

# WII-BÄNDI: designing an expressive digital musical interface for group therapeutic use with disabled people

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<b>Tiivistelmä - Abstract</b> <p>This thesis presents the developmental prototype of a gesturally controlled digital musical interface. It is called Wii-bändi, as it uses Nintendo Wii controllers to translate the gestures into music, and is constructed specifically for clients with a variety of physical and mental disabilities so that they can use it in a therapeutic group context. It is argued that gestural and emotional expressivity might be based on a theory of vitality affects, and that optimal learnability could be achieved through making use of learning schemas. It then sets out how the interface was created using a methodological approach based on action research, describing the specific contexts that led to the changes that were made to the set-up, over a period of approximately one year (between November, 2008 and December, 2009). The research is split into three cycles. The first explores the specific wishes of the group in question, establishing the core members and core values for the group who are to use the interface; the second progressively develops the interface along those lines as far as is possible, given the limits of the technological tools available; and the third consolidates what has been achieved by finding the optimal way to use the interface constructed. This was found to be a form of musical role play which is covered in greater detail in the last chapter of results. Finally, there is discussion of how best to avoid some of the technical issues that befell Wii-bändi, and the conclusion describes how the interface presents a viable model for using modern music technology to work with disabled people in the future.</p>	
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# CHAPTER 1 - INTRODUCTION

I was drawn to the topic of this thesis, by three simple facts: one is that the feelings I experience when listening to music make me move. They *literally* move me, in that I move my body in some way. The other is that I find a similar tendency to jump or move, even as a fully-grown man, when I experience joy, pride, frustration and many other emotions in less musical aspects of my everyday life. And thirdly, I drum. It is this connection between motion, emotion and music which, I believe, is intrinsic to music's therapeutic value. If an interface could be designed using technology so that the gestures (however uncoordinated they may be) made when experiencing emotions while listening to music were enough to *express* that music and contribute to it as well, then it would be a truly therapeutic musical instrument for people without musical training. It would also have more varied sounds than a drum. Furthermore, the technology could be tailored so that less physically able people could also benefit from such an interface. For the purposes of this thesis therefore, I explored the possibilities of using Wii controllers as an expressive interface for creating music, so that a variety of instruments could be played on the same interface easily, intuitively, harmoniously and (most of all) with pleasure by a specific group of disabled people in a group setting.

It would be no mean achievement if the release of energy that music, and the emotions around it cause, could somehow be harnessed. How we feel when we play or listen to music is what makes it so powerful a medium. Nevertheless, unless you have musical training, it is not always easy to harness the natural movements that accompany such emotions to actually *make* music. There has already been some research into interactive musical interfaces that use gestures to control emotional features in the music (e.g., Friberg, 2005., Castellano et al., 2007., Ulyate & Bianciardi, 2002.), however the emphases in each of these studies have been slightly different my own. For most people it takes years of practice at one instrument to express themselves adequately in the way they want. Others content themselves with active listening: singing along, tapping feet, or dancing. And there are others who might have once done all these things, but are now ill or have had accidents and consequently feel they can no longer enjoy music in such a way. The present study addresses specifically this latter group of people, but with the broader picture in mind. It takes into account how emotions find expression in music, and how current technology might make this musical expression easier to achieve for a wider range of people.

Early in 2008 I was introduced to the idea of using Nintendo Wii controllers as a means for controlling musical instruments. My research then focussed on an expressive digital interface, in the hope that the wide variety of musical parameters and sounds that can be generated on a computer, with the help of an up-to-date digital audio workstation

(DAW), could be tapped in a more intuitive, and specifically user-friendly way, than with the traditional human-computer interface: keyboard and mouse (Machover et al., 2004).

By using Wii controllers with the software packages Ableton Live and Osculator, I was able to perform a small concert at university that got positive feedback, and went on to demonstrate the interface at a conference (Reed et al., 2008). During this period I thought more specifically about the end users, in other words adapting the interface for children and/or disabled people. Eventually I was lucky to be put in touch with a home for the disabled in Helsinki, so this became the focus clientele for my thesis. In the space of a year, regular monthly trips were made to try out new versions of the software with the clients (except for a month in the summer), and this thesis is based on an account of that project. The project was called Wii-bändi, as the most tangible part of the interface for the clients was the Wii (not the computer software behind it), and the people I made it for were all Finnish. Indeed, by the end of the year there was a definite feeling of playing in a “bändi” together.

The idea was to provide an activity which is fun, motivating and stimulating, both on a mental and a physical level. To do this the instruments needed to be sufficiently easy and intuitive to control, and yet equally challenging to encourage some effort, and therefore satisfaction, when a degree of mastery was achieved. This balance between a low threshold for learning and a relatively high ceiling for performance ability (Wessel & Wright, 2002) has been key to the project’s most successful moments.

The group nature of this study, into seeing what does and does not work in a particular context meant the most appropriate methodology for the study was action research. All through the project, feedback was very important: not just from the clients who used the set-up, but also the staff at Invalidiliitto, as well as colleagues at the university. This took many forms (verbal, non-verbal, written, English and Finnish) and informed changes that were made for future sessions.

