each school.

My role at the assemblies was to facilitate the assembly by introducing the songs as well as accompanying on piano. A brief introduction of myself and the reason for the visit was done in the beginning, however the singing was in focus and 25 of the 30 minutes consisted of singing and learning the songs. At the assemblies four or five songs that together embraced different moods and topics were sung. The song-lists were made in consultation with the principals so that the students both knew and did not know some of the songs beforehand, thereby resulting in slight differences between some of the setlists for each school. All songs have Danish lyrics and are written by Danish authors and composers with *Den blå anemone* and *Noget om helte* being the only two songs represented at every morning assembly. The following table presents the song-lists for the different morning assemblies².

² See appendix 2 for descriptions of the songs.

Bornholms Højskole 14/03

- 14: Jorden har vendt sig en omgang (*The earth has turned its round*)
- 281: Den blå anemone (*The blue anemone*)
- 85: Ingen har guldtårer fældet (*Nobody had shed golden tears*)
- 159: Undertiden (*The time of wonder*)
- 202: Noget om helte (*Something about heroes*)

Engelsholm Højskole 16/03

- 24: Godmorgen, Lille Land (*Good Morning, little country*)
- 281: Den blå anemone (*The blue anemone*)
- 556: Fuglene (*The birds*)
- 202: Noget om helte (*Something about heroes*)

Ry Højskole 17/03

- 14: Jorden har vendt sig en omgang (*The earth has turned its round*)
- 281: Den blå anemone (*The blue anemone*)
- 556: Fuglene (*The birds*)
- 202: Noget om helte (*Something about heroes*)

Silkeborg Højskole 18/03

- 24: Godmorgen, Lille Land (*Good Morning, little country*)
- 281: Den blå anemone (*The blue anemone*)
- 556: Fuglene (*The birds*)
- 202: Noget om helte (*Something about heroes*)

Table 2: Song-lists for the different morning assemblies.

3.2 Materials & stimuli: questionnaires and the IIS-scale

Just Before and after each assembly students had to respond to a questionnaire regarding their feeling of inclusion of their ingroup with themselves (by responding to the IIS-scale) as well as answering briefly to questions regarding their prior experiences with group singing and acquaintance with the songbook. Three slides were put up on a big projector screen with the first slide being a presentation of the project and the reason for the study, where the two next slides presented QR-codes and links for the different questionnaires³. The questionnaires were designed and managed in the online survey tool SurveyXact. License for usage was granted via Aarhus University. Students were instructed to bring their smartphones to the morning assembly so that they were able to reach and answer the online questionnaires. A Danish and English version of each questionnaire was produced so that both the Danish and international English-speaking students from the schools were reached. In the questionnaire before singing students were asked to inform sex(es) and age and lastly how they felt close to the group of fellow students around them at that given time by responding to the IIS-scale. After singing, students again had to respond to the IIS-scale as well as answering a few other questions regarding their relationship with group singing and the songs from the songbook⁴.

Every time students were asked to express their feeling or meaning it was by selecting a point on a 7 degrees scale from 0 to 6 where 0 meant “not at all”, and 6 the opposite, “very much”. The reason for doing this is because the IIS-scale were accompanied by the numbers from 0 to 6 thus making the answering-design equal for the whole questionnaire. As shown earlier the IIS-scale does not have the numbers from 0 to 6 in its original form, however this is added in the present design to make it as easy as possible for respondents to choose their desired feeling in the online survey tool.

³ See appendix 3 for the presentation-slides.

⁴ See appendix 4a and 4b for the questionnaires.

Furthermore, the limited time of 30 minutes at each morning assembly demanded a design that took little time for respondents to fill out and having no need to type in words and sentences when answering. The reason for starting at 0 instead of 1 is because the lowest feeling of closeness in the IIS-scale is visually represented by the circles to be not connected at all. The following figure (Figure 8) shows how the IIS-scale were presented and described in the questionnaire.

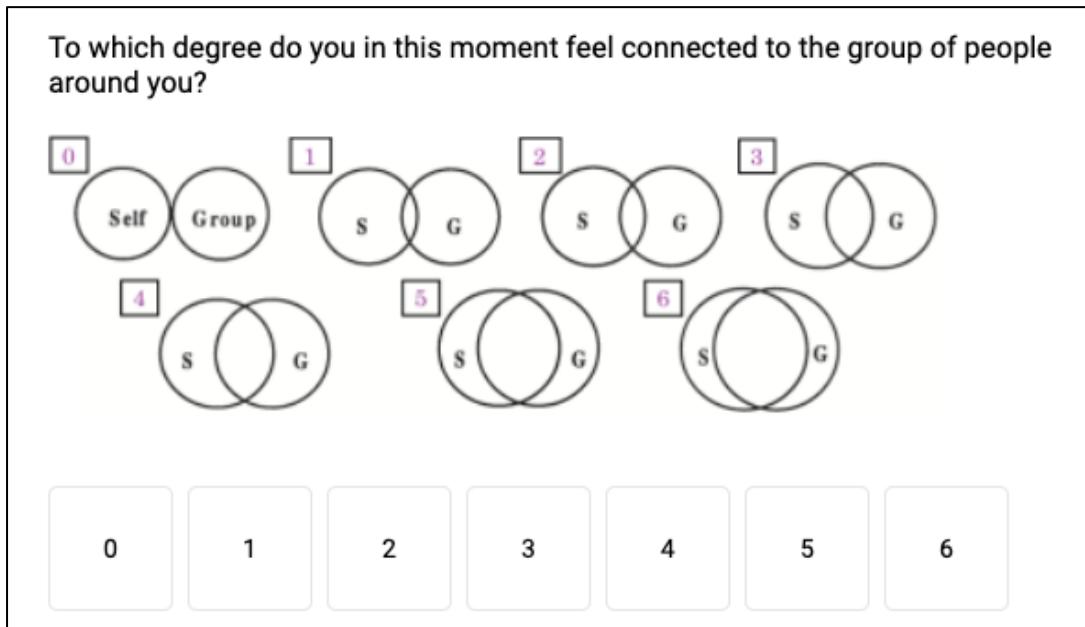


Figure 8: The IIS-scale as presented in the questionnaires.

The data gathered from the questionnaires were subsequently downloaded from SurveyXact and exported into a CSV-file in Numbers. The CSV-file was then converted with the statistical program JASP in which the statistical overview and analysis was made. Microsoft Excel was also used in addition with JASP for statistical design related purposes.

3.3 Participants: the folk high school students

A total amount of 262 (56 at Bornholm, 57 at Engelsholm, 62 at Ry, and 87 at Silkeborg) folk high school students filled out the questionnaire before the singing where 255 (56 at Bornholm, 55 at Engelsholm, 61 at Ry, and 83 at Silkeborg) answered the questionnaire afterwards. Possible explanations for the absence of seven respondents after singing may be due to toilet visits, low smartphone battery levels, or protest-leavings because of bad song choices by the author. Furthermore, five respondents were registered as only filling out the introductory questions related to age and sex(es). That means the five questionnaires were left unfinished when asked to fill out the IIS-scale.

