Høgskolen i Bergen

Masteroppgaven

M120MU513

Predefinert informasjon

Startdato:	11-05-2016 15:00	**Termin:**	2016 VÅR
Avslutningsdato:	18-05-2016 12:00	**Karakterform:**	Norsk 6-trinnsskala (A-F)
SIS-kode:	M120MU513 1 MA	**Studiepoeng:**	60
Eksamensform:	Masteroppgaven		
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Kandidatnr.: 94

Informasjon fra deltaker

Jeg godkjenner avtalen om tilgjengeliggjøring av masteroppgaven min i BORA: Valgt

HØGSKOLEN I BERGEN

BERGEN UNIVERSITY COLLEGE

Exploring the Dark Matter of Björk's Biophilia Universe

A Study of the Biophilia Educational Project Based on Grounded Theory Methodology

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Spring 2016

Abstract

This Master thesis offers a close examination of the Biophilia Educational Project: a multimodal, inter-institutional education programme conceived by Icelandic avant-garde/alternative rock music artist Björk, that aims to teach children about music, nature, science and technology through creative work. This study seeks to document the evolution of this unique project, from initial idea through the pioneering *Björk: Biophilia* iPad app album, and its affiliated educational programme that has achieved government support and distribution in all the Nordic countries. Further, the thesis seeks to develop knowledge of the project's design that may be used to conceive, implement, or improve similar practices elsewhere. This thesis is the first to provide a detailed, independent account of the Biophilia Educational Project in English. The methodology for this study is based on a constructivist grounded theory paradigm (Charmaz, 2014), seeking to inductively generate knowledge through concurrent data collection and analysis. The main body of data consists of interviews with teachers and steering group members of the Biophilia Educational Project, in addition to classroom observations and a review of documents and digital artefacts. The results show how Biophilia may be understood as a vast, elaborate concept that stretches beyond the end-to-end use of the app album in question and demonstrates how diverse perspectives may affect the perceived usefulness of Biophilia in music education. Biophilia's success in Iceland and other Nordic countries is to some extent attributed to the "wow factor" (Bamford, 2006), but as with other arts education programmes, conclusiveness regarding exactly which elements contribute to its popularity has proven difficult. The development and implementation of Biophilia appears to have strong roots in the musical cultures of Reykjavik, and this is seen as a significant contributor to its appeal in terms of the "wow factor".

Sammendrag

Denne masteroppgaven tilbyr en nøye undersøkelse av Biophilia Educational Project: et multimodalt, inter-institusjonelt utdanningsprosjekt skapt av den islanske avantgarde-artisten Björk som har til hensikt å lære barn om musikk, natur, vitenskap og teknologi gjennom kreativt arbeid. Denne studien søker å dokumentere dette unike prosjektets utvikling, fra idéstadiet, via det nyskapende *Björk: Biophilia* app-albumet for iPad, og det tilhørende pedagogiske opplegget som har oppnådd offentlig finansiering og distribusjon i de nordiske landene. Videre søker oppgaven å utvikle kunnskap om Biophilias prosjektdesign, som kan vise seg nyttig for å unnfange, implementere eller forbedre liknende praksiser andre steder. Denne oppgaven er den første til å tilby en detaljert, uavhengig gjennomgang av Biophilia Educational Project på engelsk. Metodebruken i denne studien er basert på et konstruktivistisk grounded theory paradigme (Charmaz, 2014), med hensikt om å induktivt generere kunnskap gjennom parallell datainnsamling og analyse. Hoveddelen av datamaterialet består av intervju med lærere og styringsgruppemedlemmer i Biophilia Educational Project, i tillegg til klasseromsobservasjon og gjennomgang av dokumenter og artefakter. Resultatene viser hvordan Biophilia kan forstås som et vidstrakt, omfattende konsept som strekker seg forbi den avgrensede bruken av den aktuelle appen, og demonstrerer hvordan ulike perspektiver kan påvirke den opplevde nytteverdien av Biophilia i musikkopplæring. Biophilias suksess på Island og i de øvrige nordiske landene er i en viss utstrekning knyttet til "wow-faktoren" (Bamford, 2006), men som i andre kunstfaglige utdanningsprosjekter har det vist seg vanskelig å avgjøre hvilke elementer som bidrar til dets popularitet. Utviklingen og implementeringen av Biophilia har tilsynelatende sterke røtter i Reykjaviks musikkultur, og dette blir ansett som et betydelig bidrag til dets tiltrekningskraft med tanke på "wow-faktoren".

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Acknowledgements

I will join in on the stereotype straight away: This project has been a long and winding road with tons of discoveries, things learned, problems solved and decisions made. I have had a lot of fun too. This was the year where I got to live in Houston, Texas for some months and it was the year I realised that I was actually a saxophonist, and sold lots of guitar equipment to become serious about my "saxuality". I have seen beautiful places that I never knew existed, discovered the amazing smoked brisket of Texas and played several gigs as a horn player. I was even hospitalised after a failed orthopaedic surgery a month before deadline. And then there is this thesis. Little did I know about how I would spend the better part of each day getting to know Björk and her educational project, and writing this thesis to share the knowledge. I am glad I did.

I would never have found the drive to write this thesis if it was not for the the encouragement and support of the people close to me. First and foremost, my supervisor David Gabriel Hebert, who have aided me in every phase of the project, pointing the direction, and still allowing me to discover the road on my own. I am very grateful for his hours and dedication. I also want to thank the Biophilia Educational Project steering group for their assistance, and my informants for sharing their knowledge and insights. It is pretty obvious that these contributions make up the very core of my thesis, and it is a shame that I cannot thank you by name. Still, you know who you are, and please accept my anonymous gratitude. Without your kindness and enthusiasm, this thesis would not exist.

I would like to praise the patience and support of my fiancée, Terese. I love you! Then of course, my study mates, especially Jonas and Ragni whom I spent nearly every day of the final months with at the study hall. Thank you so much for the fun times, the fiery discussions and the tremendous amounts of coffee we have consumed together. A secondary nod to Jonas for the countless woodwind jam sessions that kept us sane. And to Linn Kristin for reminding me that it is still a good idea to write music when in a process of writing *about* music.

May 2016

Bård Vågsholm Husby

Biophilia *noun* bio·phil·ia \ˌbī-ō-ˈfi-lē-ə, -ˈfēl-yə\

a hypothetical human tendency to interact or be closely associated with other forms of life in nature

The term "biophilia" was popularized by psychoanalyst Erich Fromm in the 1960s. In his work, he used the word (from *bio-,* meaning "life," and *-philia,* meaning "friendly feeling toward") to describe the biological drive toward self-preservation. In the late 1970s, American biologist Edward O. Wilson extended the word's meaning, seeing it as the perfect word for "the rich, natural pleasure that comes from being surrounded by living organisms." Recently, "biophilia" has been in the news as the title of Icelandic singer Björk's latest project, a multimedia production that (according to the website for the Manchester International Festival) "celebrates how sound works in nature, exploring the infinite expanse of the universe, from planetary systems to atomic structure."

Dark matter nonluminous matter not yet directly detected by astronomers that is hypothesized to exist to account for various observed gravitational effects

From the Merriam-Webster Dictionary (n.d.)

1 Introduction

> It would be of the greatest interest to create music specifically for the phonograph. Music whose true image – its original sound – could be preserved only through mechanical reproduction. This would indeed be the ultimate goal for the phonographic composers of the future.
>
> – Igor Stravinsky (1930, p. 65)[1]

We live in an age of broadband internet technology. Recent years have provided us with high-speed connections both at home and on the go, multi-finger touch interfaces, portable streaming-based entertainment and a significant increase in the compatibility of all kinds of digital devices. The presence of these electronic gadgets in many aspects of everyday life has probably come to stay. As I write these words, my "paper" is stored on a cloud service and accessed real-time from my laptop computer. Concurrently, I am listening to a radio-style playlist streaming random modal jazz tracks from a huge library somewhere; delivered through noise-reducing headphones that actively phase out the computer fan noise (as well as the coffee slurping and keyboard clicking of my study hall neighbours). This kind of working environment is by no means unique to my personal situation. A recent survey of Spotify users suggests that most subscribers to the service listen to music in their workplace for motivation or distraction (C. Katz, 2014).

Furthermore, surveys suggest the online video streaming service YouTube has become the main source of music consumption for young people (Michaels, 2012). One does not have to speculate extensively to see the implications these developments might have for music. Music streaming services are the main medium for casual listening (International Federation of the Phonographic Industry [IFPI], 2015), and the smartphone has become the hub of choice for real-time online access to millions of tracks from all the major labels as well as DIY productions. Recording one's own music is easier and cheaper than ever before, and it is entirely possible to make high quality soundings, and release-ready records on an iPhone[2]. With the increasing popularity of tablet computers in recent years, mobile touch-interface devices have led to the creation of various software representing new takes on familiar instruments as well

[1] Translation to English from original article in German by Mark Katz (2010, p. 118).
[2] Consider the albums *Start the Now* by One Like Son and *Phone It In* by Nuclear O'Reilly which were both recorded, edited and mixed in GarageBand for iOS.

as some quite original inventions costing a fraction of the price of hardware instruments with similar features and capacities. With this came a new breed of innovative music software, designed with efforts to harvest the potential of this new technology. One such software is the *Björk: Biophilia* app (Second Wind Apps & RelativeWare, 2011) for iPad[3]. In this app, each song of the album was represented by separate mini-apps, each having its unique design and musical possibilities.

During the winter of 2014, I spent four weeks in practice teaching at a primary school in Reykjavík, Iceland. I immediately felt familiar in this country, as there are several cultural traits shared with Norway. However, as the days went by, I also became increasingly aware of certain differences to Norway, both in school culture and in aspects of everyday life. My main impression was that the people of Iceland seemed to be more musically engaged, playing instruments, singing, attending concerts and participating in other music events. I also reflected on possible reasons for Iceland's significant music export despite having a population not much bigger than Bergen. There was also the impression that "everybody" was a choir singer, and that it was almost considered weird for someone not to be singing in one form or another.

Furthermore, I got the impression that the schools in that country were somewhat competing with each other over having the most comprehensive arts teaching. Several schools in the Reykjavík area had acquired additional digital technology for use in teaching, and the Apple iPad seems to be a favoured unit. Seeing how ICT was used in teaching at primary and secondary levels, and hearing how arts teachers praise and embrace the new technologies, it seemed obvious that Icelandic arts education has come a long way in implementing ICT.

Toward the end of my stay in Reykjavík, I was introduced to the Biophilia Educational Project. The project, active since 2014, is built upon the 2011 Biophilia app and is a large-scale inter-institutional collaboration that advocates "creativity as a teaching research tool, where music, technology, and the natural sciences are linked together in an innovative way" (Biophilia Educational Project, 2015). The project has been implemented in schools and arts institutions in the Nordic countries to offer school children learning experiences based around themes from music and natural sciences, teaching these simultaneously.

[3] Tablet computer from Apple, released in 2010 and arguably starting a new wave of popularity for touch-screen devices.

1.1 Rationale

The Biophilia Educational Project is interesting for a number of reasons. This is not the first time digital tools have been incorporated extensively in an educational program. Neither is it the only time an artist has made efforts to offer their own music in an unconventional format on a digital platform (some popular examples would be Lady Gaga's *ARTPOP*, the *David Gilmour in Concert* app, the *XX* app, and to a certain degree, Jay-Z's *Magna Carta* app). Nevertheless, it is arguably quite rare to see an educational project achieve the level of publicity and profile Biophilia has. Even so, the project has seen little-to-no interest from the music education researchers, based on the absence of published research related to the project. Neither has the project seen much challenging of its claims to teach students skills necessary to "develop their musical imagination, to push their creative boundaries and make music in an impulsive and responsive way, inspired by the structures and phenomena of the natural world" (Biophilia Educational Project, 2015). The only apparent exception to this being one fairly critical Icelandic language article in a non peer-reviewed journal (Guðmundsdóttir, 2014), as well as a few articles discussing the *app* in isolation from the educational project (Blickhan, 2016; Engberg, 2013).

Biophilia is a multi-facetted phenomenon. On the surface, it might appear to be a project that is mainly about an iPad app that children play with, while learning about music and natural sciences through this interaction. This was the starting point for my master project, as this description is pretty close to what is commonly found in public sphere discussions of Biophilia. I saw a need to investigate the role and function of the iPad app in educational use, as well as acquiring a deeper insight into how the project was organised and executed in the Nordic countries. A thorough description of the project would enable me to uncover success factors and challenges in extracurricular projects that may be transferable to designing similar projects in the future. Furthermore, the intriguing nature of Biophilia, even when not having any first-hand knowledge of the project suggested that there was something about the project that had the ability to draw interest, a sense of wonder amongst school children, teachers and politicians, and last but not least, government funding. An attempt to isolate these factors would be of value to music education if these are transferable to new and different projects that do not depend on Björk and Iceland to take form.

As this research project developed, several models of explanation and description of Biophilia started to emerge from the data. I have made efforts to challenge these conceptions as they developed, and the resulting reduction is presented and discussed in the final chapters of this

thesis. By offering a description of the phenomenon as well as an attempt to explain its development and implications, I hope to make the Biophilia Educational Project more accessible to the research field as well as highlighting factors that may contribute to the successful development and implementation of extracurricular, interdisciplinary educational projects in the future.

1.2 Research problem

My research problem saw substantial evolution from the time of initial data collection and analysis. It developed from a broader, ethnographic and process-related inquiry to one that would be descriptive of Biophilia as well as explanatory, in the sense that I wanted to find out what could be learned from Biophilia for application elsewhere and how to predict its successes and failures in such settings. Originally, I intended to focus on the iPad app as an artefact and an educational tool as that was more or less my understanding of the concept. After my first few interviews, I realised that this alone would not tell what I found to be the most interesting part of the story: namely, *how* did Biophilia evolve and what is it really about? *What* characterises the learning environment of a Biophilia project? Furthermore, if considering Biophilia Educational Project an original, didactic approach, is there something to be learned that can improve aspects of music education elsewhere? This has generated the following questions to guide my search for new knowledge about the Biophilia Educational Project:

- What is the concept of Biophilia and the Biophilia Educational Project; how did it evolve and how is it implemented in compulsory music education in the Nordic countries?
- What contributing factors to Biophilia's "wow factor" can be identified through inductive qualitative research, based on the experiences of some Icelandic teachers and other informants close to the Biophilia Educational Project, as well as Norwegian music teachers observed in a pseudo-experimental trial with the Biophilia app?

1.3 Orientation to Biophilia

As this paper will demonstrate, Biophilia is most sensibly fathomed as one unified concept shared across two closely-related phenomena: (1) the 2011 Björk album of the same name, and (2) the derivative educational project.

The Biophilia *album* by Icelandic artist Björk Guðmundsdóttir was released in the Autumn of 2011, and was the first of its kind in the sense that its main medium of release was an iPad app.

Although several artists have released software-based albums, the Biophilia app was different in that it went somewhat beyond the jukebox style app interface of its peers and rather provided mini-games for each song where the user manipulates the listening experience by tactile interaction with the touch screen. These mini-games are officially referred to as the *songapps*[4]. Accordingly, the iPad album (which later also saw an Android release, as will be explained later) will be referred to as the *appalbum* or the *appsuite* and the subordinated apps as the *songapps.* The album may be labelled as a *concept album* (discussed in chapter 4), dealing with themes of nature and human emotion and the superordinate theme of man's love for nature and the bond between humans and other living systems, sometimes referred to as the *biophilia hypothesis* (Wilson, 1984).

The idea of an educational platform around Biophilia was allegedly conceived as Björk developed the concept and began its baby steps during the Biophilia tour from 2011 through 2013. The educational platform started out as workshops in relation to the concerts, and was mainly executed by the musicians and crew, later in collaboration with local arts centres. Their aim was to make educational workshops for children where they would be learning about themes of musicology, natural sciences and technology using Björk's concept, and to a large degree, the iPad app. In 2012, a pilot project was started in Reykjavík, where teaching ideas using, or inspired by, the Biophilia app album were tried in local primary schools. This pilot project, called Biophilia Educational Program expanded into what is currently known as the Biophilia Educational Project, where the developed teaching concept has been brought to the Nordic countries, including Greenland and the Faroe Islands, with support from the Nordic Council of Ministers and the University of Iceland. This project saw implementation in 2015 and will see an internal evaluation by the end of 2016.

In doing this research project, I have mostly found it useful to about Biophilia as one concept, and not seeing the educational project as separate from the album. Since the educational aspects of Biophilia are closely related to the music itself, and considering Björk's long-time intention of making Biophilia educational, I find it fair to regard the entire thing as a *meta-concept*. In this setting, the term would suggest seeing the music, the app album and the educational intentions and efforts as a single entity. This would also serve to acknowledge the artistic

[4] The one-word spellings ”songapp”, ”appalbum” and ”appsuite” are used in all documents and official mentioning of the Biophilia apps, and will therefore be spelled this way in this thesis.

visions of Biophilia. Even so, in this thesis, the different elements are often referred to in isolation for simplicity and to avoid elusiveness in discussing them.

1.4 Personal interest and involvement

I was first introduced to Biophilia through practice teaching in Iceland, as my supervising teacher was taking part in the project, and had taught using Biophilia to his students at a school in Reykjavík. My very first physical interaction with Biophilia was seeing the artefacts, and trying out some of the songapps during the 2014 Nordic Council of Ministers conference in Reykjavík where the Nordic countries were invited to take part in expanding the project. I did not immediately form a research interest in the project, but I remember a certain curiosity that persisted after returning to Norway. When deciding to focus my master thesis on Biophilia, it was mainly a result of an apparent absence of literature on the project to be found in research databases, and an extension of the mentioned curiosity, as I was pretty sure that there was *something* to be learned. I just did not know what.

I have had a keen interest in digital tools in music education since I first started my teacher education in 2011. My primary and secondary school music education memories have no digital tools in them, except for the occasional use of Microsoft Word and PowerPoint as well as internet search engines. I bought my first tablet, an Apple iPad 2 sometime in early 2012 and became familiar with GarageBand, an Apple software that mostly resembles a simplified Digital Audio Workstation with on-board software instruments and sampling capabilities. I began bringing GarageBand and other tools into my teaching practice and eventually wrote about digital competency for my Bachelor thesis in 2014. I see myself as a digital immigrant, in the sense that I did not actually grow up with these tools, but feel obliged (and happy) to familiarise myself with the ever-developing technologies that may support my teaching practice, to better mirror the world of music outside the classroom as well as to make use of the technologies that school children use in their spare time. I do not consider myself an advocate for digital tools and I would not consider them replacements or substitutes for conventional instruments or equipment. Even so, I would argue from a personal standpoint that tablets and computers have an enormous potential as time savers and quality enhancers in the music classroom and in schools in general, in addition to having intrinsic practical and aesthetic values of their own.

I do have semi-professional working experience from rock bands, as a live audio technician and with music recording and production. Therefore, there is a good chance that I am fonder of, and

know more about certain aspects of music technology and digital tools than the average music teacher. Still, my scope in this thesis is on the "grass roots" level, discussing Biophilia and its adherents from a school teacher perspective.

1.5 Overview

Chapter 2 explains the theoretical framework for this thesis, and is intended to be an orientation to the scope of this thesis in relation to pre-existing knowledge on the field, as well as presenting existing theory and findings that was thought in the early stages to possibly relate to the results of my research.

Chapter 3 is the method chapter, presenting my research design and description of methodology, as well as providing insight to the processes involved in developing and completing this research project.

Chapter 4 may be seen as an analysis and interpretation of the artefacts of the Biophilia Educational Project, featuring descriptions and several screenshots from the Biophilia app. This chapter is heavily based around my *memo writing* from early stages of the project. Memo writing is considered a fundamental aspect of grounded theory studies (Birks & Mills, 2011), and even if this study does not adhere strictly to a grounded theory paradigm, I include much of the original memo writing to demonstrate my understanding of the Biophilia concept, in an attempt to further clarify my perspective in discussing the data.

Chapter 5 contains results from observation followed by reflections based on memos from later phases of data collection. The observation data is, despite its auxiliary function, presented here as it better represents the chronological order of data collection, and contributed directly to my understanding of the artefacts and documents mentioned in chapter 4.

Chapter 6 presents the main results from this study, taken from eight interviews with teachers and steering group members who have direct experience with the Biophilia Educational Project.

Chapter 7 presents data from what I will refer to as the "deviant case", where I sought specifically for contrasting data material to challenge the then emerging categories from my initial analysis of data presented in the earlier chapters.

Chapter 8 provides a discussion of the categories that emerged from compiling all data, considered in relation to a search for existing theoretical concepts that could contribute to understanding the data material. Some theoretical perspectives in this chapter appeared late in

the research project through *theoretical sampling* (Birks & Mills, 2011) and is therefore not included in the conceptual framework (chapter 2).

Chapter 9 concludes the thesis and presents my final interpretations with suggestions regarding how knowledge generated from this study may be used to in the development of extracurricular projects elsewhere or software for music education and its use in compulsory music education.

The APA 6th reference style is used for citations throughout this thesis. I have chosen to deviate from the publishing format for ease of reading, hence the occasional use of footnotes for additional information. Interviews are, contrary to APA 6th guidelines, added to the literature list with the date of the interview stated there, and interviewees cited plainly in-text or by their pseudonym in parentheses to avoid cluttering of references in-text.

1.6 Delimitations

This thesis generally deals with the development and execution of interdisciplinary arts projects, specifically the case of the Biophilia Educational Project, striving to offer a *descriptive* account of its origins and history as an arguably successful extracurricular project in Iceland and the Nordic countries. Furthermore, this thesis attempts to *explain* the features and elements that seemingly contribute to Biophilia's popularity as well as addressing the perceived challenges and issues with the project on different levels. These findings could prove useful in the design or implementation of similar projects elsewhere.

The Biophilia Educational Project is a multi-faceted phenomenon, that could, hypothetically, be approached in a number of ways: As a cultural or a political phenomenon; a music album; an issue of curriculum development; or in terms of specific issues within the project, such as the question of creativity; learning environment; students' self-efficacy or other issues I have seen raised amongst teachers, by the media, and administrators or others familiar with the project. Within the context of a Master thesis, I have chosen an approach that I feel is relevant to the field of music education, aiming to share knowledge that is not easily accessible elsewhere. In this manner, this is a story of how a "DIY punk project" became a zeitgeist of music education in Iceland, and how this knowledge could potentially help stimulate and guide the development of similarly innovative music education projects in other contexts.

2 Conceptual framework

This chapter serves as an orientation to the literature and theory that has been used to establish a framework for the generation of data and its interpretations. Having mainly an inductive focus, this framework was not established from the start of the research project. This chapter may be considered a backdrop, as an extension of the orientation of this thesis.

2.1 The Wow factor of art projects in compulsory education

> Education should be centered on the *Wow factor* engendered through the arts and build in all young people innovation minds, a creative spirits and an enthusiasm for life and learning [sic] (Bamford, 2006, p. 150)

The term *wow factor* is, within the context of music education research, commonly attributed to professor Anne Bamford (2006) and her work based on international-comparative analyses of arts education research on behalf of UNESCO, seeking to highlight benefits of arts education programmes and charting quality criteria based on case studies and survey data from more than 60 countries. Bamford (2006) shows that education policy in many countries has been impacted by considerable advocacy for the arts, but this has not necessarily led to widespread implementation of "quality arts programmes". Still, Bamford notes that "traditional schooling fails to meet the needs of many children who are marginalised within the education systems," and that the arts programmes hold unique potential "to redress this concern" (Bamford, 2006, p. 149). In a different report, on arts education in Norway, Bamford (2011, p. 10) notes that Norway values arts education and extracurricular cultural experiences highly, but that the "actual" effect of such programmes has not been officially assessed. She also praised *Den kulturelle skolesekken* ("The Cultural Rucksack"), a large-scale official programme designed to offer all school children professional, high quality cultural experiences, and found this programme to be a major strength in Norwegian arts education (Bamford, 2011). A similar report Bamford (2009) wrote about the situation in Iceland suggested that the arts education in Iceland was of high quality, but that partnerships with ouside agencies like artists, industry and cultural organisations (like *Den kulturelle skolesekken* in Norway) was not common in Iceland at the time.

A working definition of *wow factor* can be derived from the preface of Bamford's (2006) book based on data from the study: "the excitement and unexpected results that are difficult to be definitive about but have enormous impact on the teachers, artists, children and even communities where effective arts-rich education occurred" (Bamford, 2006, p. 18). Bamford

(2006, p. 18) notes that the term has been especially used "in relation to the children's artistic achievements". Bamford (2006) argues that the wow factor served as a "potent force" that aids the motivation of students, artists and teachers despite restrictions and difficulties in arts implementation.

Bamford (2006) also finds that arts education is not only of value to the learner, but also to the teaching and learning environment, and the community. Most examples of quality arts-rich education entail partnerships between schools and the local community (Bamford, 2006, p. 146). Even so, this also leads to challenges and demands for negotiation, outreach and reinforcement. In most of the cases examined by Bamford, partnerships were considered to have been improved by more time and resources.

Central to Bamford's (2006, p. 140) report is that the positive benefits of arts projects only seem to be in play when certain quality criteria are met: (1) Active partnerships between schools and arts organisations and between teachers, artists and the community; (2) Shared responsibility for planning, implementation and assessment and evaluation (3) Opportunities for public performance, exhibition and/or presentation; (4) A combination of development within the specific art forms (education in the arts) with artistic and creative approaches to learning (education through the arts); (5) Provision for critical reflection, problem solving and risk taking; (6) Emphasis on collaboration; (7) An inclusive stance with accessibility to all children; (8) Detailed strategies for assessing and reporting on children's learning, experiences and development; (9) Ongoing professional learning for teachers, artists and the community, and; (10) Flexible school structures and permeable boundaries between schools and the community

Bamford (2006, pp. 141-142) further argues that the successful delivery of arts education appears to hinge upon (1) clear and consistent objectives, (2) evidence base/adequate casual theory, (3) minimisation of veto-points (delivery chain without bureaucratic obstruction) (4) committed and skilful implementation officers, (5) consistent and continuous political support; and (6) favourable external conditions. Bamford's (2006) findings, being based on extensive meta-analysis of arts education programmes, may prove useful as a framework for understanding and discussing other projects elsewhere.

Bamford (2006, p. 149) writes that there has been an increase in interest for the potential of arts-based educational programmes, but that there are few attempts at rigorous research on the process or outcomes of such programmes. This may serve as a rationale for research on such

topics as the present Master project, which considers Bamford's framework for charting and understanding the development and implementation of the Biophilia Educational Project.

2.2 Digital tools in music education

The changing nature of music through the spread and development of digital technology is arguably a relevant discussion topic for music education research in the 21st century. Implications of this would be considering the need for compulsory music education to adapt to the changing surroundings, making the curricular music activities relevant for the young. Alternating the scope of Bamford's (2006) wow factor, Pamela Burnard (2009) wrote that there have been several initiatives in the UK and elsewhere aimed at creative work in schools by the extended use of new technology. Seemingly praising such concepts, she also notes that they only result in "pockets of innovative practice":

> Lack of support for the creation of space and time for music does little to achieve widespread implementation of the latest government edicts. How much teachers can do as managers of new technologies depends on what policy-makers can facilitate through new models of educational provision (Burnard, 2009, p. 199).

Burnard's (2009, p. 198) summary of related research suggests that embedding creativity and technology in curriculum development depends on "*time*, *space* and *interactivity* […] coupled with teacher expertise". Ensuring these four elements are addressed may then be seen as a principle for successfully merging creative work and technology in compulsory school teaching practice.

Some of these discussions relate to the personal use of technology in absorbing (and sometimes creating) music that young people engage in and experience outside of school and other organised music learning activities. One of the terms that sometimes show up in this context is *m-learning*, or mobile learning, meaning learning activities that occur on mobile mediums like phones and tablet computers as well as enabling learning outside a school or home environment. This trend is considered a result of the increasing availability of these mobile units (Zhang, 2015b). Furthermore, this increasing penetration rate has led to m-learning becoming a topic in educational research, especially efforts to understand its benefits in comparison with traditional learning methods and electronic learning (Zhang, 2015a). However, there are several issues facing m-learning. Zhang (2015b) summarises the scholarly discussion of m-learning as:

> How to change the traditional teaching curriculum and materials into digital contents, how to design a good content that suits mobile devices and mobile teaching methods, how to improve the interactive and communication functions on mobile programs, how to educate senior educators to use mobile technologies in their teaching, how to protect IP and confidential information online, how to keep stable networks and signals during using, and how to engage students in learning function instead of playing games (Zhang, 2015b, p. 3).

According to Zhang (2015b), successfully designing an m-learning interface is about understanding the relationship between students' needs and requirements and the technologies available. In bridging the gap between compulsory education and voluntary, personal learning, there is a potential for enhanced performances and lifelong learning. However, the current technology has some shortcomings such as software restrictions and mobile high-speed internet limitations that prevent "true" mobility, hence making the mobile learning platforms complementary to face-to-face learning methods, called *blended learning* (Zhang, 2015b).

Jonathan Savage (2012) explains how cross-curricular teaching is usually approached in UK schools; often conceived as an organisation of school-level curriculum resulting in a theme-based approach, with subject teachers designating lessons to comply with the theme being taught. Such approaches are valued in the National Curriculum although not considered statutory (Savage, 2012). Savage (2012, p. 80) refers to a report from the Consortium of Institutions for Development in Research and Education in Europe concluding that such approaches, with school subjects adapting to a superior theme, have limited effect. A different approach seems more effective, with teachers adopting an *enriched pedagogy*. Savage's (2012) article seeks to identify elements of this approach through four case-studies supplemented with interviews. Savage (2012) found that the teachers in the study demonstrated cross-curricular pedagogy in their work within their subjects, with elements such as references to other subjects being taught in their schools, conceptualising through illustrations, homework relating the taught theme to other subjects and comparison of technical vocabulary from other subject areas.

Bo Nilsson & Göran Folkestad (2005) completed a two-year empirical study of Swedish children composing music within the limitations of a personal computer, with aims of the research being producing knowledge about the creative processes taking place. Eight-year-old children were invited to make music to complement pictures. Nilsson & Folkestad repeatedly collected MIDI-files from the children's work and focused on analysing the processes of

creative music work. The authors found that children give meaning to their creative music work in various ways, and urge that children's creativity be taken seriously (Nilsson & Folkestad, 2005). Nilsson & Folkestad (2005, p. 35) also note that talking with children about their music making may provide valuable insight, but that their creativity is best understood through their "musical discourse".

In a recent Master project, Mikkel Nyrup Hjelmeland (2015) did a qualitative study of adolescent school children and their practice of composing music with computers. Hjelmeland (2015) was investigating subjects' identity and musical skill development through observations and interviews. The master thesis provides several perspectives on the skills needed to successfully use the computer as a musical instrument, and suggests that the computer is an already familiar and preferable tool for adolescents to express themselves and manifest their identity. In a broader discussion of music education, this and similar studies would suggest that the implementation of technology in music classrooms is not only about meeting curricular demands of digital competency but also about the potential modern technology provides of saving time (by students' being somewhat familiar with the interface), appearing relevant (by "sounding like your idols") and thereby having the use of music technology being a source of motivation in itself.

In his article *Garage band or GarageBand? Remixing musical futures*, Lauri Väkevä (2010) argues that rock band practices are unable to address the full spectrum of popular music, and that a variety of approaches should be incorporated to ensure that music education stays relevant. Examples of popular culture music phenomena include DJing, remixing/mash-ups, collective online songwriting, home productions and a variety of sharing platforms. Väkevä (2010, p. 60) cites Gracyk (1996) as support for his claim popular music should be considered an original art form, and that it often differs from other genres in that its aesthetic value is less related to live performance. Väkevä (2010) suggests that educators should consider expanding the "garage band model" of informal music pedagogy to include diverse forms of digital artistry, and be open-minded to questioning existing musical practices.