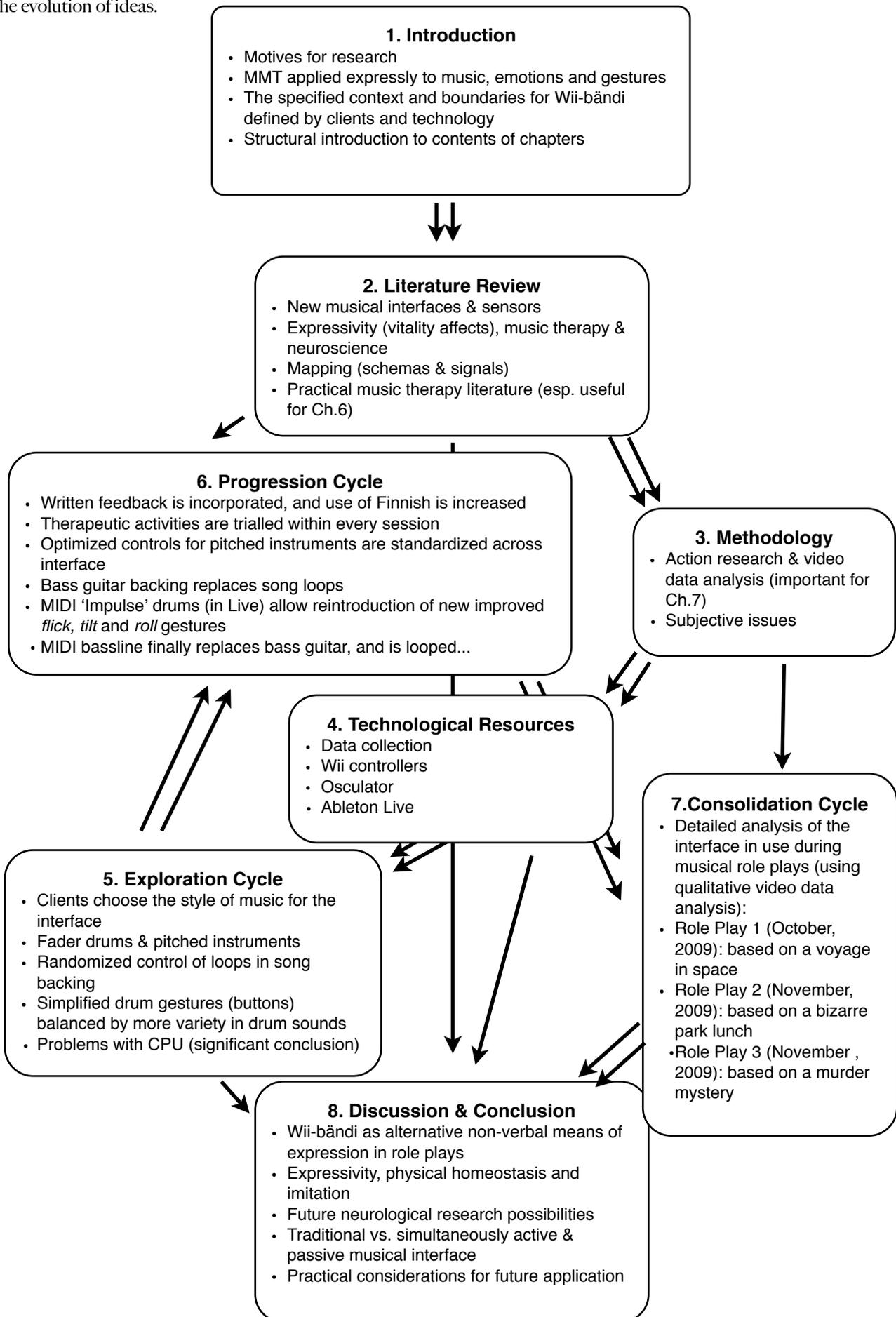
In essence I took a concrete situation (working with disabled people) that required me to create a specific environment in which participants could make expressive music. The subject was particularly appealing because the nature of the Music, Mind and Technology degree, as a whole, encouraged a multidisciplinary approach (quite often three-pronged) and this thesis topic certainly required one. In terms of the *music* aspect, I used a multifaceted DAW (Ableton Live) which required practical familiarization with a lot of musical parameters; in terms of *mind*, the participants were people overcoming physical and mental handicaps of one form or another, and were interested in a new therapeutic activity, so issues in music therapy and psychology were relevant; and in terms of *technology*, the project involved familiarisation with all that was necessary to effectively map signals from the Wii controllers to Live using a graphical user interface called Osculator (Troillard, 2009).

This thesis therefore describes the development of a prototype. It is due to the cyclical nature of the methodology that old ideas have either been returned to, or

jettisoned. This is covered more fully in chapter 3, but in essence, action research means that the project goals are not only the researcher's goals, but have to be shared among all the participants (Baker, 2007). Therefore a description of the clients backgrounds is included in the chapter on methodology, as they are a very important part in the design of the interface. This thesis was only one of the goals behind Wii-bändi. Another was to try and create an application that could be used without me having to be there as an afternoon's therapeutic activity. The hope was that it could be shown to other clients besides just the ones who participated in our project, and adapted for use by the staff. Finally, data in action research is collected in a different manner to other, more quantitative research, so I set out at the end of chapter 3 how the results collected over the months form a series of cycles.

Another essential aspect to understanding the implications of the results is to have the necessary knowledge of the equipment used, and how it works. The fourth chapter, therefore, details the hardware and software used so that, not only is the reader familiar with the key terms, but also the technological limits within which the research was carried out. The results, and how these affected developments for the next cycle of research, are laid out in chapters 5,6 and 7 (with specific reference to the video clips which are chapter referenced on the accompanying DVD - appendix D). Each chapter describes a series of visits (and changes to the Wii-instruments accompanying them) that mark a distinct phase or cycle in the project's development. Chapter 7 also includes three specifically annotated clips of video from the final cycle to bring the results to their conclusion. The concluding chapter is a discussion of possible future developments for the Wii-bändi application, and how it might be used by practising music therapists, with a view to further doctoral research and its use in other possible contexts.

Figure 1.1: Chapter plan for this thesis showing the main (double arrow) and tributary (single arrow) pathways taken in the evolution of ideas.



## CHAPTER 2- Literature Review

### 2.1 New Musical Interfaces & Sensors

Let us first look at the interface between human and instrument. How do we get the required gestures to act upon an instrument? Musical software instruments are normally controlled with devices that are either derived from traditional mechanical and electro-mechanical instruments, such as the piano keyboard, or with generic (i.e., not musically oriented) input devices, such as the alphanumeric keyboard and the mouse. The Nintendo Wii controller is of course designed for use with a games console. It has several ways of translating gestures into signals that can be sent to a computer. Apart from traditional



Figure 2.1: Cullen using wire loop aerials to control theremin (Jones, 2004)

Dancing, as a way of playing a musical instrument, is an attractive proposition for designing a truly *expressive* interface!

These early gestural interfaces are significant for this research, as I wanted to include a theremin sound, even if it was to use a different sensor technology. The reasoning for this was to explore a variety of rationales for mapping particular instrument

game controls such as buttons and a joystick, it has accelerometers, which means that a wide variety of circular, vertical and oscillatory movements can also trigger signals and musical parameters. It is the possibility of these gestures which could make it a very interesting digital musical interface (DMI).

Instruments controlled with 'empty-handed gestures'<sup>1</sup> (Miranda & Wanderley, 2006) of the kind accelerometers are capable of detecting, have triggered music in the past, and indeed in the present, with other kinds of sensor. As early as the 1920s, the theremin, with its distinctive ethereal wail, has relied on capacitive sensors to detect shifts in movements of the hand. The freedom that this kind of musical controller allows inspired the dancer Philippa Cullen, in the 1970s, to try and control this instrument through dance moves alone (Jones,

<sup>1</sup> Gestures for which no physical contact with a device or instrument is involved.

sounds to gestures. One rationale was to see if sounds already culturally associated with sweeping gestures through the air (i.e., the theremin) made the instrument's design more appealing than for other instruments, where the same gesture delivers an atypical musical sound (e.g., just tilting the hand to play a saxophone).