Possible reasons for this and what this may tell us about the design will be discussed later. Since the sex and age choices were informed before the singing, the following information is based on the answers given at the beginning of the assemblies. 30 (11%) students were in the age between 17-19, 205 students in the age 20-24 (77%), 24 (9%) in the span of 25-29 years old, and lastly 7 students (3%) were in the category of 30+ of age. A single person did not wish to inform age. A total of 185 (69%) identified as female, where 78 (29%) identified as male. Three persons (1%) identified as non-binary, where a single person did not wish to inform sex(es). Out of the in total 267 responses before singing, 26 (10%) of them were registered in the English version. However, 34 (13%) English respondents were registered out of the in total 255 in the questionnaire after singing. Possible explanations for this are difficult to determine, but this ultimately makes it difficult to distinguish the Danish and English respondents as being either a Danish student or international students.

The students were informed in the opening slide presenting the study that their answers were anonymous, and the only personal interaction I had with students in relation to this study before gathering data was in the facilitating and presenting role talking to or instructing the students as a group. However, a few informal interviews with students from Bornholm Højskole were facilitated a few weeks later after the described morning assemblies. This was done with the purpose of broadening and opening further discussions related to the questions about relation to and previous experience with group singing and the folk high school songbook.

4. Results

In this section the results of the study are divided in two. First the results from the respondents' scores on the IIS-scale before versus after group singing will be presented, where the three in-depth questions relating students previous accounts with singing and their relation towards the IIS-scale will be presented.

4.1 The IIS-scale

A significant higher mean (M) score on the IIS-scale was reported after the singing at the morning assemblies ($M = 4.686$, $SD = 1.172$) as compared to the IIS-scale-scores reported before singing ($M = 3.920$, $SD = 1.252$, $t(254) = -31.223$, $p = < 0.001$). As presented in Table 3 and Figure 9 (page 49), these results are the mean scores across schools, age, sex(es), and chosen language in the questionnaires, where V1 = before singing and V2 = after singing.

a				
Frequencies for Alle_for				
Alle_for	Frequency	Percent	Valid Percent	Cumulative Percent
0	1	0.382	0.382	0.382
1	10	3.817	3.817	4.198
2	23	8.779	8.779	12.977
3	54	20.611	20.611	33.588
4	84	32.061	32.061	65.649
5	67	25.573	25.573	91.221
6	23	8.779	8.779	100.000
Missing	0	0.000		
Total	262	100.000		
Frequencies for Alle_etter				
Alle_etter	Frequency	Percent	Valid Percent	Cumulative Percent
0	1	0.382	0.392	0.392
1	5	1.908	1.961	2.353
2	8	3.053	3.137	5.490
3	22	8.397	8.627	14.118
4	48	18.321	18.824	32.941
5	110	41.985	43.137	76.078
6	61	23.282	23.922	100.000
Missing	7	2.672		
Total	262	100.000		

b				
	N	Mean	SD	SE
V1	262	3.920	1.252	0.077
V2	255	4.686	1.172	0.073

c							
Measure 1	Measure 2	t	df	p	Mean Difference	SE Difference	Cohen's d
V1	- V2	-31.223	254	< .001	-0.824	0.026	-1.955

Table 3: Frequencies (a), Descriptive statistics (b), and Student's t-test measures (c).

It is shown in table 3 (a) how the frequencies of the IIS-scale answers are generally more distributed in the 4+ scores. Where in the before conditions only around a third of respondents answered 5 or above, twice as much, two thirds, answered 5 or above in the after condition. However, it is to be noted that 14 % of answers are still at 3 or lower on the scale after singing.

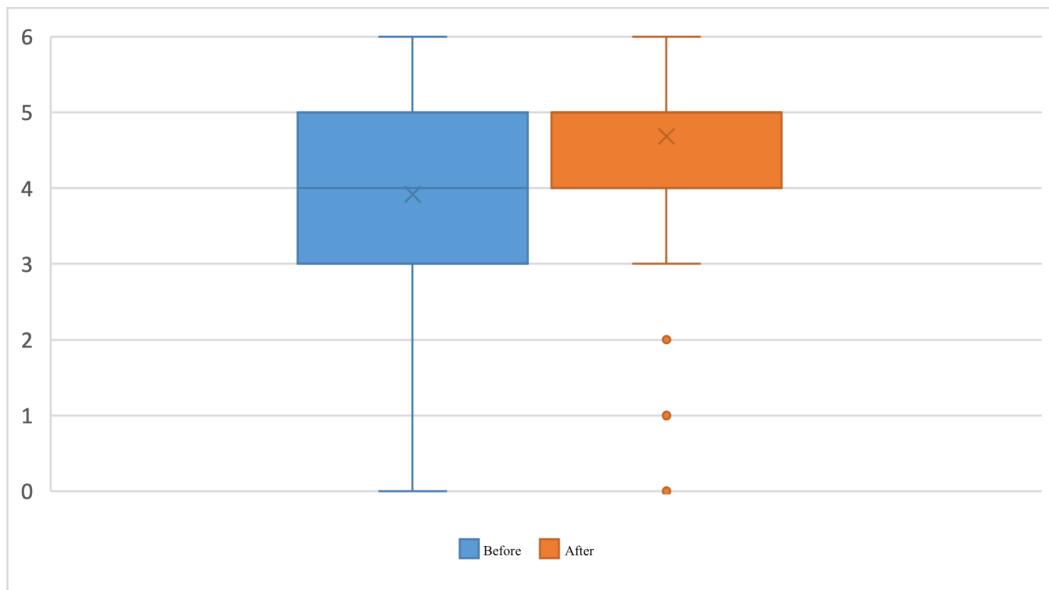


Figure 9: Boxplot of Before versus After-conditions⁵.

⁵ The three dots below the “whiskers” of the boxplot in the After-condition images answers “0”, “1”, and “2” as outlier-values defined by the inter-quartile range (the distance between 1st and 3rd quartile).

With the significant higher mean score of a feeling of cohesion amongst the students after singing compared to before, the main hypothesis is thus accepted. In other words, it can be concluded, based on these results, that group singing at Danish folk high schools generally increase the feeling of cohesion amongst folk high school students.

4.2 Personal statements

The distribution of answers when respondents were asked to respond to in which degree the IIS-scale makes sense when expressing the feeling of closeness to the surrounding people is presented in Figure 10. Mean score for all respondents is 4.459 showing a relatively high degree of meaning when using the IIS-scale in relation to feelings of cohesion. Standard deviation is measured to 1.382.