David A. Williams (2014) addresses the use of iPads in music education specifically, focusing on their role as musical instruments in an ensemble situation. Williams (2014) provides a compelling argument for how the iPad could be considered a musical instrument, comparing its features and characteristics to that of an oboe. The main argument regarding whether musical sounds are made or not depends in this view on the person in control of the instrument rather

than the features of the tool itself. Williams (2014) claims that traditional music education is misguided when only recognising certain instruments, as this devalues other musical instruments along with their associated genres and styles.

A study by Stuart Wise, Janinka Greenwood and Niki Davis (2011) looked at how teachers incorporated digital technology in secondary music education. Wise et al. (2011) used questionnaires and interviews of nine teachers, assessing their familiarity and utilisation of digital tools, as well as their opinions on whether digital technology is supporting musical development. All teachers had used either the *GarageBand* DAW or the *Sibelius* notation software, or both, extensively in secondary music education, and showed different attitudes toward western notation as a tool for composing and toward the use of pre-recorded loops in original compositions. A common finding amongst the teachers in the study was that they reflected on their use of digital technology as a way of accommodating to the needs and interests of their students, even though not all of them found it easy to adapt their teaching. Two of the teachers in the study argued clearly that there is a need "to balance the use of digital technology with the opportunity to develop other musical skills and undertake other music activities" (p. 129) as they found their students enjoying performance on "traditional" instruments, as well as arguing for the "realness" of a non-digital approach.

In the article *Working towards a theory for music technologies in the classroom*, Jonathan Savage (2005) provides viewpoints on how information and communications technology (ICT) may be used in developing new approaches in music education. Savage's (2005) argumentation is grounded in three case studies and action research projects with children in upper compulsory education. The author provides suggestions toward understanding the children's compositional activities in light of relevant theory, and concludes that introducing ICT in music education clears the path for new types of workflow and practices borrowed from electroacoustic music, and that this workflow demonstrates a new level of intimacy in student's engagement with the composing activities. The article is already slightly dated (which will soon enough happen to the present study as well), but what remains relevant is Savage's (2005) argument that the documenting and sharing of classroom experiences with ICT in music education could aid in the development of a practice-based theory for its application. Over ten years later, this kind of unified theory still does not seem to have attained a broad application in the field of music education technology.

> Our primary focus should be on seeking creative approaches to the use of ICT in music education that develop musical dimensions within the curriculum in ways that would be impossible without the technology. By using carefully chosen technologies within the music curriculum in this way, pupils' musical experiences can be more challenging, varied and educationally richer than those possible within a music curriculum devoid of ICT (Savage, 2005, p. 179)

S. Alex Ruthmann and David G. Hebert (2012) points to a general tendency in music education curricula from what they call a "traditional Eurocentric curriculum, typically emphasising Western traditional music" to more diversity in the musical practices, often including new media related to virtual- and online music learning (p. 567). Furthermore, they point to how new technology has changed young peoples' access to music creation and sharing tools as well as tools for music learning. Another obvious benefit of internet technology is the potential access to information and media related to world music. Ruthmann & Hebert (2012) see this as an argument for moving music education further into the virtual and online domains, and that this also has the potential of eradicating the often repeated value-based segregation of music to "higher" and "lower" standards (being classical music and popular genres, respectfully) (p. 568). Ruthmann & Hebert (2012, p. 570) suggest the virtuality aspect be understood in terms of three qualities:

1. Richly Synchronous Interactivity: Much online education and musical collaboration consists primarily of asynchronous interaction, resulting in experiences that are not fully "virtual" in nature.

2. Exploitation of Unique Possibilities: Attainment of objectives and accomplishments that could not otherwise be achieved (with implications outside virtual space), including educational, musical, and scholarly objectives.

3. Sense of Transcendence: Release from limbo – an intermediate state or place of confinement – whether through aesthetically or intellectually stimulating experience.

Fig. 2-1 "Theorizing qualities of virtuality" (Ruthman & Hebert, 2012)

These perspectives may be used as a framework for understanding Biophilia, as the iPad app and the educational programme can be seen in relation to multiple aspects of digital learning. In an educational setting, the iPad app could represent a learning environment in itself, but also as a general music technology tool used in different classroom practices.

2.3 Björk's *Biophilia*

The search for literature that directly addresses Björk's *Biophilia* has yielded very few results. Helga Rut Guðmundsdóttir[5] (2014) wrote a short article about Biophilia that comes across as fairly critical towards its suitability for educational purposes. This article is written in Icelandic, and is published in *Uppeldi og menntun* (which is referred to in English as the Icelandic Journal of Music Education). In essence, Guðmundsdóttir (2014) provides a review of the song apps as a rationale for what she sees as limited potential for educational purposes, the main concerns being that the apps have a somewhat closed framework for musical creativity. Guðmundsdóttir (2014) acknowledges the artist's intention of providing the user with means to engage in creation of music without the need for prior musical skills or knowledge, but seems to find that the apps fails for the same reason, by not meaningfully connecting the activities to musicology and conventional musical knowledge.

In an upcoming book release[6], Samantha Blickhan (2016) has written a chapter discussing the Biophilia app suite, discussing its video game-like character and how the user's interaction with Biophilia affects the listening process. Initially, Blickhan (2016) notes that the app is not marketed as a video game, and speculates whether this could relate to the word *game* conveying "a light-heartedness or lack of seriousness that Björk does not intend to communicate to *Biophilia*'s listeners and users" (p. 2). Blickhan (2016) finds that classifying any of the song apps as games, bringing the word *app* into the equation makes things more difficult, as apps are often understood as either *tools* with specific function or functions, or as *games*. Biophilia does not work well in either of these descriptions, as the song apps do not relate to specific outcomes, and as games would fail to reward user investment with a progression or a notion of winning or being correct (pp. 9-10). Blickhan (2016) compares Biophilia to Rock Band and SingStar, as the objective might be understood as being performance related "though for the most part Björk does not give users the opportunity to be incorrect" (p. 10). The "interactiveness" of the

[5] No family relation to Björk Guðmundsdóttir. Icelandic last names are typically patronymic, thus rarely indicating family.

[6] The manuscript was obtained through directly requesting it from the author, who was kind enough to send a copy. The author requested that the manuscript was kept from circulation, but will be published in 2016. Please refer to www.ludomusicology.org for more information about this publication.

songapps brings “a greater level of personal attention to elements of Björk’s songs” (p. 24). Blickhan (2016) further suggests that a contribution of this format is the harnessing of the personal involvement that is common of video games and applying that to a musical experience.

2.4 The musical cultures of Reykjavík

Iceland has a notable music export, and the Icelandic musical cultures has also seen some interest from researchers internationally. Some of these publications discuss unique features of music in Iceland.

Tony Mitchell (2013) wrote an article on similarities between the music scenes of Iceland and New Zealand. In terms of cultural and geographical features, Mitchell (2013) suggests that music is connected to geography, particularly in the sense that music often reflects factors of social life, labour and other features unique to the locality in question. In this sense, it might be argued that music of Iceland will have unique sonic features based on its geography, and there appears to be a wide-spread notion that Icelandic music reflects aspects of geography and social life. However, this is not unique to Iceland or to modern music genres. For instance, it is known that Sibelius and Grieg reported direct inspiration from their respective countries, Finland and Norway (Grimley, 2004, 2006).

Nick Prior (2014) wrote an article on the music of Reykjavík, discussing amongst other things, “how the urban area of the capital supports creative networks and attendant forms of knowledge, conflict diversity and collaboration” (p. 1), and how music education is an integrated part of cultural life. Even so, the role of music education is only a small part of Prior’s article. Prior (2014) claims that music education in schools provides Icelandic children with a basis for musical habitus as well as a musical network. This seems to be an area deserving of more attention from researchers. Prior (2014) writes that there is hardly any English-language academic work done on “Iceland’s musical worlds”, and that “one of the article’s rather modest aims is to provide non-specialists with a critical introduction to some selective aspects of this cultural setting” (p. 3).

Robert Faulkner (2013) has written an ethnography on the singing culture in Iceland, with a particular focus on men and male identity. Still, Faulkner (2013) provides insight into the choir communities of the island and the historical importance of the sagas. What appears relevant for this Master project is what Faulkner (2013) calls Iceland’s *second music revolution*. It is described as urban styles of music growing out of Reykjavík with strong traces to musical voices and styles brought by the Americans at the US Naval Air Station in Keflavik half a

century ago. This second music revolution is likely to be the roots of the modern alternative rock scene of Reykjavik. Furthermore, Faulkner (2013), like Prior (2014), confirms that there has been little systematic research on Icelandic music.

Arts and Cultural Education at School in Europe, a report by the EU's Education, Audiovisual and Culture Executive Agency [EACEA], features an extensive analysis of arts education and its curricula and policies in European countries (Education Audiovisual and Culture Executive Agency, 2009). In a sub-chapter on *aims and objectives of arts and cultural curricula*, the report provides a matrix for comparing the presence of rather different visions across various European countries. Compared to Norway, Iceland shares formulations of goals in the following areas: (1) Artistic skills, knowledge and understanding; (2) Critical appreciation (aesthetic judgement); (3) Cultural heritage (national identity); (4) Individual expression/identity/development; (5) Cultural diversity (European identity/world awareness); and (6) Creativity (imagination, problem solving, risk-taking) (Education Audiovisual and Culture Executive Agency, 2009, pp. 18-22). Furthermore, the above report indicates the following additional goals found in the Norwegian arts curriculum: (1) Social skills, group work, socialisation, and cooperative work; (2) communication skills; (3) enjoyment, please, satisfaction and joy; (4) variety and diversity of arts; (5) engaging with a variety of art forms and media; (6) performing and presenting (sharing pupils' own artistic work); and (7) environmental awareness, conservation, sustainability and ecology (Education Audiovisual and Culture Executive Agency, 2009, p. 18).

The six aims mentioned above are not found in the Icelandic arts curricula, according to the report (Education Audiovisual and Culture Executive Agency, 2009). Conversely, Iceland has one notably aim not found in the Norwegian curriculum; self-confidence and –esteem (Education Audiovisual and Culture Executive Agency, 2009). In framing my research project, knowing about these differences in explicit curricula content would contribute to the development of my research interest. I speculated that the openness in the Icelandic curriculum, together with the stated goals of self-confidence and self-esteem was something that would contribute to Icelandic teachers' sense of professional freedom as well as their work ethics. Henceforth, this was a subject in my interviews with Icelandic teachers. Also, it is interesting

to note that the absence of aims related to *performing* in the Icelandic curriculum is contradictory to i.e. Prior's (2014) findings of rich *musicking*[7] cultures in Icelandic schools.

It might be relevant to approach Björk's Biopihlia both as a musical album in relation to the musical cultures from which is has its heritage, and additionally consider how the educational project relates to the traditions of compulsory arts education in Iceland. These examples of litterature and policy served as a starting point for my inquies and played an important role for the formation of my research interest in Biophilia, both as an art piece and as an educational project.

[7] The verb *musicking* is used to refer to any kind of musical performance, composition or listening activity (Small, 1998).

3 Method

This Master thesis is a qualitative study with a research design that is heavily inspired by grounded theory methodology, in particular the constructivist variant advocated by Kathy Charmaz (Birks & Mills, 2011; Charmaz, 2014). Grounded theory is essentially a methodology for discovering theory from data that serve to explain both actions and interactions in a social context (Glaser & Strauss, 1967). One prominent characteristic of grounded theory is the simultaneous collection and analysis of data, and continuous comparison of new data to pre-existing data. One of the aims of grounded theory is to go beyond description, and generate "general categories and their properties for general and specific situations and problems" that can further "provide theoretical guides to the layman's action" (Glaser & Strauss, 1967, p. 30). Grounded theory is usually derived from qualitative data and is, as a paradigm for qualitative research, characterised by going beyond the exploration and description of phenomena and striving to explain the processes to a larger degree (Birks & Mills, 2011, pp. 17-18).

The processes of data collection and analysis for this thesis draws significant inspiration from grounded theory methods, albeit without adhering to a strict scheme or precise tradition within grounded theory methodology. Rather, this qualitative study uses grounded theory methodology for its general guidelines as a basis data collection and analysis.

The origin of grounded theory is usually credited Anselm Strauss and Barney Glaser, beginning with their 1967 publication *The Discovery of Grounded Theory* (Birks & Mills, 2011). One of the main points introduced with this book was a notion of systematically generating theory inductively from the data collected instead of the more established position of using existing theory to test the data (Glaser & Strauss, 1967). Glaser and Strauss (1967, p. 4) also suggested grounded theory might prove useful in preventing researchers from "opportunistic use of theories that have dubious fit and working capacity".

Through data collection and thesis writing, I have identified with a constructivist approach to qualitative research, as contrasted with the more established objectivist tradition within grounded theory research. Charmaz (2006, p. 130) describes a constructivist approach as one that "places priority on the phenomena of study and sees both data and analysis as created from shared experiences and relationships with participants and other sources of data". In the revised edition of her method book, Charmaz (2014, p. 234) clarifies her approach to grounded theory methods and theorising "as social actions that researchers construct in concert with others in particular places and times". The nature of my study leads to the generation of data that often

comprises spoken attitudes, thoughts and informants' personal conceptions of music education pedagogy and ideology. These are concepts that I as a researcher would find difficult treating as values that are not affected by social context, influence by researcher and the interaction between me and my informants and the data collected (see Charmaz, 2014, pp. 234-241). Therefore, I am assuming that my research is a construct of the research situations and I would be hesitant to discuss my findings as "discoveries".

3.1 Design

The initial data collection was followed by an open coding, a form of analysis based on identifying themes and keywords that seemed important to the informants, in addition to forming questions for further research inquiry based on the initial outcomes. Through the course of this project, I have been collecting and analysing data concurrently. Also, I saw a need to transcribe and thoroughly work through the interviews in retrospect, to better guide my search for new data. This cyclical approach is part of what separates grounded theory from other methodologies (Birks & Mills, 2011, p. 10) and is one of the reasons for my use of a grounded theory type of design for this study. I did not start generating memos until returning from Reykjavík in late September 2015, as I had kept myself busy researching open sources for data that could relate to the coding from the first interviews and observation. After a longer interview with informant Helgi in October 2015, which illuminated more about the origins of the Biophilia Educational Project, I started refocussing my study towards the apparent X-factor that seemed to have contributed to the success of the project. Two superordinate categories emerged; explanations of Biophilia's development as a haphazard "DIY punk thing" as one of the informants informally called it, or as a result of artistic and academic inter-institutional collaboration.

This analysis, in turn, led to a process of *theoretical sampling*, meaning strategic sampling of new data to develop the emerging categories through saturation and challenge (Charmaz, 2006, pp. 56-57). It was also at this point that I began to research literature that could prove relevant to the categories. Earlier in the Autumn of 2015, I had only reviewed literature that dealt with the musical cultures of Reykjavík and Iceland. Construction of a thorough literature review in the initial phases of a study is heavily debated in the field of grounded theory (Birks & Mills, 2011, pp. 22-24). In my study, I had been searching for and reviewing literature as a way of improving my sensitivity and knowledge in relation to the emerging themes and categories. This is something that could be seen as closely related to Glaser & Strauss' (1967) theoretical sensitivity, meaning the ability to have theoretical insight into the area of research as well as

being able to make something out of these insights (p. 46). Literature or theorising that emerged late in the process is in this thesis not a part of the conceptual framework, but is rather applied directly in the discussions of which it emerged. This has been done to demonstrate some of the chronology of theoretical sensitising in this study.

3.2 Rationale for a Grounded Theory-based design

Grounded theory is considered a useful approach for a research study when: (1) little is known about the area of study; (2) the generation of theory with explanatory power is a desired outcome; and (3) an inherent process is impeded in the research situation that is likely to be explicated by grounded theory methods (Birks & Mills, 2011, p. 16). The first and last point here weighed heavily when deciding to make use of grounded theory methods in my research. I was especially attracted by the need to treat data collection and analysis as an intertwined process where every piece of data would lead to some new understanding or to challenge a conception, while also suggesting new areas where more data was needed. The ambition of generating theory with explanatory power was initially something that introduced some serious doubts about whether grounded theory would be a suitable approach. Criticism towards grounded theory may be found in discussions of the terms involved, especially the notion of *theory* and it being *grounded* in something, and it being *discovered* (Thomas & James, 2006). Thomas & James (2006) further argued that the seemingly continuous reinvention of what grounded theory is or should be constrains and distorts the qualitative inquiry, and that the findings generated are "inventions", rather than "theory", and that "theory" itself has a broad array of possible definitions, especially in educational discourse. I consider my findings theoretical in the sense that they suggest an understanding of the phenomena in question, though not suggesting an ultimate explanatory function.

The purpose of my research design has been to collect qualitative data broadly, with the intention of using this data inductively to generate a thorough description of the Biophilia Educational Project as well as an attempt to develop an explanation of its popularity and appeal, and understand how these factors may be used to design or improve upon other projects elsewhere. Herein is a clear intention of identifying factors of project design, human factors or didactic content that could both explain Biophilia's appeal with politicians and teachers. This is useful knowledge as it could be used purposefully both for the design of new projects and in making projects attractive. A flexible approach has allowed me to make the necessary adjustments to compensate for limited resources and access, as well as lack of routine and

expertise, especially related to the interviews and their transcripts, and the search for documents and theoretical literature.

3.3 Original plan

I first contacted the Biophilia Educational Project steering group in April 2015 with a general enquiry of approaching the project with a research interest. They offered assistance in helping me find a school that would run the project in the given suitable time frame and welcome the participation of a researcher.

When I first started planning this thesis project, my intention was to collect data in a Norwegian primary school, as this would make my personal logistics easier. After being in dialogue with a representative from the Biophilia Educational Project, I decided to look for a school in the Reykjavík area, as this appeared the most realistic option when considering my time frame for data collection. Unfortunately, establishing contact with participating schools and scholars in Norway proved difficult, apparently because the appointed steering group had experienced problems due to illness and changes in constitution. After continuing with making agreements for research in Reykjavík, I was informed by a third-party that Biophilia would be taught at one school in south-western Norway at approximately the same time as my planned data collection. I tried establishing contact with the head master of the school in question, but there was never a reply to my inquiry.

A few days before travelling to Iceland, I was informed that it would not be possible to observe as planned, as the schools had not started their Biophilia projects. I travelled to Iceland with an intention of revisiting my plan and methodology to allow for different kinds of data collection and as it appeared, a shift of focus away from the student-perspective and the ethnographic approach. Upon starting data collection, I had no clear hypothesis or problem area but decided to try and make arrangements for interviews that could help me understand more about the educational project. Consequently, I looked into the possibility of adhering to a grounded theory type of research design.

3.4 Interviews

One of the means of data collection for this study was personal interviews with seven informants. In order to acquire more in-depth knowledge about the Biophilia Educational Project, its history and pedagogy I conducted interviews with members of the Biophilia Educational Project steering group in Reykjavík as well as a few teachers who have experience with teaching Biophilia. The information available on the development and history of the

project through open sources was somewhat limited, and I found it necessary to actively generate such information through the mentioned interviews. I considered this useful for clarifying the concepts involved, as my initial understanding of Biophilia was entirely based on information from the official web page, personal conversations with a few Icelandic teachers as well as shallow exploration of the iPad app. The interviews with steering group members were mainly about Biophilia Educational Project as a phenomenon, its trials in different educational institutions and its implementation and distribution both within the Nordic countries but also as an open-access educational project. The interviews with teachers were more directed towards pedagogy and didactics, the use of Biophilia in a classroom setting and the perceived and experienced benefits and challenges in doing a Biophilia-project.

All individual interviews were conducted semi-structurally, relying on a common interview guide, though without strict phrased questions. The interview guide was made early in the process, and designed to reflect my general inquiries towards the Biophilia project while still making sure that I could attain some insight into informants' views on education ideology and the use of Biophilia in music education. Less structure also makes it easier to follow the natural flow of communication (Birks & Mills, 2011, p. 75). This way, the questioning did change slightly for each interview, as I was able to triangulate information related to history and ambitions of the project, allowing me to devote more focus to the other aspects of interest, as well as following up on areas where the informants would seemingly have more knowledge and experience. In conducting the interviews, I identified with a *constructionist conception* as described by Roulston (2010): Whatever data generated in the interviews is seen as a product of the local situation, and is an unstable value that is a result of the project, the interview situation, previous experiences of all actors involved and many other factors.

For logistical reasons, four of the eight interviews were conducted by VoIP (Voice Over Internet Protocol) though the use of Skype. In-person interviews are preferred as interviews conducted at a distance puts the researcher at risk of missing or misinterpreting nonverbal cues (Nagy, et al., 2010 in: Birks & Mills, 2011, p. 75), but this was not practically possible as the duration of my stay in Reykjavík was limited. VoIP enables researchers to conduct interviews that would otherwise have been impossible due to different geographic locations (Birks & Mills, 2011, p. 86) and such, the use of mentioned technology allowed me to reach out to informants in Iceland and elsewhere, regardless of their or my current location. This is something I find to have been a key factor for progression and development of my research project.

3.4.1 Informants

All informants in this master project are addressed by pseudonyms.

Birkir is a music teacher currently teaching at multiple schools in the greater Reykjavík area. Birkir is also an avid professional musician, and spends several weeks touring internationally every year. In the interview, he expressed a fondness for digital tools, and the iPad in particular, and he apparently uses the tablet extensively in his music teaching as well as in playing music professionally. His views on music education and his emphasis on activities of playing and singing together in ensembles and exploring the potential of instruments is comparable to the concept of Rhythmic Music Pedagogy. From the interview, Birkir does not seem very bound to curriculum, teaching material or a specific ideology. His professional opinions and preferences appears to be more based on prior positive experiences in music education, an emphasis on rhythmical music activities and rock band practises, understood as the playing-by-ear-based preparing and performing of either popular songs or original music through the rehearsing and playing of different popular instruments.

Ragnar is a science teacher working at a primary school in a suburb of Reykjavík. He does not hold an education within music, but described himself as a general enthusiast about music, though in our conversations he stated himself that he was not able to analyse- and discuss music in appropriate jargon. Still he demonstrated knowledge beyond what you would expect of a layperson. Ragnar expressed a great interest for the musical elements of Biophilia, both in our conversations and in teaching his pupils.

Sigmundur teaches music for primary and lower secondary school pupils at a school in the Reykjavík area. He is also a semi-professional musician and plays and records with a well-known pop-rock band. He started teaching music some years ago, around the same time as tablets started emerging in the general public. He describes himself as interested in digital music technology, and uses many different tools extensively on a hobby basis and with his band. His affiliation with the Biophilia project started with him participating in the pilot project, and he went on to take active part in the project steering group later on.

Dagmar is a coordinator for the Nordic Biophilia Educational Projet and has been working closely with the steering group since early 2014. She was employed by the Icelandic Ministry of Science, Culture and Education to be a project manager for three years. She was interviewed to provide information about the status of the Nordic project as well as its ambition and development.

Iðunn is a professor of natural sciences at the University of Iceland and has been a steering group member in the Biophilia Educational Project since the first incarnation was developed in Reykjavík in 2011 and 2012. She is credited from other interview subjects as an essential contributor to both contents of the educational project as well as its suggested teaching methodology.

Helgi is an Icelandic artist currently affiliated with the Biophilia Educational Project as Björk's representative, responsible for conserving and curating the educational concept. He is also one of the original contributors to the workshops. Helgi was interviewed to acquire a detailed history of how the project developed since its conception, and to achieve further insight to the ideology of the Biophilia concept, beyond what was available through document collection.

Ingibjörg is a music education professor who has not been directly involved with the Biophilia Educational Project. Nevertheless, she has followed the development with interest and taken an active part in discussing the implications of this and similar projects. She has personal relations to several teachers who have taught Biophilia, amongst them Sigmundur, but they do not share a professional relationship.

The table below presents an overview of the eight interviews in their chronological order.

Interview #	Informant	Interview type	Environment	Total duration	Date
1	Iðunn	In person	Small meeting room	54 min	Sept 28 2015
2	Sigmundur	Skype	Rehearsal room	63 min	Sept 28 2015
3	Ragnar	In person	Large classroom	23 min	Sept 29 2015
4	Dagmar	In person	Meeting room	58 min	Sept 30 2015
5	Birkir	Skype	Home office	48 min	Oct 7 2015
6	Helgi	Skype	Home office	99 min	Oct 13 2015
7	Ingibjörg	In person	Lecture room	51 min	Jan 26 2016
8	Sigmundur	Skype	Rehearsal room	49 min	Feb 16 2016

Fig. 3-1 Overview of personal interviews

3.4.2 Recording equipment

Interviews are commonly recorded with an audio recorder in order to free the interviewer "to concentrate on the topic and the dynamics of the interview" and to enable re-listening (Brinkmann & Kvale, 2015, pp. 204-205). Face to face interviews were audio recorded with a Zoom H4n portable digital recording device[8].

Skype-interviews were recorded using the app *Call Recorder for Skype*[9]. This software allows simultaneous recording of any microphone connected and the incoming audio from the opposite end of a Skype-conversation in compressed or uncompressed formats. More important than encoding bitrate is the internet connection. Whether or not the broadband[10] at hand was stable and fast was the main defining factor affecting the quality of the audio recorded. Moreover, when video quality suffered, non-verbal cues were harder to identify and this is likely to have affected communication. In interview 5, I was using an ADSL broadband internet connection which proved barely sufficient for video conversation because of the low bandwidth.

3.4.3 Transcription

All eight interviews were recorded and transcribed in detail, also including breaks, hesitations, "thinking sounds" and occasionally non-verbal cues. Glaser (as cited in Birks & Mills, 2011, p. 76) discourages the recording and transcribing of interviews, claiming it introduces inefficiency, detraction of focus and the generation of large amounts of superficial data. Even so, Birks & Mills (2011) recommends taping interviews, especially for novice researchers, as it can be used for later reference and serve as documentation for quotations that might be useful in defending categories. Transcription of interviews is indisputably time consuming, though I have found the process itself useful as it demands focused listening to the digital recordings. As I transcribed, I would keep "post-its" close by to record peripheral information recalled from the interview situation, or thoughts, ideas or new inquiries that came to mind.

All face-to-face interviews were done in English, which raises the possible issue of of language barriers. All informants speak English as a foreign language, but all were also more or less fluent. The focus group interview was done in Norwegian and translated to English in

[8] The H4n has a set of stereo condenser microphones set in an X/Y-pattern, allowing the recording of a stereo field equal to 120 degrees. In practical use, the recordings will allow the natural separation of subjects; helping identify the origin of the sponen words when recorded without visual information This helps the transcription process significantly. In my experience, voices and conversations are recorded with very high quality, minimising the risk of indistinguishable spoken words or glitches.

[9] Call Recorder for Skype: http://www.ecamm.com/mac/callrecorder/

[10] A general reference to high-speed internet access with a fixed availability.

transcription. I have made efforts to preserve the original vocabulary and language style of the Norwegian informants to the extent possible. The English interviews were transcribed exactly as spoken, concerning vocabulary, grammar and flow. In quoting informants within this thesis, I have chosen to make grammatical corrections to syntax and choice of words where applicable, being careful not to change or alter meaning or content. I have a limited understanding of written Icelandic, and I have had help from a native speaker as well as the occasional use of Google Translate in understanding non-private documents used in this thesis.

3.5 Documents

Throughout this project, documents of different types were collected. To begin with, the collection was open and without specific selection criteria; striving to collect as much information related to the Biophilia Educational Project as possible. Later in the project, I looked more closely for information related to Biophilia in popular culture as well as the development of the Biophilia concept as a whole, also including visual documents and physical material. Data was collected from openly available internet sources, and sources like films, artwork and artefacts, in this case digital software. These would be considered non-traditional data sources (Birks & Mills, 2011, p. 83). Henceforth, all such sources will be referred to as documents for simplicity.

As Charmaz (2006) notes; texts are constructed for specific purposes and are built within particular discourses (p. 35). The documents collected for use in this study would be classified as *extant texts* according to Charmaz' (2006) terms, meaning that the construction of these documents is not affected by the researcher (p. 37). From the starting point, this would mean that extant texts may be treated as objective information to a certain degree. Nevertheless, these documents are either collected through research on open internet sources using search engines, or via suggestion from informants. While the textual content of the documents may be approached in an objective manner, the selection of documents should be considered as governed by the scope and limitations of my research inquiries. Furthermore, textual documents such as reports and newspaper/magazine articles are likely to be influenced by their stakeholders.

3.5.1 Public documents

Some of the documents used for research on the Biophilia Educational Project are either reports or presentations of the Biophilia Educational Project through official sources. My attention toward these documents has come through suggestions from people within the steering group,

and they are mostly written by individuals affiliated with Biophilia. As such, this material is read with an assumption of being slightly biased towards being overly positive towards Biophilia and its potential in education. However, the actually data mined from such sources is mainly limited to neutral historical facts.

3.5.2 Popular culture documents

Especially during my initial research, I was active in collecting magazine- and newspaper articles that related to Biophilia, and these documents played a part as a backdrop for some of the early interviews. Other articles are directly cited in this thesis when they are found to provide useful information that was not accessible elsewhere. In using such documents, I have strived for an awareness that entertainment sources often carry some degree of sensationalism, as well as often being secondary sources themselves.

I have also made copies of all written material from people who have purchased the app inn Apple App Store (iOS) or Google Play Store (Android) and left a review. These have also served as topics for interviews, and are to a lesser degree used directly in the thesis. Such reviews are accessible through the respective online store websites or their mobile OS counterpart.

3.5.3 Visual documents

In preparation for my study, in order to acquire a deeper understanding of the Biophilia concept, I spent time finding and reviewing several documentary films and YouTube clips. Data from some of these videos are mentioned in this thesis and are cited as ordinary sources. I have also used video recording for the "deviant case" (described later in this chapter) as a mnemonic aid and to capture activities and events as they occurred (Merriam, 2009, p. 145). Björk has posted several videos on YouTube that relate to the Biophilia songapps[11]. These have played a role in my familiarising with her concept, but are not directly used in this thesis. The same goes for the 2013 concert film *Björk: Biophilia Live* (Fenton & Strickland, 2014), which I have watched several times in an attempt to familiarise myself further with the visual and musical concept of Biophilia.

3.5.4 Physical material

In chapter 4, there is a description of the Biophilia appsuite as experienced by my direct interaction with it using a recent iPad model. In writing about the Biophilia app, it serves as

[11] Björk's channel, BjorkDotCom, can be found at https://www.youtube.com/user/bjorkdotcom

both an artefact and a virtual document, in light of its central role to the educational project and all other data collection in my research (Merriam, 2009, p. 146).

At one point, I looked into the possibility of data mining from the Biophilia app to generate precise behavioural data on interaction and use of the songapps in a clinical or experimental trial setting. After consulting with two programming experts, this idea was abandoned as it would be too time consuming, expensive and would supposedly require partly rebuilding the app. This idea could be pursued in future studies if financial support is available.

3.6 Observation

In this study, I have used unsystematic observation as an auxiliary data collection method. Originally, I intended to perform intensive participant observation over two weeks, with interviews being used to add richness to the observation data as recommended by Brinkmann & Kvale (2015, p. 143). This plan had to be abandoned early in the research process when access to Icelandic music classrooms for intensive observation of Biophilia lessons proved to be difficult for a Norwegian Master student with limited time and financial resources.

In terms of Gold's (as cited in Merriam, 2009, p. 124) typology, my observation efforts would be compatible with the suggested stance of *observer as participant.* As a researcher, my presence was known to the pupils and teachers involved, and my plans for data collection and further project work informed. In assuming this stance, participation or interaction with subjects is secondary to the researcher's role of information gatherer. One desirable goal is to achieve a peripheral membership role, which Adler and Adler (as cited in Merriam, 2009, pp. 124-125) describes as the researcher observing and interacting "closely enough to establish an insider's identity without participating in those activities constituting the core of group membership".