One could say that because the Wii controllers have to be held in the hand, they are not being triggered by empty-handed gestures after all but, more strictly speaking, gestures in the air. Nevertheless the fact is that without touching any obstruction other than air when moving the controller, musical parameters are changed. So in most cases the gestures required are non-typical of traditional musical instruments. And it should also mean that the clients, for which Wii-bändi has been specifically designed, can create music more easily than on a traditional interface.

In the past many previous digital musical interfaces have looked to professional musicians and hence the paradigm of traditional musical interfaces to find their design niche, for example strings in the case of the 'V-bow' (Nichols, 2002); or wind and brass for 'The Pipe' (Scavone, 2003). This gets around the problem of whether they are 'easy to learn' by partly avoiding the problem, and targeting professional musicians who would already have skills that could be easily transferrable to the new interface. Such interfaces might be difficult to master for a non-musician, but they would allow for a greater freedom of expression and expertise once mastered.

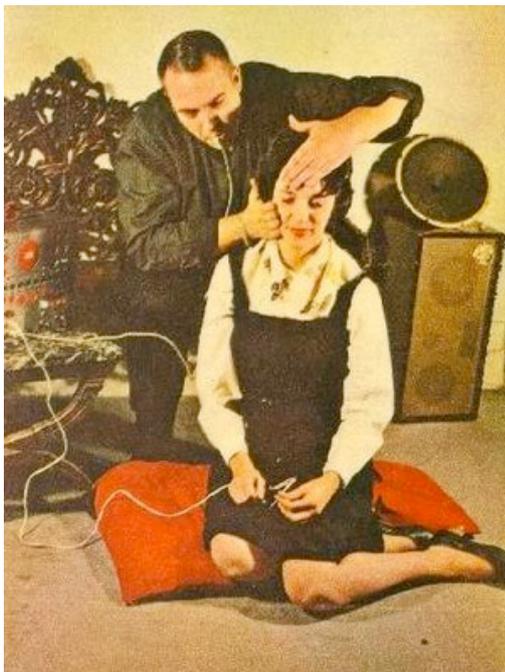


Figure 2.2: Bruce Haack's "Dermatron" or "Peopleodian"

Other new musical interfaces have tried for what I would term *novelty value* and hence more outlandish ideas. As far back as 1965 Bruce Haack demonstrated on American TV his "Dermatron", or "People-odeon" as it was also known, an invention of his that allowed one to 'play' people using the different pressures and other parameters of skin-to-skin contact to control the pitch and ADSR<sup>2</sup> of a number of oscillators. The person would be sitting on aluminium foil, with a wire going from it to the oscillators, while Haack would be wearing a metal bracelet also wired to the instrument. He would be able to 'play' the person by touching their forehead in different ways - the larger the contact, the lower the note<sup>3</sup>. You could say this gets round the problem of whether it is easy to learn, by making that problem less important than the new one that springs to mind: 'is this novel and different?' Certainly for the era, and

<sup>2</sup> ADSR is an acronym for the attack-decay-sustain-release envelope in sound synthesis

<sup>3</sup> <http://www.krokeai.com/Krokeates/Arts/Praxiteles%20Pandel/Praxiteles%20Pandel.htm>

the kind of TV show it was on, making music by touching people was novel enough to be almost taboo (Anagnos, 2004). A little bit later, the Finnish electro-acoustic pioneer Erkki Kurenniemi based his DIMI-S on a similar idea: the pitch of the instrument was changed by the amount of surface area touching between players (Ojanen et al., 2007).



Figure 2.3: Squeezables (Weinberg, 2002)

More recently another kind of musical interface with almost as much novelty appeal, has been the 'interactive dance club' (Ulyate & Bianciardi, 2002) where music playing in a club was controlled by danceable gestures. The interface and musical content were designed to reward movement, dancers' actions elicited an immediate and identifiable response, and instructions were not included as the interface was supposed to be intuitive. These three features have also proved significant in the design of the Wii-bändi interface.

But for the purposes of this study I wanted something somewhere between these two paradigms of *professional* and *novelty* instrument - so that it would be motivating because there was something novel and different about it, and yet also worth persisting with, because with increased mastery of the controls would come more musical possibilities. In this way it could later be used as a tool for music therapy. Weinberg calls this 'bridging the thoughtful and the joyful' (Weinberg, 2002). Choosing a fun and different interface from a games console context is an attempt to find a low ability entry threshold, and the manifold possibilities of Live, and the fine scaling of Osculator are intended to provide the means for as high a performance ceiling as possible (within the restrictions of the given technology).

New interfaces for musical instruments are rarely commercially available, and nor are they ready-made. Accelerometers have been used quite a lot in previous expressive digital musical interface designs such as the Musical Playpen (ibid.), Fireflies, Squeezables (ibid.), and Beatbugs (Aimi, 2002), but these all had to be built from scratch (figures 2.3 & 2.4). Another practical issue with Beatbugs was found to be wires that became unattached. In contrast, Wii (and its companion "Nunchuk") is widely available, wireless and can be used independently of a games console.

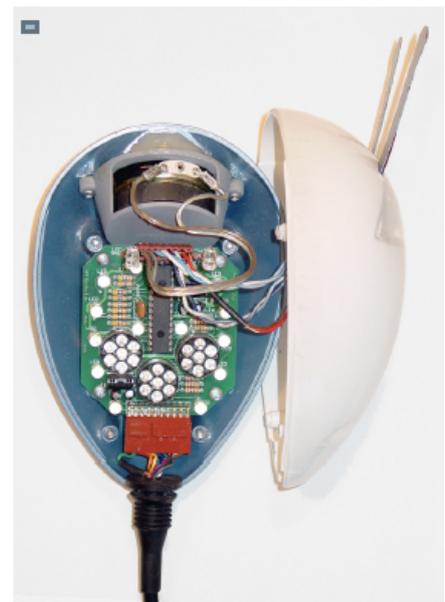


Figure 2.4: The innards of a Beatbug (Aimi, 2002)

## 2.2 Designed for Expressivity

Collins (2006) notes the ‘close relationship between music and human movement’ (Clarke, 1999b, page 494), and points out that this is backed up by many recent neural imaging studies, which show co-activation of auditory and motor areas (Janata and Grafton, 2003, Ferrandez et al., 2003, Lewis and Miall, 2003, Griffiths et al., 2001, Schubotz et al., 2000, Grahn, 2005). In addition, Fraisse asserts ‘all of the rhythms that we perceive are rhythms which originally resulted from human activity’ (Fraisse, 1982, page 150). Neil Todd’s model of musical expression in dynamics (Todd, 1992) and in earlier papers for tempo, explicitly uses a dynamic system based in kinematics, a point that Fraisse’s review also makes from a wealth of supporting evidence. This indicates haptic motion is at rhythmic rates, and perception of beat prefers a foot-tapping tempo.