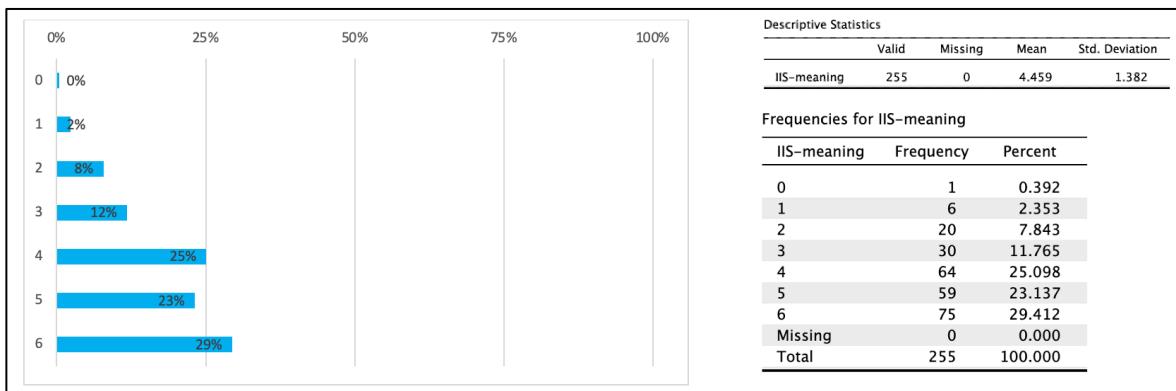


Figure 10: Descriptive statistics and frequencies of respondents' experience of answering the IIS-scale.

When asked to respond to whether they felt any emotional connection to the songs being sung during the assembly a mean score of 3.788 is measured as presented in Figure 11 (page 51). The standard deviation is measured to 1.305. The mean score is an indication of the songs having an emotional connection with most of the students with only 57 respondents (22 %) scoring 2 or less. This thus indicates that the songs being sung at the assemblies have had an emotional impact on the students, and that the students are personally connected to them.

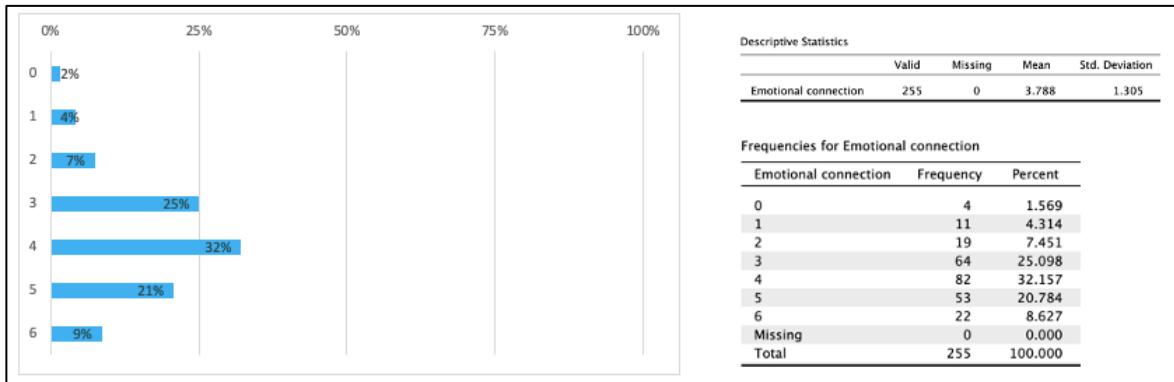


Figure 11: Descriptive statistics and frequencies of respondents' emotional connection with the folk high school songbook.

Last question was about to which degree the respondents feel group singing has been a part of their lives before going to folk high school. Where 0 were not at all and 6 very much, it is a broad picture presented in Figure 12. The mean score is measured to 3.494 with a standard deviation of 1.848. The relatively high standard deviation value together with the dispersal of answers indicates very different earlier experiences of group singing amongst the students before going to folk high school.

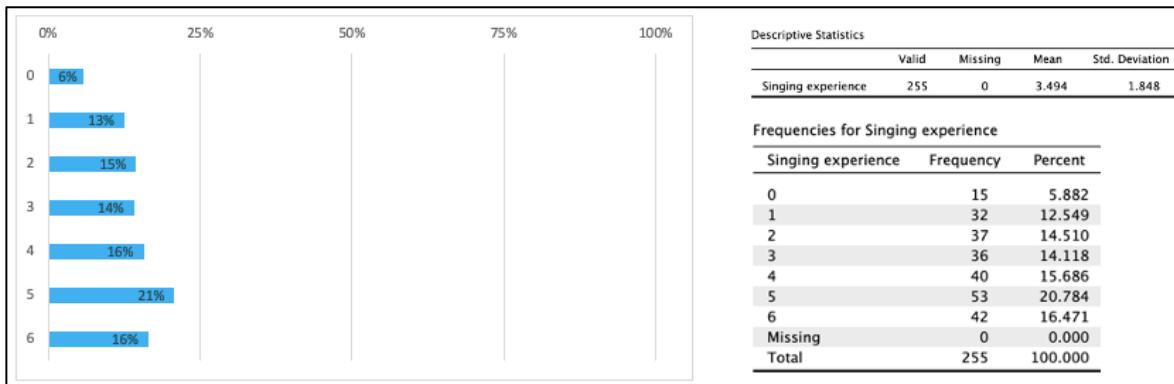


Figure 12: Descriptive statistics and frequencies of respondents' earlier experience with group singing.

To sum up the results, the main hypothesis is accepted because of the significant increase in the mean score of feelings of ingroup inclusion in the students' selves. In other words, group singing generates a stronger feeling of cohesion than before the act of singing. Furthermore, the IIS-scale seems overall to be a competent tool for measuring feelings of cohesion amongst the students. Also, the songs from the songbook seem to have an emotionally tying impact on the students. Lastly, these results seem not to be correlated with the students having generally much experience in group singing beforehand, because this is not the case.

5. Discussion

In the following the results from the study will be discussed and put together with the theoretical work from the first part of the paper. In section 5.1.1 the cognitive and communicative aspects that lay the ground for prosocial and cohesion-establishing behaviour will be covered. Subsequently, in section 5.1.2, the neurohormonal and -chemical as well as physiological and -psychological aspects related to the act of singing will be discussed and put in relation to the present study.

In the sections following a discussion of possible confounding factors, the present study's own design and methodological aspects, as well as possible ways for further studying in this topic will be unfolded.

5.1 Discussion of results

By accepting the main hypothesis, as mentioned in the results section, it is concluded that around 25 minutes of group singing at morning assemblies generally establishes a greater feeling of cohesion and connectedness in the folk high school students attending the assembly. This is expressed in the increase of the students' responded mean scores in the IIS-scale with a significant mean increase of almost one point (0.824) on the scale. Told in the terminology of the IIS-scale, the students overall felt their selves more included in the ingroup. Or, switched around, the ingroup was more included in the students' selves after singing.

The main question is then, which forces lay behind this tendency? To discuss this, the sociality of the group singing situations will be dissected. Afterwards, cognitive and health-related outcomes of singing will be put together with the aforementioned to shed light on any possible causal relations. All of this is based on the studies and literature covered in the first part of this paper.