The main advantage of observing the Biophilia Educational Project in action was achieving a first-hand account of the learning environment of the project in its naturalistic setting. I was hoping to discover situations, patterns and student actions that could help enlighten the project pedagogy. I recorded my observation as written sequential narratives on a laptop computer, with added short-form cues and keywords. Merriam (2009, p. 129) urges that field notes and observation data should be documented in a full narrative format as soon as possible after observation. In my study, I decided to write my my field notes as narratively as possible during the observation itself. There were two main reasons for this. First, the narrative, story-telling approach seems to me personally a natural manner of organising events in a logical and holistic fashion, making it easier to recall both details and the larger picture of the situations observed.

Secondly, a narrative approach could potentially serve a similar purpose to highly detailed keyword-based field notes as suggested by Merriam (2009, pp. 128-130) while at the same time aiding the recall of situations and allowing me to contemplate more deeply the observations made. Charmaz (2006, p. 22) suggests that field notes from observations in a grounded theory study differs from that of ethnographies in being more *conceptual* renderings rather than prioritizing the setting. In my own field notes, this is reflected via a narrative style, with frequent shifts of focus between individual and collective actions, notes on pupils' mastery or struggles and efforts to identify significant processes.

3.7 Deviant case

After my initial data collection in September and October of 2015, I was eager to generate more data that could help cast light on real life experiences of Biophilia. As I collected and analysed data later that Autumn, I saw an increasing need to find data that might challenge my initial conceptions as well as impressions of informants' viewpoints, as the categories seemed to be saturating to some degree rather soon into the project, meaning that I soon was able to accurately predict what would be observed or heard, with few surprises. At the very least, there was a clear pattern of praise and sense of amazement related to the Biophilia project coming from most students and teachers. I made efforts to find more possibilities for classroom observation, but this proved difficult, as I was unable to establish communication with the suitable schools in Iceland during my brief visit. Secondly, I considered designing a pseudo-experimental trial for school children aged 10-12, to study their interaction and involvement with Biophilia in a semi-controlled setting. This idea was ultimately abandoned, as there was not enough time to collect the necessary approvals, consents from parents etc.

In grounded theory terms, designing and executing a deviant (or *negative*) case may be considered a means of *theoretical sampling* as it is done to challenge the emerging saturation of categories and "find new variables or to provide alternative explanations…"(Charmaz, 2006, p. 101). Charmaz (2014, p. 199) also notes that acts of theoretical sampling "prompts you to predict where and how you can find needed data to fill… gaps and to saturate categories". Designing a deviant case seemed a realistic alternative to spending several more weeks in Iceland without the support of a substantial research budget. In February 2016, I conducted a simple field test in Norway with teacher education students where they were given time to explore Biophilia at their own pace and discretion, followed by a focus group interview where their experiences and reflections were discussed. A focus group interview is "an extension of the standard interview in which two or more participants engage in a specified area of

discussion led by the researcher" (Birks & Mills, 2011, p. 76). With the limitations mentioned, I selected and invited five Norwegian subjects to participate in the trial. Selection was purposeful in the sense that subjects were selected based on having completed a music education degree and having no previous experience with Biophilia, neither the app or the educational project. Still, there was a significant degree of convenience involved in sampling these informants, as these were all people I know personally. This could be a threat to the validity of the deviant case, as these subjects are not likely to be representative of a heterogeneous population of music teachers. Still, their insight would be valuable no matter their viewpoints, as their not having used Biophilia was their main qualification for participation. Furthermore, it was not an aim of this case to provide generality, but rather produce deviating viewpoints in a planned, methodological manner.

Subjects were informed of my research interest, but given limited information about the case design. They were seated in a lecture room around a square table with iPads lying flat on the table in front of them, then given 45 minutes to explore the Biophilia interface, without any instructions. Earphones were used by all five participants. A video camera was placed on a 6 ft. tripod, angled down towards the table in order to see what was happening on the screen. Immediately following the trial, a 45-minute focus group interview was commenced. Focus group interviews are characterised by "a nondirective style of interviewing, where the prime concern is to encourage a variety of viewpoints on the topic in focus for the group" (Brinkmann & Kvale, 2015, p. 175) Brinkmann & Kvale (2015) urges that the role of the focus group interviewer is that of a moderator, creating an atmosphere that is permissive to personal and conflicting viewpoints and nurturing their variety. The possible exchange of viewpoints among subjects of the group is a central feature of focus group interviews, enabling data generation not possible in a private interview. The interview was also video recorded.

3.8 Sampling

Finding subjects for my study was essentially *purposeful sampling*, understood as choosing participants or subjects based on conscious criteria and avoiding random choices in this process (Maxwell, 2005). According to Maxwell (2005) purposeful sampling itself is a quality criterion for qualitative research, as opposed to *convenience sampling*, where subjects are chosen haphazardly. It is still important to acknowledge that informants in my study were not randomly selected from a well-defined population. Most were contacted directly based on tips and suggestions from previous informants, or in the deviant case, chosen according to educational background. A common factor is relations or some kind of acquaintance between me and the

informants, or amongst the informants. This familiarity is something that has allowed me to search specifically for the right information at the right time, having some idea of people who might have knowledge on subjects, although these relationships are not without threats to validity.

3.9 Ethical considerations

3.9.1 Informed consent

Informants and participants in this study were informed both orally and via formal documentation (via consent forms) about the study and the nature of their requested participation and the security of collected data. The deviant case participants were first invited, asking for their participation describing the nature of their involvement and privacy concerns, but were only given complete information about the purpose of the study at a later stage, as permitted by the human subjects review. This was to avoid participants seeking information about the Biophilia Educational Project in advance, as this was seen as an important variable to be controlled. They did, however, know that my research project was related to Biophilia in one way or the other. At the day of the trial, participants were again informed in full about the study and implications for their privacy and the voluntary nature of the study and then asked for a final consent. The information letters can be found in the Appendix section.

Group interviews with students was originally part of the research design. Therefore, information letters with consent forms aimed at students and their parents was sent to the administration of two schools during my stay in Reykjavik for further distribution. When it became clear that possibilities of observation and interviews with students were limited, the research changed its focus. When the plan changed to unsystematic, short-duration classroom observation, information to – and and concession from – the two participating schools was organised by a member of the Biophilia Educational Project steering group, as this demanded information in Icelandic adapted from the information letters. Written consent from parents is normatively a prerequisite for classroom research, but was not requested for these observations for the following reasons: (1) Observations were focused on the teachers and their creation of a creative learning environment, (2) the observations were unintrusive, and I was not actively engaging with students, (3) No sensitive data was to be recorded, (4) observations were unsystematic, and (5) observations were of short duration. Schools were encouraged to collect written consent if they found this to be of ethical importance. Upon initiation of the Biophilia lessons, the students were informed of the research by their teacher, after which I presented

myself to them and explained my research intentions, their anonymity, and what they could expect of my participation in the classroom setting.

3.9.2 Anonymity and privacy

The research project was reported to the Data Protection Official for Research, Norwegian Social Science Data Services (Norsk senter for forskningsdata [NSD]) on August 3rd 2015. On August 25th 2015, I received feedback from the Data Protection Official, finding that the planned data collection was in accordance with the ethical standards expected, and is therefore considered to be within the bounds of Norwegian legislation on privacy and data protection (*Lov om behandling av personopplysninger. Personopplysningsloven*, 2000). Changes were made during the course of data collection and requests to extend the time allowance for data collection, as well as the expansion of collection methods were reported consecutively. The scope for the study underwent change as well. Relevant correspondence from NSD can be found in the Appendix section.

3.9.3 Funding

My travelling to Reykjavík was partly funded through a Nordplus[12] grant applied for through Bergen University College, and partly self-funded. The Nordplus programme is affiliated with the Nordic Council of Ministers[13], which is also a contributor to Biophilia Educational Project. To my knowledge, there is no further relationship between Biophilia and Nordplus, and the Nordplus grant had no conditions or references to Biophilia at all. There were no other compensations or incentives involved.

The Icelandic Ministry of Education, Science and Culture, which is a contributor to the Biophilia Educational Project has been informed about my research and its purpose, and gave their informal endorsement by email correspondence on June 9th 2015. The Ministry has no direct involvement in this specific research project, but one of my informants is employed by the ministry to organise the Nordic Biophilia Educational Project, and that participant's views were therefore carefully scrutinised for any possible biases.

[12] A sub-program of the Nordic Council of Ministers that finances collaborations within education in the Nordic countries (website: www.nordplusonline.org).
[13] An organ for collaboration between the governments of the Nordic countries (website: www.norden.org).

4 The artefacts of the Biophilia Educational Project

The following chapter compiles the information available to me through open sources along with directly collected data (my personal interactions with the app) for the purpose of understanding the Biophilia Educational Project via its artefacts, primarily the iPad app that is central to the project. In writing this chapter, I have strived to be as unbiased as possible. I would like to make the reader aware that I was initially sceptical to the claims made about the potential for learning music creation and theory through interacting with this software. For a long time, I felt that I was unable to fully comprehend the intention and purpose of the Biophilia Educational Project, as different sources would point in different directions and my initial impressions of the software might have affected my personal interpretations as well.

4.1 The appalbum

Upon virtually entering the Biophilia app suite for the first time the user is presented with a monochrome space slowly moving closer towards a galaxy in the distance, and a familiar voice is heard as a narration from Sir David Attenborough starts playing.

Welcome to Biophilia. The love for nature in all her manifestations, from the tiniest organism to the greatest red giant floating in the farthest realm of the universe. With biophilia comes a restless curiosity, an urge to investigate and discover the elusive places where we meet nature, where she plays on our senses with colours and forms, perfumes and smells. The taste and touch of salty wind on the tongue. But much of nature is hidden from us, that we can neither see nor touch, like the the one phenomenon that can be said to move us more than any other in our daily lives. Sound. Sound harnessed by human beings delivered with generosity and emotion is what we call music. And just as we use music to express parts of us that would otherwise be hidden, so too can we use technology to make visible much of nature's invisible world. In Biophilia, you will experience how the three come together: nature, music, technology. Listen, learn, and create. Travel the cosmos lying at your fingertips, touch the galaxies and move through their three dimensions. Discover the different song apps as they are introduced into the constellations and explore their extra features. And should you feel lost in space, you can always use the musical compass icon to take you home. Now, forget the size of the human body, remember that you are a gateway between the universal and the microscopic. The unseen forces that stir the depths of your innermost being, and nature who embraces you and all there is. We are on the brink of a revolution that will reunite humans with nature through new technological innovations. Until we get there: Prepare, explore Biophilia.

Fig. 4-1 Transcript of the app introduction (Second Wind Apps & RelativeWare, 2011)

Sir Attenborough's narrative appears to be a manifestation of Björk's artistic intention with *Biophilia,* but is effectively also a quick-start user guide. This narrative was also partly played back as an introduction for the Biophilia world tour concerts (Fenton & Strickland, 2014), and seems to aid as a preparation for the listener, establishing both a context and highlighting the essence of the concept.

The main screen of the appsuite consists of Björk's galaxy. Some of the stars shine brighter than the others, and are marked by a unique colour and a title: Crystalline, Hollow, Mutual Core, Sacrifice, Thunderbolt, Solstice, Dark Matter, Virus and Moon. Nine are to be counted, grouped in separate constellations. Compared to the CD-version of Biophilia there seem to be one track missing; Cosmogony. As long as the tablet is not muted, the user is able to hear the distant overdubbed howling of female voices in a slowly upwards glissando, reminiscent of the

haunting soundscape accompanying the monolith in Stanley Kubrick's 1968 feature film *2001: A Space Odyssey*.

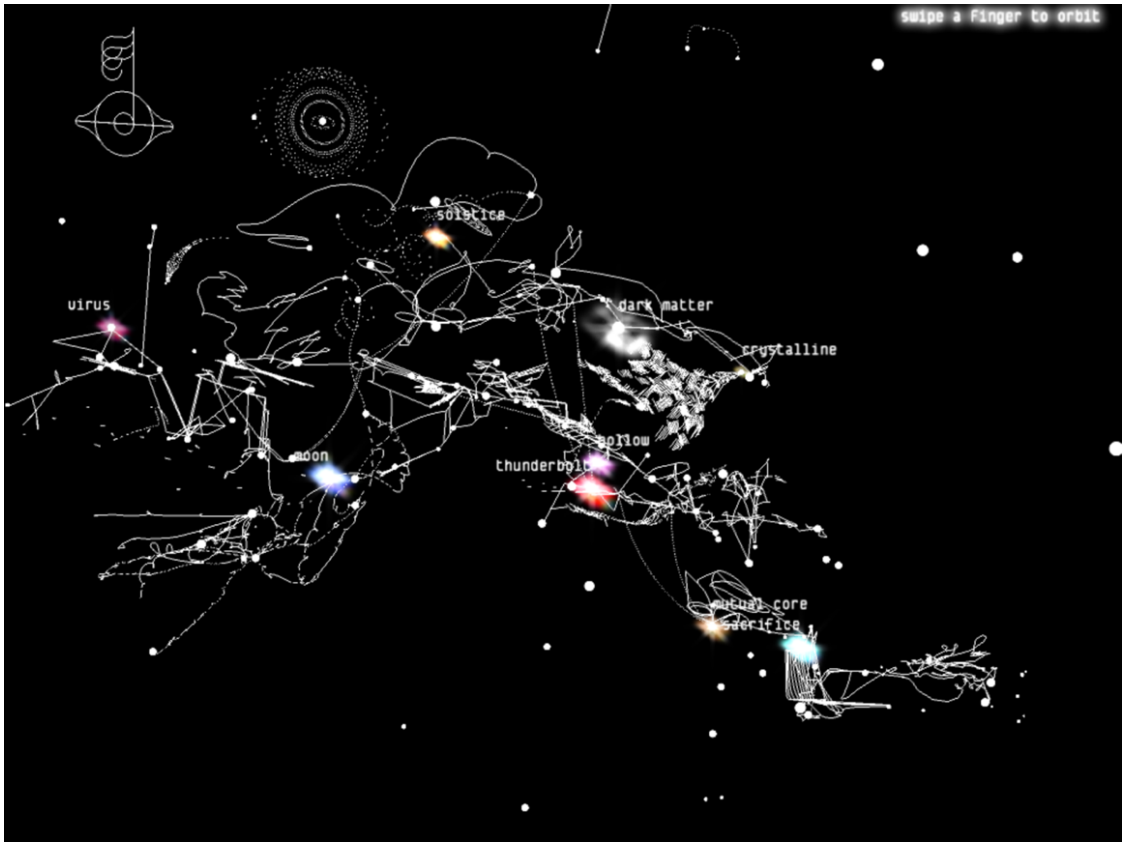


Fig. 4-2 Cosmogony

The galaxy may then be considered the *songapp* for *Cosmogony.* Song app is the preferred term for the individual tracks within the Biophilia app suite. In the top left corner recedes the *compass*, which is identifiable as the general logo for everything related to Biophilia.

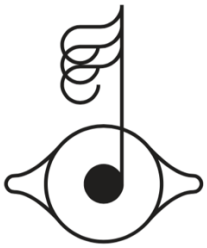


Fig. 4-3 The Biophilia Compass (from *Learnteach*: Biophilia Educational Project, 2014)

The compass essentially delivers a "back"-function, to pause or exit the song apps, or when in Cosmogony, presenting a simpler overview of the nine song apps of the galaxy for easier access. When navigating the three-dimensional galaxy of the main screen, moving closer to the coloured stars causes playing of audio snippets revealing the song within. Tapping the stars enables entry to the selected songapp's main page. Some functions are similar in content when comparing the songapps. For instance, *Play* will activate the main function of the songapp. *Animation* will play back the song displaying lyrics and a visualisation of unconventional notation. The *Score* addition is a puzzling one considering Björk's opposition to traditional western notation. *Score* displays a video of each song's notated score played back with low-quality MIDI[14]-triggered instrument samples and vocal sound representation. Essentially, this appears to be a MusicXML[15] file, but in a fixed format that does not permit freedom to use it outside the app suite or alter the contents in any way. *Lyrics* and *Credits* are quite self-explanatory. The final feature is a short essay to accompany each song app, first presenting a text about Björk's inspiration and intention with each of the songs, followed by an accessible analysis by musicologist Nicola Dibben.

[14] MIDI: Musical Instrument Digital Interface. The most widespread protocol for communication between musical instruments, often containing information about instrument type, pitch, velocity and modulation.
[15] A digital file format for musical notation, supported by most notation software and DAWs.

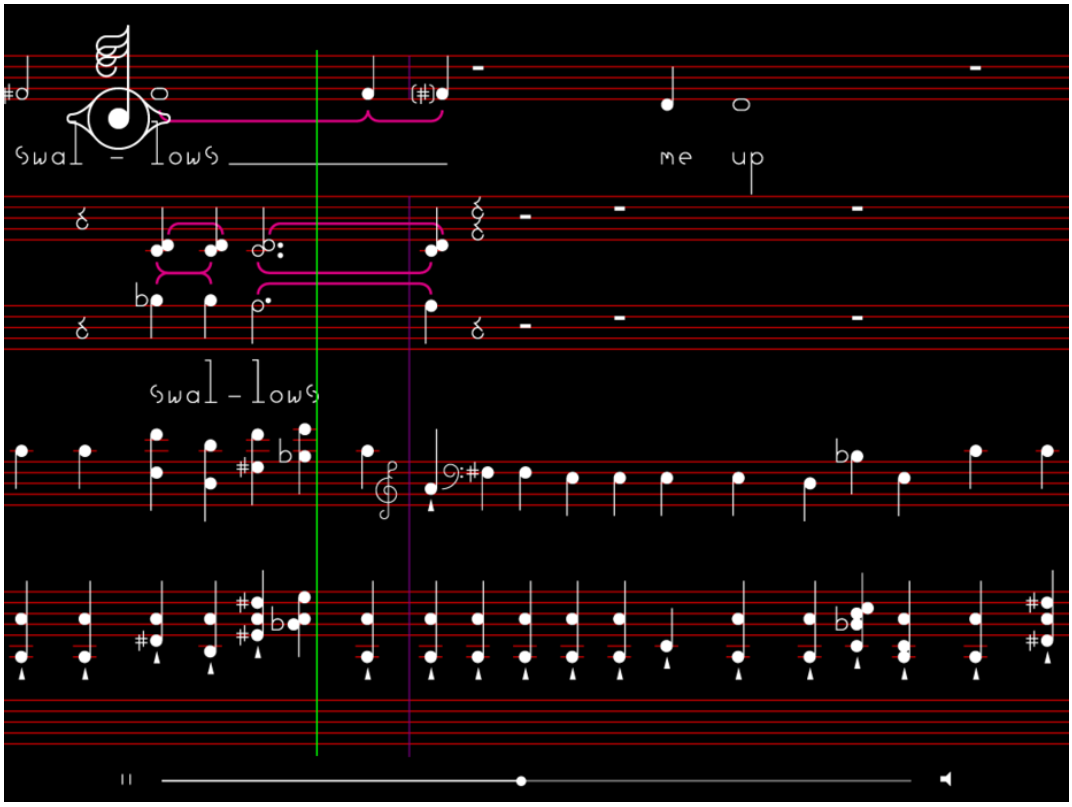


Fig. 4-4 Example of score view

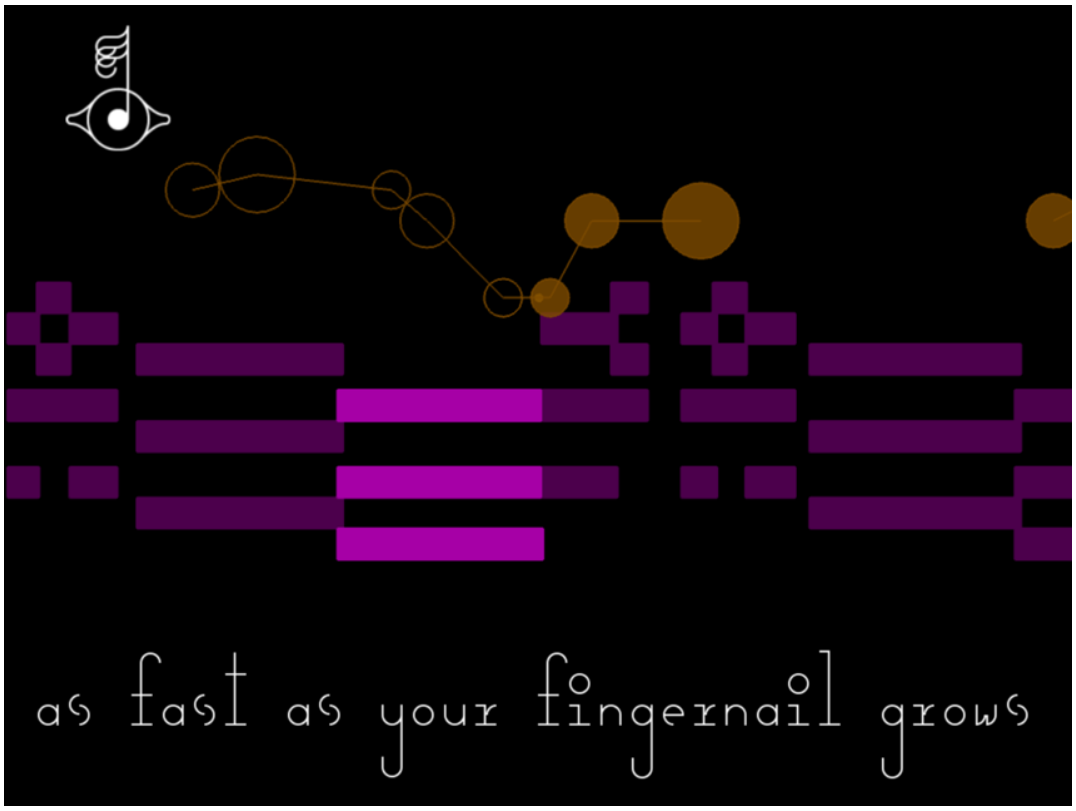


Fig. 4-5 Example of animation view

4.1.1 Moon

The musical topic of *Moon* is sequences (patterns) and music sequencers [16] (Biophilia Educational Project, 2014). The main view of the song app provides strong hints towards the scientific topics, featuring a slightly abstract skeleton crowned with a moon, seemingly floating above the earth. There are strings running through the skeleton and curving along it, forming an uninterrupted cycle. The strings have 17 moon-like circles (referred to as "pearls") attached to them, which are played as musical notes, sequentially, with harp samples. The user is able to interact with these pearls as well as the larger moon on top of the skeleton. Rotating the moon adjusts the *flow*, practically the number of pearls active in each sequence. Rotating the pearls adjusts note value and is accompanied by an indication of its notation. A swipe across several pearls works as a faster way of changing the sequenced melody. The left string has the strongest melodic function, with notes approximately in a soprano range. The right side offers bass notes that provide a counterpoint to the melody. It is not possible for the user to change the tempo of the sequence, and the pearls trigger notes of fixed lengths. Moon offers some additional control functions; *clear*, *save*, *load* and *song*. Tapping on *song* activates a pre-programmed set of sequences replicating the Moon track as it appears on the album, while using the sequencer to reproduce every note as opposed to activating a pre-recorded backing track or its equivalent. By default, the 17 pearls will sequence a pattern equal to a 17/8-time signature, but by altering the flow (controlled by rotating the moon), any number of beats between 1 and 17 can be generated.

[16] *Music sequencers* is typically used to refer to hardware devices or software that enables recording, editing and programming of musical information.

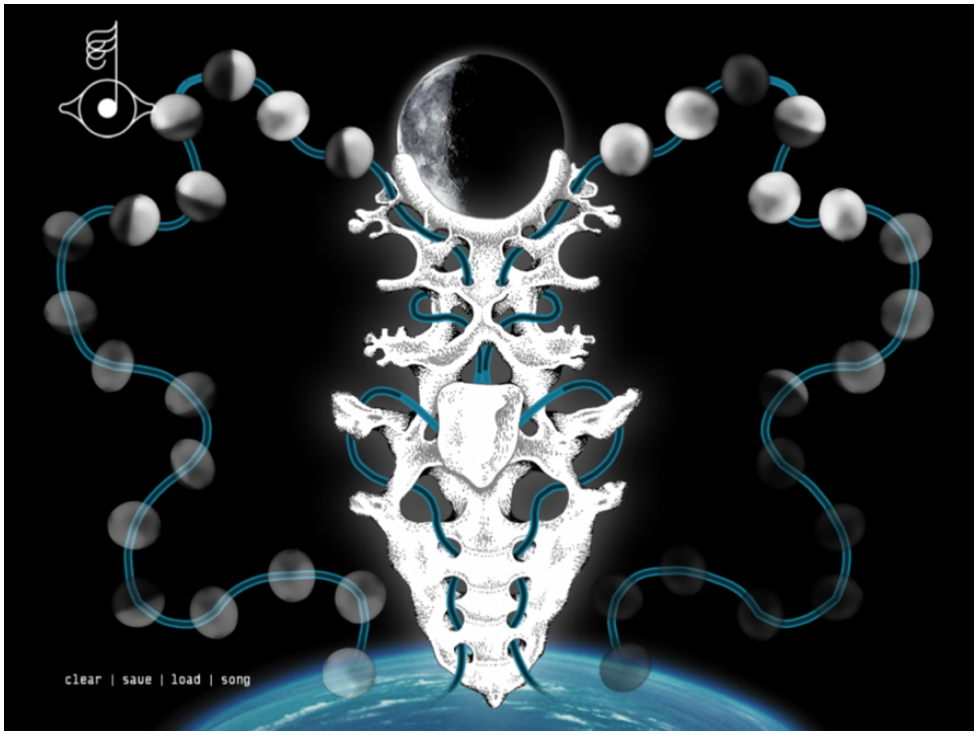


Fig. 4-6 Moon

4.1.2 Thunderbolt

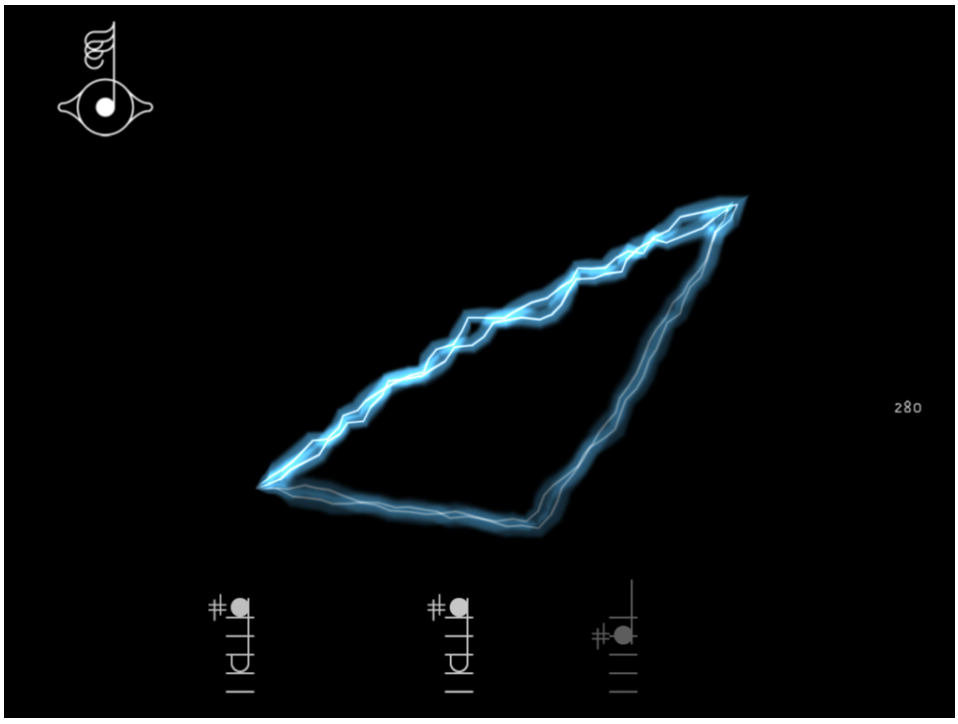


Fig. 4-7 Three finger arpeggio in Thunderbolt

The Thunderbolt song app has two functions: song mode and instrument mode, with the latter one being the default setting. The touchscreen is pitch black, except for the Biophilia compass in the upper left corner. Touching the screen with one finger triggers different electrical, static and lightning sounds and by drawing on the screen, Thunderbolt produces a sustained static sound. The musicality of the app reveals itself when touching the screen with two or more fingers simultaneously. A lightning bolt is drawn between the points of contact, and this triggers a rising arpeggio pattern based on the position of the fingers used. Its sound is sampled from a tesla coil, giving the Thunderbolt instrument a timbre and character that arguably separates it from common synth sounds. The X-axis controls the pitch range, with the deepest bass notes to the left, rising as one moves rightwards. The Y-axis controls speed, and is complemented by a numerical indicator at the right side of the screen, ranging from 50 to 600. The drawing length of the lightning governs the number of notes in the broken chord. Arpeggios are apparently fixed to diatonic scales. Thunderbolt is in my experience the song app that is easiest to fathom as a musical instrument; due to its flexibility and its ability to work in several tempi and being responsive to user input to a significant degree (as opposed to triggering pre-defined samples). Thunderbolt's song mode included the abovementioned functionality, but plays back Björk's track within the interface, allowing the user to imitate or add arpeggios or sound effects.

Fig. 4-8 Example of free drawing in Thunderbolt

4.1.3 Crystalline

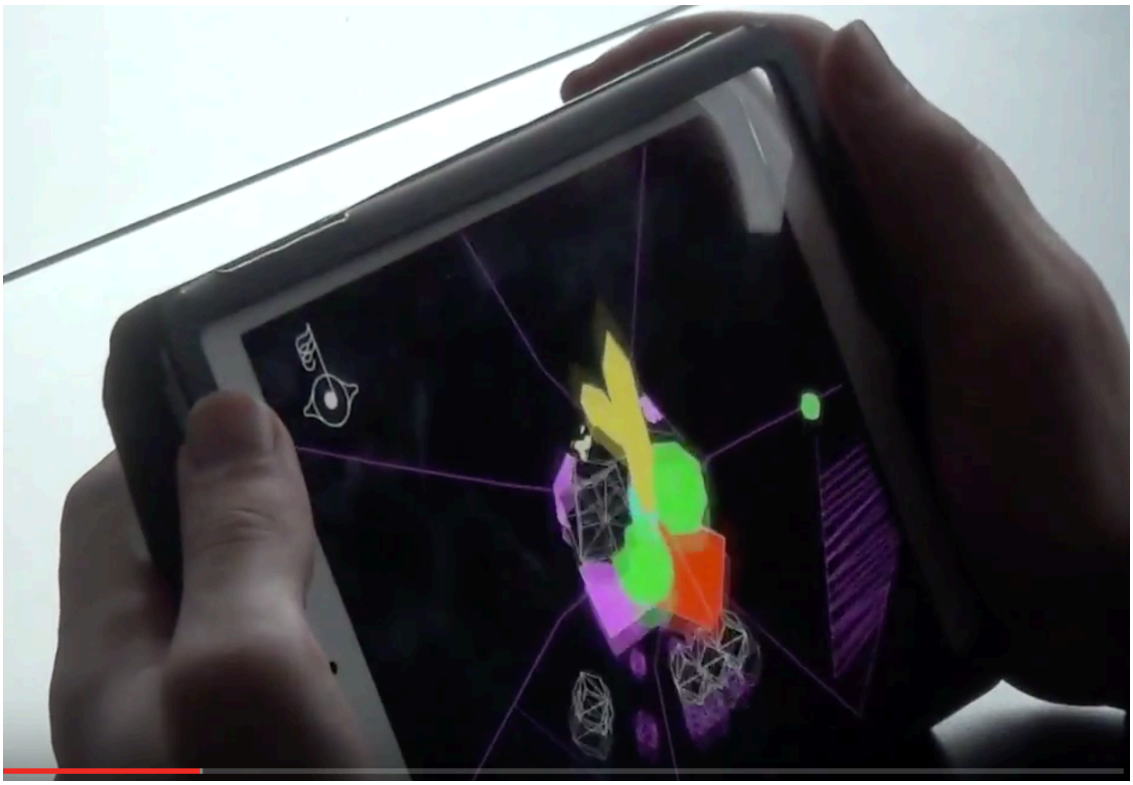


Fig. 4-9 Teacher interacting with Crystalline during the deviant case app trial

Crystalline was the first single from Biophilia and is recognisable from its use of the *gameleste*, a purpose-built custom percussive keyboard instrument that is remote controllable from any MIDI unit. Björk composed this song by playing the gameleste with a $9 video game controller used in place of a MIDI-keyboard or other conventional means of musical input (Hooper, 2013). The Crystalline song app is a quite different concept, mostly resembling an arcade-style video game. The game takes users through three-dimensional tunnels, manoeuvring by tilting the tablet (e.g. front/back or side/side). The tunnel walls are clad with crystals of different colours which can be collected by navigating closer to the walls. As the user completes one tunnel (song section), an open space is reached, where several new tunnels, effectively new song sections, can be entered, to progress the song. As opposed to similar looking video games, there are no lives to be lost or points to be gained per se, but Crystalline is likely to still have a video game appeal. Also, each tunnel has a colour assigned to it, and by "picking up" crystals of the correct colour, the controllable crystal grows, eventually reaching a complete state where a new song section is unlocked. In the Biophilia Educational Project Learnteach, Crystalline is suggested for teaching song structure. (Biophilia Educational Project, 2014) By selecting entry to different

tunnels, the user essentially chooses how to arrange the order of song sections. Each tunnel also has a visual representation of the gameleste chords being played.