So if music creates a haptic feeling, through kinematics, of movement at rhythmic rates, and emotions move us, then movement is central to understanding the relationship of music and emotions. But what gestures should be chosen for Wii-bändi, if we are to make it a truly expressive instrument, and one that could be used in a therapeutic situation? Ideally if people could make music (and not uncoordinated noise) by moving more easily in the way they feel, then possibly the ultimate expressive musical instrument would have been designed.

In developmental psychology, the term ‘vitality affects’ have been used to describe emotions in terms of their intensity over time (in other words their shape and flow), as opposed to their semantic content. They are described in terms of kinetic or dynamic qualities such as ‘surging’, ‘drawn out’, ‘explosive’, ‘fleeting’, or ‘fading away’ (Stern, 1985). This resembles the flow of energy, and indeed emotion, in music. I believe these are the most tangible parts of emotion that music can most clearly represent, more tangible than more semantic definitions of emotion.

Surprisingly only a few music and emotion studies take this emotional ‘flow’ into account, even though both phenomena change as a function of time. As Eerola and

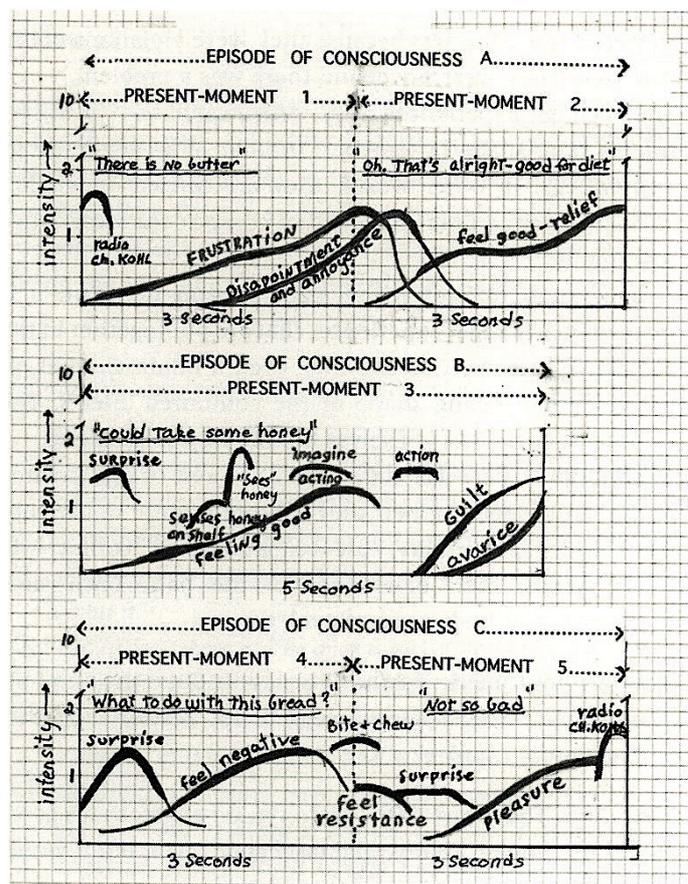


Figure 2.5: Vitality affects from ‘micro-analytic’ interviews (Stern, 2004).

Vuoskoski (2010) note in their review of this literature, there are only a few studies where participants continuously self-rate their emotions (Schubert 1999, 2001, 2004; Lehmann & Sloboda, 2001; Grewe et al., 2007; Luck et al., 2008) in order to try and capture the moment-by-moment fluctuations in emotional experiences, and yet even these studies continue to focus on the semantic content. The problem with analysing affects, feelings or emotions in this way, is that the techniques needed to deal with such data are a great deal more complicated. Also, perhaps more importantly, it takes extra effort for the participants to concentrate on temporal fluctuations in their own emotional experience. This translation problem has sometimes been described as the 'semantic gap' (Leman, 2008). In comparison, physiological and neural measures are almost by definition temporal in nature, and in these cases the temporal dynamics involved are usually better developed.

Describing exactly what these emotions are or 'mean' has less to do with music, and more to do with language. Keeping away from traditional content-based descriptions of emotions when experiencing music, and instead focussing on the shape of how the emotions unfold over time, might be a more accurate way to express them physically, musically, and eventually verbally (if necessary). In addition it would be closer to what is actually physiologically happening. Ideally Wii-bändi would become an interface where these sort of issues could be explored further, as although some studies have tried to analyze movements during music-induced emotions (Boone & Cunningham, 2001; Camurri et al., 2003), cross-modal issues of music-induced emotions are still largely unexplored.

Vitality affects is a theory from psychotherapy that Stern based on music perception, and it seems pertinent therefore to consider it in a music therapy context. It describes far more clearly *how* emotion is expressed in music; whereas the basic emotion, dimensional, or hybrid models in music and emotion research attempt to explain *what* emotions are expressed (Panksepp, 1998., Russell, 1980., ). Working from this *how* premise neatly avoids unnecessary pondering on any semantic gap, and addresses the more practical issue of which musical parameters are most important in the design of an expressive instrument. Indicators for the sort of parameters that would express vitality affects best are given in the literature. For example rhythm, tempo, dynamics, instrument voice, duration of notes and beats, intervals, key, pitch, melody, contour, and chromology (Smeijsters, 2005, page 119). Such parameters of control are required to enable the process of schematic 'conservation and variation' (Snyder, 2001) when making music, so that players can imitate each other, while also having the means to vary from an established theme.

There has been more quantitative work in neuroscience than music research, to confirm the flowing analogue nature of emotions as suggested by vitality affects. There are parallel systems in the body for detecting emotions: flows of electricity in the neural system, and chemicals in the blood (Berthoz, 1997). And these two systems work at different speeds, so it is understandable that we have waves of feeling, that vary in shape

and velocity, rather than clearly discrete states. Equally we have movements that vary in velocity and shape and which overlap when playing or listening to music. These range from the smallest foot-tapping and head-bobbing movements to bigger ones, such as swaying, dancing and jumping for example. In other words pressing a button to play 'happy' or 'tender' is not musical enough. It is the sort of categorical expressivity that does *not* accurately reflect emotional expression in music, nor is helpful in designing an expressive instrument. A button is digital (on/off), whereas emotions are not so simple, and depend on many factors and flows concerned with the body's homeostasis. Equally the way emotion is expressed and triggered by musical parameters is through parallel systems of perception, (e.g., harmony, rhythm or timbre), which do not always change at exactly the same moment. Ideally we need to be able to express this fluidity in the same way as we perceive it.