5.1.1 The sociality of group singing

In the group singing situations at the morning assemblies all students are seated in their own chair next to each other typically in a form of assembly hall used for gathering a high amount of people in the same room. It resembles a form of lecture hall and common for all assembly halls are a presentation screen and a platform for the speaker as well as a grand piano for accompanying the singing. The arrangement of the whole room therefore serves as a fixed orientation from the students towards the speaker. In other words, the students' attention is arranged by the spaciousness of the room to be joint and oriented towards the speaker(s) standing at the platform or sitting at the piano. This means that students sitting in an assembly hall find themselves in a position where they share

their sensorimotor information and mental representations with their fellow students (see Table 1, page 8). Put another way, students are in a joint, albeit passive, action with a joint attention towards the person presenting or speaking being the shared goal creating joint perspectives in the students. This joint attention and action making in the form of singing together thus creates a shared intentionality amongst the students.

When the actual singing begins, another dimension is added to the situation. Now a visual focus must be fixed towards their own songbooks and the situation is now also dependent on how well they know the songs, their individual abilities to read sheet music, as well as their relationship with singing. Their visual attention shifts dynamically between the person instructing and accompanying and the songbook. At the same time, alignment between the instructor and the students happens with music being the primus motor for this. If the students and instructor do not manage to mutually align together over the given song, the interaction and singing will collapse. The social nature of the situation is thus highly dependent on a high amount of reciprocity between the presenter and the group of students.

With the accompanying music being the primary source for attention, the interaction between the students and the instructor is dynamically shifting between interaction types 3, 4 and 5 as presented in Figure 1 (page 11) by Gallotti et al. (2017). This categorization is, however, dependent on categorizing the group of students as a single unit thus being the one part in a dyadic interaction, where the instructor/accompanist is the other. So, buying in on this definition means that the interaction between the instructor in a typical singing session and the students is highly social. The jointness of attention and action as well as the shared intentionality of the students facilitate a feeling of unity and establishes the students as a group. Hereafter a highly social interaction between the instructor and the students takes place, where all interlocutors share a responsibility for the singing to work out.

Furthermore, the group singing is characterized by a collective social entrainment (see Figure 3, page 19), engaged by the common rhythmic synchronization that derives from all singing the same song with harmonic, rhythmic and melodic patterns. This spatiotemporal coordination, resulting from the rhythmic responsiveness in the songs, synchronizes the behaviour of the students and leads to the students to tune into each other and respond actively to the auditory output from each other. This social entrainment thus creates an interpersonal rhythmic synchrony that promotes prosocial behaviour in the students.

As explained earlier, all songs in the songbook have a semantic meaning and address different themes relatable for the singers. This is both true for the lyrical and textual meaning as well as for the compositional and musical aspects of the songs. As shown earlier, music has the ability to elicit affective engagement in musicians based on psychophysical cues that reveal emotional content dependent on the nature of these cues. Tempo, melodic and rhythmic complexity, pitch range and timbre are five musical aspects that can be looked at to investigate what type of emotion is evoked in the listener. The songs from the morning assemblies thus carry each their own psychophysical cues in relation to their own compositional qualities. Musical and theoretical analysis of the different songs chosen for the assemblies are not delivered in this paper, however a crucial point to be made is, that each song can provoke emotional content in the students each in their own way. Therefore, the songs are to be considered as pathways and auditive artefacts that provoke emotion and affective engagement in the students singing the songs.

By eliciting affective engagement, singing then functions as a mediator for creating shared feelings and emotions in the students, thus creating a common emotional connection across all singing students. The notion of contagious heterophony can furthermore be used as an explanation for how the emotions connected to the qualities of the songs are shared and spread out in the group of students while singing. This is, of course, dependent on the songs having an inherent quality in relation to their composition and that the people singing are synchronized.

Also, the notion of music as a coalition signalling system can be useful in this regard. The shared intentionality characterizing the morning assemblies delivers a possibility as well as a willingness in the students to coordinate their actions and establish joint effort making. This then further establishes a feeling of cohesion through singing. As mentioned in section 1.2.4, the more synchronized a group of people is in making music or singing, the stronger the coalition of the group tends to appear. An important aspect of group singing in Danish folk high schools is to learn the songs properly before performing them in their entirety. This could be evidence for the coalition signalling system to play a part in the feeling of cohesion when singing the songs. When people sing together and they feel confident and know the structure and melody of the songs, the more power and emotion seems to be put in the performance. And a good performance of a song is then to be considered as evidence for a cohesion creating ritual which both elicit and share emotion in the students. At the same time the good performance establishes a feeling of cohesion inwards based on the shared emotions as well as the coalition signalling dynamics. This analysis is backed up by the results from the questions related to the students' emotional investments in the chosen songs for the

morning assemblies (see Figure 11, page 51). Some of the songs had already been performed by the students several times earlier during their respective semesters, and they were therefore already well acquainted with the songs beforehand. This means that the individual vocal interpretations are characterized by a greater amount of confidence thus leading to a more synchronized and united musical performance, that, as described, then leads to a greater feeling of cohesiveness when performing.

An important aspect to mention when singing together at Danish folk high schools is, that the songs are almost always contextualized and made relevant by the presenter before singing. For example, my focus for this session was to sing songs that were suitable for the given time of the year, thus focusing on songs with spring and liveliness as themes. This means that the students should feel personally concerned by the text and the mood of a given song.

Therefore, the act of group singing both has a fixed intentionality in the form of the clear semantic meaning delivered by the textual content of the songs as well as the musical act of singing itself having an inherent floating intentionality provoking feelings of affect in the singers. In other words, group singing in Danish folk high schools carries a both fixed *and* floating intentionality. However, this is true when the presenter succeeds in presenting the songs in a personal and relatable manner to the students where there is no doubt about the communicative as well as cultural importance and personal relevance of the songs.

The results from the present study have until now been seen in relation to the social and communicative act of group singing at Danish folk high schools. In the next section possible cognitive, neural, and sociopsychological explanations will be discussed to investigate how the earlier mentioned health-related outcomes and neural aspects of singing play a role in the feeling of cohesion amongst students when singing together at morning assemblies.

5.1.2 Possible cognitive, neural, and sociopsychological explanations

As elaborated in the first part of this paper, a lot of health-related outcomes are connected to the physical act of singing. These will in the following be recruited to discuss the reason for the significant increase shown in the student's responds to the IIS-scale after versus before the morning assemblies. However, a critical point to be made is that the present study has so far not distinguished between physical activity and the act of singing. The reason is that physical activity is considered as an integrated compound of singing, and that it is not possible to conceive of singing without being

physically active. This gives rise to some blind spots in relation to the health-related outcomes, that, as will be evident later, make it hard to safely conclude whether these outcomes are related to the singing *per se* or to any side effects caused by simply being physical active *because of singing*.

As it was shown in the Kreutz et al. (2003) study (section 1.3.1), singing has the potential to increase the level of secretory immunoglobulin A (sIgA) in performers thus leading to a physiological arousal and increase in affect. This outcome of singing may very well have a say in why the students' overall feeling of cohesion increases after the morning assembly. As discussed in the previous section, affective engagement has shown to be an important factor when sharing emotional states and feelings related in a group. Therefore, a very likely reason for the students' greater feeling of cohesion is both a result of the earlier described coalition creating mechanisms *as well* as the physiological outcomes connected to the increase of sIgA caused by the physical act of singing.