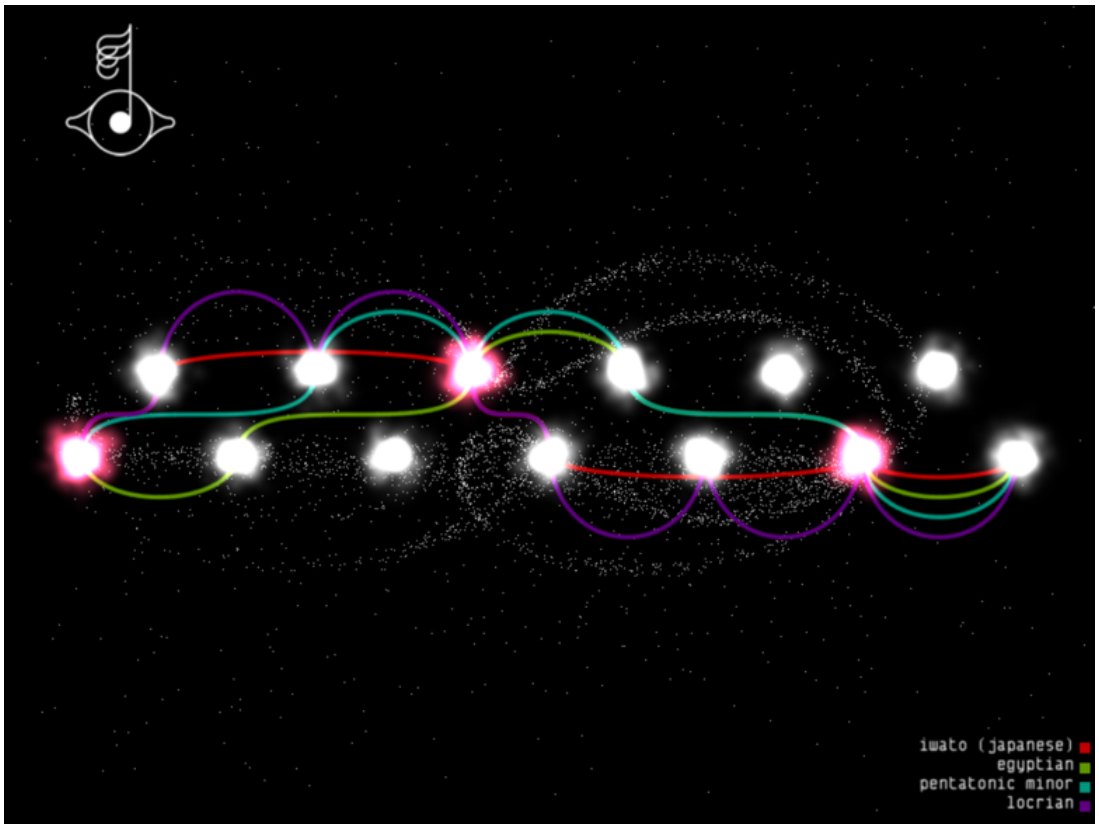


Fig. 4-10 Dark Matter

4.1.4 Dark Matter

Dark Matter defaults to *instrument mode* where the user is greeted with a keyboard of 13 bright dots, arranged in two, offset horizontal lines. Each dot is assigned a note and the span of the instrument covers an octave, from left to right with each step representing a semi-tone in a chromatic scale. The way Dark Matter's layout is arranged, activating the lower line of dots will sound as a whole note scale. As a note is activated, many tiny stars are drawn toward it and starts spinning in orbit. Simultaneously, coloured lines are drawn between most of the un-activated dots to indicate the steps of given scales. The bottom right corner of the screen reveals the name of the scales involved. It would appear that any combination of activated notes will always provide four suggestions to compatible scales, as long as it is played diatonically. The suggested scale names in the bottom right corner would appear to cover every commonly used scale as well as several rarities. Active notes are indicated by the dark matter turning light red.

Notes are *toggled*[17], and there is no *latch* function within the app so every note will have to be deactivated manually when changing chords. This could provide a challenge, but using multiple fingers to interact with the instrument certainly helps. The 2014 documentary *Biophilia: Live* shows Björk playing the Dark Matter keyboard on an iPad as part of the performance (Fenton & Strickland, 2014), suggesting that it is possible to master quick chord changes with some practice.

The *song mode* of Dark Matter shows a sequence of intervals to be replicated by the user. As these are identified and entered correctly, the chord triggers a sample from the Dark Matter song. Continuing to identify the correct chords enables further progression through the song. As in *instrument mode*, the scales involved with the chords or intervals being played are displayed in the corner of the screen.

[17] Toggling is when tapping a note functions as an on/off-switch. Latching is when continuously pressing a key sustains the note.

4.1.5 Hollow

Upon engaging the Hollow song app and pressing play, a CGI video starts playing, zooming through blood tissue, skin tissue, a prophase cell, mitotic spindle, cytoplasm, nuclear membrane, nuclear pore, chromosomes, nucleosomes, centring on a major groove protein, then revealing the DNA strains. Then we follow the major groove proteins cyclic spin down the nucleus, its motion synced with the pulsating organ of Björk's music, visually ending up with an illustration of a DNA string. The animations are very vivid, featuring a punchy colour palette. The protein ends its journey reaching the replisome, which is introduced with a change in the song structure and a slight increase in tempo. As the user is shown the replication of strains an electronic beat is introduced. From this point onwards, the video becomes more psychedelic, as it is generating what would appear to be Björk's face from molecules. According to the songapp's accompanying essay (by Nicola Dibben), this part is inspired by Giuseppe Arcimboldo's "fruit face" paintings from the 16th century (Second Wind Apps & RelativeWare, 2011). The camera pans out through the opposite direction of earlier, ending the song.

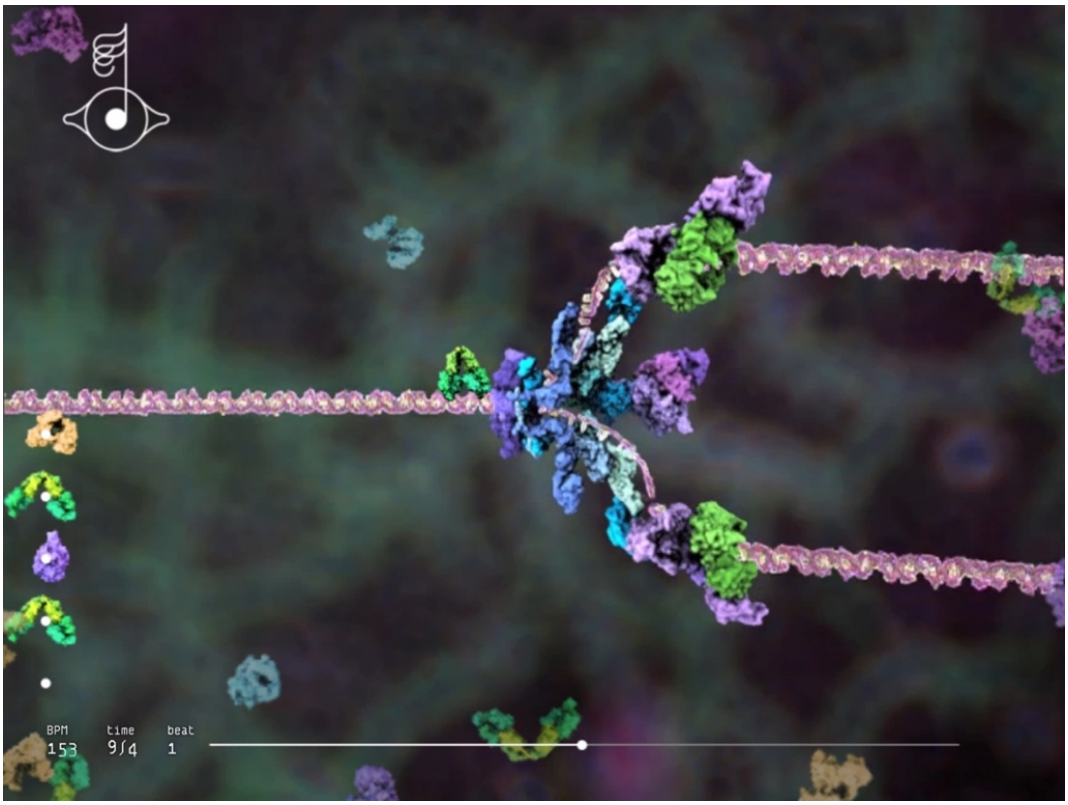


Fig. 4-11 Hollow

The next screen is the interactive part of Hollow, showing the replisome in a two dimensional view. Colourful enzymes are spinning around in the background. Touching these enzymes adds

them to a “queue” on the lower left part of the screen, soon to be spun towards the replisome. As the enzyme reaches it, a drum sample is played. The user can also interact with a bar at the bottom of the screen, changing the tempo as per beats per minute, indicated in the lower left part of the screen. There is also an indication of the form of the active time signature.

According to the accompanying essay by Nicola Dibben, Hollow was composed using a video game controller, as with Crystalline, Moon and Dark Matter (Second Wind Apps & RelativeWare, 2011). The video game controller would be controlling the organ, but the connection to the functionality of the Hollow song app does not appear to be very strong. The Hollow songapp could be considered a form of drum sequencer, while at the same time seemingly making an effort to inform the user of the nature of the rhythm that is being produced. Additionally, it would prove difficult to intuitively use the app to produce a desired beat, so it is rather a demonstration of a selection of time signatures, randomly activated by the user.

4.1.6 Virus

The Virus songapp is a mini-game where the apparent purpose is to protect a healthy cell from the attacking viruses that appear. By flicking viruses away with fingers swipes, the cell stays intact, but the song does not evolve from the initial two verses. If the user lets the viruses breach the cell, the next possible interaction is shaking the nucleus to fend off the DNA injected by the virus, but this will also keep the song from evolving. In order to progress through the song, the user must let the DNA work its way to the nucleus, dissolve it, and let the newly reproduced viruses spread to other cells, eventually ending the song.

The alternative mode of Virus is the instrument mode, which resembles the song mode in design. The main interactions here are setting nuclei in motion within the cells, creating a looping sound of a marimba-like instrument, helping the viruses enter the cells and touching them to produce a higher pitched plucking sound. On a side note, *Virus* is able to send MIDI-information over Wi-Fi or through InterApp audio to control software instruments in other apps like GarageBand.

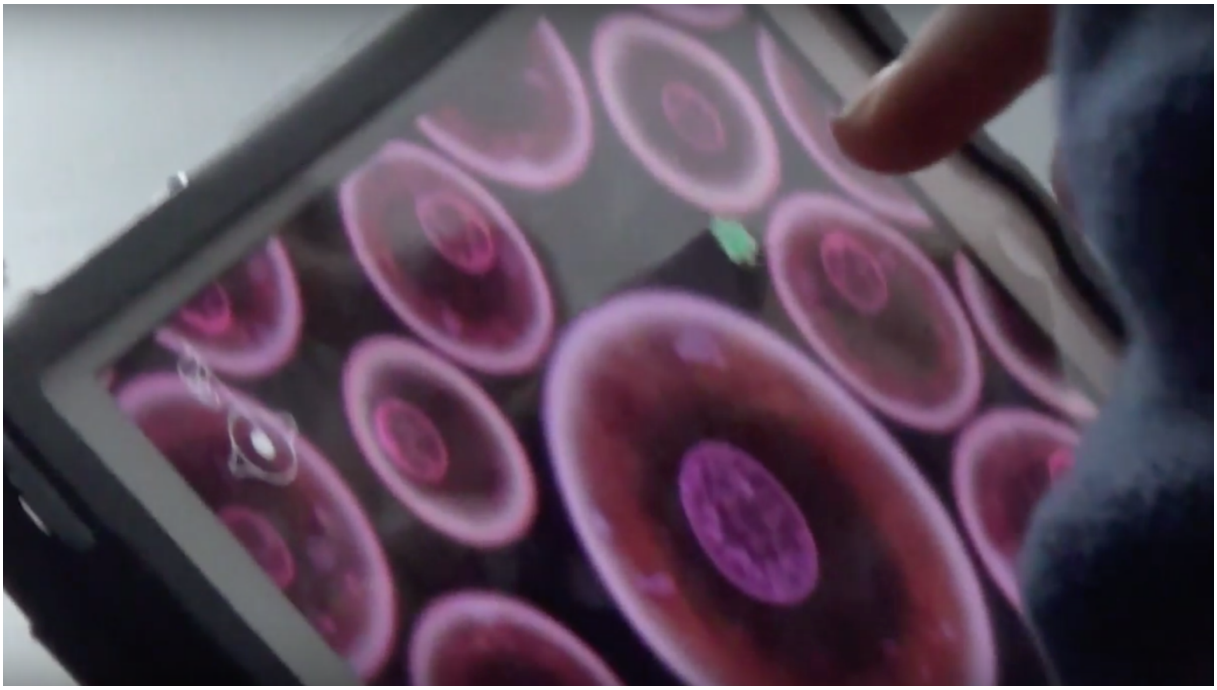


Fig. 4-12 Teacher interacting with Virus during the deviant case app trial

4.1.7 Sacrifice

In the Biophilia Educational Project, *Sacrifice* is suggested for teaching notation. The interface is in many ways similar to a text editor, presenting the user with a sort of alphabetic keyboard of 26 letters plus space, delete, play and a button for hiding the keyboard. Seven scale notes can be entered, starting at A above middle C. The timbre is reminicent of a church-bell type of sound in a low register. When these are entered, they are represented by their usual position in a staff as a quaver that is slightly altered to look like the letter from which its name is derived. The other letters are linked to different kinds of samples like sound effects, beats, vocal sounds and sung words; “why”, “can’t”, “you”, “give”, “her”, “room”. These are represented by symbols similar to the letters *H* through *M*. It is arguable that this song app can be approached in two different ways. One is to think of it as entering text, and experiencing what musical sounds the app generates based on the input by the user, entering messages, names, et cetera. Another use would be to approach it as a sequencer, working with the keys as samples and arranging them into a desired musical structure without regard for the keys’ corresponding alphabetic meaning.

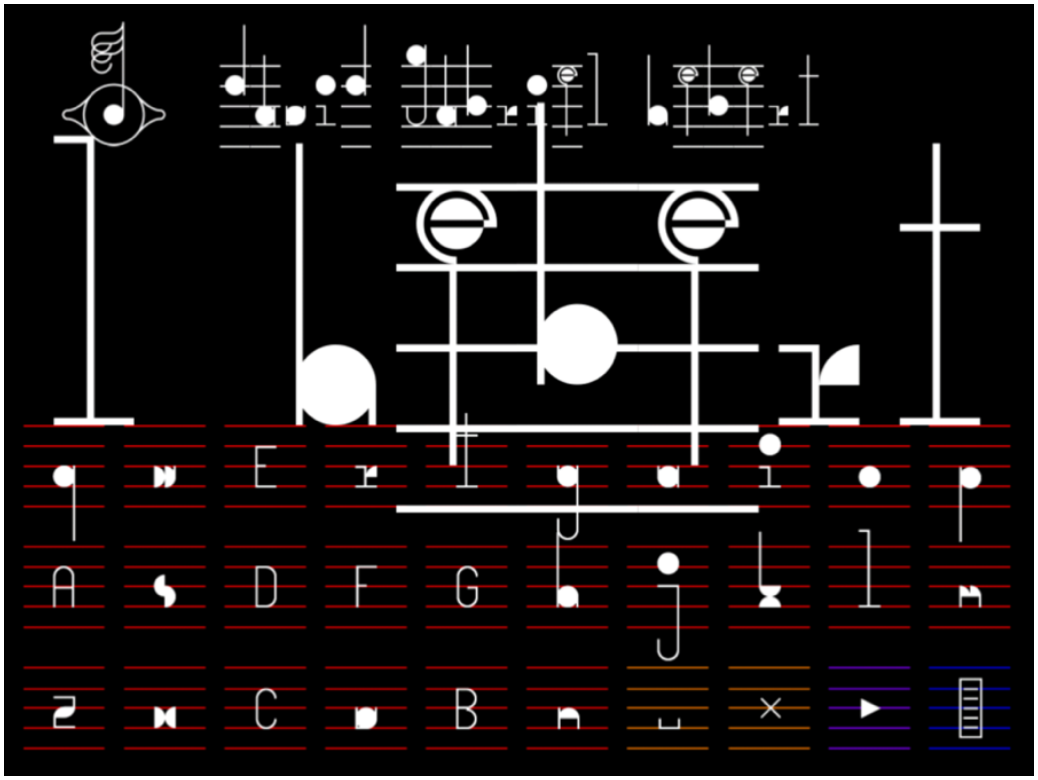


Fig. 4-13 Sacrifice

4.1.8 Mutual Core

The Mutual Core songapp provides the user with the option of playing an organ-based instrument by itself or as a co-performance with the Mutual Core track as recorded by Björk. The main screen visualises layers of ground separated as tectonic plates. These are visually connected by strings. The plates have some antimagnetic-like resistance, and in order to combine them the user will have to continuously pull them together with two or more fingers. The level of resistance is possible to adjust from the menu. By moving the plates vertically, variations of the chords are sounded. There is a good amount of possible variations when combining the tectonic plates to chords, as the layers from each plate can be combined by touching them and pulling the tectonic plates together. In song mode, the app changes interface when the song moves to the chorus, or it can be manually accessed from the menu if in instrument mode. This other interface features a visual representation of a globe and its internal layers, with a red core in the middle. This segment, or chorus, features hard, grinding beats but no chords or other accompaniment to the vocals. The layers are half-open and can be spun by the user, and exposing and touching the red core will end the chorus and return to the tectonic plates.

It seems the animation feature for Mutual Core contains an unfinished mix of the song, completely omitting the beats for the chorus. Thus the chorus is left with Björk's lead vocals supported only by a slow rising glissando of female voices, similar to the ones found in *Cosmogony*.

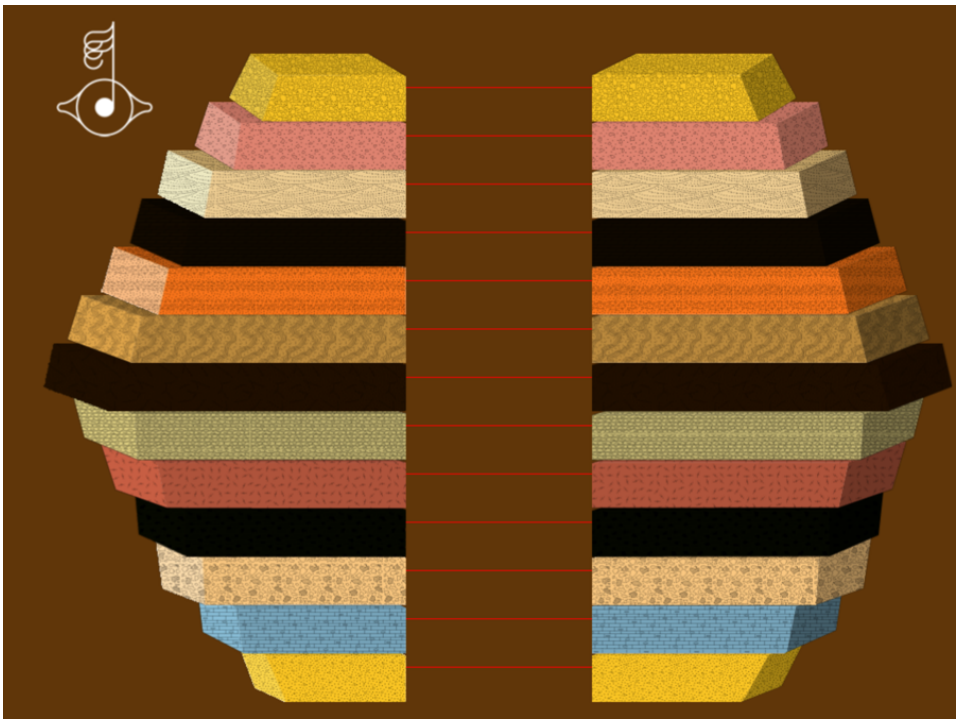


Fig. 4-14 Mutual Core

4.1.9 Solstice

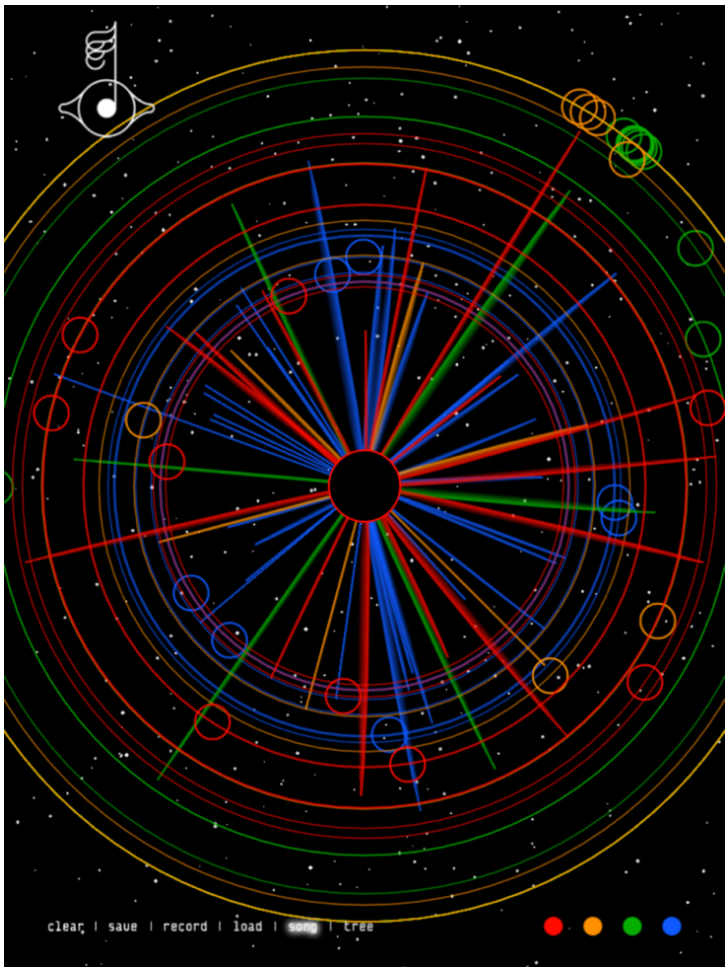


Fig. 4-15 Solstice

Solstice's main screen is a harp-type instrument allowing the looping of a sequence of notes. The user can assign four sequences at the same time, illustrated by four different colours in the two dimensional solar system depicted. Cycling between the loops is done by touching the sun in the middle of the screen. Drawing lines (or beams) from the centre and out assigns pitch with bass notes being the furthest away from the sun (i.e. longer strings). By touching any area outside the centre, a "planet" emerges and is assigned an orbit with a constant radius. This planet can then be spun in either direction and in any speed by flicking it. By cycling through the four colours, numerous loops can be added, providing good possibilities for designing intentional (or random) polyrhythmic patterns. The four colours operate at separate levels, made visible by tapping *tree* near the bottom of the screen. The view then changes to a side-oriented three-dimensional view of the solar system, illustrated as a spruce-like tree. The app allows "songs" to be saved in addition to a record mode, which seems to do exactly the same thing,

but this might be due to a software bug. During the 2011 Christmas holidays, Solstice was released in a free, standalone holiday version providing a slightly altered visual design. The *Solstice* song was composed with the pendulum-harp seen in the live concert video footage, in which pendulums equipped with cylindrical, remotely rotatable harps are essentially played by gravity, being plucked by a fixed pick when they pass the centre point. In a similar fashion, the music of the app is governed by a form of gravity (the orbit of the planets) and the position and length of the beams (or harp strings).

4.2 The conception of the Biophilia appalbum

Björk released her *Volta* album in 2009 to favourable reviews[18]. The album arguably features a quite complex soundstage, incorporating elements from industrial genres and electronica as well as orchestration. Biophilia was to Björk a a departure from what she called the "confrontational nature" of preservation that Volta represented (Graham, 2011). Biophilia represented a more minimalistic type of music composition, with songs more or less being based around a single instrument and voice. Several of the instruments used for Biophilia were build-to-order, and a few were made to respond to MIDI-signals from touch-interfaces Lemur and Reactable, essentially allowing Björk to perform these compositions accompanying herself using these tools. In the documentary *When Björk met Attenborough* (Hooper, 2013), several of these custom instruments and their controller interfaces are demonstrated, amongst them the use of a video game controller to control the *gameleste*[19]. The song *Crystalline* is said to have been composed using this gameleste-PlayStation controller combination. Another arguably innovative instrument was the programming of a Tesla coil to produce bass arpeggios for *Thunderbolt*. From any perspective, there is little doubt that *Biophilia* represents a deliberate artistic attempt to fuse music, nature and technology, and arguably succeeded in that. This fusion is the DNA of everything Biophilia, and is also highly prominent in the educational project.

Apple released the iPad in 2010, a wireless tablet-computer based on its already fairly established iOS mobile platform known from the iPhones. It had a 9.7-inch multi-touch screen, camera and Wi-Fi with optional cellular connection and had a large amount of productiviy software and video games available upon launch. There was a general praise from critics, noting

[18] Based on the "metascore" from Metacritic, compiling several newspaper, magazine and user reviews (http://www.metacritic.com/music/volta/bjork).
[19] The gameleste is a bespoke instrument built for Björk by Matt Nolan that can be described as a lovechild between a gamelan and a celeste.

that this was essentially something new that was not like any pre-existing home electronic gadget, but at the same time offering the functions of most of them. *CNET* reporter Donald Bell put it this way: "In an act of aggressive tech convergence, Apple has consolidated your Netbook, e-reader, gaming device, photo frame, and iPod into an elegant, affordable supergadget" and claimed that the iPad was "the first affordable tablet computer worth owning" (Bell, 2010). Others focused on its more X-factor related features: "No YouTube film, no promotional video, no keynote address, no list of features can even hint at the extraordinary feeling you get from actually using and interacting with one of these magical objects." wrote Bobby Johnson for *The Guardian* (Johnson, 2010). The entry level price point of $499 USD was also considered surprising at the time. (Yarow, 2010). "You can imagine a person like Björk getting an iPad in the first few days", Biophilia developer Scott Snibble told Evolver.fm, "My understanding is that she took a look at some of the apps that came out right when the iPad came out and identified a couple of developers that were in line with her vision" (Anderson, 2011).

Björk had been contemplating suitable platforms for the Biophilia concept, and began her collaboration with app developers to look into the possibility of making the iPad the medium for the Biophilia experience (Dombal, 2011). At early stages, Björk wanted to make the Biophilia album exclusively for the iPad, and might even have considered the CD version that would eventually be released as a by-product of the song apps (Helgi, 2015). The iPad allowed software to be programmed for the same functionality as Lemur and Reactable, while at the same time offering a platform for distribution. In addition, the iPad was introduced at $499, which was considered a low and accessible price range.

Biophilia was eventually released both as an iPad app suite with some tracks and a few months later on October 5 2011 as a standard physical album, together with the release of the complete set of songapps. Biophilia generally made a good impression with critics, obtaining a score of 79 on Metacritic[20]. The Biophilia iPad app suite, upon its release, was considered the first *app album* (Anderson, 2011; Helgi, 2015) – or at least the first one to be recognised as so by the Museum of Modern Art (MOMA) in New York, which now has *Biophilia* on display, the artefact itself being the first downloadable app in their collection. (Antonelli, 2014; Beaumont-Thomas, 2014). In 2015, the museum even offered a designated Björk exhibition, featuring,

[20] See http://www.metacritic.com/music/biophilia/bjork

amongst other things, the Biophilia app as well as some of the project's unique instruments, such as the gameleste, the gravity harp and the Tesla coil (Museum of Modern Art, 2015).

Björk has also said that the visual elements of the app played an important role, finding that natural phenomena offer "some fitting visual metaphors to translate the music theory" (Graham, 2011). This would appear to be an important part of the visual design of each songapp. Björk has also praised the unique possibilities afforded by to interact with visual elements in ways that Björk did not find possible to do with music videos in the past (Graham, 2011).

4.3 OS Platform availability

The Biophilia appalbum was originally released for iOS as an iPad-only app, on July 19th, 2011, containing only Crystalline in addition to the mother app Cosmogony. More tracks were released and made available against payment, essentially joining the emerging "freemium"-trend[21] of the App Store since its launch. The complete app suite was available for download concurrently with the album release on October 10th, 2011, and was updated to allow the purchase of all song apps in one bundle, priced 20% higher than the digital download of the album in iTunes.

The Biophilia album was criticised upon its release for its Apple iPad exclusivity, to which Björk replied that she hoped and assumed that those wanting to use it on other platforms would pirate it (Perry, 2011). Furthermore, Björk faced critisism for releasing an app-based album as this would alienate potential buyers/listeners who could not afford an iPad, to which Björk replied that this was a natural choice given that the songs were already programmed for tablets and that touchscreens in any case would soon be "cheap and available to everyone" (Gregory, 2011).

[21] "Freemium" is a term used in general media to describe software that is initially free upon download but requires the purchase of extra content to utilise its full features.

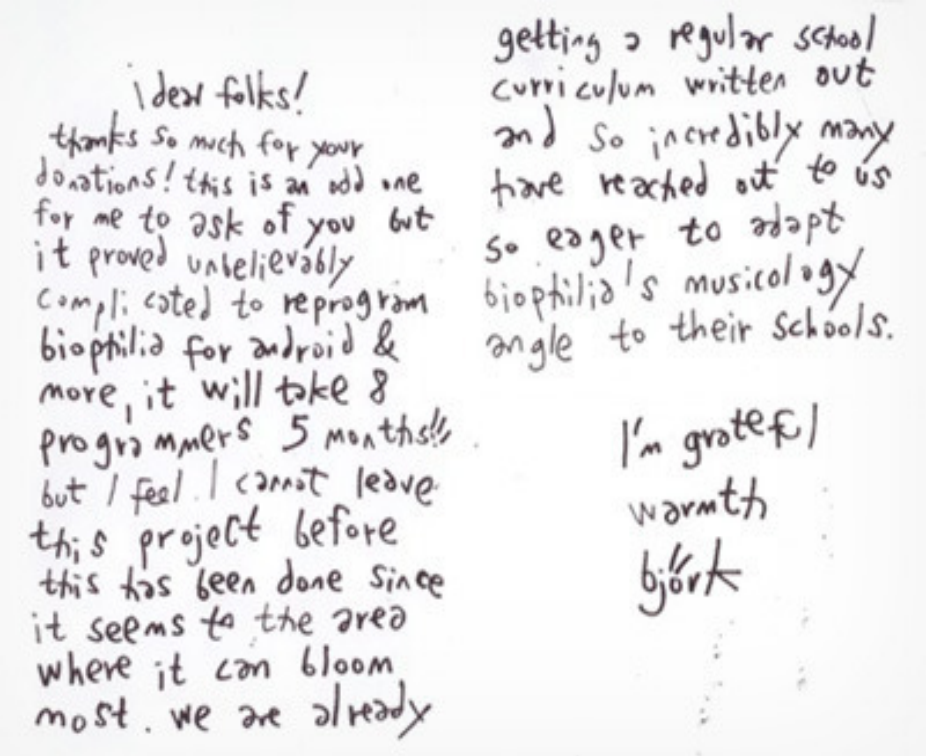


Fig. 4-16 Screenshot from Björk's Kickstarter campaign (from www.kickstarter.com)

In early 2013, Björk launched a *Kickstarter* campaign[22] to port the apps to Android and Windows 8. At this point, Biophilia had started taking form as an educational initiative. At the time, it was referred to as the *Biophilia Educational Program*. The Kickstarter campaign failed miserably, enough to place it fourth in the online humour magazine *Cracked*'s list of *6 Spectacularly Embarrassing Celebrity Kickstarter fails* (Avery, 2015). The campaign generated only 4 percent (15.370 GBP[23]) of the 375.000 GBP financing that was called for. Most criticism towards the Kickstarter campaign seem to focus on the high cost for the Android port. Biophilia was eventually released for Android later in 2013, being ported by start-up company Apportable (Olivarez-Giles, 2013). As of early 2016 there is still no Windows version available, neither is there a plan to develop one, according to my informants.