My reasons for emphasizing this link between perception and expression come from the research literature which indicates that both playing or listening to music require a degree of *intentionality* (Leman, 2008). This concept describes the mirroring process that occurs when actions and perceptions are coupled in the brain, which is also backed up by research on mirror neurons (Rizzolatti et al., 1996). In other words we perceive by using varying degrees of imitation, which the perceived stimulus then either confirms or refutes as the musical moment unfolds. In terms of expressing and listening to music, there is a level of expectation which can either be confirmed or thwarted, depending on how the piece of music proceeds (Huron, 2007). For this reason some of the parameters that each of the Wii-bändi instruments control are duplicated on other instruments of the interface, precisely so imitation could occur more easily between players.

In terms of creating effective, let alone expressive, instruments for disabled people it has been a challenge to find the right balance in controllability, as other researchers in this field have found (Benveniste et al., 2009). In terms of assessing how fun the instruments could be to play, building in a sense of expectation has proved to be a significant factor, so that musical patterns are easy to conserve and then vary without the music getting too chaotic. The instruments should be sensitive to a wide range of gestures, and yet not so sensitive that they dishearten the client because a certain finesse of movement will be required which they do not possess. One way is to map the same kind of gestures, whether they vary in size, strength or intensity, with certain musical parameters so that the players can be sure that the parameters will change in the same way, every time that gesture is repeated. With regard to the player's expectation, accurate predictions are thereby rewarded with positive musical content (Ulyate & Bianciardi, 2002), and by extension, feelings. This reward of feeling has also been described by Huron as the 'prediction effect' (2007, p.366). With increased confidence, players will hopefully become more ambitious, seeking to push the boundaries of what they can already do further out, and this should also encourage them to be more open and expressive with their gestures.

The other aspect that concerns the expressivity of the interface concerns the *type* of session we have had together at Invalidiliitto. This has determined what kinds of control are needed in a therapeutic activity. By the second cycle of trips to Helsinki, when we had established as a group in what direction the study would go, we were using a pattern to the sessions which involved warm-ups and games. Some of the ideas for such exercises were taken from literature on improvisation in music therapy settings (Wigram, 2004) and psychotherapy (Stern, 2004). This seemed to help clients express themselves better and listen to others, and it made better use of the limited time we had each visit. I was also encouraged to take a more active role in terms of directing the sessions. The nature of some of these activities made it clear that, for the interface to be a useful therapeutic device, it should enable certain musical dynamics. For example, how can a client play softly or loudly, or fast and slow, if there is not an obvious way to control that? Again the scalings have been vital for this to be enabled, and it has also meant getting to know the Ableton Live software very well too, to know firstly which parameters are mappable, and secondly what these parameters or functions actually enable the participants to do in terms of the music (De Santis et al., 2008).

With Live, gestures can effectively be mapped to parameters of sound synthesis in a way not usually feasible in a traditional musical interface, for instance the virtual size of the body of an instrument can be changed while playing the same note. There was also the possibility of enabling recording remotely, thereby combining recorded or looped music with a live performance, if clients wanted this. This meta-level of control would certainly augment the role of a traditional instrument. I tried therefore, in the first few months of research to see if I could motivate clients by combining aspects of interactive and passive music therapy (Aldridge, 1996). They were asked to suggest songs they like, which I then sampled and cut into clips which could then be manipulated in real-time like an instrument, so that it could then be part of their own music-making.

### **2.3 Mapping to the Music: Fitting not Flitting**

If players are freed from the constraints of traditional musical interfaces, how does one go about choosing the gestures to map to specific music controls? In terms of making a gestural interface that is easy to learn and which holds the attention, it is worth considering the concept of learning schemas, that has been explored more fully in educational theory (Athey, 1990). According to this theory children adopt repetitive schemas of behaviour, which they try out in varying contexts, in order to make sense of the world. It is not unreasonable to assume that as adults we continue to use these when learning new motor skills, only we have become more able to combine them with the experience age brings. Adults have more experience of patterns in the world which they can 'fit' new experiences into. Children have fewer such schema to begin with, and thus might appear to 'flit' in the way that they look in a variety of contexts for the experiences that fit with those schemas they are already in the process of investigating.

Accelerometers allow for a wide range of gestures, and of the seven schema that Athey mentions (ibid. p130)<sup>4</sup>, the three *dynamic* schemas seem the most immediately relevant: circular, vertical and side to side. They seem to be the most intuitively practicable in terms of making music with accelerometers, and together they describe the most useful movements of the Wii such as pitch, roll and yaw<sup>5</sup>. I have tried to map these gestures, in the hope that they fit not only to the musical form that is controlled, but also the emotive form expressed. The emotive element should also help to remember those gestures.

The term schemas has become very popular long before Athey used it in 1972. This is due to the adoption of the term for one of the great systems behind information technology. But in our context, the term schema means ‘a general or essential type of form’. In this way it links gestural, emotive, and musical elements of the interface through forms. For example, the gesture of *increased shaking* will lead to the emotive form of a *surging vitality affect*, and an *increase in loudness* of the instrument.

Schematic organization has other benefits for holding new information in our memory too. It has been argued that if most of the details fit reasonably well with a schema in the memory (let us take the example again from the previous paragraph), then our attention immediately moves to the details that do not correspond - “to the novel details that stand out against the background of the familiar” (Snyder, 2001. p96). For example in some instruments with a shorter sustain an *increase in reverb* is preferable to an *increase in loudness*. In this way it is easier for clients to learn the peculiarities of each instrument, without flitting aimlessly between gestures. The schemas provide an easy framework to remember controls, and within which to explore novel elements of the interface.

All controls for musical instruments can be loosely described in terms of their musical function, of which there are generically three: excitation, modification and selection. Excitatory functions can be instantaneous (e.g., hitting a drum) or continuous (e.g., bowing a cello). Modifying functions usually require neutral energy expenditure compared to excitation, and can be continuous (e.g., bending pitch), or structural (e.g., depressing a valve or button). Selecting notes can be sequential: as in the case of monophonic sounds, or parallel: as in the case of polyphonic sounds (Miranda & Wanderley, 2006).

One design benefit of digital musical interfaces, where the sound producer is separate from the sound source, is to have the possibility of standardizing some of these gestures across instruments, so excitation or modulation is the same in all. Not only might it schematically facilitate learning, but it gets around the problem that might arise if disabled people are not be able to manage all of the gestures required by different

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<sup>4</sup> • Dynamic vertical • Dynamic back and forth or side to side • Dynamic circular • Going over or under  
• Going round a boundary • Enveloping and containing • Going through a boundary

<sup>5</sup> see chapter 4, p18.

traditional instruments to achieve the same function. For example excitation would require blowing for a saxophone, hitting for a drum, or bowing for a violin, but in the interface they could all be triggered by a flick of the wrist.