Whether a positive mood change also is caused by the group singing at the morning assemblies has not been investigated in the present paper. However, an overall lift in mood has been shown to be a scientifically well-established outcome of singing, just like listening to music has this ability as shown by Unwin et al. (2002), cf. in section 1.3.1. Therefore, it can be concluded that the students are likely to have experienced a general positive lift in their mood after singing. Whether this is caused by the physical act of singing, being a part of a musical group creating and listening to music together, or simply just being physically active because of singing, is difficult to conclude based on the results from the present study.

The potential of releasing dopamine when being in a musical setting, as shown by Salimpoor et al. (2011), cf. section 1.2.1, could also be of importance when discussing the results. Figure 11 (page 51) shows a clear picture of most of the students being emotionally involved in the songs chosen for the morning assemblies. This means that there is a great chance for the songs to create a feeling of arousal and emotionally affective responses in the students when singing well-known and personally meaningful songs, thus leading to a greater affective engagement, and feeling of cohesion.

Other neurochemical and -hormonal effects caused by singing may also likely play an important role for the student's feeling of cohesion. Beta-endorphins has been shown by Dunbar et al. (2012) (cf. section 1.2.1) to be released when doing social musical activities including singing. And the release of beta-endorphins is linked to a more prosocial bonding behaviour in humans in large groups.

Furthermore, the love hormone, oxytocin, has been shown to be connected to the act of singing. Oxytocin generally has the effect of lowering stress in humans and is associated with furthering intimate relationships. As the Kreutz (2014) study (section 1.3.1) showed, oxytocin concentration has been proved to increase more when singing compared to only chatting, thus proving that, in this regard, it is the act of singing that promotes prosocial behaviour.

Lastly, the results from the Keeler et al. (2015) study, mentioned in section 1.3.1, are also of interest for the present study. The decrease of adrenocorticotropic hormone (ACTH) after singing generally leads to reduced stress in the singers which then is concluded to enhance the social flow of the singers. This could be a good explanation for the greater feeling of cohesion. However, the decrease of ACTH is also associated with a *decrease* of arousal, thus going against the results from the Salimpour et al. (2011) study with the endorphin release creating an *increase* of arousal when listening to pleasurable music.

A possible factor to discuss here is the variance of individual experience of group singing in the students. A student that is feeling at home in the group singing situation is likely to be more relaxed and less stressed because of a high confidence in own singing skills. Contrary, students with less or none experience in group singing are likely to feel more stressed in the situation, being more aware of others' opinion about own vocal skills. In other words, the individual background of the students has a lot to say whether the act of group singing itself is pleasurable in the moment or not. This said, being insecure when singing does not necessarily mean that singing together is a bad experience. In this instance, the given group of people and social culture at the given school must be accounted for, and this is not a point for investigation in the present paper.

In the Vickhoff et al. (2013) paper, mentioned in section 1.3.2, it was concluded how song structure, respiration, and heart rate (HR) are connected when singing. Figure 4 (page 28) shows how HRV-frequencies seems to align when singers perform rhythmically structured and synchronized singing together, thus creating a common respiratory pattern that leads to entrainment. Entrainment is to be considered as a clearly active factor in the group singing at the morning assemblies at the folk high schools. All songs in the songbook are compositions with structure, harmonies and melodies based on Western musical theory. These songs thus function as respiratory-guiding structures enhancing the heart rhythm stabilization through entrainment amongst the students. And this phenomenon is then concluded to be cohesion increasing factors because of the creation of entrainment and shared joint intentionality and action making in the group singing. Furthermore, as the Tarrant

et al. (2021) study (section 1.3.2) showed, group singing has the potential of creating a shared social identity amongst singers. The results from the present study together with the institutional aspects of being and living at a folk high school must be concluded to further enhance a feeling of shared identity amongst the students. And this feeling of a shared social identity must also be accounted for as a factor for creating social cohesion amongst the students.

As promised in the first part of the paper a discussion of whether it is the group singing *per se* that generates a feeling of cohesion or simply being a part of a supportive social network with a shared intentionality engaged around musical activities that is the main engine for social cohesiveness must be unfolded. Pearce et al. (2016a) hypothesize in their paper that some of the health and well-being benefits associated with group singing are driven by stronger social cohesion. So, the question is rather, is group singing the chicken that produces the social cohesion-egg, or is it the other way around? Pearce et al. (2016a) conclude in their paper that singing only manages to be more cohesion-conducive compared to other creative activities when being in the early stages of making new acquaintances explained by the earlier mentioned “ice-breaker-effect”.

The experimental design and the results from the IIS-scale in the present study fall short in relation to this issue and cannot alone shed further light on this. The present study is based on a cross-sectional design, whereas the Pearce et al. (2016a) study is a longitudinal study over a period of seven months. And looking at the results from the IIS-scale alone the only possible interpretation of answers towards this issue, is that group singing at morning assemblies is cohesion-conducive in nature when taking the IIS-scale results and the cognitive and health-related outcomes of singing into account. However, informal interviews with a few students at the folk high school of Bornholm may deliver some insights into this matter.

When asked about the feeling of cohesion all students replied that they felt more included *when* singing as well as *after* singing than before. When asked about which aspects that could be the driving forces for creating this feeling of inclusion, the musical aspects of the songs were mentioned. Lyrics and mood of the songs seem to play a big role for the general feeling and state of emotion among the students both as a group and individually. This statement thus accounts for the cognitive mechanisms and neural and physiological outcomes related to the musical aspects of singing as playing a significant role when establishing a feeling of cohesion. Therefore, the present paper concludes that when studying group singing at Danish folk high schools the songbook is such a

dominant factor in the act of singing, that the songs themselves must be taken more into consideration when investigating the establishing of cohesion while singing.

How this issue can be discussed in a more fruitful manner, will be elaborated in the subsequent section.

When talking about group cohesion and shared intentionality, motivation amongst the interlocutors also seems to be an important factor to consider when investigating in which ways the cohesive powers unfold. So, what motivational forces are at play at the folk high schools?

As explained earlier, the act of group singing is a central part of the history of the Danish folk high schools. Students at all folk high schools are at some point in their semester presented by the importance of the tradition of singing together. Students are thus aware that group singing lies at the heart of the ideology of the school. As accounted for in the previous section, the sociality of the situation grants the student a responsibility for the act of singing to work out because of the highly reciprocal nature of the group singing situation. In other words, the students are given an institutionally important and active role to maintain and pass on the traditions of group singing, which must be concluded to grant students a high amount of motivation for actively attending and taking part in group singing.

Of more cognitive and neurochemical aspects in relation to motivation the release of dopamine must also be accounted for as a source for motivation, as well as the release of oxytocin and endorphin hormones.

It is by now fair to conclude that a lot of communicative as well as cognitively, physiological, and neurochemical and -hormonal factors participate in the significant increase in students' feeling of cohesion after group singing at morning assemblies. A relevant question to ask now is why is the mean score not higher? As shown in Table 3 (page 47) 14 % of answers after singing are on 3 or below on the IIS-scale, meaning that for some students the singing has had none or maybe even an opposite effect on their feeling of cohesion. Also, the average mean score could potentially rise over a whole step further on the IIS-scale. Are there any aspects of the by now assumed reasons for the increase in cohesiveness that can have opposite working mechanisms?