4.4 Technical issues

The first time I explored the Biophilia appsuite was in early 2014 on an iPad 2 (that was released in late 2011) featuring iOS 7. As I started this study and reacquainted myself with Biophilia, I

[22] Kickstarter is a major online crowd-funding platform. Björk's campaign can be found at https://www.kickstarter.com/projects/501402653/bjork-biophilia-app-for-android-and-windows-8
[23] GBP: Pound sterling.

had upgraded to an iPad Air 2 (released Q3 2014), running iOS 9. A newer device with many times the processing capabilities, higher pixel density and more powerful GPU would in theory help the experience of any app that relies on a wide array of video and audio features, but this is unfortunately not the case with Biophilia. The app has a tendency to crash when entering or exiting song apps, and trying to access certain features will "force quit" the app every time. There also seem to be issues with audio, as Björk's vocals or the accompaniment can fail to play. This is very noticeable to anyone having previous experience with the app on an older tablet, but is probably little known to a first time user. The frequent crashes and missing access to song apps are disruptive to such a degree that I would deem the Biophilia app incompatible with the most recent devices. According to the Apple App Store version log for the *Björk: Biophilia* app, the last update containing bug fixes was version 1.4, released Dec 11th 2011 to accommodate the release of iOS 5. It can therefore be assumed that stability issues may arise on Apple units or software released after 2012. Later on, I tried Biophilia with first generation iPad Minis, also running iOS 9, but having a 32-bit CPU architecture. The Mini seemed to crash sometimes upon launching or closing a songapp, but appears to be as stable as can be given that some native bugs are to be expected.

The Android version, like its iOS sibling, carries an average rating of about 4.5/5. Interestingly, when reading the ratings and comments in Google Play, many users complain about the audio quality and several bugs. Some users compare the audio to "64kbps bandwidth mp3-files"[24], which would seem to contrast with what appears to be high-bandwidth compressed audio in the iOS version. The iOS version uses 850 megabytes of storage on the iPad, while the Android version is noted as 484 megabytes in Google Play, suggesting that there might be some credibility to claims of further compression of the music and audio within, in a given case where all other features are kept intact in the software port.

4.5 From appalbum to educational project

When Björk began touring Biophilia, it was announced that concerts would be given in the form of *city residencies*. This touring concept would involve Björk staying in each town for a prolonged period of time, giving small venue concerts, once every three days. Residencies were held in Manchester, Reykjavík, New York City, Buenos Aires, Paris, Richmond/Los Angeles

[24] I.e. users "Uguptu Zirby", dated December 25 2013 and "Tom Hogan", dated February 24, 2014. 64kbps audio bandwith indicates very high levels of compression, suggesting a very low audio quality indeed.

and Tokyo, with a final concert in London. In addition to the residencies, conventional concerts were held to accommodate festivals and single stops.

The idea of making an educational project from the Biophilia concept was not something Björk planned in detail from the very beginning, but rather an idea that evolved during the Manchester city residency and was later formalised as she returned to Reykjavík for the second residency (Helgi, 2015). As Björk has a routine of two resting days between concerts, the crew had spare time, and at some point the idea of teaching the themes of the album through use of the app began to evolve in the form of workshops, inviting local school children to partake.

Björk invited local school authorities and their teachers, as well as the University of Iceland, to take part in developing the workshops that were to be held over four weeks in Harpa[25], the national concert hall, in October 2011 (Hilmarsdottir, 2015). Helgi, a participant in the present study, was appointed by Björk to record these workshops, and remained close to the project afterwards in the development of the Biophilia workshops, curriculum and teaching methodology. Helgi ended up functioning as Björk's representative in the steering group that was commissioned, which also consisted of a representative from the Reykjavík municipality, and a representative from the University of Iceland. The experiences from the Harpa workshops evoked much interest in the project for those involved, as the workshops appeared to arouse children's interest in the themes that were covered and that the project had an impact on their desire to learn more (Hilmarsdottir, 2015, p. 3)

Following completion of the Biophilia tour, the local school authorities in Reykjavík agreed to introduce the Biophilia workshops in the local primary schools as well as municipal after-school programs, and it was at this point being referred to as the *Biophilia Educational Program.* It was not introduced as a mandatory curricular activity, but all primary schools in the municipality of Reykjavík were invited to take part in what was referred to as an interdisciplinary thematic project for students in grades 5 through 7, held in Harpa (Hilmarsdottir, 2015). This program was based on the residency workshops, and the participating teachers were invited to seminars in Harpa to be introduced to the concept. The teacher workshops had a two-directional aim: teachers were instructed in the use of Biophilia song apps, and in understanding the concept, but the participating teachers were also encouraged to give their input as to how the music and natural science aspects could be taught

[25] Harpa is a modern concert hall and conference centre located in downtown Reykjavík which houses major concerts, operas and art projects. It was completed in 2011 after being temporarily halted by a lack of financing in 2008 during the financial crisis.

effectively to create an immersive learning environment. Schools that applied to take part in the project would be loaned a flight case filled with 20 iPads, artwork, some instruments, and accessories for science experiments. This flight case is often referred to as *Verkfærakistan*, or just *Kistan* for short (translates to *the toolbox*), and was financed by the Ministry of Education (Hilmarsdottir, 2015). The project continued as a pilot project through 2014, and as of late 2015, Kistan is still in circulation although not as heavily used as earlier (Dagmar, 2015). For schools, having participated in the workshops have been the only prerequisite for booking Kistan.

In January 2012, teachers and researchers who had participated in the Harpa workshops gathered with the project team and began developing a concept of how Biophilia could be brought to classrooms within the boundaries of "ordinary" school (Hilmarsdottir, 2015). This work eventually produced *Learnteach*, the now freely available teaching guidelines accessible to anyone at www.biophililaeducational.org. The Icelandic project has seen more than 80 teachers partaking in the workshops, thus covering more than half of Reykjavík primary schools (Hilmarsdottir, 2015, p. 3).

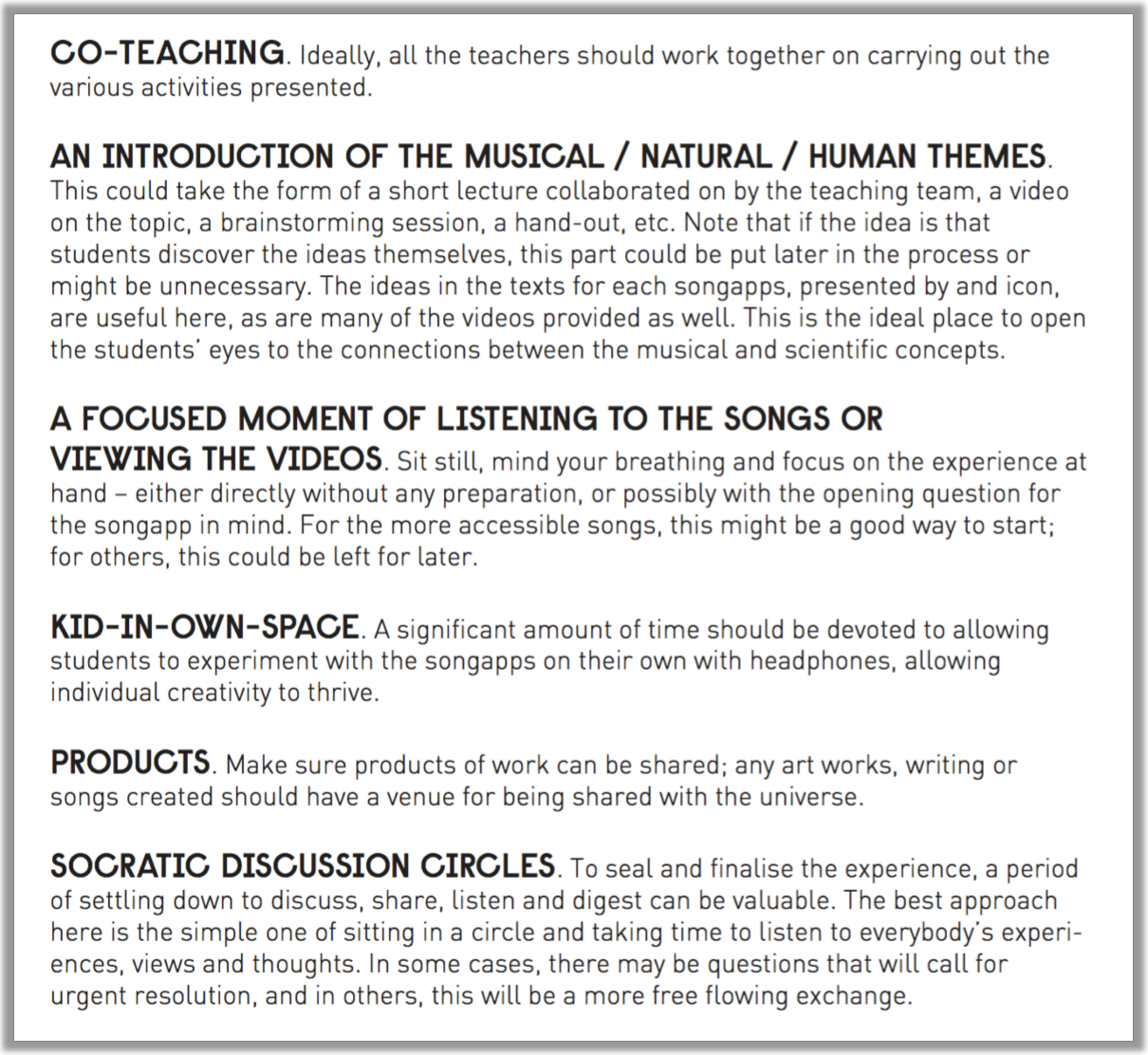
In early 2014, the Biophilia Educational Project with its artistic and educational concept was presented to the Nordic Council of Ministers, seeking cooperation in development and expansion of the project to invite teachers from all the Nordic countries: Greenland, Finland, Denmark, Norway and Sweden, as well as . This Nordic project started its planning and preparation phase in 2014, and is in 2015 being implemented, guided by a steering group consisting of members from the Icelandic Ministry of Science, Culture and Education, Reykjavík City and Háskoli Íslands (University of Iceland). The role of Kistan and the iPads has been played down some in the Nordic project. Instead, participating Nordic schools are offered a one-time grant which they are free to use at their own discretion to best accommodate the project in their local environment. Workshops are in 2015 still being held in Harpa, inviting teachers from the Nordic countries to a three-day seminar before staring implementation in their home country. Concurrently, Biophilia is included in a project named The Nordic Knowledge Train ("The Knowledge Train and Biophilia Travel Overseas," 2015). The Knowledge Train is based on a preceding Háskóli Íslands project called the University Train, and shares a central aim with the Biophilia project; encouraging young people's interest in science and technology. With the Nordic project, some further aims of Biophilia are defined as follows in a recent steering group report: promote critical thinking of students, encourage innovation, strengthen students' identity, and contribute to the professional development of teachers in creative education (Hilmarsdottir, 2015)

Biophilia Educational Project is essentially open for everyone whom might wish to use the material for teaching. The officially participating schools in the Nordic countries do have the benefit of the free teacher workshops, but Biophilia in its current state conveys an open-source image. The notable expense involved in teaching Biophilia would be for instance investing in things like tablets if such technology is not currently owned by the school in question, but for participating schools, this may be covered in part or fully by the grant given from the Nordic Council of Ministers. As the role of the Biophilia app itself has been toned down, the main message could be understood through these four aims: (1) breaking up traditional teaching patterns, (2) for teachers and school leadership to become more open to teaching several subjects at the same time with teachers of different subjects working together in the classroom (3) theme-based with emphasis on creative work, and (4) Socratic dialogue and leaving room for children to explore and create with whatever tools available.

4.6 Learnteach

The educational objectives and of Biophilia is a freely shared concept available at the webpage biophiliaeducational.org. Central to the teaching material is a document called *Learnteach*, which includes teaching guidelines for each of the songapps, as well as an introduction that bridges the artistic concept to the pedagogical intentions. Björk has expressed a desire to make Biophilia available to anyone who wants to use it (Dagmar, 2015), and Learnteach is considered a way of distributing the knowledge and methods from the workshops to whomever might find it useful in the general public. Learnteach is both an introduction and explanation of the Biophilia teaching concept, as well as a guide to the teaching principles, with several suggestions for how the apps may be used to teach certain themes within music, natural sciences, technology and human emotions.

Learnteach emphasises an unusual set of central principles for the Biophilia teaching method, as shown in the text box below. (Biophilia Educational Project, 2014, p. 5):



CO-TEACHING. Ideally, all the teachers should work together on carrying out the various activities presented.

AN INTRODUCTION OF THE MUSICAL / NATURAL / HUMAN THEMES. This could take the form of a short lecture collaborated on by the teaching team, a video on the topic, a brainstorming session, a hand-out, etc. Note that if the idea is that students discover the ideas themselves, this part could be put later in the process or might be unnecessary. The ideas in the texts for each songapps, presented by and icon, are useful here, as are many of the videos provided as well. This is the ideal place to open the students' eyes to the connections between the musical and scientific concepts.

A FOCUSED MOMENT OF LISTENING TO THE SONGS OR VIEWING THE VIDEOS. Sit still, mind your breathing and focus on the experience at hand – either directly without any preparation, or possibly with the opening question for the songapp in mind. For the more accessible songs, this might be a good way to start; for others, this could be left for later.

KID-IN-OWN-SPACE. A significant amount of time should be devoted to allowing students to experiment with the songapps on their own with headphones, allowing individual creativity to thrive.

PRODUCTS. Make sure products of work can be shared; any art works, writing or songs created should have a venue for being shared with the universe.

SOCRATIC DISCUSSION CIRCLES. To seal and finalise the experience, a period of settling down to discuss, share, listen and digest can be valuable. The best approach here is the simple one of sitting in a circle and taking time to listen to everybody's experiences, views and thoughts. In some cases, there may be questions that will call for urgent resolution, and in others, this will be a more free flowing exchange.

Fig. 4-17 "Elements in Teaching Biophilia" (Biophilia Educational Project, 2014)

In Learnteach, each song app has an accompanying set of teaching ideas. The common features are an opening question, one or more musical ideas, one or more natural phenomena, a human/emotional/psychological theme, a suggested connection between musical and natural concepts, relationship between song apps, suggestions for activities as well as suggestions for additional material on YouTube and other open sources. The Learnteach version available online in 2015 is a sleek looking 32-page PDF document, offered in seven different languages; English, Icelandic, Norwegian, Danish, Suomi, Swedish and Faroese. Based on feedback from informants in my interviews, the Learnteach does not seem in actual practice to have a central role within the officially organised Biophilia Educational Project, but is still a document that

reflects many of the same principles and teaching suggestions that teachers are provided with (and to a degree contribute to themselves) through the teacher workshops.

The first part of Learnteach works as a statement, or manifesto, of Björk's pedagogical "creed", where some ideological and pedagogical principles are established, amongst them a rationale for the word Learnteach, stating that learning and teaching are inextricably interwoven, and could be understood as the Learnteach being a tool for teaching that has been conceived through a learning process encompassing the world tour workshops and the primary school trials (Biophilia Educational Project, 2014, p. 1). The introduction also highlights that Biophilia has a "strong multisensory aspect". Additionally, it is meant to provide a "welcome change from the heavily verbal focus of traditional education" (pp. 1-2). Interestingly, it further suggests that those preferring non-verbal methods of learning respond powerfully to Biophilia (p. 2). Learnteach also states that Western art music in the 20th century is one of the sources of inspiration (p. 2). This is something that is not often mentioned in my data material, but can be recognised by such elements as the scores that accompany the songapps.

> Education, like art, music and love, is a contested field. Opposed forces collide and infectious ideas invade the core of the operation, while a huge number of people seem to enter and leave without notice like the dark matter of the universe. Biophilia forms part of one such force, or possibly maybe more an infection, a seed that may be planted, find its kin and possibly spread out through large parts of the system, meeting resistance, adapting and maybe finally metamorphosing into something unrecognisable. We'll see. (Biophilia Educational Project, 2014)

This segment of the Learnteach deserves some attention as there are some central ideas that may be extracted from it. First, it seems to acknowledge that Biophilia is likely to meet opposition from "the establishment". Secondly, slightly exaggerated, there is an ambition of spreading the teaching ideas to schools everywhere and reaching those who are inclined to adopting such principles, finally changing education as we know it.

Although not directly based on any official subject curricula, Learnteach incorporates some of the principles in the most recent Icelandic curriculum. In my second interview with Sigmundur (Sigmundur, 2016), he stressed that the Biophilia project developed out of a practice-based approach, and that the Learnteach reflects this in being mainly inspired by the work and ideas "from the floor" and not from a national curriculum. "It's been an essential part of [the educational project] that the process has been an extra-curricular thing, outside of the brick and

mortar of the school", said Sigmundur "and therefore it doesn't make a good case in consolidating against the curriculum". Still, he emphasised that the "general part" of Learnteach advocates values like ethics, equality and democracy, which are shared with the latest Icelandic curriculum revision (see Ministry of Education Science and Culture, 2012).

4.7 Educational Project themes overview

The following table (Fig. 4-15) is made to provide the reader with a quick overview of the songapps in terms of their suggested themes within musicology, natural sciences and themes of humanity and emotions. The keywords within are taken from the *Learnteach* (more on this later) and the previously mentioned essays by Nicola Dibben within the appsuite and represents my interpreted reduction of the content.

Songapp	Music theme	Natural science theme	Emotional/human theme
Cosmogony	Harmony Intervals	Music of the spheres Planterary orbits	Religion and big bang theory
Crystalline	Song structure Chorus-verse relations	Crystal formations Minerals	Confinement vs. freedom Perception and memory
Moon	Sequences Sequencers	Human biorhythms Moon phases, tide etc.	Emotional rebirth Mistakes and new chances
Virus	Generative music Dynamic music	Viruses Parasitic symbiosis	Dependency on others Attraction
Sacrifice	Musical notation	Sexual reproduction Evolution	Patriarchy and male domination in western music
Dark Matter	Scales Atonal and arhythmic music	Dark matter	Emotionality of music
Hollow	Rhythm Meters/time signatures	DNA/genetic heritage Evolution	Nature vs. nurture
Solstice	Counterpoint	Gravity Earth orbit	Human kind as lightbearers
Mutual Core	Chords	Tectonic plates Volcanic eruptions	Tension/release Tension between lovers
Thunderbolt	Arpeggios/arpeggiators Broken chords	Lightning and thunder The Tesla coil	Miracles and religion

Fig. 4-18 Overview of themes in the Biophilia Educational Project

5 Biophilia in action

I had the opportunity to observe some Biophilia teaching upon my brief stay in Reykjavik in the Autumn of 2015. The lessons I observed were led by two different teachers, Ragnar and Stella at two different schools in the greater metropolitan area. Ragnar is mainly a science teacher, but made great efforts to teach musicology concepts that seemed to have developed directly from Learnteach. Stella was an educated music teacher and had an assistant teacher helping her with the classroom organisation. Both classes observed were for fifth graders (aged 10). Both teachers had participated in the "official" Biophilia teacher workshops in Harpa, Reykjavík.

5.1 Ragnar's class

Ragnar's lessons were about geometry and rations in music and nature, with a particular focus on the Fibonacci-sequence, fractals and the golden ratio. The lessons also covered topics related to sound waves and frequencies, pitch and some elements of aesthetics. His lessons were notably varied, in the sense that he seemed to purposively change activities every 10-15 minutes. Every change brought a set of open questions. For example, after playing an audio clip containing rain and thunder, Ragnar asked his students what they heard, and eventually rephrased the question to get both concrete and abstract answers in return. Then he continued asking whether there were musical qualities in what they heard, to which many of the students surprisingly came up with several suggestions related to loudness, beats and dynamics. Later, there were discussions of musical counterpoint and harmony. The presentation of themes seemed to be inspired by the Thunderbolt section of the Learnteach, mixed with elements from Solstice. The mid-part of Ragnar's lesson featured a *kid-in-own-space*[26] session where the children were handed out iPads and given time to explore at their own pace. This resulted in a situation that was, to me, surprisingly calm with children scattered across the classroom, mostly silently engaging with various Biophilia songapps using headphones. The instructions given to the students were a bit unclear to me due to the language barrier, but the children were using different song apps, while some were even using completely different apps, like *Animoog*[27] and *Soundrop*[28]. In the following phase, the children created short musical pieces of their own, and at the end of the lesson these were shared and discussed. I noted that several of the children,

[26] The Learnteach term for students' free exploration of the Biophilia app

[27] Animoog (http://www.moogmusic.com/products/apps/animoog-0) is an advanced synthesizer emulator software primarily designed for the iPad.

[28] Soundrop (https://itunes.apple.com/us/app/soundrop/id364871590?mt=8) was one of the first available music apps for the original iPad and was developed by Max Weisel, one of the developers who later worked on the Björk: Biophilia appsuite.

somewhat surprisingly, seemed to make an effort to use the Fibonacci sequence actively when designing harp patterns in Solstice. This sharing and discussing setting might be seen as a manifestation of the principles of *products* and *Socratic discussion circles* in the Learnteach. However, it did not seem like the students made efforts to save the works permanently.

In my observation notes, I reacted negatively to the use of cheap, small PC speakers for playing music, audio and sharing students' work. The classroom was equipped with an inferior speaker system that was incapable of loud volumes and also distorted the audio at almost any level. I saw two problems with this: one is the aesthetic issue where the music does not sound as full or detailed as intended. Secondly, less audible sounds give room for more noise amongst students, and there were at least two examples of students not paying attention to what was played on the audio system. It is not a given that better or louder audio would have caused students to focus more, but this should not be a plausible concern when teaching music in the first place. It is possible that this biased me in situational understanding, but I felt that Ragnar was trying to use the audio clips and music to create moments of concentrated listening (as suggested in the Learnteach principles), but these efforts were impeded by low audio quality.

5.2 Stella's class

Stella's teaching was similar, in that there was an observable connection to the Learnteach guidelines, but she did not include the use of iPads at all. Upon starting her lesson, Stella had made a significant effort setting the mood; having removed chairs and desks, dimmed the lights, prepared instruments, et cetera. The children were lined outside the classroom and guided inside, where *Moon* was playing on the audio system. As the children took their place, Stella gave an engaging talk about the moon cycle and the circle of life. Most of the children were calm and attentive, while a few were distracted by nearby instruments and objects. Stella continued talking about the supermoon lunar eclipse that was about to occur over Reykjavík whist showing an animation video on YouTube. After that, Stella read from a 19th century diary entry, describing a previous supermoon. Stella's instruction emphasised multimodality, mixing different sources of information, scientific and personal renderings, adding musical and visual stimuli, both as isolated and peripheral elements. There was a short presentation of the moon app using an iPad streaming the video to a projected computer through the use of *AirServer*[29]. However, the audio was not responding, so the only audible audio was from the tiny iPad speaker. The pupils were actively listening and participating, one comparing Moon to a music

[29] AirServer is a third-party software made for wireless transfer of video and/or audio through Airplay (the proprietary wireless protocol used in Apple's ecosystem).

box. But the lack of audio volume and clarity made every noise in the room a significant distraction. Stella tried troubleshooting without success and had to move on with the lesson. The next phase was used for group work. Students were assigned to different smaller rooms where they were to compose a piece of music inspired by the supermoon lunar eclipse. The group I followed the closest did an activity resembling one found in Learnteach, where the students make a light show with an overhead projector and transparent discs representing the planets, then filmed the projected light show. Other students did an enactment of the orbit of the planets including an eclipse. A third group composed a piece of music and notated its structure and dynamics by drawing the stages of an eclipse. In general, the groups were well organised and saw active participation from the great majority of students. The activities in Stella's class were, in comparison to Ragnar, somewhat more advanced and ambitious but saw fewer changes in activity. However, Stella's students did not go through the same sharing/discussing regiment that Ragnar's students did.

5.3 Reflections on the Biophilia teaching concept in relation to Learnteach

Biophilia seems to be at risk of being misinterpreted as having an exclusive focus on using the app suite as a form of complete learning environment. If considering the Learnteach as a manifesto of Björk's educational ambitions for the project, the role of the digital tools in this environment will have to be deemed of secondary importance. Approaching Biophilia from the outside is likely to lead to an interpretation of the *appsuite* itself as the context for all learning activities, while Learnteach is available as a guide for using the songapps properly, according to discussions in the deviant case trial. In any case, such an impression is not unlike the one I held myself before starting to collect data for this project. As this study has progressed, my understanding of the *context* or *environment* and the *tools* of the learning experience within Biophilia has changed several times, from thinking of the app as a kind of end-to-end learning environment to understanding it more as a tool that may or may not be used for teaching and learning. At the same time, Biophilia is a statement of progressive pedagogy in the sense that it encourages alternative approaches to music and reorganising school days and classrooms to focus on theme-based learning. In the latter, the Biophilia concept serves a context for the learning environment: a framework to provide structure for its abstract and inquisitive nature. In this context, Björk is expendable (which may actually have been her intention, contrary to concerns about Biophilia as a promotional platform for her music). From my classroom observations, these projects appear to maintain their qualities independent of Björk's music.

Pamela Burnard (2009) raised the question of whether ICT should be at the centre of school curricula or whether to treat the tools as auxiliaries for other purposes.

> The challenge of technology is to find ways of developing the knowledge about digital music consumption and production brought from the home to school; moving technology from being an 'add-on' to being in the centre, embedded rather than integrated in the secondary music curriculum, employing technology to do more than merely 'serve' tradition; and enabling technology to bring 'real world' experience into the classroom (Burnard, 2009, p. 197).

A significant part of debating technology in music education relates to building connections and relevance to the technology that children and young people engage with at home and elsewhere, and where one stands in this discussion will have an imperative impact on how one understands Biophilia. If one approaches Biophilia as a tool for "serving" traditional music education, it seems unlikely that Biophilia can contribute anything that is not better achieved through the use of alternative tools. Unfortunately, by offering notated versions of the songs as well as musicological analyses, the intention of the Biophilia songapps might be misunderstood. The way I see it, this is where Learnteach becomes useful both for presenting Biophilia the way it was intended, but also to widen the focus prevent the assumption that the app itself is to be considered a learning environment independent of the outside world.

Considering Biophilia an m-learning artefact might prove difficult. There are tools within that serve the purpose of some musicology-related learning, such as the notation and essays, but it is very unclear what a layperson would learn from exploring Biophilia on their own. Given the bigger concept of the Biophilia Educational Project, adding a physical learning environment, teaching guidelines, instruments and several activities to the equation, the potential for learning becomes much more plausible. The latter is also the kind of use that seems to be favoured in official descriptions of the app and the project, and judging the app in isolation would leave much to be desired in terms of a complete learning environment. Following these assumptions, it would seem appropriate to label Biophilia as a *blended learning* project, where a digital medium with its own content and merits is unified with traditional teaching methods and curriculum.

5.4 Biophilia as a new breed of concept album

In her brief discussion of Biophilia, Maria Engberg (2013, p. 25) suggested that the *gestures*[30] of the user "build new image constellations, explore sound patterns and invites us to think about a music album as a multi-aesthetic space that we are all part of, reacting to and with rather than only receiving". She further argued that "the name, *Biophilia*, becomes a metaphor for the organic design and interaction of the application, invoking life, intimacy, and co-creation between artist and audience" (Engberg, 2013, p. 25). On another level, this tactile interaction with the environment can be seen in relation to the notion of the biophilia hypothesis; of human beings intuitively seeking affiliation with nature and other life forms (Wilson, 1984). Considering Björk's broad vision of fusing technology, nature and music, drawing a picture of the complete concept becomes a quite complex undertaking.

The tactile and visual elements of Biophilia are first and foremost there to make the user take active participation in the listening experience in a world where music is more often consumed in segments while attending to other tasks or stimuli. As Biophilia developer Scott Snibble suggested in an interview with *Wired* magazine, before CDs, people would sit "cross-legged on the floor" listening to the albums while examining the 12-inch album cover, reading the notes and looking at the artwork (Van Buskirk, 2011). Snibble referred to this as a "tactile multimedia experience" that has been lost with the digitalisation of music to which Biophilia might be seen as one response, facilitating a return of this active involvement in the listening experience (Van Buskirk, 2011). This nod to listening habits of previous habits is shared in reviews of the appalbum, which widely praise its facilitation of active listening. (Kiss & Needham, 2011; Rao & Emami, 2011; Schiesel, 2011).

I find it accurate to categorise *Biophilia* as a concept album. Still, it is quite clear that Biophilia takes a few steps further than the average LP record concept album (even the elaborate theatrical live shows and feature film of the rock operas like The Who's *Tommy* and *Pink Floyd The Wall*), in that Biophilia also includes an educational element with clear intentions of sparking children's interest in natural sciences and the creation of music. There is no clearly stated goal in Learnteach to affect children's listening habits. The basic idea of a app-based musical *album* might be shared with several others, like Lady Gaga, Jay-Z and David Gilmour. There are several renowned apps for *learning* (or playing with) music theory (e.g., Oiid, EarWizard, Toca Band, to name a few) or app games that are purely for musical *fun,* like Magic Piano or Sing.

[30] Read as meaning the physical act of interacting with the touch screen.

Biophilia is different from other apps in that it has combined these elements as part of a larger concept. Some of the songapps may be “one trick ponies”, but the Biophilia appsuite stands as a bold, original statement of forging music, technology, science and education to an extent that is seldom seen in popular music.

6 The interview material

The following data from interviews contains citations and paraphrasing of informants. Brackets indicate an editorial change of syntax or the insertion of a direct object or noun to clarify the context of the statements. Italics within citations indicate the emphasis of words as they were expressed in the interviews and audible in the recordings.

6.1 Interdisciplinary teaching

Science teacher Ragnar said he found concepts like musical counterpoint – he did not seem to know the term, but described it – to be an essential part of Biophilia, and sometimes difficult for him to teach successfully due to a lack of formal music teacher training.

> But I do have the math and the physics. I can explain how that happens … Building a memory bridge is what I am most excited about. Having the pupils build the music, or like in Solstice, compose a *piece*, and then later they always think about music and Fibonacci, the growth of leaves and how the water freezes into snowflakes; how it is actually in a *rhythm*. It's always the same, but different. It has a core mechanic that is consistent, similar to how bass lines and tempo [function in a song]. (Ragnar)

Furthermore, Ragnar found that in in his Biophilia classes, the nature of interdisciplinary teaching had the ability to engage and interest pupils who would usually have shown less activity and participation in class. In Ragnar's view, this has to do with the "memory bridges" and associations that can emerge in teaching music and science together. In his experience with teaching Biophilia, pupils who were fond of math and science but with limited interest in music could show a sudden interest in making music, and that the same went for those who liked music but were not interested in science subjects.