Wii-bändi therefore attempts to use learning schemas and schemas of memory to make it easier for non-professional musicians to transfer the skills they develop playing one Wii instrument, to another. Once expressive gestures are found that are achievable, and can be duplicated across the different instruments, there remain three major mapping issues to resolve.

- Number: how many gestures to how many musical parameters (through splitting or duplication)?
- Sensitivity: how large a signal, and thus gesture, is required for each musical parameter?
- Polarity: does increasing or decreasing the amount of gesture in one particular dimension increase or decrease the amount of musical parameter?

In terms of the number issue, gestures can of course be mapped to musical parameters in a straightforward one-to-one fashion. But they can also be mapped 'convergently' - when a number of gestures trigger the same parameter, and 'divergently' - when one gesture controls several parameters at once (Rovan et al., 1997). This was done through a mixture of splitting and duplicating the signal in Osculator.<sup>6</sup>

In terms of signal sensitivity, the threshold of the trigger for the musical parameter controlled by each gesture could be altered according to the client's needs. The ideal balance would be that the gesture was achievable, yet at the same time encouraged the maximum movement. This meant that big erratic gestures could be scaled to map to subtle changes in musical parameter, or small gestures could control larger changes in a case where a client could not move very much.

Finally, the polarity mapping determined in which direction the gesture was made so that, for example, an *up* gesture would trigger an *increase* in a musical parameter, not its decrease which would be counter-intuitive and quite possibly confusing.

The best way for discovering in detail how to do this, has of course been to work with the clients in question, to get to know them, what they can and can't do, and to craft the interface on a trial and error basis. So this informed my choice of methodology, and has determined the form of data that has been used. The details of the data gathered from these trials are thus covered in the penultimate three results chapters of this study, and conclusions are then drawn in the final chapter.

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<sup>6</sup> See section 4.3 on 'Osculator' in appendix B (p101)

## CHAPTER 3 - Methodology

### 3.1 Action Research

The research took many turns over the course of the months it was carried out. The methodology chosen was action research, as it needed to be quite flexible. The reasons it had to be flexible were threefold: because of the evolving context in which the instruments were going to be used; the fact we could only go once a month (at the most for only a few hours); and most importantly because the aim was group-oriented and therefore had to take into account the opinions and feedback of all the participants.

The sessions were recorded on video so that they could be analysed later, as a more intrusive form of self-assessment would have detracted from the very thing - therapeutic benefit - that we were trying to measure. In this way the interactive and social nature of the sessions remained intact, and also the video perhaps encouraged a degree of performance in some of the clients, which was a positive thing if it caused them to be less inhibited than usual. All the people that appear in the video clips were made aware that this thesis would eventually be published online and gave their consent for this.

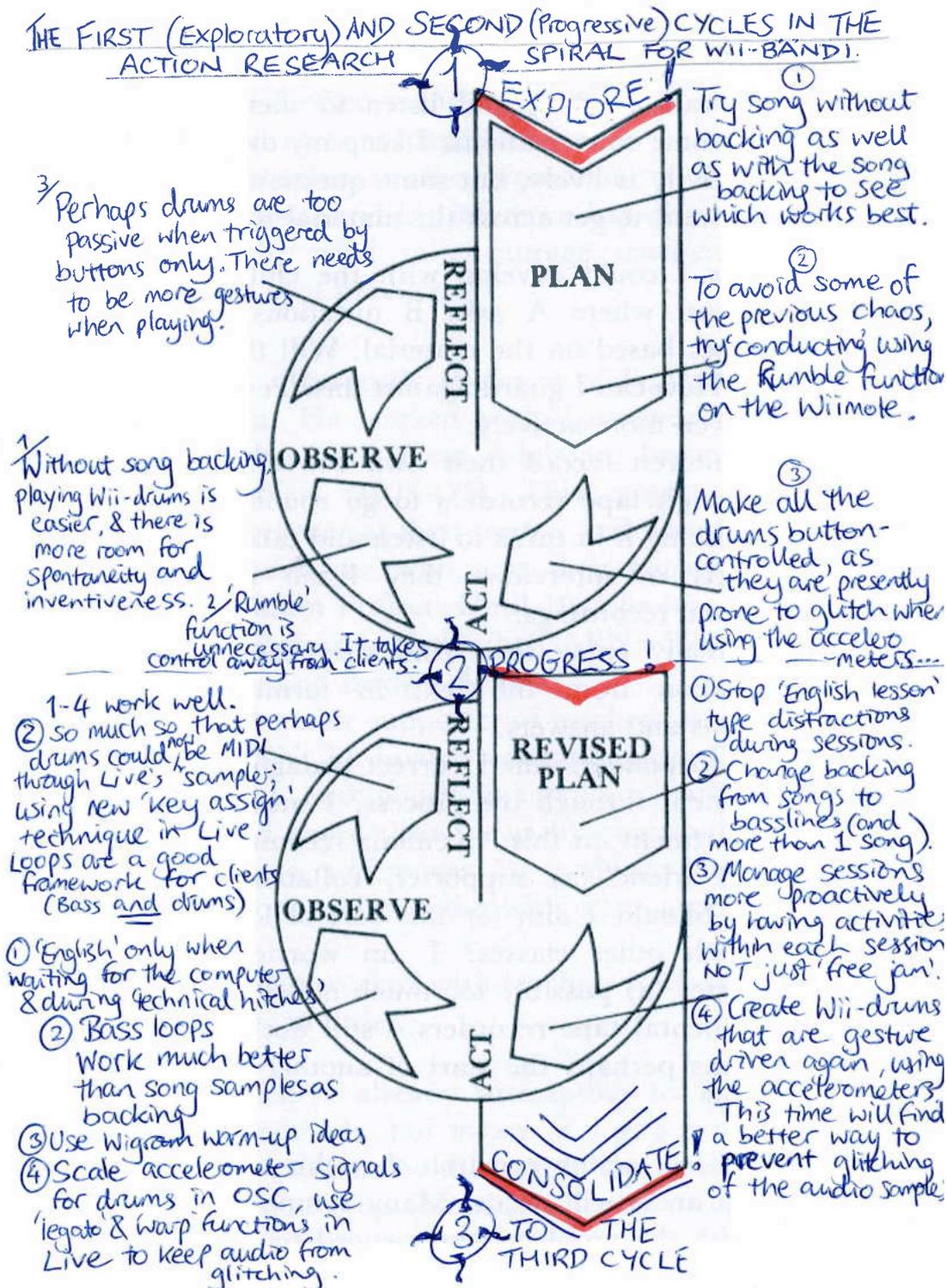
Action research is known by many other names, including participatory research, collaborative inquiry, emancipatory research, action learning, and contextural action research, but all are variations on a theme. Put simply, action research is “learning by doing” - a group of people identify a problem, do something to resolve it, see how successful their efforts were, and if not satisfied, try again (O’Brien, 1998). It involves a continuing spiral of planning, acting (implementing plans), observing (systematically), reflecting and then re-planning, which then takes you to the next cycle of the spiral, until an agreed goal is reached. In our case the goal was limited by time, changing personnel and making the best of the designated technology available. Figure 3.1 below is an illustration depicting two of the cycles in our particular spiral of research, with specific examples of each action stage, to show how progress in Wii-bändi was made using this methodology.