To tackle this question the PCM-model (Figure 5, page 34) can show useful. As described in section 1.4 the model describes how the musical perception and learning prediction are highly individual mechanisms that are dependent on a lot of different factors. For example, cultural background,

state of mind, and musical competence are factors to consider in this regard. This means that students have widely different backgrounds, experience with, and attitude towards the act of singing. Some may have had a lot of experience with singing and feel good about letting go of social boundaries and sing in tune without problems. For others it may be a completely new practice creating a form of performance anxiety, while others may even have had bad experiences beforehand with singing.

In an informal interview, a student described how she thought she was tone deaf until attending the folk high school. She just recently learned that she can actually learn to sing, and that through her life she has been holding back while singing together with others. In other words, the act of singing depends a lot on the students' individual attitude towards it, which again depends on a lot of factors related to their upbringing and culture from their life before attending the school. Of course, we may not conclude much based on a single informal interview, however this reflection underlines the importance of taking individual difference in the students into account.

The present study does not deliver further methodological insights into this discussion, but how it can be fruitfully tackled in other approaches will be discussed later.

In conclusion, the results derived from the present study shows a significant increase in feeling of cohesion in folk high school students after singing at morning assemblies, thus accepting the main hypothesis. The sociality of the group singing situation provides a room for affective engagement and a feeling of shared intentionality and responsibility for establishing and maintaining coalition and cohesion in the group of students characterized by a shared social identity. Furthermore, the act of singing leads to neurohormonal and -chemical as well as physio- and psychological changes that enhance the feeling of bonding and cohesion in the students. Among these is the release of sIgA, oxytocin and endorphin hormones as well as dopamine. Also, it has been shown how respiratory synchrony and HRV-entrainment play a role.

In the following section a discussion of possible confounding factors for the study will be unfolded. Finally, the present paper will be discussed in relation to the area of cognitive research in group singing in general with a focus on experimental design and methodology. This is done in an attempt to shed light on what this paper does not manage to capture as well as what it can contribute with and what further studies can draw from the present study.

5.2 Confounding factors

The different repertoires of songs at the morning assemblies are a factor of uncertainty for the overall design. As mentioned earlier, the songs were chosen in consultation with the respective principals of the schools to match the students' general knowledge of the songs beforehand. There were therefore both well known, slightly known, and unknown songs at each morning assembly. This leads to different song lists (Table 2, page 45), meaning that the different assemblies were not of similar nature in relation to the impact of the chosen songs. As discussed earlier, the mood, meaning and lyrical content of songs in the folk high school songbook have a strong impact on how the group singing itself is unfolded. It is therefore a nearly impossible task to even out and simulate an overall similar atmosphere at the different schools since the setting and background at each school are different from each other. In other words, the gathering of data for investigation has been done in four different chunks happening at different times, spaces, and settings, while the data itself have been treated as a single unit for analysis.

The main reason for visiting different schools were to expand the number of participants, thus heightening the reliability of the data. However, this expansion comes with a price, and the price is the uncertainty caused by the different settings at each school. Yet, each school visited in the present study is very similar to the others in relation to educational and institutional profiles, thus attracting students that share interests and sociocultural backgrounds.

Another confounding factor that can have a potential impact on the results is the physical setting of the morning assemblies when the students had to answer the questionnaires. As a student pointed out in an informal interview, she felt somehow "watched upon" when answering the IIS-scale. The students generally sit closely next to each other, and this awareness that friends and people next to you can see your answers might have an impact on the students in the way that they feel "obliged" to show that they feel close to their peers. This social phenomenon is called *social desirability bias*. This bias may also explain the missing five respondents in the questionnaire before singing that did not choose to answer the IIS-scale question (as mentioned in section 3.3). Some students may simply not have felt that they could answer the questionnaires without being judged by their neighbours. If this factor was accounted for, and the students were free of different group biases, the mean score of cohesiveness could generally be expected to be lower.

My own role as presenter and accompanist must also be taken into account. As discussed earlier, the presenter and/or accompanist is very much responsible for the unfolding and general atmosphere of the group singing at morning assemblies. The energy and musical choices of accompaniment have an impact on how the students feel addressed, and if I choose to play a song in a melancholic, energetic, or even goofy manner, this has an impact on the general mood of the students. In other words, since the presenter stands in a highly social and reciprocal relationship with the students, the students' feeling of cohesion is also partly a result of my presence and guidance as a presenter. The results of the present study are therefore somehow connected to me as a communicator and researcher, and this naturally carries some inherent problems, since I cannot be an objective investigator of myself and what impact my personal presence and style of presenting might have on the students at the morning assemblies.

Also, since I am living and teaching at Bornholm Højskole, the students attending this school have a more personal relationship with me compared to the students at the other three schools. This might have an impact in the way that the atmosphere at Bornholm likely was more relaxed since the students knew me beforehand. At Engelholm, Ry, and Silkeborg I was a guest coming from the outside presenting and playing at the assemblies possibly creating a more solemn attitude and atmosphere in the overall interaction at these three assemblies compared to the one at Bornholm.

5.3 Experimental design and methodology

When investigating health and well-being in relation to social relationships, Pearce et al. (2016a) show the importance of distinguishing between the different types of such relationships. For example, how factors like group size impact engagement of the interlocutors and how people in the group are related family- or friendship-wise. The present paper operates with a definition of a group, which is not based on a specific amount of people, but more related with the participants' motivation and feeling of responsibility and shared intentionality. The design of this study does therefore not account for the size of the groups investigated, and how size plays a role in the feeling of cohesiveness amongst the students. Folk high schools can vary in number of students from 30 to 200, thus making the groups completely different in atmosphere and social dynamics. Being more specific when describing the types of relationships involved in the social groups being investigated, could be a solution to this matter.

Furthermore, the aspects of time and place of the investigation have an impact on the students' disposition of feeling of cohesion with their peers. The morning assemblies were held two months into

their semester. How would the results have turned out if the assemblies were held a month or two earlier, or if they were held at the end of the semester? To dig further into this a longitudinal experimental design with more than one assembly at each school could be a fruitful way of investigating the cohesive powers of group singing unfolding over time at the Danish folk high schools.

Also, students attending the chosen schools for the present study are only a margin of students attending Danish folk high schools across the country. As mentioned, there are over 70 folk high schools, each with their own different prioritisation of group singing. If, for example, only sports focused schools were visited the results would have likely looked a little different, since group singing does not have the same importance at schools focusing on sports. The group of students would be of different personality types than in the schools investigated in this study. So, to have a more sufficient mean score for students in general at Danish folk high schools, schools with more varied profiles and courses should be visited. This is also valid in relation to geographical placement of the schools. In the present study all schools, except from Bornholm, are placed in the middle of Jutland. Further studying should therefore also focus on getting data from schools placed in other parts of Denmark.