Sigmundur claimed that in teaching music and science together, teachers are reaching more students than by teaching one subject by itself, because an interdisciplinary subject will bring different angles or approaches to the teaching situation. In his experience, pupils often become more enthusiastic about music through science and technology as a result of interdisciplinary teaching. Even so, he acknowledged some obstacles to this, especially concerning how school days are organised. Sigmundur has found it difficult to coordinate the time schedule and number of pupils per teacher, for which there are quotas. "The main restriction is the structure of the school. But Biophilia is a great tool to break that structure", he claimed.

Dagmar, like the teachers interviewed, argued for adopting an interdisciplinary approach to teaching in schools. “From the starting point, from Björk’s ideology, it was very important to mix music and natural sciences. But the ideology behind it is the cross disciplinary thinking and working in a creative way with two different subjects.” For this reason, the steering group has been open to letting participants combine other subjects than music and natural sciences when doing a Biophilia teaching project. “We just have to see the connection to Biophilia, so that we can trace the development. But we are encouraging everyone to use different subjects”.

Iðunn sees the interdisciplinary nature of the Biophilia teaching as one of its main benefits, and said she believed that we will experience a stronger impetus for interdisciplinary work in schools in the future. She also argued that the teachers involved in developing material for project would benefit from the cooperation in their future teaching, especially based on the natural sciences usually not containing much creative work in her opinion.

When reflecting on the possibilities of a Biophilia teaching project limiting the available time for other curricular activities, Iðunn found this to be an actual issue, but that the mutual benefits in the collaboration between teachers are valuable and inspiring for their future work, justifying such priorities. Still, the connection of themes between subjects is not always found to be compatible.

> The scientists had to face [this] when they saw that Björk was making… similarities with something in music that wasn’t scientifically correct. They had to forget what is *correct.* They had to remember that, okay, this is a piece of art, this is the way the artist sees it. Can [this be] interpreted in a scientific way? Can it [be made] scientifically right and still being truthful to the artist? And I think that this is also something the schools will be facing (Iðunn).

From the project officials, the balance between teaching music and natural sciences is important. Helgi said it was always important for Björk that there was a “fifty/fifty balance”, because they imagined music teachers would emphasise creative work while science teachers would be more interested in pragmatic skills or knowledge. As the teaching material grew, there was also more teaching of music and science together, as opposed interchanging scientific and musical themes. “We had developed it into being more of an interaction between a music teacher and a science teacher. To think of the similarities and how they can work together. Breaking it up… More of a flow or a flux. But Björk was really clear on that it had to be even.”. Helgi talked about the benefits as a synergic effect where there are elements within the subject-

related themes that go well in the opposite subject and help the students form stronger connections. He also mentioned the fun factor, and that it "breaks up" expectations.

Helgi expressed a view that even when the connections between the musical and scientific themes involved are vague or "unscientific" they can still be of high educational value as they help facilitate stronger memory through students engaging, holding concentration and building stronger associations through an often changing stimulus. Helgi argued that this is something that is harder to do within a conventional classroom setting, but that the true differentiator of Biophilia is its ability to engage pupils in both science and music. Helgi has experienced children who claimed they did not care for the subject and had a change of mind when working with the Biophilia project.

One of the major goals of the Biophilia Educational Project is to break up conventional teaching methods in schools. Helgi suggests that just by agreeing to teach music and natural sciences together, one essentially breaks one barrier and might free time to teach continuously for two hours or more. He further suggested that by doing this, teachers have the option of teaching several themes on rotation, not necessarily focusing on a single theme for more than about fifteen minutes. The learning material and contents of Biophilia are not organised in a sequential, chronological or progressive order, and Helgi felt that this is useful in adaptive learning. "It's chaos. And It's like the chaos makes a storm in the mind of the child [laughs]… It messes everything up, but in a *good way*. Kids are making connections all over the place anyway."

6.2 Cooperation between teachers of different subjects

Two of teachers interviewed, Birkir and Ragnar, did not have actual experience with teaching Biophilia cooperatively with another teacher. Birkir said he was really interested in trying, but that it had not been possible for him in his current working environment. Ragnar had also not done this, and expressed that he as a science teacher saw limitations in not being able to work together with a music teacher.

> When I'm teaching the app it's really hard. I can hear a good tune, but I don't know how to build it up. I don't know like the bass line… or how high and low melodies interact with each other, those kinds of things. So maybe if I had a music teacher *with* me who could direct the musical parts of the [teaching program], I could focus on the connections and teach them. Because I think [the pupils] really need an educated

> musician to be able to *build* a song. I can hear their work and say 'Yeah, it sounds nice', but in essence I don't really know what makes a good song.

Sigmundur believed teachers could benefit from teaching together beyond the Biophilia concept.

> It certainly makes the *job*, the *profession* a lot more scientific. Music teachers, or arts and crafts teachers, they're used to working alone a lot… Working with the science teacher, that's really rewarding. We're finding new ways to get some points across, and we're making new connections. So it's actually a *creative* process.

Iðunn expressed a view on the cooperation between a music teacher and a natural sciences teacher as bringing a synergic effect that supports the creative work in teaching both subjects.

> And when a music teacher gains more knowledge about natural sciences… it does something for his self-confidence. It does something for his view of the world or [of] the cosmos that *wow – now he knows more*. But creativity is not one sided! It's many-sided, like a crystal!".

6.3 Teaching Biophilia within compulsory education

Birkir expressed an independency from the teaching material. "I just do it my own way, and let the kids to it themselves. Then I help them if they need anything". He did not state a specific reason for this, but it appeared as if he mainly uses Biophilia as a type of fun musical activity, as his pupils have shown a great interest for Biophilia and the use of tablets. His use of Biophilia can be considered compatible with the kid-in-own-space activity suggested in Learnteach, where children are given time to work with the iPads on their own without an explicit direction or assessable outcome. Birkir also makes sure that there is time for the pupils to hear each other's work at the end of a Biophilia session, which is also a principle that appears in Learnteach. He argued that this is an important part because the pupils might become motivated to imitate or develop each other's ideas.

Ragnar stressed the importance of providing the pupils with optimal challenges.

> With problem solving we use to give them projects that are difficult enough to have them *trying*, but not over-challenging. You need to give everybody a project that they can handle. With interactive books like computers and iPads you can do that very easily.

> Normally in math it would be like… sequential. You need to finish a certain code, but with interactive books, it is easier to design a project that really works for them.

On discussing success criteria for doing a Biophilia teaching project within compulsory education, Iðunn argued that it is important for all staff at a given school to be prepared and informed and that project work is done without too much adaption to conventional school day schedules.

> It is incredibly important to get as much away from the daily routine as possible. If there are a lot of walls – I am also talking about real walls – I think it should be taken as much outside of the box as possible. Because it's so incredibly hard for teachers to do that. As much as they want to, there is so much [that has to] happen.

Iðunn also mentioned the importance of technical resources like equipment and a working internet connection, but was of the impression that this is more or less in order with the schools involved to this point. "The head master [also] has to be so very ready for Biophilia, because the teachers cannot do this without having freedom. And it's difficult. Schools are quite rigid in their schedule.".

Helgi talked about the Biophilia Educational Project as a constantly evolving platform.

> It's really hard to put down the pedagogical ideas of Biophilia because it was kind of just a work in progress for a long time. We're still figuring it out! It's really experimental. It's not *more* experimental than other stuff that has been done, but it *is* experimental. It's asking teachers who usually don't teach together to teach together, it's asking kids to learn two things at once, and be *creative* within that [and it has a weird singer and it's taught on iPad], so, new technology.

Informants disagreed significantly when discussing the suitable age range of students in Biophilia. Iðunn from the steering group mentioned that Biophilia has been tried with high schools and afterschool programs and even kindergardens, partly for its affiliation with the Nordic Knowledge Train. "In kindergarten, we saw that this is really a challenge for the teachers. You have to do it so differently. But I think that they can have great fun with it.", Iðunn said. Primary schools, especially students aged 10 to 12 are considered the target age group. She considered the slightly older pupils to benefit more of Biophilia as a contrast to their °teenage world¨. She also noted that the target range was set because "it is the part of the school that is easiest to try new things with". Teacher Birkir was of the impression that Biophilia

worked well with the youngest school age students and became less relevant and interesting for them as they reached 12 or 13 years old. Helgi found the target age of 10-12 to be the ideal age range for Biophilia, mostly based on the aspect of maturity. “I find a difference when they are thirteen, then the hormones are raging, and they’re starting to be *cool* and they’re not as open. But… kids ten to twelve, they are quite open but also quite clever”.

6.4 Outcomes of teaching Biophilia

Birkir said in the interview that he believed the children would be able to learn certain things from the Biophilia songapps without the teacher having to facilitate the connection. He mentioned song structure, and discovering how minor changes in arrangement or note values can change the character of a song. He compared Biophilia to other musical apps, suggesting that the other apps would teach children something that is transferable to conventional instruments “but with a Biophilia app, they have something that doesn’t look like a normal instrument and they have their own vision of how to play those instruments”.

Helgi has experienced that the recording he has done of children’s Biophilia compositions end up being a source of pride and sense of accomplishment, even if their work ends up sounding either close to Björk’s original work or the work of their classmates. “Some would find, well, that the kids are just making a version of her song. It has the same scale. [Much] of the time it has the same speed. And it has the same sounds. And of course, I’ve recorded hundreds of these things and of course they always pretty much *sound* the same… But in the eyes of the *kid,* it’s always their composition. It’s their *pattern*.

Ragnar noted that some of his pupils has shown a very visual approach to composing music when working with Biophilia. Some pupils would draw complex geometrical figures apparently not listening or even having audio enabled on the tablets, and the pupils would still demonstrate pride in their compositions, even if the pieces ended up sounding “unpleasant”. “It didn’t *sound* good, but the notes *looked* good. Maybe sometime in the future it will be cool music, like Björk’s. Strange music! Not for everybody, but it’s *music*”.

6.5 Relation to Western/traditional music education[31]

> All the songs are just *way* out of our western music habits, because the songs are all in odd time… and crazy chords… It's a great album, but it is just so unlike music that you're used to listening to (Birkir)

While Birkir merely noted that Biophilia represents something different, Sigmundur demonstrated views that oppose what he refers to as traditional western music education, with its emphasis on learning by notes and leaving the exercise of composition for those in mastery of instrumental skills and music theory.

> I think we're really stuck. In Iceland, we have had very old material for teaching music. Really old. Textbook. Activities. We have been teaching the same thing for almost twenty years I think… We're stuck in the *western* music school, emphasising *notation* instead of *music.* Without reading notation; making music, listening to it, analysing it without the boundaries of notation. Because that's a barrier for a lot of students (Sigmundur)

He went on explaining how the intuitive nature of the iPads facilitates the pupils into producing sound and music that is "not just gibberish", without demanding pre-existing instrument skills. He believed this will support the pupils' self-confidence.

> I am being very prejudiced against western music education. It kind of has a stamp of being elitist. It's not all including, and that's my main problem with it. That not every kid is getting to great music and build self-confidence. They *can* actually do something, listen and express themselves about music. Also there is the emphasis on notation and western music history. I'm not trying to work against it but rather go around it I guess. Making it a bit more *global*… Also, in a creative – or creating environment – it's *personal*. the *lesson* that you get or the music you create is personal. And I think that's something that traditional western music education doesn't really provide.

In the interview with Helgi, he said Björk has been critical towards contemporary music education, described by him as a concept where children go to music school to learn how to

[31] The term *western traditional music education* and variants of it were used by several informants, and interpreted as refering to either European art music and its use in education or as a general term for 'conventional' teaching methodology in classrooms and instrument pedagogy. The exact meaning was interpreted as context-dependent, but I concluded that the term is used by informants as an umbrella-term, covering most aspects of music education that is not modern, progressive and featuring strong emphasis on elements like creativity, technology and improvisation/generative music.

recite music and where the composing of music is reserved for experts with many years of practice.

> Some of these kids who have learned a lot of music might never have… been encouraged to create their own music. You're always learning something, and always just trying to play the scale right, and you're always wrong. There is never a part in there where you should just do whatever, you know?

According to Helgi, Björk attended music school as a child and did not have much appreciation for "the old system": "It didn't really go well with her character" he claimed. This is reflected in an interview Björk did with Pitchfork (Dombal, 2011), where Björk is cited as being opposed to music education as a child, finding it "too academic".

Ingibjörg argued in favour of a traditional approach to structure in music and music composition. "I think Björk forgot how much she herself knows about structure and that you always need to be working [within] some structure.". Ingibjörg said. "Say you know a lot about structure and you're trying to break free from it, then at least you need to have some frame to be working within. You can't really go into that without knowledge of how to think abstractly about music". It appears from this statement that Ingibjörg is presupposing a need for knowledge of musical elements to enable abstract thinking about music. This view does not appear in the other interviews; the other informants seem to talk about abstractness in music as an opposite of the concrete, predictable and "sensible". Ingibjörg further defended this view saying that no matter how you treat "the building blocks of music", something is going to come out of it, but it may not be so satisfying if you do not understand how your efforts lead to the creation of music. "Music is very abstract when it's happening, but in order to *create* music and be in charge of the creation, you have to have some concrete knowledge of the abstractness that is happening.". Based on this viewpoint, Ingibjörg argued that some of the songapps would benefit from being more predictable and enabling saving and curating of sound modules, to allow for structures of chord progressions.

I asked Ingibjörg about her views on Biophilia purposively opposing western traditional music practices, to which she replied "we have to decide on something. Sometimes it's just too confusing if everything is allowed". She continued comparing the understanding of music to reading, suggesting that people benefit from knowing where to start reading a page and in which direction. "We need some handles on how to represent the abstractness of the music. And once you have those boundaries, you can do a lot of things".

6.6 The role of Björk or the musical material itself

Helgi compared Björk's role to that of a "mascot", noting that the children usually do not know Björk or her music. Although they easily become interested, even for her somewhat unusual appearance in the album artwork. Helgi reflected that maybe this "mascot-effect" should not be underestimated, as he implied that students tend to pay attention to, and remember teachers who have strong characters.

Iðunn argued that Björk does not necessarily appeal to the children through their interest in music. "Kids at this age [..] they don't even know who Björk is. Not the Icelandic kids! They have never listened to her music. And if they ever did, they don't even like her music! [laughs] I think the thing that matters is that we cut through, and it is going into the schools and we are sort of sending this little mole into the system. Which is just fine [laughs]". Birkir had a similar view: "The kids don't really like the songs. But they think it's really fun to *play* with them. But also, they could hook on something, like a cool drum beat, and they might really like *that"*.

Sigmundur said he believes the use of odd scales and meters is an intentional strategy by Björk, where she set certain boundaries for herself when composing the music, and that the apps reflects this in a way. "She kind of created her persona with a weird hair that looks like a galaxy. And the harp on her dress. So she's like the weird science music teacher, and then she creates this world, and in this world, you can create as well. Within the same restrictions". Birkir als

6.7 The software and hardware

Ragnar uses iPads extensively in his teaching, and finds that this is useful for his preferred style of teaching, which may be described as problem based learning. When introducing new themes for his pupils, he would give them a topic to research and explore by the use of digital tools. Ragnar said he found it important for teachers to keep an open mind and get to know the new tools that emerge in the educational world.

In discussing the app and its role in the project, Sigmundur talked about the iPad app primarily as a tool, and opposed the idea of the app being the centrepiece of the Biophilia Educational Project. "It shouldn't be about the *app*. It should be more about the concepts behind it… If you're looking at the educational project, I think the main strength is the interdisciplinary nature.". Sigmundur also stated that the app is "not that strong as an educational tool" as it hasn't been updated through its lifespan and that it would be desirable to update it with functionality to make it better suited as an educational tool.

Birkir had noticed technical glitches in Biophilia, but insisted that these have not been a problem for him in his teaching. When the app crashes "they just relaunch the app". Iðunn also acknowledged some shortcomings in the technical aspects of the app suite, like frequent crashing, but did not think of this as a significant problem. Iðunn informs that it has been Björk's wish and encouragement that any app could be used for teaching Biophilia, and that it should not be limited to using the Biophilia app suite.

> Somehow, kids *love* the iPads… The touch screens. Björk wanted the teaching to be very tactile. There is a difference between having a mouse, keyboard and computer screen or in working with hands on the screen. There is something *magic* that happens with that (Helgi)

Helgi also praised the possibilities touchscreens and iPad instrument apps provide in enabling children who had no instrumental background to create music regardless. Although he notes that most of the song apps are not typical instruments. "Kids saying I don't know how to make music were basically saying they don't know how to play an instrument. Three days later, the same kids had written six songs and I had recorded them with them. So it was quite a change."

Helgi was clear that the use of other apps should be welcome in a Biophilia project.

> It doesn't have to be *her* app. I found it kind of useful to connect things as a starting point, but a lot of the time we use different apps if they do the thing better… So it's not about the app. It's just about the idea of teaching.

6.8 Special needs

Ragnar urged that the Biophilia teaching principles and material is especially useful when teaching pupils with Attention Deficit/Hyperactivity Disorder for its possibilities of using multiple types of stimuli in the teaching situation. Ragnar mentioned the use of visual stimulus as something he strives to always provide when teaching, and pairing this with oral explanations whenever possible. "With interactive teaching, you need to use every tool available. Sounds, you know, you can *hear* sounds but you can also *see* sounds. You can *form* it. You can *feel* it. Like the leaves, you can feel how they form and then you can see how they form. So now they know [not only] that every snow flake is special. Now they know why".

Helgi has found the abstract nature of the Biophilia interface to especially useful when teaching children with learning difficulties like ADHD and dyslexia. "We could see that they [were better able to] focus on what they were doing… We even had one autistic girl working with us.

She had a great time. Well okay, having a great time is not the issue – do they *learn* something? And in my mind, this is more of a stimulus program. Nobody is [expecting] kids from ten to twelve years old to *really* learn about dark matter, or even the moon. It is [more about] turning them on to science and having them want to learn more."

6.9 Challenges in implementation of the Biophilia Educational Project

Project coordinator Dagmar saw a potential issue in the current organisation of the Biophilia Project in that teachers might end up feeling that their autonomy is threatened.

> When you are working with teachers on a project like this, they need to feel ownership of the project from the beginning, and not that they are just being handed something they should do in a certain way, and 'that's it'.

Dagmar also suggested a solution to this concern, by organising the project to be physically closer to the classrooms, with the project steering group working closer together with the teachers who are involved in the Educational Project.

> Of course it would take more time and more resources… I don't really see how we could have done it differently in terms of the resources that we had, but, we are *hoping* that from now on more of the work will be done at the grass-root level.

For the Nordic project, the steering group chose not to include Kistan, the flight-case with iPads and other teaching material. Dagmar informs that they provided economical support to participating areas, and wanted to grant them the autonomy to decide how to spend their resources based on the local availability of iPads and other learning material. Part of the decision of not continuing to include Kistan was the short life span of technology, and the fear that any tablets bought would be rendered useless within a few years.

Iðunn found it likely that teachers "push" their schools into applying for Biophilia.

> In many cases, the teachers asked the headmaster to apply. In other cases, the head master is just a visionary and he or she decides [to find the right people to do it]. Because the applications were really strong. They were full of ideas… They had put down their ideas and their aims and their strength and weaknesses.

The applications the schools sent to take part in Biophilia became the basis for project evaluation, so that the schools would be evaluated on their own terms, according to Iðunn.

Helgi has experienced difficulties in dealing with some participating teachers in that it has been difficult to instruct them in methods of teaching and the ideology without some feeling patronized. He believed some of the incompatibility might be related to Biophilia coming from "a punk mentality" where it was not expected to be expanding to schools in the Nordic countries. The DNA of the teaching principles and ideology emerged in workshops for children at different institutions that were visited during the city residencies, and have might not always be compatible with the views of professional school teachers. At the same time, other teachers who want to participate find that the Biophilia project reflects their values and ideas.

6.10 The future of Biophilia

Sigmundur believed the Biophilia Educational Project first and foremost serves as a kind of a pilot project incorporating new kinds of collaborations, using technology in new ways and facilitating mind-sets and attitudes that forge new thinking and creative work. "I think, in the future, we will look back at this project as a sort of stepping stone. How we got from the traditional music room to something that is more technological. More interdisciplinary. And whatever the strengths of this project are. [The app might be] good for two more years, but I really hope we can take it to the next level and apply its ideas, because I really believe that is important."

Dagmar also emphasised that the continued existence of Biophilia in its current form is not necessarily one of the aims of the project.

> We give [schools] this kind of package. These teaching guidelines and this concept, and obviously one of the main goals of this Nordic collaboration is to see if the project can develop and evolve further… We're hoping that they will create some new ideas. And we are hoping that the steering group in each place will collaborate on that and [further develop] the ideas from the teachers together on an academic level, in schools or in arts institutions, museums… So we are hoping that this collaboration will lead to something more.

Helgi called the Biophilia app suite a "closed package" when discussing its potential for future development with its risk of soon being completely incompatible with modern operative systems if not overhauled. "Our hope is that by going into the Nordic countries, that something *new* that is *not* Biophilia comes out of it… What remains is the *ideas* of teaching." Björk's ambitions for Biophilia are also not limited to the Nordic countries, said Dagmar. "Her ambition has always been to make this material accessible to everyone. That's why we have the website".

The steering group plans to keep the website updated as new new and updated material and ideas emerge from the workshops and the field experiences with Biophilia.

> People are right when they say I'm sure that something else is being done in this field. Yes, there is. But I think that it has not been done in this way. And… when you have an opportunity that such a great artist donates something to the kids, just like [that], it would be very stupid not to use the opportunity to go into the school system and try to make a difference. Because we must make changes. And if Björk can be the icebreaker, I think that's just great (Iðunn)

Helgi suggested that Biophilia might be considered as borrowing bits and pieces from other directions of alternative pedagogy, and that its main effort is paving the way for new thinking and new development.

7 The deviant case

The following material is taken from the deviant case focus group interview with five music educators who all have at least a Bachelor degree or higher within music education. Further, these teachers had no prior experience with Biophilia. Participants were also observed through a trial of the software prior to the interview. Material has been restructured from its original chronology. Please refer to chapter 3.7 for details on the deviant case design.

When trying Biophilia for the first time, some of the participants reacted with frustration. This was visible on the faces of Nora and Sara in particular. “I realised I felt really impatient,” said Sofie, “because a lot of the time, I didn’t quite get what this was. It was almost to the point where I felt *stupid*, like ‘why am I not getting this?’… Some of the games, I didn’t get at all”.

All participants chose to use their iPad’s case cover as a stand, to set it stationary at the table in front of them. During the first minutes of the trial, Sofie went through three of the song apps while the others stayed with their first choice.

7.1 The appsuite

Sara would have wanted instructions for each app to appear before the games/instruments were initiated, as she had problems understanding the functionality of the song apps. “It would be important for teachers to know the app thoroughly if they’re going to use it in teaching. I wouldn’t take it for granted that children intuitively know how to operate these instruments”. I asked if the instructions provided in each app would be sufficient, to which Sara replied, “I suppose, but I’m not going to read any instructions! [laughs] So I’m not sure the pupils would either”. Those who inquired the instruction pages at some point, did not care to read them carefully as they were found confusing or unclear.

The participants had different experiences with Thunderbolt. Two did not discover multi touch gestures, and Lukas did not try using more than two fingers. “But then again, I didn’t read the instructions.”.

Sofie did not understand that tilting the iPad was necessary to control Crystalline.

> I was tapping for my life, thinking that what I did made a difference and adding crystals to the thing. And then I stopped tapping to just watch it for a while and I realised that everything progressed in exactly the same way. I didn’t think about lifting the iPad and tilting it around [laughs].

Sara found Dark Matter interesting and compared it to ear training, with a certain element of reward for identifying correct intervals. Emma was not as impressed. “I tapped correctly but I didn’t feel like I got anything out if it” Emma said, “I never progressed”.

The other participants agreed that Dark Matter might be a suitable tool for teaching scales and intervals. Nora noted that the user interface was confusing and “somewhat annoying”. Sofie added that she found it problematic that the scale notes were in *toggle mode*, so that the notes are switched on and off, and that she would rather prefer a *latch mode* with an adjustable duration. Some of the participants mentioned Hollow as the most obvious natural science themed app, but did not see the connection between the video and the Hollow Machine. Emma even closed the app as she thought the video *was* the game, and didn’t care much for it.

None of the participants found or read the Nikki Dibben essays that are contained within the nine songapps. The essays may serve as a guide to better understand Björk’s concept, as they provide information about the Björk’s inspiration for of the songs and suggest – in layman’s terms – how the emotional themes are related to the musicology.

The five participants liked the graphical notation that accompanied the songapps, and found it to be a good visual accompaniment to the music, but some felt that the representation was not consistently presented, as the duration of the musical notes does not always match their horizontal visual counterpoint.

> I think it would have been beneficial if the app suite was less depending on the source material. Some of the apps are more… rhythmic you might say, but most of it is just ‘pling’ and ‘plong’ in a way [laughs]. Working with structures more similar to pop music could make things easier (Nora)

Lukas disagreed with this, and said he liked the fact that the music was “not very pop-y”: “It shows that music is more than four-four”. To which Nora countered “maybe it should have it all, because music *can* be four-four as well”.

Sofie said she got the impression that the Biophilia app is designed to help you actually learn the songs, by including lyrics and notation, and that this appears to be an important part of the concept. Nora agreed to this. Sara added that she found this to be a “really cool way of releasing an album”

7.2 Using the Biophilia appalbum in music education

Lukas stated early in the interview that he didn't see any obvious ways children would learn anything from using the app in isolation. Sara agreed with Lukas.

> There are some obvious limitations with this tool that makes me think I cannot find use for it. Because what you hear is what you get, and the scope is pretty set within each app in a way. I think pupils would get bored with putting together these sounds for more than maybe fifteen minutes. So I probably wouldn't go out and buy a classroom set of iPads to use this software. But it is definitely a worthwhile addition – to do something completely different than what is usually done in the classroom. (Sara)

Sofie agreed with Lukas and Sara, adding that she "loved the idea" of working visually and auditive at the same time and mixing up school subjects. But if this philosophy or ideology is justified, or manifested, good enough with an app? I'm not so sure".

Lukas argued that teachers would need to take their respective national curricula into account if using Biophilia within an ordinary school setting. "The pupils are supposed to be trained in music composition and musicking. If you're going to use Biophilia for that, you would also need an explanation of what the notes represent". Lukas used the arpeggios in Thunderbolt as an example. "Knowing what notes make up the arpeggio becomes important if they're supposed to learn something, and have it be accountable and compatible with the curriculum".

All five participants agreed that there is a sense of randomness and unoriginality when creating musical sounds in Biophilia. Nora explained it by making things happen and sounds appear through her interaction with the apps and then realising "it wasn't me who made it nevertheless. The idea and everything was already there. I kind of just pressed play on different things.". In spite of this, Nora felt inspired to make music on her own after the Biophilia trial. "Maybe not on *this*, but when I get home, I might make something. So that's positive."

Lukas and Sofie argued that using Biophilia in integration with other musical activities in the classroom might be difficult. "The distance is pretty far between the soundstage of this app and the soundstage you might be able to produce with the instruments and equipment usually available in a music classroom", Sofie said, further arguing that Björk's material would be hard to play on conventional instruments. "Though, you could of course just use the apps and there's nothing wrong with that".

Emma was the only participant who spent some time watching the scores of the songapps. She commented that the arrangements were complex and "very Björk". Furthermore, she said "I am used to reading notation, but what I was presented with in those scores was highly complex to me. Both the way it's notated and the way it's composed".

"You could say the same thing for her voice and her melodies", Sofie added, arguing that the musical material deviates significantly from conventional pop music and the music preferred by the young, making it hard to work with the lyrics, melodies and rhythms in a classroom setting. Sara contrasted Biophilia with nursery rhymes. "They usually have some moral idea or piece of knowledge that the children are supposed to learn, which they do, through repetition and familiarising with the content". Sofie continued that such pedagogical principles that would not work with the Biophilia material, to which the other participants expressed being in agreement.

7.3 Biophilia as an individual and a social activity

The focus group participants mainly saw the Biophilia app as an individual activity, with limited opportunities for sharing and co-working based on their trials. This was somewhat reflected in the trials, where there was only one occurrence of a participant seeking contact with another. Nora also questioned the usefulness of having a teacher present.

> I imagine a classroom with pupils sitting around with each their headphones, maybe sharing an iPad… Point being that the teacher is not likely to be standing in front of them demonstrating and explaining them in hindsight what they did and how that relates to music theory… For teaching music theory, this is probably not a very suitable tool in my opinion.".

Sofie agreed and added that she did not feel the "individual nature" of the Biophilia app is able to support social aspects of music and music learning. She praised the idea of not advocating right or wrong approaches that some students might find intimidating, but said that "it's not realistic to use this the way music has been taught up through the years.". When asking the participants whether they saw any possibilities of using Biophilia in a social setting, Sofie and Lukas suggested using the tablets without headphones, albeit arguing that it would not be easy to work with several songapps together as their musical scales are not compatible with each other.

> Still, I tend to think of music as a social activity, but that's definitely relative to cultural inheritance and identity. But how music is consumed and how it is made is maybe drifting away from that social aspect. Maybe leading to more people not thinking about music as a social thing. And that doesn't have to be a problem. So maybe if you're trying to help someone get into music making without downloading heavy, complicated software and teaching them about beats and loops and such, this kind of tool could be a starting point. (Sofie)

Nora contrasted this with saying that she would have liked the apps to have less of a "video game" type of design, to help facilitate creative control.

> There is a sense of randomness, and not really knowing how [the software] is responding to your inputs. You're not really in control. So it could have been offering more options to shape or edit what you are doing, or grasp what is going on, in a much simpler way. Take GarageBand as an example. Many have that software installed already, and it is quite suitable to get started with making music and producing on your own. And you would be able to get a pretty good idea of what you are doing and not just things that sparkle and you not really knowing what happened.

Sara apparently agreed by adding "if designing an app for pedagogical purposes, you might want to add music from other artists as well, whatever most suited to the teaching goal at hand. But in this app, the *music* is always the starting point, even when it might not have the desired pedagogical suitability".

The group discussed the fact that the app and its material is in English, and commented that this might be an issue when teaching in the Nordic countries, especially when used as a teaching tool with younger children. The group meant that some of the natural sciences terminology within could be too difficult to handle for EFL[32] students.

Nora said that she felt "locked" in her view that she didn't find Biophilia to be very pedagogical, and that she would have liked to know more about the concept and how the developers imagined this could be used for teaching purposes. She expressed that she saw a clearer eligibility for teaching natural sciences as the connections (or the "memory bridges" that Helgi and Ragnar

[32] English as a Foreign Language.

talked about) were stronger in that regard than it was for music theory. Sara said she found the information content too poor even for natural sciences.

> Sure, you get some shallow idea of viruses attacking cells, but that's it. Then there's something about the journey of a protein on another stage and that's it for that story. I think you could be facilitating a lot more learning in any given timespan by different didactic approaches.

7.4 Discussions about the concept and its abstract qualities

Lukas' initial comment in the group interview was that "this software is definitely outside of the box that we normally operate within", to which the others agreed. "I had to open some doors, especially concerning creativity" said Sofie. "I had to search for solutions in a different way than I normally do. I kind of had to force myself to think outside the box. Like [Lukas] was saying, the thing is outside of the box, so you have to *think* outside of the box to get what the thing is about".

The participants discussed the role of notation and use of symbols that are not immediately familiar to them. Nora found it frustrating to have to deal with such musical symbols, especially in Sacrifice as she did not find out how to produce the desired sounds. "I just lost the connection and gave up."

> Sara: "I don't see the point of making new symbols when a working solution already exists".
>
> Nora: "Me neither, if it's supposed to be used for learning about music".