Action research is intrinsically subjective, but it is perhaps useful to consider this study not as the opposite to quantitative research, which would mean only one methodology could be true, but as ‘dialectically related’ (Kemmis & McTaggart, p349). In this way both quantitative and qualitative analysis can be seen as mutually constitutive aspects of one another. Further research could, for example, test some of the conclusions of this study more quantitatively on a number of specific criteria with a larger sample of clients. I will attempt to bring such possible criteria to light through the course of this thesis, and reiterate these in the conclusion. But first, Wii-bändi had to be made, and its qualities decided upon by myself, the clients, and the staff who worked with them at Invalidiliitto.

A researcher, quantitative as well as qualitative, must be honest about how much of the data is due to their ‘behaviour’ and how much is due to the subject’s ‘behaviour’.

Decisions to ignore some data and include others are prone to a degree of subjectivity. Action research accepts this as a given, and tackles this problem head-on by forcing researchers to share objectives with participants. If the context requires a different methodology, then such changes should be made. A rigorous methodology should be important, but researchers need not be slaves to 'methodolatry' as one researcher calls it (Janesick, 2003).

Figure 3.1: An example of two cycles in the spiral of action research for Wii-bändi



### 3.2 Subjects & Subjectivity

A small point on this matter should be immediately cleared up. It is not that *subject* is an inherently bad word, as in most cases of research it would be grammatically correct to describe people performing an action (that also happens to be the focus of your study) as the 'subjects', since they are the ones performing the action. I would argue that people have simply got the wrong meaning of a homonym when they think it means 'subject to' as in a monarch, pain, God, or even... a scientific researcher. *Subjectivity* has got a bad name for itself in this way, even if it refers to the first grammatical meaning, and it is action research which attempts to tackle this matter head on. Instead of trying to eliminate subjectivity altogether which would be impossible with this kind of qualitative research, it is perhaps better to spread it out among the participating subjects.

'It is not possible to have a true science of persons unless the inquiry engages with humans as persons. And since persons are manifestly capable of making sense of their behaviour, the distinction between a 'researcher' who does all the thinking and 'subjects' who do all the behaving is completely inappropriate' (Reason, 2003).

If this current research is subjective, it is because the participants are agents of change, as much as the researcher. Their feedback altered the development of the interface, and so they influenced the direction of the research.

Working in a group is perhaps the most significant part of action research (Baker, 2007). Both at the participant level, as well as at the author level, a group is needed to nurture the flexible attitude that seems to be at the heart of this process. Opinions must be taken into account, decisions must be justified, but most of all one must be aware that the knowledge itself is moving forward. In this respect, the learnability of the interface has become one of the most important goals of the project. How do clients learn to use these instruments? It also means I have had to learn how to present updates and demonstrate improvements to the instruments in the most effective way.

Feedback was gathered in the form of questionnaires, as well as verbally in the sessions, and these were video-taped. In this way it was clear in what form progress was being made, and in what ways Wii-bändi had become easier to use and more sensitive to the particular requests of the clients. The video data also provided much needed justification for practically all of the changes that were made.

The action research took place over a period of almost a year. The monthly visits provided a physical reality, and therefore a tangible framework upon which to hang these cycles of research: in other words, something new was created for each visit. However I could not change everything every visit, otherwise the clients would not be motivated to practise, if they knew that it would be totally different next time anyway. So each new cycle has instead been determined by a major development which in retrospect, marked an evolutionary stage in the visits. Each cycle has a chapter devoted to it in the results section of this thesis.

There were three cycles. The first cycle was exploratory and lasted five months, as we settled on regular attendees. In this time participants played with the interface and views were gathered concerning their taste in music, personal goals for the project, and the way they wanted to proceed. For example there was no desire to develop an interface for clients to play individually with the computer, only in groups. Because participation was of course voluntary, it took some time to settle on those who really wanted to take part, and those who dropped out early on.

In the second cycle I directed the sessions with more certainty of what was required for the group, and a lot of progress was made. For example we developed some improvisation exercises, and we dropped the idea of having samples of the actual song in the set, replacing it with samples of the bassline. It lasted four months and participants found the best ways of playing with each other during this period. After the summer a new client joined our group too, and this had a consolidating influence on ideas that could be incorporated into the final cycle. We should perhaps reiterate when talking about *months*, that we were limited to only one visit per month throughout the course of the project, which consisted of a two hour session.

The final cycle consolidated all the previous research, which actually meant drawing a line at some other possible avenues for development, and focussing instead on those that had been chosen by the group. For example role play situations seemed to be what the group as a whole enjoyed. This cycle covered the final two months of research, culminating in a Wii-bändi demonstration in front of other clients from Invalidiliitto, who had heard so much about our project, but never as yet participated.

Interestingly the duration of each cycle decreased, almost exponentially, the closer we got to the end of the year. The first cycle was exploratory, the second was progressive on all fronts, and the final cycle consolidated the progress made in the second. The importance of recognizing the inherent subjectivity of action research can be illustrated when looking at the effectiveness of metaphors to describe this phenomenon. The spiral of research could be evoked, in dynamic terms, as some kind of heat-seeking missile gradually honing in on its target; or in geologically slow terms, as a pebble being rubbed smoother and smaller as it rolls up and down the beach. Then again, perhaps it is more like a dog circling a few times before it finally gathers itself into the most compact lump to curl up for the night. As the reader, you obviously get to choose, but personally I would go for the dog metaphor as it best evokes the 'fun' and hopefully comforting nature of the setting that this research was hoping to achieve.

Apart from the need for the methodology itself to be fun for participants, as their feedback (and therefore involvement) was a big part of the research, the instruments also needed to be so. This 'tailoring' of instrument design to the specific group of participating subjects, all with their own subjective needs, likes and dislikes, is at the heart of the methodology. For this reason the final sub-section of this chapter is an introduction to the participants, their individual disabilities, and a little about their background. Basics in the

technical background, that is the hardware used, are then covered in chapter 4, while the software details regarding Live and Osculator form appendix B. Together, these are included so that the description of the changes made to the Wii-bändi interface during the course of the year easier to understand in the final results chapters.