It has been argued how the songs themselves play a big role for the general atmosphere in the group singing. To be more aware of the general atmosphere generated by the songs being sung at morning assemblies, a more thorough preparation of song lists could be an aspect worthwhile focussing on. To do this, thorough musical theoretical and lyrical analyses of the songs should be done beforehand. In that way, the impact of the songs could be better accounted for, resulting in a more scientifically supported unfolding of the assemblies with more control of creating a certain mood and atmosphere at the assemblies.

Furthermore, musical analyses of the songs used in a potential new similar study could provide further insight into how compositional and musical features play a role in the evocation of affective engagement in the students in relation to group singing as well.

In the experimental design for the present study, there was no control of whether the students chose to answer in English or Danish. If this was controlled in a way so that the international students only answered in English and Danish students only did in Danish, an analysis of cross-cultural differences in feeling of cohesion amongst the students would have been possible. Unfortunately, this is not the case, leaving the present paper with only the opportunity of treating the students' answers

as one unit. Furthermore, the present experimental design also limits us in analysing the answers from the schools independently. In the creation of the questionnaires in SurveyXact, the questionnaires were treated as a single data-gathering unit. If the questionnaires were split as units only to be used once at the different schools, comparing answers between the different schools were possible.

Therefore, further studying with a similar design should focus on making the two above-mentioned aspects possible. This would require little changes in the presentation of questionnaires and is practically possible. So, for the present study it is a bit of a confinement of analytic content, however it can be used as a hint for developing on further investigation in potential future studies.

As mentioned in the previous section, the individual differences in the students' attitude towards singing cannot be accounted for in the present study. The concluding questions in the questionnaires regarding the more personal statements from the students towards singing could in this regard be developed further. In this way, it is possible to consider the individual differences. This could practically be done by letting the students write more detailed about their attitude towards singing in the questionnaires. This would then demand a more thorough data-analysis with coding of the free answers. Also, a more confined system towards qualitative interviews could provide fruitful in this regard.

To conclude, the use of the IIS-scale must be mentioned. Figure 10 (page 50) gives the impression that the IIS-scale is overall a well-working tool for measuring the feeling of cohesion in the participants. Less than 20 % of the respondents chose 3 or below on the scale. The IIS-scale can therefore be said to be a scale that is coherent with the students' feeling of cohesion in their ingroups. However, as discussed earlier, answering the IIS-scale could for some students seem to be a sensitive and personal matter, that thus needs to be considered when creating an experimental design with the use of this scale.

6. Conclusion

This paper investigates the phenomenon of group singing at Danish folk high schools and what role singing plays in establishing feelings of cohesion in students. In the first part of the paper, the defining mechanisms of social cognition and interaction that lay the ground for human social interaction are described. Theory of Mind (ToM), joint action, social alignment, shared intentionality, and

reciprocity are some of the key notions mentioned in this regard. Hereafter, the origins of music making, and its communicational aspects are being elaborated on, and the notions of affective engagement, rhythmic synchronization, entrainment, and floating intentionality are derived and described in this process. The cognitive and health-related aspects related to singing and social cohesion are then described, and it has been shown how there are numerous positive cognitive, neural, and psychological as well as physiological outcomes related to the act of singing and the feeling of cohesion in general. Concludingly for the first part of the paper is the description of the newest research on music in the brain, the predictive coding mechanisms (PCM), as well as a description of and a sociocultural introduction to the Danish folk high school institutions and the role of group singing at these schools.

In the second part of the paper an experiment conducted at four different folk high schools by the author is described. The theoretical and analytic foundation is first accounted for, followed by a description of the chosen methodology for the study: the Inclusion of the Ingroup in the Self-scale (IIS). The methods and materials for the study are described before the results derived from the study are presented. It is shown that group singing has a significant increase in the student's feeling of cohesion after singing compared to before singing.

The results from the study are then discussed in relation to the theories and notions described in the first part of the paper to find possible explanations for this effect. Here it is shown that the sociality of the group singing situations at the morning assemblies are providing room for affective engagement and a feeling of shared intentionality and identity. Furthermore, the physical act of singing leads to neural, physiological, and psychological changes that enhances social bonding and a feeling of cohesion in the students.

To conclude, confounding factors as well as a discussion of the experimental design and methodology are presented with the purpose of delivering insights relevant for further studying in this area of research.

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8. Appendices

8.1 Appendix 1: The five Danish group singing typologies

8.1.1 Appendix 1a: Danish original version

	KORSANG	HØJSKOLE-SANG	LEJRBÅLS-SANG	LEJLIG-HEDSSANG	STADION-SANG
MÅL	Æstetisk perfektion	Fælles stemning af sindet/refleksion	Hygge	Fejring	Eufori
FORM	Flerstemmigt, koordineret	Enstemmigt, alsang	Flerstemmigt, ukoordineret	Enstemmigt, mere eller mindre koordineret	Enstemmigt (eller ufrivilligt flerstemmigt)
KOORDINE-RING	Følg dirigenten	Følg oplæg/akkompagnatør	Følg hinanden/forsanger	Følg hinanden/akkompagnatør	Følg mængden
TEKST	Ofte vanskelig, udenlandsk	Budskab, høj tekstlig kvalitet	Blandet, "vi mødes i omkvædet"	Kraftigt vekslende kvalitet	Enkelthed, let at lære
DELTAGERE	Korsangere	Kursister	Dem, der vælger det til	Alle tilstede-værende	Mange af de tilstede-værende
KLANG-IDEAL	Formaliseret, ensartet, klangfyldt	Fyldigt, delta-gende	Intet/engagert	Intet (bare der er nogen, der synger)	Kraftigt
VIL GERNE	Løfte os	Flytte os	Samle os	Fejre os	Opildne os
VI HOLDER	I hånd med dirigenten	I hånd med et budskab	I hånd med hinanden	I hånd med hovedpersonen	Hinanden under armen

Skovgaard (2020).

8.1.2 Appendix 1b: English translated version

	Choir singing	Folk high school singing	Campfire singing	Occasional singing	Stadium singing
Goal	Aesthetic perfection	Common reflection and tuning of minds	Hygge (creating a cosy atmosphere)	Celebration	Euphoria
Form	Polyphonic, coordinated	Monophonic, singalong	Polyphonic, uncoordinated	Monophonic, more or less coordinated	Monophonic (or involuntarily polyphonic)
Coordination	Follow the director	Follow presenter / accompanist	Follow each other / lead singer	Follow each other / accompanist	Follow the crowd
Lyrics	Often difficult, foreign language	Message, high poetic quality	Mixed. “We'll meet in the chorus”	Much variation in quality	Simplicity, easy to learn
Participants	Choir singers	Students / course members	Those who choose it	Everyone attending	Many of the attending
Ideal sound	Formalised, homogenous, sonorous	Full-bodied, participating	Nothing but being engaged	Nothing but being engaged	Powerful
Wants to...	Lift us	Move us	Gather us	Celebrate us	Excite us
We are holding hands with...	The director	A message	Each other	The key figure	Each other

8.2 Appendix 2: Song descriptions

14: Jorden har vendt sig en omgang / The earth has turned its round

A lively morning song from an old Danish revue celebrating the new possibilities for every citizen across the society given by the dawn of a new day. Well known by the students.