I later suggested that the input on Sacrifice may be seen as a QWERTY-keyboard where musical notes A through H are represented as pitched notes, but the informants said they did not recognise this during their trial phase. The consensus seemed to point in the direction that apps like Sacrifice would not be useful for teaching traditional notation, and that there should be a stronger connection to traditional symbols for this to be perceived as useful in their music teaching.

7.5 The promotional aspect

Some of the participants were "provoked" by what they saw as an obvious promotional aspect of Biophilia.

> "It's hard to discard the fact that this is promotional. Very much so, in a way, for an artist and based on *her* sounds and *her* approach to music. I might end up using it at some point, but it is very narrow. You have a slight sense of abstractness... floating… I realised when I put on the headset and started the app, I drifted into some sort of daze, with woooo sounds wherever you go and you get some sort of ooaah in your ears and it's such an experience in a way. But there is something about the thing I said earlier about symbols and when certain notes appear, you don't get or see the context, so I'm not sure if I see any possibility for musical learning. But maybe to become inspired, to dive deeper into it. By creating some bits and pieces, maybe it leaves you wanting to create more in a way. (Nora)

Nora emphasised that what she saw as a clear promotional aspect takes away some of her interest in using Biophilia in education. "Not that I don't like Björk – I love her music – but there's the overhanging sense when you're opening the app, it's *her* music and everything spins around that".

Sofie agreed with Nora, and sees it as a problem on a different level, where time is allocated to teaching Biophilia.

> I can see that this is a piece of art. But I am also kind of provoked that one single piece of art should be allowed to be so central in schools. It's an interesting example of how things can be done and how you can combine different sensory impressions and break things up to provide an *experience*, but I am provoked that this thing would have a special privilege in schools. That it should be pitched to education as something that should be given priority and be spent money on with tight budgets when many schools have a hard time buying basic equipment and instruments.

At this point I informed them about the grant participating schools are given from the Nordic Council of Ministers to cover expenses for learning material.

"It's still money that the Council of Ministers could have used on other things… It's obvious that Björk is a genius in her artistic ways, but many are. It all becomes very narrow if she is allowed to take up much space in schools." Sofie said, with Sara expressing her agreement.

> And that also goes for schools being granted money to buy iPads to do this project. That would mean every participating student is allocated a significant sum of money. And the

> grand total is significant. Probably a huge amount of money. It would be bad use of funds to buy iPads to do this kind of thing specifically, in my opinion. (Sara)

8 Discussion

8.1 Threshold and motivation for music creation

The Biophilia educational concept offers a way for young people to engage in the creation of music without the need for intrinsic knowledge of music and musical instrument techniques. In the narrowest understanding of the concept, the appsuite is the main artefact, and its nine main songapps all offer some kind of compositional tool that is controlled by the touch screen of the tablet, and lets the user generate musical sounds, control their duration and to some degree, their arrangement.

The threshold (in terms of maturity and prior knowledge) for interacting with Biophilia is arguably low, but not necessarily lower than other app software offerings for Apple and Android tablets. Compared with other apps that are commonly used in Biophilia teaching such as GarageBand and Animoog, one finds that these apps also provide a means of sounding "good" for the novice user, as the timbre and pitch manipulation entailed do not require hours (or years) of practice. Still, Biophilia is different from other much used apps for music education, in the sense that GarageBand and Animoog for the most part are controlled by an X-axis pitch control (as in a claviature) and a Y-axis sensitivity to either timbre, modulation, intensity or velocity. This kind of predictability of correlation between the visual and auditive elements is less common with the Biophilia songapps, thus making it less intuitive for the user to consciously make sounds with a desired outcome. On the other hand, some informants would argue that the conventional layout of Animoog and GarageBand make students' experiences and acquired knowledge transferable to other synthesizers. Similarly, as Birkir argued, even transferable guitars and other stringed instruments. Criticism towards Biophilia is heavily based in this aspect of predictability and transferability.

There is also quite a steep learning curve to harvest the full potential of several of the songapps. Even so, this does not seem to be a problem in the Biophilia classroom. From observation and teacher interviews, it would appear that children tend to approach the Biophilia appsuite without any ambitions or standard to guide their efforts, hence making Biophilia a kind of virtual music sandbox that the children can experience and explore at their own pace. Since the songapps are based on samples of unconventional instruments, it is unlikely that children would use an existing reference to guide their sound production, as they are more likely to do when using

software like the Smart instruments [33] in GarageBand. Thus, it is plausible that children do not experience making "mistakes" when playing the Biophilia instruments to the same degree as with other instrument-like apps.

In using several different apps within a Biophilia project in schools, the pros and cons of each app may ensure that every child is able to produce sounds that they find enjoyable and that have musical qualities that would not be achievable with conventional "acoustic" instruments. On the other hand, based on the way the teachers who served as informants in this study interpret their respective national music education curricula, there is also a need to teach pupils basic instrument knowledge that cannot be substituted with a digital platform. Informants in this study argued that as a *musical instrument*, the Biophilia app suite cannot replace the use of other instruments, but could be a "fun" addition. Still, some teachers expressed concerns that the total amount of hours designated for music education in compulsory education is limited, making it "problematic" to spend much time on Biophilia.

During the short period I was able to observe Biophilia in an Icelandic classroom setting, I was somewhat surprised by how motivated the fifth grade pupils appeared in working with the Biophilia themes and the appsuite. From my initial personal exploration of the app, I was not expecting that Biophilia would have the themes or the functionality to keep children interested for longer periods of time. Had accessibility been less of a challenge for classroom observations, it would have been possible to investigate this more deeply. Nevertheless, my impression has been that the themes and tools of the Biophilia project have qualities that inspire students to participate in activities as well as engaging in the iPad app for a prolonged period of time.

Some of the teachers in the deviant case found that the openness of Biophilia worked against their own motivation for using the app, as they would quit a songapp if they "did not understand what to do" (Nora). In this way, the openness (understood as in the Biophilia appsuite being a non-conventional musical device with abstract qualities and no defined end state), was experienced as something that impeded motivation. This did not seem to be the case in the classroom observation, as most children appeared to stay within one single songapp for several

[33] Smart instruments are software instruments within GarageBand that imitate conventional instruments like guitars, strings, piano and drums with high quality, dynamic samples that are controlled by touch screen or any MIDI-interface. Most of these allow one-finger triggering of trichords (with the option of expansion) in the different ranges of the instrument they imitate.

minutes at a time, as opposed to the deviant case participants. More data would be needed for conclusiveness regarding these behaviours.

The apps have some variation in their degree of their open or closed structure, understood as the extent to which the user can affect and manipulate the content and its end state. Ingibjörg, perhaps being the most critical informant, praised the openness of some songapps, especially Solstice, but noted that even this songapp is hard to control and that it is "always sort of a coincidence what happens". Ingibjörg recalled observing school children interact with Solstice: "Some kids tend to just put a lot of strings and circles going round it and it turns into complete chaos! And then they just give up on it. I never saw a child really work on it". From my limited classroom observation as well as the deviant case appsuite trial, the data would appear to support Ingibjörg's observations, in the sense that there seem to be a sense of randomness to how both children and adults design sounds with Solstice. On the other hand, it is not clear to me whether those observed had intentions of creating specific melodies and harmonic structures. In addition, children seem to be spending time with the apps even when there is no course of action or plan for music creation, something I find important to highlight as this could say something about Biophilia's ability to keep children interested.

8.2 The role of the Biophilia iPad app

The three school teachers who were initially interviewed for this study found that they are often challenged on the basis of using iPads in music education as a possible replacement for "real" instruments like the guitar and piano. A commonly heard criticism is that playing the iPad cannot take the place of learning how to play instruments, and being considered less of an instrument than the orchestral – or rock band – instruments of the previous two centuries. David A. Williams (2014, p. 94) notes that the *Merriam-Webster Dictionary* defines a musical instrument as "a device used to produce music" and continues describing a set of attributes categorising musical instruments, based on the features of an oboe. The main principles are these:

1. In the hands of the right person, the [instrument] can be played beautifully and showcase musicality.
2. In the hands of the wrong person, the instrument can be played badly and produce unmusical sounds.
3. It is likely that one must practice well.

4. It is necessary to build technique in order to get better. Improving technical skills helps develop musicianship.
5. Limitation on what is possible to perform.
6. The instrument will do nothing if no one touches it.
   (Williams, 2014, p. 94)

Williams (2014, p. 94) finds that these principles are common with the oboe and the iPad, hence defending the notion of acknowledging the iPad as a musical instrument, and claims that "the instrument is little more than a tool through which a person can produce music… The magic is supplied by the performer". There is of course one significant difference in that the tablets, characterised by their multi-touch interface represent a fairly new control system for instrument sound production. A majority of instruments in western classrooms are likely to be played by a claviature, plucking strings, hitting something with a mallet or a stick, or might even include a Boehm-like system on occasion. A flat capacitive touch screen is not very different; this glass screen will have to encompass all aspects of input; be it pitch, timbre, loudness or expression. I would argue that the role of the iPad itself could be considered equivalent to the role of a keyboard for a synthesizer, with the apps used to make sounds comparable to the synthesizer itself. The screen might be the means of input, although there would be no sound production from the iPad without some kind of an app doing the virtual synthesis or sample playback. Even so, because of the "virtual" or "digital" nature of apps, it is comprehensible that some would still question the "realness" of an iPad as an instrument. Consider then a comparison to the Yamaha DX7. The DX7 was arguably the first successful digital synthesizer, based on a frequency modulation design, and gained huge popularity mainly for its *presets*[34] (Fantinatto, 2014) or *patches.* These range from characteristic bass patches (extensively used by pop groups a-ha and Frankie Goes To Hollywood amongst others), brass sections (which sound like they are still heavily incorporated in productions of Les Miserables) and several other presets designed to either approximate the sound of traditional instruments or the analogue synthesizers of preceding decades. Few synths of such limited user tweakability[35] have experienced the kind of fame as the DX7 (Fantinatto, 2014). Its keyboard is a familiar black-and-white 61 keys accompanied by the mandatory pitch and modulation wheels. Musicians would use the DX7

[34] *Presets* are pre-programmed tones stored in a synthesizer's memory. *Patch* is often used as a synonym, but is historically referring to the use of patch cables to alter the signal route in a modular synth, and would technically imply a tone that is not stored to any memory.
[35] From 'tweaking'; often used to describe the process of manipulating the timbre and character of electronic sounds (or their digital imitations in a software environment).

more for its presets than anything else. This analogy suggests the following cliché; it's *how* you chose to play the presets that makes the DX7 sound desirable, not the (lack of) patching opportunities and tweakability. Biophilia is similar in this way, in that the songapps generally offer the user a somewhat limited sonic palette to play, but the user can definitely get "better" at playing Biophilia by practice and mastery of the touch screen interface.

The song apps of *Biophilia* represent different ways of producing sound by single or multi-finger gestures on the iPad screen. Still, it would probably be necessary to question whether *Crystalline* and *Cosmogony* could be considered instruments, as they hardly comply with Williams' (2014) principles for instrument categorisation (in particular the minimal audible response from user input). But seen as a whole, the Biophilia suite allows for some interesting sound production controlled by the users' interaction with the touch-screen, and several of the apps are instruments that needs to be practiced in order to make them sound good.

In spite of this, some may find Biophilia unsuitable for ensemble use. In the interviews, Birkir (2015) expressed that it was very hard to include Biophilia in an ensemble with conventional instruments. Birkir found two reasons for this; one is the harmonic dissonance that would occur, and the other is the irregular meters that characterise several of the tracks. This would indicate that Birkir discussed Biophilia in terms of its potential as a musical instrument. For Birkir's part, the difficulties of using Biophilia in an ensemble setting has resulted in him choosing to let his pupils work with Biophilia on their own without directing the students' work. On the other hand, he praised the iPads in general for their selection of apps and possibilities of imitating conventional instruments, as this is helpful in recreating a realistic instrument sound without demanding skills on the instrument in question.

Sigmundur (2015) was enthusiastic about the concept of using touch screens for musical control. In his opinion, Biophilia takes advantage of the touch screen in creating an intuitive interface that does not demand much computer skills for successful interaction. When asked how Biophilia is different from other musical apps, Sigmundur responded that Biophilia's utilisation of the touch screen is a strength of the app, as well as its distance to traditional western music; purposively avoiding Aeolian and Ionian scales and providing a variety of meters and scales.

Ingibjörg had a different view towards the Biophilia app. She believed Björk wanted the app first and foremost as a compositional tool whilst having hopes and expectations beyond the abilities of the first generation iPad. This is reflected in the interviews with Helgi and

Sigmundur, as the educational plaform was mostly designed after the app was completed, and they have not prioritised improving the design to better suit educational purposes.

The Biophilia appsuite certainly offer several qualities as a musical instrument and as a teaching tool, but it does have undeniable shortcomings. Be that as it may, Helgi and Sigmundur were both clear that "it is not about the app", and that the concept and teaching ideas behind Biophilia should be seen as its main contributions as an educational platform.

8.3 Self-efficacy and model learning

In my interviews with Icelandic informants, several expressed a view that the *Biophilia method* is able to serve as a source of increased "self-esteem" for the children who take part, as they are able to efficiently create original music and take pride in their creations. Analysing the interview material, I have concluded that the concept the informants referred to as "self-esteem" may be better understood in terms of Albert Bandura's (1997) *self-efficacy* concept: the belief that one is capable of doing the actions needed to reach ones goals, or at least of learning how to do so. Using Bandura's social cognitive theory could also prove useful for understanding children's motivation for engaging with, and learning from, Biophilia.

Observational learning is a key feature of Bandura's social cognitive theory, and is in essence any learning that is reinforced by performing modelled behaviours and skills, and it is suggested that children are more likely to imitate models that have some kind of status to the learner, helped by competency, power, prestige or enthusiasm (Woolfolk, 2014, p. 430). In my analysis, I have considered the role of Björk as a plausible model for student behaviours. Informants Helgi and Sigmundur saw Björk's role more as a "mascot" as opposed to an artist or musician, and that this is enhanced by the "big, red hair and weird dresses", having children react to her *persona* more than relating to her as a musician or artist. In the early workshops, recalled Helgi, children would react with curiosity and awe to the character Björk created for Biophilia. Adding the role of the *model* to the equation of motivation through accessible, low-threshold tools and a concept that is able to direct children's attention to the learning goals at hand, it would seem that Biophilia most likely makes a solid framework for model learning, and that Björk, or her *persona* in this case, plays an important part in the learning environment. In recreating or manipulating this music, app users are effectively imitating a sound concept or soundstage that is pretty much set in stone. This is not necessarily a bad thing, as the high production quality of these sounds and samples may add to the sense of mastery for the children (or adults) working with them. If children also demonstrate self-reinforcement through intrinsic motivation for the

task at hand, it appears even more valid to suggest that the Biophilia learning environment is designed in accordance with key principles of model learning.

The role of Björk herself in the project was uniformly criticised by the Norwegian deviant case participants. A few of them felt that the close connection to Björk and her artistry worked against their considering using Biophilia sometime in the future. Similar views were also seen in some participants in the Icelandic survey. All expressed a respect for her as an artist, and some had a personal relationship to her music. Conversely, the deviant case informants felt that in light of Biophilia being an *educational* project, it was wrong to allocate time and resources into material that promotes a single artist and musical style. Carrying such views, there is obviously a possibility that these teachers would not take part in, or actively seek to participate in a Biophilia project. Whereas, in the case that the decision is made elsewhere, they might play down the role of Björk or avoid linking the project work to her music or artistry. A possible outcome of such a hypothetical case is that the model learning possibilities are weakened.

I find it likely that introducing the Biophilia songapps in school music education has the potential to contribute toward strengthening children's musical self-efficacy. Through working with these apps, they are able to produce loops and short pieces of music that rather quickly "sound good". Even so, most informants seemed to find that there is a lot of random sound generation that would not meet most people's aesthetic needs in music. Especially Ingibjörg and Sara argued in a way I understood as their seeing the creations possible via the Biophilia songapps as lacking much aesthetic value. However, the argument for Biophilia strengthening children's *self*-efficacy does not necessarily rely on the aesthetic judgments of experts, as this is in Bandura's (1997) definition only a question of our *beliefs* about personal competence or effectiveness. Moreover, considering the findings of Nilsson & Folkestad (2005), a scholarly discussion of value or quality in children's creative work might have to be put aside to make room for the children's own experience of their products, and preferably considering it as a form of play for them. It is, however, important that the invitations to make music have a didactic framing and that there is variation in the working methods used (Nilsson & Folkestad, 2005). The actual, or objective, competence is therefore of less interest to this particular discussion, but becomes important when discussing Biophilia as a "brick and mortar" activity where the children are expected to meet discrete music learning goals set by a national curriculum.

It is important to keep in mind that learning can be understood as a broad term, and is not necessarily limited to the teaching of new behaviours and attitudes. Woolfolk (2014, p. 432) points out the other possible outcomes of observational learning: directing attention, encouraging existing behaviours, changing inhibitions and arousing emotions. According to Helgi, "turning children on to making music" is more important for Björk and the educational project, than the actual acquisition of musical skills, and I conclude this is indeed how Biophilia potentially makes its most profound contribution.

8.4 Benefits for children with learning difficulties

Some informants, both teachers and members of the Biophilia Educational Project steering group suggest that the teaching concept of Biophilia is especially suitable to children with learning difficulties. Informant Helgi gave examples of cases where this was especially successful, and two of the teachers mentioned children with Attention Deficit Hyperactivity Disorder [ADHD] as being especially benefiting from the Biophilia teaching methods. As I understood my informants, this potential is seen as relying on Biophilia's multimodality.

It has been suggested that children with ADHD function best "when learning activities are brief and when intense cognitive tasks alternate frequently with hands-on experiences" (l'Etoile, 2005, p. 39). A Biophilia project often incorporates visual and auditive stimuli as well as tactile and musical inputs, something that is seen as beneficial when teaching students who suffer from ADHD. It is widely accepted that use of several simultaneous sources of sensory input aids concentration and immersion in the task at hand through rich stimulus. Nevertheless, this notion may be challenged by the idea that this would not work for "every" child with ADHD, and that some would thrive on greater predictability of the lessons (Melago, 2014, p. 40) Still, it could be argued that predictability and structure is a question of classroom management and something that is not in opposition to a multimodal learning environment. A common trait of children with ADHD is that they seem to not achieve as much stimulation from a given perception as non-ADHD children, hence requiring more stimuli to reach optimal arousal levels (l'Etoile, 2005, p. 40). Moreover, it it is seen as beneficial that music teachers strive to highlight new information to account for this (l'Etoile, 2005, p. 40). A discussion of Biophilia's possible positive role in teaching children with learning difficulties like ADHD seems necessary, and is something that should be investigated. My data material does not cover this ground sufficiently definitively assess the claims of my informants, but this is arguably something that should be of interest to the music education research field for further studies.

8.5 "Breaking up traditional teaching practices"

A stated goal of the Biophilia Educational Project, based on the Learnteach document and interviews of people affiliated with the project, is to introduce experimental teaching methods and to purposefully deviate from conventions of how a school day normally operates. The Learnteach guidelines advocate the introduction of new approaches and new ways of thinking about music education in the classroom, while the informants express the same intention through negative phrasing; the most frequently occurring phrase being "to break down traditional teaching methods". It is somewhat difficult for me as a researcher with limited knowledge of the Icelandic school system to fully understand their heritage and customs, but through interviewing and analysing transcripts, I developed an impression that Icelandic teachers generally feel a strong sense of loyalty to the physical teaching material that is present in schools. Iceland being a small country, the selection of text- and method books has been very limited and thus, as Sigmundur described it, ends up appearing old and outdated. The teachers express that they experience having the freedom to make professional didactic decisions, but again, their "loyalty" to the teaching material seems to introduce boundaries and limitations, that would later on be challenged by new and experimental ideas of teaching. As a Norwegian music teacher, the Learnteach methods do not appear to so significantly deviate from the norm of music teaching in Norwegian compulsory schools, but it is unclear to me whether this is a question of customs in Norway, Iceland or my own personal experience and inclination to the methods of teaching Biophilia. There is of course also the possibility that there is no link whatsoever. The data material is limited in this area, I would have wanted to interview more teachers in both countries and possibly collect survey data to address this question more closely, something that was not possible within the scope (and timeframe) of this project.

Savage (2012) proposed that cross-curricular teaching in itself might not account for desired effects, but that benefits from such teaching might rather rely on *enriched pedagogy* through more elaborate conceptualising of themes through illustration and connection to other school subjects. Considering this in relation to some of the informants' views on "building memory bridges", it is likely that the positive outcome of a Biophilia teaching project relies on such enriched pedagogy rather than the actual (temporary) merging of school subjects. On the other hand, the data material suggests that it is a stated ambition of Biophilia Educational Project to call for change in the conventions of school day organisation. In a famous Royal Society of

Arts[36] presentation, Sir Ken Robinson (2008) claimed that the educational system of the West is modelled on industrialism and that specialisation in separate subjects and that this leads to an insensible standardisation and "product line mentality", and it is compelling to draw similarities to this in the rationale of the Biophilia Educational Project. It is then difficult to understand whether the cross-curricular teaching in Biophilia is an aim in itself or whether it is supposed to serve a higher function. In any case, the teachers in this study appeared to find motivation in their own practice that would potentially make them strive towards a teaching practice that is essentially examples of enriched pedagogy. In addition, they claimed to see clear benefits for their students in them discovering new academic interests and experiencing mastery through creative work. In this way, I find it likely that a Biophilia teaching project could have the benefits of cross-curricular teaching independent of the nature of the official aims or ambitions.

Another understanding of the cross-curricular qualities and multimodal approach of Biophilia can be obtained through the levels-of-processing theory, first theorised by Craik & Lockhart (1972). In their suggested framework, the vividness and availability of memories is best understood by the depth of processing, alternatively the degree of stimulus elaboration (Craik & Lockhart, 1972). Deeper level processing, or *semantic processing*, would suggests a synergy of several sources of stimuli including elements of elaboration, and that this is associated with high memory retention and long-term memory traces, as opposed to the more shallow perceptual processing (Ekuni, Vaz, & Bueno, 2011). The way the teachers and the steering group informants described their experiences with teaching Biophilia, it would seem like the teaching concept for Biophilia would facilitate semantic processing, hence leading to better memory of the learning experience, through its cross-curricular approach and by offering several sources of stimuli for every objective, often incorporating tactile experiences, artwork and music while also encouraging students to present and discuss their work. I find this concept reflected in the term *memory bridges* when it was used by some of the informants in this study to describe their personal viewpoints on Biophilia's potential for facilitating learning in music and natural sciences.

8.6 Inter-institutional collaboration

Particularly early in the Biophilia Educational Program development, several collaborations were established. The original workshops were held in different cultural institutions, and the steering group sought to collaborate with the University of Iceland, and later the Nordic Council

[36] Often abbreviated RSA, full name Royal Society for the Encouragement of Arts, Manufactures and Commerce (www.thersa.org).

of Ministers. This large-scale initiative in 2012 was apparently the first of its kind for Iceland, considering Bamford's (2009) report. To begin with, the project arguably started with Björk, and the collaboration with Reykjavíkurborg (The municipality of Reykjavík) appears to have been the strongest connection. This inter-institutional collaboration has led to Biophilia being strengthened through the input of teachers, academics and others, which again has contributed to a stronger image and PR effect. Gaining distribution through the Reykjavík school system makes virtually all music– and science teachers in Reykjavík know about the project. Many Icelandic teachers in the Reykjavík area have taken part in a Biophilia workshop. Hence, the project has seen many opportunities over time for suggestions and improvements from the practice field, and the teachers, given that they are satisfied with their participation, end up being unofficial ambassadors for the Biophilia Educational Project. Informants in my study who have been officially affiliated with the project are often taking part in voluntary work and activities related to Biophilia, and use the teaching material in their practice even when not doing a Biophilia project.

With a population of 184.000 (CIA World Factbook, 2014) Reykjavík is hardly a metropolis by global standards. From my visits to Reykjavík, one truly gets the impression that people's networks are quite intertwined. In one of the memos, I considered the possibility that such a project would benefit from the physical closeness of institutions as well as the small population in Iceland, increasing the likeliness that professionals from different institutions would have pre-existing personal relationships, making collaborations easier. In the context of this thesis, this is pure speculation from my side, as I would probably need to address such a hypothesis through ethnographic methods. In the interviews, I was somewhat surprised that all of the Icelandic informants seemed to be acquainted with each other, as well as knowing several teachers at schools across Reykjavík who had taught Biophilia at some point. Even if the data are insufficient to compellingly confirm the positive synergy of such networks, I find reason to believe that this has been an important part of developing the Biophilia Educational Project, through informants mentioning each other's contributions and the general knowledge of cooperating institutions that seems to be present.

When doing my preparations for this study, I made efforts to connect with the Norwegian Biophilia steering group with no outcome that would contribute to my thesis. Later, in the interviews with Sigmundur and Dagmar, difficulties of organising the steering groups in the other Nordic countries was mentioned. It was confirmed by Sigmundur that Norway was especially challenging due to illness and other unfortunate events, effectively inhibiting the

progress of the Norwegian project. Bamford (2006) shows that strong partnerships between schools and outside arts and community organisations is a characteristic of quality arts programmes, and this also appears to be a core focus and success factor in the Biophilia Educational Project, where a deficit in inter-institutional collaboration may hinder this or other projects from flourishing.

Indicating contrast, the collaborations in Iceland appears to have been working well and ensuring widespread knowledge about the project, and has led to it being taught in after-school programs and extracurricular arts programs as well as in compulsory music and science education. The continuing establishment of similar inter-institutional collaborations would be likely to improve on arts and culture in Icelandic education, which is already considered being of high quality (Bamford, 2009). However, such initiatives require substantial financial contributions, and it is important to discuss the implications of this. Hebert & Heimonen (2013) raised this potential issue when discussing The Cultural Rucksack in Norway: the importance of assessing if such financial contributions are used to actually "support student achievement in the arts, rather than as a means to provide mere exposure to artists" (p. 145).

8.7 The workshops as a framing device

While acknowledging some shortcomings with the project and the iPad app, my Icelandic interviewees showed a uniform positivity towards Biophilia and its teaching methods, putting me at risk of a *framing effect*[37] bias if relying too heavily on this data. Following the initial data collection, I was contemplating ways to contrast these findings. It was in a sense a question of finding the right variable to remove from the equation, and I ultimately decided that I would need to find informants who had not taken part in a Biophilia workshop. From hearing about the workshops, and seeing short video clips demonstrating their content, I speculated that the workshop context could have some mesmerising qualities that would serve to mask certain imperfections. Concequently, comparing the views of Icelandic and Norwegian educators' viewpoints should be seen in light of their different prior experiences with Biophilia. Nevertheless, I was under the impression that the Icelandic informants spoke for themselves without an apparent need to sell a certain message. However, I noted that the three informants who were members of the steering group would use bigger words and bolder statements

[37] Framing effect in this context meaning the psychological principle of understanding, and reacting to a given situation differently based on how it is presented or worded (Tversky & Kahneman, 1981). In other words, these are decision making problems were the descriptions of the problem are seemingly equal but still lead to different decisions.

concerning the possible effect of teaching Biophilia. These teachers and administrators appeared to love what they are doing and care deeply about both children and education. The Norwegian deviant case teachers were very similar to the Icelandic teachers in their education and background, but the difference in the degree of acceptance and support for the use of Biophilia within compulsory music education was highly notable. Keeping in mind the bias issue mentioned above, the most significant differentiator here seems to be whether or not they have taken part in a Biophilia workshop.

In any case, it should be clear that the workshops play an important role in the Biophilia Educational Project as a source of inspiration and motivation for the teachers, by way of introducing themselves to the concept in the company of their colleagues. For the teachers involved, the workshops held by the official project serve as an introduction to the concept, ideology and pedagogy of Biophilia. Sigmundur described the process of getting to know the apps more thoroughly through his initial participation as "eye opening", causing him to realise that the concept was much bigger than his original impression. It also changed his perspective on the app, from an artwork or "something to enjoy" into a tool for creative work. Later on, Sigmundur had a closer affiliation with the project through the steering group, and explained that he felt Biophilia was a good match to his pre-existing philosophy of teaching; "so when I got to work on the project, getting to know all the ideas behind it and to bring in my own, it really cemented my own philosophy".

My findings, although based on few informants, show a clear difference in attitudes and expressions of motivation for using Biophilia between the teachers who have undergone a Biophilia workshop (the Icelanders) and those who have not (the Norwegians). The Icelandic teachers, as well as the other Icelandic informants appear to be more unified and similar in their attitudes toward Biophilia and its pedagogical potentials. The Norwegian informants were, in general, more critical and discrediting of the app in particular as a learning tool. Even so, the Norwegian teachers were mostly positive to the concept and how Biophilia might motivate teachers and students to "think outside the box", but were especially critical to the role of, and focus on Björk, as a central figure. I wish to emphasise that the same teachers praised the concept, the music and Björk's innovative artistry, but were merely sceptical to these things being given political and promotional attention through an educational project. From my data, it appears likely that the workshops play an important role in forming the attitudes and motivation of teachers for using Biophilia.

8.8 Ownership and autonomy

The data material shows some degree of discrepancy between the Icelandic informants' experience of ownership and autonomy in teaching Biophilia and the predictions of the Norwegian informants. The Icelandic teacher interviewees expressed a high degree of independence and autonomy in their approach to Biophilia. Their use of the appsuite and/or concept would for the most part be supplemental teaching material within the framework of their everyday practice. The three teachers all identified with student-centred didactics. Birkir had a preference for rock band practices while Sigmundur and Ragnar would for the most part explain their use of Biophilia as an extension of their interest in multimodal teaching. I am assuming that these three teachers are not representative of the given population (Icelandic teachers), but their use of Biophilia might serve as examples of how Biophilia does not have to rely on a holistic project design to have value in compulsory music education, but might as well be used as an alternative source of stimuli and tool for creation. When observing Ragnar teach two lessons of Biophilia, there was a clear pattern of switching activities and rotating different sources of information and stimuli, and the use of iPads with Biophilia appeared to be appreciated by the students. It also seemed that many students stayed "on-topic" with their iPad activity, for instance designing Fibonacci/golden ratio-inspired geometrical structures in the Solstice songapp after being introduced to these structures from iPad videos and whiteboard illustrations.

Björk's representative, Helgi, said there had been situations in the Icelandic workshops where some teachers seemed to be in opposition to the teaching ideas, sometimes expressing feelings of being patronized. The teachers interviewed in my study were all actively choosing to take part in Biophilia in some way or the other, thus making it likely that they are personally motivated to become more involved with the material. If a school applies to take part in the official educational project without the full support and decisive participation of its teachers, it is likely that teachers would show less interest and openness in approaching the teaching principles of Biophilia. However, such a discussion would require more knowledge about the teachers involved to generate theory.

The interview data suggests that the musicological and didactic content of these workshops might, in some cases, be overly advanced, even for teachers with an education in music. Informant Ingibjörg, having observed one of these workshops, claimed that adult teachers taking part in these lessons sometimes become very confused and fail to see the connection between the musicology and science themes of the songapps. "I understood where they were

trying to go and what they were trying to accomplish, but… most people need five years of music study before they can grasp what it was all about", Ingibjörg said. "Sometimes people think that by using very simple terminology, you can make something understandable, but the music [of Biophilia] is really complex."

The manner in which the Biophilia teaching concept is presented in Learnteach and elsewhere can be understood as inviting and fairly open to interpretation and customisation, and not a script to be strictly followed. Still, teachers will have to be motivated and open-minded to make use of the learning material. By this reason, successful Biophilia teaching is likely to depend on whether teachers themselves have made the decision to use it and the opposite case would potentially invoke feelings of patronising. On a general level, it seems essential to take into consideration the importance of voluntary and motivated participation when designing art-based educational projects.