24: Godmorgen, Lille Land / Good Morning, Little Country

A popular morning song written to the opening of the suspension bridge connecting Jutland and Zealand over “The Great Belt” celebrating the Danish cultural connectedness. Well known by the students.

85: Ingen har guldtårer fældet / Nobody had shed golden tears

A lively and difficult song describing the Christian congregation history with the lyrics written by N.F.S. Grundtvig. Slightly known by the students.

159: Undertiden / The time of wonder

A melancholic pop/rock song describing the difficulties of being a single parent. Written by the popular Danish musician Søren Huss. Slightly known by the students.

202: Noget om helte / Something About Heroes

A swingy humorous song celebrating peaceful times and the happiness of the triviality of everyday life. Well known by the students.

281: Den blå anemone / The blue anemone

A very famous and beautifully melancholic song written by the Danish poet and member of the resistance movement Kaj Munk in WWII celebrating the arrival of spring.
Well known by the students.

556: Fuglene / The birds

The most beautiful song in the songbook. Has deep existential lyrics which rise questions about the way of living in the modern society in relation to the climate crisis.
Unknown to the students beforehand.

8.3 Appendix 3: Presentation-slides of questionnaires

Hej!

Her er to (meget korte) spørgeskemaer: én til før fællessang, og den anden til umiddelbart efter.
Here are two (very short) questionnaires: one to fill out before singing together and one for afterwards.

Jeres svar vil være anonyme.
Your answers are anonymous.

Venligst scan de følgende QR-koder eller skriv linket i din mobil-browser (vælg den på dansk).
Please scan the following QR codes or write the link in your browser on your phone (choose the English one).

Tak for jeres hjælp!
Thank you for participating!

Syng bravt!
#happysinging

Kh Hjalte,
Specialestudende, Aarhus Universitet



Spørgeskema #1 / questionnaire #1
(før fællessang / before singing)



Dansk:



<https://survey.au.dk/LinkCollector?key=GD95315XSJ36>

English:



<https://survey.au.dk/LinkCollector?key=AYC21P7WJNC5>

Spørgeskema #2 / questionnaire #2
(efter fællessang / after singing)



Dansk:



<https://survey.au.dk/LinkCollector?key=VV3K12GFL29J>

English:



<https://survey.au.dk/LinkCollector?key=8C1P91EAS612>

8.4 Appendix 4: Questionnaires

8.4.1 Appendix 4a: Before singing (Danish and English version)

AARHUS UNIVERSITET

Angiv venligst din alder

17-19
 20-24
 25-29
 30-34
 35-39
 40+
 Ønsker ikke at angive

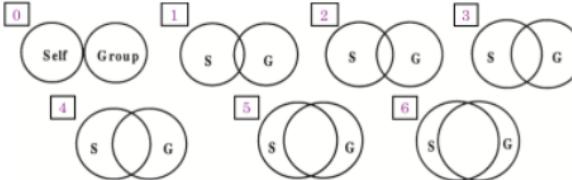
Angiv venligst dit køn

Kvinde
 Mand
 Non-binær
 Andet
 Ønsker ikke at angive

FØRIGE **NÆSTE**  50%

AARHUS UNIVERSITET

I hvor høj grad føler du dig i dette øjeblik forbundet med gruppen omkring dig?



0 1 2 3 4 5 6

FØRIGE **NÆSTE**  75%


AARHUS UNIVERSITET

Tak for dine svar.
Der kommer få nye opfølgende spørgsmål efter jeres fællessang på en ny QR-kode.

Syng vel!

[FORRIGE](#) [AFSLUT](#)  100%


AARHUS UNIVERSITET

Please inform your age

17-19
 20-24
 25-29
 30-34
 35-39
 40+
 Do not wish to inform

Please inform your sex

Female
 Male
 Genderqueer
 Other
 Do not wish to inform

[FORRIGE](#) [NÆSTE](#)  50%

AARHUS UNIVERSITET

To which degree do you in this moment feel connected to the group of people around you?

The diagram consists of six pairs of overlapping circles, each labeled with a number from 0 to 5. In each pair, the left circle is labeled 'S' (Self) and the right circle is labeled 'G' (Group). The degree of overlap between the two circles increases from 0 to 5.

0 1 2 3 4 5 6

FORRIGE **NÆSTE** 75%

AARHUS UNIVERSITET

Thank you for answering.
There will be a few new questions after your singing session with a new QR code.

Happy singing!

FORRIGE **AFSLUT** 100%

8.4.2 Appendix 4b: After singing (Danish and English version)

AARHUS UNIVERSITET

I hvor høj grad føler du dig i dette øjeblik forbundet med gruppen omkring dig?

0 1 2 3 4 5 6

I hvor høj grad synes du, at figuren ovenfor giver mening for dig, når du bliver bedt om at udtrykke, hvor meget du føler dig forbundet med gruppen omkring dig?

0 = slet ikke
6 = i meget høj grad

0 1 2 3 4 5 6

NÆSTE

40%

AARHUS UNIVERSITET

I hvor høj grad vil du sige, at du føler dig følelsesmæssigt forbundet til de sange, du har sunget i dag?

0 = slet ikke
6 = i meget høj grad

0 1 2 3 4 5 6

NÆSTE

60%

I hvor høj grad vil du sige, at fællessang har været en del af dit liv før dit højskoleophold (i din opvækst / i skolen / på institutioner / i foreninger)?

0 = slet ikke
6 = i meget høj grad

0 1 2 3 4 5 6

FORRIGE NÆSTE 80%

Tusind tak for din besvarelse.
Jeg ønsker dig alt det bedste på dit højskoleophold!

FORRIGE AFSLUT 100%

AARHUS UNIVERSITET

To which degree do you in this moment feel connected to the group of people around you?

The diagram consists of seven Venn diagrams arranged horizontally. Each diagram shows two overlapping circles labeled 'Self' and 'Group'. The degree of overlap is indicated by a number from 0 to 6 above each diagram. A color-coded legend indicates that the numbers correspond to the following degrees of connection:

- 0: Self only (no overlap)
- 1: Very little overlap
- 2: Little overlap
- 3: Moderate overlap
- 4: Quite a lot of overlap
- 5: Very much overlap
- 6: Group only (no overlap)

To which degree do you think that the figure above makes sense for you, when asked to express your feeling of connection to the group of people around you?

0 = not at all
6 = very much

0 1 2 3 4 5 6

NÆSTE

40%

AARHUS UNIVERSITET

To which degree would you say that you feel emotionally connected to the songs that you have sung today?

0 = not at all
6 = very much

0 1 2 3 4 5 6

NÆSTE

60%

AARHUS UNIVERSITET

To which degree would you say that group singing has been a part of your life before your current stay at a danish folk high school (in your childhood / at school / at institutions / cultural associations)?

0 = not at all
6 = very much

0 1 2 3 4 5 6

FORRIGE **NÆSTE**  80%

AARHUS UNIVERSITET

Thank you for answering.
I wish you a fabulous time at your højskole!

FORRIGE **AFSLUT**  100%