8.9 Biophilia as a product of Iceland's musical cultures

8.9.1 The Icelandic Rock Scene

Icelandic rock music has seen significant international success since the early 1990s, and at that time it was suggested that the Reykjavík rock scene found its originality through a synthesis of the nation's cultural inheritance together with international trends in rock and punk genres (Gudmundsson, 1993). Gestur Gudmundsson (1993) suggested that this development could be traced from the initial *rock era* of the late 1950s and early 1960s through beat, hippie, alternative & disco, punk and pluralistic genres, and that the musical development is strongly connected to the adherent youth culture of each era.

> Icelandic rock was born when rock artists finally managed to bring the spirit of rock'n'roll into the Icelandic language, a process that took several generations of youth culture. It made it possible for rock artists to express their feelings verbally, not only with body language, and thereby also gave them access to their rich literary heritage – on their own terms. From then on the music became more personal and more original because it was combined with words that truly expressed the musicians' feelings and attitudes (Gudmundsson, 1993, p. 58).

Björk, with Sugarcubes, were arguably a notable part of this establishment of *Icelandic rock* in the international music world (and Björk has continued having a significant role in this development through her evolution into avant-garde art music). Without claiming a correlation,

it would seem that the overseas interest in Sugarcubes, came from their releasing singles with English lyrics. Sigur Rós started becoming well known internationally at a time where they had released two albums in Icelandic and was making a third album, *( )*[38], that would be sung entirely in a made-up language (like Scottish band Cocteau Twins, and other innovative predecessors). Recent years have seen the success of indie rock bands such as Of Monsters of Men, as well as several less internationally famed, but highly acclaimed indie acts like Múm, Ásgeir Trausti, Emilíana Torrini and the electronic act GusGus. It is especially this strain of pop-oriented indie rock that appears to fuel the idea of the Icelandic rock scene representing something different than its European and North-American counterpart, especially when it comes to being inspired by Iceland's majestic nature.

Some researchers argue that the innovative and highly productive music scene of Iceland is a product of Icelandic music education and its strong roots in Icelandic culture (Prior, 2014) Others also point to the unique geological features of Iceland as a source of inspiration and aesthethic heritage (Mitchell, 2013). Besides, the country apparently has strong community practices of music, considering Faulkner's (2013) study and the numbers from the *Screaming Masterpiece* documentary suggesting that you would expect to find 12.000 music students and 3.000 choir singers in Iceland (Magnússon, 2005).

Not everyone agrees that Iceland *is* unique. Especially not Þórir Bogason of the *Reykjavík Grapevine*:

> So what is it about Iceland that leads to such great music? Every time you ask this, PR agencies piss themselves with glee and half of the music scene vomits a little. And so are born the stories of being under the influence of unique Icelandic nature—the stories that will get written about (because that's what this game is really about) (Bogason, 2012)

Bogason (2012) brings up Of Monsters And Men as an example, claiming that there is "nothing particularly Icelandic about them" and that this band has inspiration from acts outside Iceland and is "repackaged with commercial gloss and major label backing". He also weighs in on the popular notion of Iceland producing a disproportionate large amount of noteworthy music for its small population:

[38] Known to some as the "*Untitled*" album.

> Most existing commentary on the matter is pure fluff. My sense is that the small size of the Iceland's market forces musicians to appeal to more mainstream or widespread sensibilities. There is also something particular about Icelanders themselves that I think has a lot less to do with the influence of barren lava fields and more to do with an ingrained professionalism, Scandinavian utilitarianism and hard work ethic. (This is the type of story that does not get written about, because it doesn't fit the image we expect of musicians) (Bogason, 2012).

Bogason's main argument is that PR strategy is a significant factor in establishing the idea of inspiration from nature and environment in the Icelandic music scene. Although this argument is not generated through research, it is, at the very least, important to consider the possible effect PR and marketing on making Icelandic music appear unique, having a disproportionate-to-population success, or any other means of attractiveness to the international music industry and the masses.

8.9.2 The rock star effect

When it comes to Biophilia, all five informants in the deviant case interview, as well as Ingibjörg, felt that Biophilia first and foremost is a promotional tool for Björk's music. Ingibjörg, having more knowledge than the deviant case participants about the educational project, claimed that Biophilia's successful implementation in Icelandic schools with the support of local government, as well its distribution to other Nordic countries is also a matter of promotion and public relations. On one side, it is tempting to look at Biophilia as the ultimate manifestation of the Icelandic rock heritage with its innovative and otherworldly concept of fusing technology, music and nature (with actual references to natural phenomena as such). On the other hand, the critics may be right, and Biophilia's appeal may have nothing to do with Iceland and everything to do with Björk's marketing skills: the "rock star effect" of having *anything at all* appear more interesting and compelling through it being fronted by an internationally acclaimed celebrity.

In my interpretation of the interview data, I found that the more critical informants are to the alleged promotional aspect or rock star effect of the Biophilia Educational Project, the less likely they are to suggest any possible benefits or positive effects of bringing this project into schools. Interestingly, the deviant case informants and Ingibjörg were very expressive of their admiration for Biophilia as an *art piece*, more so than informants from the steering group or the Icelandic teachers.

These perspectives on the possible revenue-generating promotional intentions or the possible link between PR and attractiveness to schools and politicians does not have to exist on the same axis as the stated ambitions and intentions of the Biophilia Educational Project, but it is obvious that inheritance of one of these viewpoints is likely to affect one's level of agreement to the other. In my interpretation of the data, I find the opposites to closely relate on one aspect: The informants that had the closest affiliation to the project seemed to think and talk of Björk's function in the project as that of a mascot, suggesting that the children would not relate to her as an artist, or her music, as they would with "their own music". Further, they tended to deny Björk having financial motivations behind the project, pointing to the relatively low price for the app (equal to a CD album), the free teaching guidelines for everyone, and the free participation for schools in the Nordic countries.

Ultimately, this research can only confirm the presence of what appears to be contrasting views about Biophilia's nobility and its benefits for music education, and provide the interpretation that this project has been driven by factors like DIY-mentality, voluntary efforts, and a wish to make a difference and make changes in how people think of, and teach music. Whether or not the educational project has had an impact on Björk's record sales is unknown, and might also be a relatively uninteresting consideration. Biophilia is mainly a story of an educational project that attracted the enthusiasm and financing from the Nordic Council of Ministers, sufficiently to make all the Nordic countries take part in piloting and further development, something that does not seem to have been the case for any other similar arts project. An emerging theme in this investigation is that Biophilia is well received by both teachers and students, and may help provide a learning environment that is different from what is conventionally experienced in Nordic compulsory schools. It is non-intrusive and can be taught within the boundaries of national curricula, although some prefer to think of it as a purely extracurricular activity.

8.10 The wow factor

It is suggested from this discussion that the Biophilia learning environment indeed has an ability to awaken the curiosity and interest of teachers, students and politicians, and it is likely that Biophilia teaching can lead to outcomes unique to its environment. If this should be the case: is it the concept and pedagogical platform of Biophilia itself that leads to the learning outcomes observed by the project management, or could they be explained otherwise? Could it be that the concept itself plays a smaller role, and that the projects main contribution is to be found in its general qualities; being an immersive environment with a sense of multimodality that is seldom seen in compulsory music education (in lack of resources to do so)? In light of

Bamford's (2006) finding about the wow factor, the hard to identify determinant contributing to sense of excitement and unexpected outcomes; the Biophilia Educational Project may be an example of a project where the wow factor plays a major role. It appears self-explanatory that the wow factor is not necessarily one single factor, but might be a synergy of all the small changes and effects that such a project might represent in a classroom setting. Considering Bamford's (2006) suggested characteristics of quality arts education, the Biophilia Educational Project seems to be in compliance with most characteristics[39], as it is (1) based on an interinstitutional partnership; (2) features shared responsibility for planning and implementation; (3) has opportunities for performance and presentation; (4) both uses art as an approach to other learning goals as well as focusing on the art itself; (5) encourages critical reflection, (6) emphasises collaboration and (7) is accessible to all children. Besides, the enrichment of any learning environment through temporary or permanent technology, instruments or "eye-candy" might contribute to the wow factor, considering the tendency for poor resources usually allocated to the arts in schools (Bamford, 2006, p. 73).

It is not clear whether Biophilia is able to meet the criteria of featuring detailed strategies for assessing and reporting on children's learning, experiences and development; ongoing professional learning for teachers, artists and the community; and flexible school structures and permeable boundaries between schools and the community (Bamford, 2006). The learning goals within music, nature and technology are not expressively stated in the teaching guidelines. Rather, there are themes to be worked on, and the intentions might be easier identified in the general project objectives: things like promoting innovations in schools independent of classes, disciplines, age and physical learning environment and to "encourage young people's interest in creativity, natural sciences and technology" (Biophilia Educational Project, 2015). Unfortunately, it appears that these ideas are hard to translate to real world practice, with teachers possibly opting to use Biophilia as supplemental material within their established routines. Instead of devoting several days for a teaching project - discarding time schedules and separation of school subjects - teachers in this study seem to have found this too difficult and time-consuming to organise. Should this be the most common case, then the wow factor is found in the appeal of the artefacts and the associated teaching methods, even when taught within a conventional classroom setting. However, the data material is not rich in this regard,

[39] See (Bamford, 2006, pp. 88-89) for the exact bullet points used for comparison. Where the Biophilia Educational Project is partly complying with the criteria, a shortened version of the criterion in question is provided.

and other research designs in future studies would prove useful in determining the actual influence of such circumstances to Biophilia's wow factor.

There appears to be a strong connection in praise and feelings of awe surrounding Biophilia for those who have spent time and made an effort to immerse themselves in the concept, especially through participation in the workshops. Without making claims about correlation, it would seem that in learning about the concept and "realising that it's not just about the app" as one informant put it, contributes heavily to teachers' enthusiasm for teaching Biophilia and for active participation in developing the project. The three Icelandic teachers interviewed described their own philosophy of teaching and motivation for teaching Biophilia in terms of opposition of the "old system" or the existing conventions of how a classroom experience should be, and appear personally involved in advocating Biophilia from an interest in changing "the way people think about education" rather than an interest in promoting Björk's music.

9 Conclusion

This study has been a search for data that could help describe the Biophilia Educational Project and its artefacts, provide examples of how it has been used in schools and suggested ways of understanding the concept and its successes and flaws. The rationale for this study was the seemingly scarce amount of research having been done on Biophilia, and an apparent need to present a different scope than existing literature, as these would mainly seem to evaluate Biophilia as an end-to-end music education app. In presenting one way of understanding the wider concept, I hope to demonstrate the potential usefulness that Biophilia and its teaching principles might have for compulsory education. The study is based on an inductive, qualitative design that draws heavy inspiration from Charmaz' (2014) constructivist approach to grounded theory.

9.1 The concept is not what you think

Björk's Biophilia concept is simultaneously vast and detailed, and the Educational Project is an integral part of this unique vision. From the outside, the Educational Project is at risk of being thought of as built around the *Björk: Biophilia* iPad/Android app, presumably allowing the app itself to serve as the complete learning environment. The limited pieces of literature on Biophilia and its potential for learning seems based on this presumption, which leads to conclusions of incoherency and a lack of usefulness in education. In media, the app is commonly referred to as a "game", but there are also suggestions that one might learn some musicology through playing it. The data indicates that it is not unlikely that this "closed package" was an ambition in the early developmental stages. However, as the educational concept developed, the app was seen more as a tool or medium for creative work within a larger and more complex learning environment.

Thus, evaluating the Biophilia app based on its abilities as a stand-alone teaching tool or comparing it to m-learning platforms leads to disappointing results, and frankly, make little sense if one is willing to accept the perspective of Björk's larger concept: the unification of music, nature and technology. Not identifying with or accepting this intention is connected to criticism towards Biophilia's potential as a learning tool, and in particular negativity regarding its potential as a promotional tool for Björk.

Subordinately, teachers interviewed who have taken part in an official Biophilia workshop were likely to demonstrate more enthusiasm, find more teaching ideas and show a higher degree of appreciation for the Biophilia Educational Project than those who did not share their workshop

experiences. Criticism from "workshoppers" is mostly about technical problems with the app or with tablets, as well as difficulties with reorganising teaching practices within the physical limitation of their school environment. Teachers who were not familiar with the educational project discussed the app in terms of its usefulness for existing practices, fulfilling learning objectives in their national curriculum, and seemed especially concerned with what they found to be promotional objectives of Björk and her music. The teachers who were positive towards Biophilia demonstrated views that Biophilia harmonised with their personal ideology of teaching, representing a welcome change from conventional teaching practices based around "Western traditional" music and education traditions. However, these interpretations are based on few informants interviewed in varying settings, and this must be taken into account when evaluating the validity of this depiction.

9.2 There is something about Biophilia

Biophilia and the educational project have an aura of being something unique and special. Objectively, it is, as avant-garde concept albums by world-renowned alternative rock musicians, originally released for iPad and with intentions of teaching children about science, music and technology is not your everyday app purchase or teaching tool. Subjectively, looking for the building blocks of this aura has proven difficult, as is usually the case with art programmes in education. However, when analysing interview material from informants close to the project, there seem to be a strong sense of community in the project development. Further, it would appear that these informants think of the project as an extension of an Icelandic punk-rock mind-set, praising non-conformity and revolutionary thoughts, in this case challenging and changing general conceptions of teaching in schools as well as how music is made. I find this to be a significant contribution to the wow factor of Biophilia, as problems with community and inter-institutional collaboration seem to be the main obstacle for Biophilia in Nordic countries other than Iceland, besides the technical issues. The technical issues are not only noticeable, but seem to reduce songapp functionality by a large proportion in modern iPads with 64-bit architecture. The software bugs are less noticeable on older units. The Android version suffers from low fidelity audio. Interestingly, this did not seem to be a problem in my few sessions of observation, and according to the steering group members interviewed, this is mostly an issue for teachers. Children would "just restart the app".

The teaching guidelines and artefacts of Biophilia, have a very George Orwell-esque character to their names, and in lack of a better English word, I would like to propose that the successful use of Biophilia requires some degree of *doublethink.* The word stems from Orwell's classic,

dystopian anti-establishment science-fiction novel *Nineteen Eighty-Four* and denotes the concept of holding two contrary beliefs while accepting both of them as true. Seeing a potential in Biophilia seems to require a flexibility in teachers' personal philosophy of education, music and sometimes also a willingness to deviate from their existing teaching practice. The absence of such doublethinking, or being in disagreement of the educational projects values and ideology is obviously not a great starting point for using Biophilia in any educational setting. Some, like informant Birkir, would approach the iPad app as an alternative instrument and include that in compulsory music education as a "fun" and "different" activity. Such utilisation was also suggested by those who were mostly critical towards it, as an example of alternative music practices that is arguably different from music education of the past, as well as the music children commonly engage with outside school. It is however clear that the official Biophilia workshops contribute to teachers' attitudes toward Biophilia and to using it in their own practice, and increase the likelihood that teachers will find it valuable and enrichening in their learning environments.

One major discussion topic in the deviant case was the financial backing the project has received from the Nordic Council of Ministers, which the five participants found provoking based on a presumption that the educational system would better spend their resources on other areas, in addition to them finding it problematic that the project is so heavily based on Björk and her music. However, these participants were not familiar with Learnteach, thus made their judgement based on a perspective of the app as an end-to-end learning environment.

Interview data, as well as my own observations, suggest that Biophilia is able to engage children on a deep level, and despite the technical flaws of the app, is able to hold their concentration and focus for long durations of time. Children demonstrate an interest in working with the songapps, and do not seem bothered by the fact that the songapps may not offer much actual manipulation of samples or original sounds. In creating short musical phrases in Biophilia, they still appear to find pride in having made a piece of music, even when the qualities of this music may not be recognised as such by others. The multimodality and rich stimuli of a Biophilia classroom setting is also likely to be a good environment for children with learning difficulties.

9.3 Managing expectations

As described in the method chapter, this master project changed during its course on several levels. Initially, I held the belief that the app was in fact an end-to-end learning environment, but as I began collecting data, realised that this straight forward assumption was both wrong,

and not a suitable starting point for my research. Developing a clearer undersstanding of the Biophilia concept became a major part of my efforts, requiring the research to widen and change scope. I was somewhat intrigued when discovering the larger concept and learning that the appalbum itself was not really that important to anyone, and even within the Biophilia Educational Project the use of other apps is strongly encouraged for covering the grounds of music and natural sciences. In spite of this, I was surprised to see how well the Biophilia app worked in a classroom setting. Seeing students making small pieces of music and seemingly taking pride in what they made, even if it was just a couple of seconds of sounds with a varying degree of pleasantness that would hardly be listed for airtime on any major radio station anytime soon.

9.4 Delimitations

According to Antony Bryant (2014, p. 120), one major pitfall of qualitative research is "failing to offer more than impressionistic (re)description – that is, simply taking various accounts or observations of some domain of interest and weaving them into a narrative with little or no conceptual depth or practical relevance". As a novice researcher, this has been on my mind throughout the process of developing this thesis. The main body of data for my research consists of interviews, supported by documents, digital media and classroom observation. The data is thereby highly subjective in nature, and most units of data reflect personal viewpoints to a significant degree. Three of my informants had a close affiliation to the organisation of the Biophilia Educational Project, and one had been a part of Biophilia since the original studio sessions. The Norwegian educators whom participated in the deviant case were also a fairly homogenous group, in having a somewhat similar educational background and work experience. On one hand, the informants might represent diversity, and to some degree, extremes in terms of viewpoints and attitudes. On the other hand, this is likely to have led to an early saturation of categories that may have too rapidly solidified. Because of the subjective nature of the data, my own analysis included, possibilities of conclusiveness in establishing theory from the categories is limited.

9.5 Implications

The findings of this research may prove useful to anyone searching for more in-depth knowledge about Biophilia and its educational project. Hopefully, this thesis is able to provide a thorough case description demonstrating a wider scope than the more common "learning-something-by-playing-video-games" branding that Biophilia seems to have achieved. This is useful as an example of the complexity surrounding the wow factor of this and similar projects.

Teachers should be aware of prejudice and preconceptions when approaching or considering teaching an educational project of external origin, as actively seeking an understanding of the intentions, goals, and concept of an educational project would appear fundamental to whether or not a potential for enrichment of learning environment is seen. Further, Biophilia is an example of a project that encourages omitting time schedules and conventions about subject- and classroom organisation, which at the same time is one of the stated main objectives of the project. Even so, many teachers would seem to rather use the teaching ideas and artefacts within their ordinary practice. In deviating from this practice, there is a change in the learning environment that allows for a different approach to classroom activities, but is also more challenging in terms of management and organisation.

The Biophilia Educational Project has the potential of awakening enthusiasm and energy in teachers and school administrations. At the lowest level, it can represent a novel supplemental activity in music and natural science education, but at the higher level the project seems to reflect some teachers' ideological and philosophical standpoints on education to a larger degree than what national curricula do. In such cases, schools and their teachers, as in the two observed, seem able to create new learning environments that break with children's expectations, allowing them to explore and create on different terms than what is normally seen in compulsory education. Politicians have to be aware of the potential implications of financially supporting selected arts projects, as this may seem unjust towards other projects or even towards curricula objectives in the perspective of some teachers. This is then likely to lead to opposition toward the project and its objectives, even when those in opposition identify with and enjoy the content and artefacts.

Biophilia is not suitable as an end-to-end learning tool, but this is fully understood among the project's management. The app is aging quickly, not having seen much change since 2011. While the app is technically flawed, the idea of using an app interface with touch screen control, having original, unconventional musical input and being designed for educational purposes is something that had yet to be designed and implemented and should be a welcome addition to music education. Many appear to appreciate what Björk *tried* to do with Biophilia, and despite some technical flaws its vision seems both noble and innovative.

Approaching Biophilia from a quantitative perspective would be useful to contrast the interpretations of this thesis. Learning more about the teachers involved, their personalities, political orientation, age, experience and other factors could help establish causality in the

understanding of why teachers engage in teaching Biophilia and similar concepts, and predict whether or not they are likely to work actively for their school to take part. Further, knowing more about the Biophilia Educational Project's implementation in the other Nordic countries would be of interest to challenge the idea of a "Reykjavík bias" in its ease of distribution and the size of its supporters.

9.6 Final remarks

In doing this study, I sought to explore the Biophilia Educational Project and its artefacts, in an attempt to generate a thorough understanding of its concept and its implications for music education. Furthermore, I wanted to learn more about the elements of Biophilia that may have contributed to its "wow factor", in order for this knowledge to be available for future design, implementation or improvement of similar extra-curricular arts education programmes. Biophilia is a vast and deep concept that is both a milestone in Björk's artistic career, introducing a approach for consumption of music as well as being an innovative and elaborate educational project that has seen significant support and praise in the Nordic countries. However, the actual classrom practice of Biophilia teaching appears to vary significantly between different settings. Teacher's motivation, philosophy of teaching and degree of participation in the official Biophilia Educational Project are seen as the significant differentiators. Moreover, questioning the nobility of Biophilia's intentions (in contrast to its promotional fuction of Björk's music) is likely to lead to opposition towards teaching Biophilia. Biophilia's "wow factor" is not easily discovered, but it seems obvious that the depth, diversity, rich learning environment play important parts. Further, the fact that the project has been granted much attention both in mainstream media and with politicians suggest that the "halo effect" of Björk's celebrity status is a significant contribution to the "wow factor". It is obvious that not every arts education programme have the luxury of being fronted by a world-renowned artist, but as shown in this thesis, this can might as well lead to begrudgement.

Biophilia is aging quickly and the technology is ever evolving. I am certain that the next generation of arts education projects based on unique technology will improve upon current solutions and designs: bringing multimodality and rich learning environments to mobile units globally and evoke even larger discussions about compulsory music education, learning, aesthetics, benefits and financial interests. There is a certain chance we will look back and see how Biophilia might have paved the way.

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Appendix

Norsk samfunnsvitenskapelig datatjeneste AS
NORWEGIAN SOCIAL SCIENCE DATA SERVICES

Harald Hårfagres gate 29
N-5007 Bergen
Norway
Tel: +47-55 58 21 17
Fax: +47-55 58 96 50
nsd@nsd.uib.no
www.nsd.uib.no
Org.nr. 985 321 884

David Hebert
Senter for kunstfag, kultur og kommunikasjon Høgskolen i Bergen
Landåssvingen 15
5096 BERGEN

Vår dato: 25.08.2015 Vår ref: 43961 / 3 / MSS Deres dato: Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 02.07.2015. Meldingen gjelder prosjektet:

43961	*The learning environment of the Biophilia Educational Project*
Behandlingsansvarlig	*Høgskolen i Bergen, ved institusjonens øverste leder*
Daglig ansvarlig	*David Hebert*
Student	*Bård Vågsholm Husby*

Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger er meldepliktig i henhold til personopplysningsloven § 31. Behandlingen tilfredsstiller kravene i personopplysningsloven.

Personvernombudets vurdering forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvern/meldeplikt/skjema.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://pvo.nsd.no/prosjekt.

Personvernombudet vil ved prosjektets avslutning, 09.10.2015, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Katrine Utaaker Segadal

Marie Strand Schildmann

Kontaktperson: Marie Strand Schildmann tlf: 55 58 31 52
Vedlegg: Prosjektvurdering

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

Avdelingskontorer / *District Offices*:
OSLO: NSD. Universitetet i Oslo, Postboks 1055 Blindern, 0316 Oslo. Tel: +47-22 85 52 11. nsd@uio.no
TRONDHEIM: NSD. Norges teknisk-naturvitenskapelige universitet, 7491 Trondheim. Tel: +47-73 59 19 07. kyrre.svarva@svt.ntnu.no
TROMSØ: NSD. SVF, Universitetet i Tromsø, 9037 Tromsø. Tel: +47-77 64 43 36. nsdmaa@sv.uit.no

App. 1 Letter of approval from NSD

Fra: **Marie Schildmann** marie.schildmann@nsd.no
Emne: Prosjektnr: 43961. The learning environment of the Biophilia Educational Project
Dato: 5. januar 2016 kl. 11.20
Til: bard.vagsholm.husby@stud.hib.no

MS

Hei,

Jeg viser til endringsmelding mottatt den 15.12.2015 vedrørende supplerende metode for datainnsamling. Vi registrerer at dert vil gjennomføres observasjon av lærerstudenter i forbindelse med bruk av en applikasjon til iPad. Det skal også gjennomføres oppfølgingsintervjuer av de samme lærerstudentene. Personvernombudet mottok i tillegg en endringsmelding den 09.10.2015 vedrørende en utvidelse av antallet intervjuer i den opprinnelige datainnsamlingen. Vi betrakter ikke det som en vesentlig endring, men registrerer at dato for prosjektslutt i den forbindelse ble endret til 31.12.2015. Det fremgår av endringsmelding og informasjonsskriv at data som innhentes anonymiseres fortløpende. Deltakerne kan være identifiserbare overfor hverandre, men er gjort oppmerksom på dette. Basert på informasjonsskriv vedr. den planlagte observasjonene og påfølgende intervjuer, registrerer vi 01.03.2016 som dato for anonymisering/prosjektslutt. Du vil da motta en henvendelse fra oss vedrørende status for behandling av personopplysninger.

--
Vennlig hilsen
Marie S. Schildmann
Seniorrådgiver

Norsk samfunnsvitenskapelig datatjeneste AS
(Norwegian Social Science Data Services)
Personvernombud for forskning
Harald Hårfagres gate 29, 5007 BERGEN

Tlf. direkte: (+47) 55 58 31 52
Tlf. sentral: (+47) 55 58 81 80 / 55 58 21 17
Email: marie.schildmann@nsd.no
Internettadresse www.nsd.no/personvern

App. 2 Letter from NSD in relation to expansion of methodology

Research interview about the Biophilia Educational Project
Information letter

My name is Bård Vågsholm Husby, and I am conducting research on the Biophilia Educational Project, focusing on how teachers incorporate it into their teaching. The study is a qualitative study based on interviews with informants who are familiar with the teaching of *Biophilia,* both as teachers and project developers. With this research, I am hoping to generate knowledge on how the use of Biophilia teaching principles, and its potential implications for the future of music education.

I am inviting you to be an anonymous informant for my research project. This will be a semi-structured interview with open questions about your thoughts, ideas and experiences with the project. There should be no need for you to prepare for the interview. I will record our conversation and transcribe it for further processing. My research project is reported to, and approved by the Data Protection Official for Research, Norwegian Social Science Data Services. The Icelandic Ministry of Culture, Science and Education and the steering group for Biophilia Educational Project are also informed of my research project.

Participation is voluntary. You are free to abort the interview at any time without stating a reason for it, and without it having consequences. You may also decline to answer questions. There should be no risk or discomfort involved in this project. To minimise the risk of compromising your confidentiality, any direct or indirectly identifying information will be left out of the transcript, and the digital file will be deleted after transcription is complete, no later than December 31 2015. In including data from the interview in my thesis, it will be adapted so your identity will not be recognisable. My thesis will be completed by mid May 2016.

There is no compensation involved, but I hope you share my interest in researching *Biophilia,* and that you find value in sharing your thoughts on the project.

If you have any questions about the interview or my research in general, please do not hesitate to contact me at (+47) 452 03 433 or my supervisor Professor David Hebert ((+47) 450 30 892).

Best regards,

Bård Vågsholm Husby
Master student in Music Education
Bergen University College, Faculty of Education

Du inviteres til å delta i et forskningsstudie som har til hensikt å undersøke fenomenet Biophilia Educational Project – et prosjektbasert utdanningsprogram for mellomtrinnet laget av artisten Björk i samarbeid med Universitetet på Island og lærere i Reykjavik. Forskningsstudien er en del av mitt arbeid med masteroppgave i musikkpedagogikk ved Høgskolen i Bergen. Biophilia Educational Project kjennetegnes av innføring av prosjektarbeid i en periode på mellomtrinnet, hvor to eller flere lærere samarbeider om å undervise tverrfaglig og emnebasert, med fokus på emner fra musikk og naturfag. App-albumet *Biophilia* for iPad og Android er et sentralt verktøy i programmet. Jeg har allerede gjort en del datainnsamling i Reykjavik, hvor jeg har observert Biophilia-undervisning og intervjuet lærere og andre med tilknytning til programmet. Studien du nå inviteres til er en oppfølging av det jeg har gjort fra før og er et forsøk på å kontrollere funnene.

Studien innebærer et forsøk hvor du vil bli bedt om å utforske en iPad-app i eget tempo og uten instruksjoner. Det gis inntil 45 minutter til denne seansen. I etterkant av forsøket vil du bli bedt om å ta del i et gruppeintervju.

Det vil bli benyttet videoopptak for å muliggjøre tilbakevirkende observasjon. Det vil også gjøres lydopptak med håndholdt opptaker av dette intervjuet. Opptak vil forbli på minnekort i min besittelse frem til senest 1. mars 2016 for deretter å slettes. Opptakene vil kun være tilgjengelig for meg og veileder, og vil behandles konfidensielt. Det vil ikke kobles personopplysninger til opptakene, men forsøket er meldt til NSDs personvernombud da video i prinsippet er identifiserende. Lydopptaket transkriberes og filene slettes innen 1. mars 2016. Eventuelle direkte eller indirekte identifiserende opplysninger vil anonymiseres i det skriftlige materialet.

Din deltakelse vil være kjent for inntil 5 andre deltakere i tillegg til meg selv og veileder. I masteroppgaven vil du være omtalt anonymt, eventuelt med et alias slik at du ikke skal kunne kjennes igjen. Det er likevel en mulighet for at andre deltakere vil kunne gjenkjenne deg i det skriftlige materialet. Studien omhandler ikke sensitive eller personlige temaer, men vil være knyttet til dine faglige opplevelser og vurderinger. Studien skal ikke medføre noen ulempe for deg som deltaker. Det er dessverre heller ingen kompensasjon involvert, men jeg håper likevel du finner verdi i å delta.

Deltakelse er frivillig, og du kan når som helst trekke deg fra studien uten å gi begrunnelse eller at det medfører konsekvenser for deg. Ved oppmøte vil du bli bedt om å gi et informert samtykke, hvor du bes om å signere på at det overnevnte er lest og akseptert.

Oppgaven ferdigstilles og leveres medio mai 2016.

Spørsmål kan rettes til meg, Bård Vågsholm Husby på bard.vagsholm.husby@stud.hib.no / tlf. 452 03 433 eller til veileder prof. David Gabriel Hebert på dgh@hib.no / tlf. 450 30 892

Vennlig hilsen

Bård Vågsholm Husby
Masterstudent i musikkpedagogikk
Høgskolen i Bergen

App. 4 Deviant case information letter

Interview guide - teachers

1. small talk

2. Information
    a. My research project
    b. About the interview and its purpose
    c. Audio recording. Tell the subjects about the reason for recording audio, how it will be used, and how their privacy will be protected.
    d. Questions?
    e. Connection to the Biophilia Project

3. Experiences
    a. Private use of ICT and other tools. Prior use in music education? Other experiences with digital tools?
    b. When/how were you introduced to BP?
    c. Initial thoughts/reflections on the Biophilia-project

4. Discourse questions
    a. The music subject and the use of ICT in schools
    b. Cross-subject/interdisciplinary work
    c. Teacher's autonomy in Biophilia teaching
    d. Does biophilia affect your work as a teacher? The learning environment?
    e. Is Biophilia unique/different from other digital platforms? How?
    f. The qualities of the iPad-app

5. Conclusion
    a. Anything to add?
    b. Questions?

App. 5 Example of interview guide

Intervjuguide negativ case

1. Umiddelbare reaksjoner
    a. Var noe interessant?
    b. Mindre interessant?
2. Lodde ut hvilke sangapper som ble flittigst brukt. Diskutere én og én (prioritere de mest populære – tidsavhengig)
    a. Beskriv opplevelsen
    b. Hvilken type instrument/verktøy er dette?
    c. Tanker rundt koplingen til natur/naturvitenskap
3. Kan dette brukes i musikkundervisning?
    Hvordan?
    Ser du koblinger til eksisterende praksis?
4. Ville du selv benyttet disse verktøyene I musikkundervisning?
    a. Hvorfor/hvorfor ikke?
5. Styrker/utfordringer ved appen
    a. Hva kunne vært annerledes for å bedre opplevelsen og bruksområdene?

    Oppsummering/evaluering av økten