### **3.3 Working with Invalidiliitto**

Invalidiliitto is the name of the organisation that runs the care home at Porslahti in Helsinki where the sessions were held. Invalidiliitto loosely translates as the National Association of the Disabled in Finland. An essential part to understanding the development of Wii-bändi is understanding the context of the home in which it was being used. Porslahti is home to 27 clients in total who live, eat, and sleep there. It is important for there to be a wide range of activities to stimulate and encourage the residents to nurture positive attitudes to their rehabilitation or ongoing condition. Only about half of the clients would have been able to use Wii-bändi, as there were also some more severely disabled people in the home for which holding a Wii controller might have been too difficult. It should be reiterated that those who did participate gave their full permission for us to record video data featuring them in it, and agreed to be mentioned in a thesis that would later be available online.

We agreed with the staff at Invalidiliitto to try and provide a therapeutic activity which they could follow through independently, with small groups of clients. They did use the interface when we were not there, but there were logistical issues, which I had no control over, that made it difficult for them to use it in such a way consistently. The number of staff per group of clients was limited, while the number of people who could use Wii-bändi at any one time was limited to 5. This made it often unfeasible as a regular weekly activity, I was told, as the group had to be split and there weren't always enough staff for this. Either we should have insisted on another time slot being timetabled for Wii-bändi, when there would have been enough staff available, or created an activity that would have allowed a mixture of active and passive participation and turn-taking, but unfortunately this was not made clear enough to us earlier on.

A significant problem was that Invalidiliitto did not have a computer of their own with the same operating system, and of course we had to return the university computer they were using at the end of the project. Although I would have liked to have left something with them so that they could have continued using it after the project, in line with proper action research, this was logistically not possible. This was a serious flaw in the project. Action research needs to exist in practice, and not only in theory! These very practical issues of distances and equipment should be taken into account in any future research of this kind.

Nevertheless, there were people who were keen to use the interface, and these people eventually formed Wii-bändi in the flesh. This core group of clients changed only a little throughout the year, so I was able to tailor it specifically for a total of 5 clients. In March, 2009, at the end of the first exploratory cycle, information about the clients'

background was finally given to me in written form by Sannamari (see appendix A, p100), together with her own opinions about the benefit of the sessions for each participant. I have therefore incorporated this information, together with my own observations, in the following section on the participants. It should be noted that this feedback had no mention of Vesa however, as he did not join our group until September, 2009. Luckily he was very open about his background and able to express himself quite well in English, so let us start with him.

### 3.4 Participants

**Vesa** was the most recent addition to our group, and although he was last to join, his contribution was definitely not the least. He was also the only member of the group to talk happily in any depth about his disability and, significantly perhaps, this was at the end of our last session in December 2009. This perhaps indicates that the activity had had some therapeutic effect for this to be possible. He was also keen to sing and be creative, responding well to activities that stimulated the imagination.

He said that in 2002 he had fallen 20 metres on his head and suffered major brain damage which had also left him blind. He said he had also been unable to walk for a while. By the time we saw him he was able to walk with only occasional use of a stick (and/or his care assistant) but was completely blind. Although the reasons for this accident were not known, I am glad to say he expressed a degree of awe, amazement and happiness at having fallen 20 metres and *survived*. It was also nice that each time Vesa came (from September, 2009 onwards), he had with him his care assistant Janne, who naturally joined in and took part in some of the playing (as can be seen from the video footage). Having a personal assistant with a client also added to the overall amount of confidence in the room, and might partly explain why Vesa was to take such a prominent role in the proceedings of the final research cycle.

It was important for Vesa to be able to suggest ideas for role playing, and song subjects during the sessions. He responded well to activities that used his imagination and encouraged interaction between the group members, as he was not afraid to parody himself as some kind of 'rock god'. This confident humour, and his enthusiasm was infectious and increased the overall energy of the whole group.

**Harri** was with us from the very start for nearly all of the research visits, except for the one in June, 2009. He was born blind with cerebral palsy, is confined to wheelchair, and has only limited use of the upper half of his body, which means his hand gestures were limited to rapid, small movements. Together with Vesa, he was the most extrovert in the sessions, and was keen to try all the instruments, as well as sing. For him it was clear that the social aspect of the sessions was very important.

Music was evidently a very big part of his life and he could already play the keyboard, so he was interested in seeing what more the interface could bring to him. In

this respect the sessions were a form of occupational therapy for him, to which he could bring his encyclopaedic knowledge of music trivia, and his love of speaking languages (not only did he seem to like speaking English with us, but he also liked to show off his Italian and French).

According to staff at the home, he talked about Wii-bändi a lot. One sign that he had taken it to his heart was that he apparently talked about it with his mother, and apparently he would often ask the staff “When are the boys coming again?”<sup>7</sup>. If anything, care had to be taken handling this enthusiasm, so that we spent the sessions effectively playing music and using the interface rather than only talking about his favourite topics when others in the group wanted to get on.

**Heikki** was a musician before he became disabled, and he has since stopped trying to play the piano because it was too difficult and it depressed him. He has specifically had trouble with the fingers in his left hand which is now restricted to very weak and small movements, and was also wheelchair-bound. This obviously frustrated him and created a mental block with regard to many activities, seeing himself as someone who was “sick” and therefore incapable. The sessions seemed to alleviate some of these inhibitions, and we have many examples on video of him laughing and evidently enjoying himself.

Wii-bändi was very important therefore for momentarily lifting this depression so he could actually do something. In this way it had motivational benefits that meant he exercised fine motor skills in his hand without the usual weariness. Other times he made quite an effort to express something musical and seemed to feel rewarded by this.

He particularly enjoyed finding a role for himself within the band (often playing saxophone), but at the same time seemed to enjoy the freedom that the interface gave in terms of choosing instruments that, with a traditional musical interface, he would not normally be able to play.

**Timo** was diabetic. He was not in a wheelchair and could move all his limbs, however he had some brain damage which meant he had very poor peripheral vision and so relied on his hearing quite a lot. Also his short-term memory was very poor, which meant he had trouble concentrating for long periods of time. It also meant the interface had to be easy to learn each time he picked it up. Before becoming disabled, he had played the drums which meant that he was most interested in playing that instrument in Wii-bändi, nevertheless he did also experiment with the pitched instruments during the study, particularly the marimba/flute.

We were told by staff that it was very important he use both left and right sides of his body as he had some issues with laterality. For this reason the evolution of the drums

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<sup>7</sup> See Appendix A: “Soiton merkitys” (p99)

in Wii-bändi very much followed Timo's reactions to them, more than any other member of the group. As with Heikki, Wii-bändi seemed to increase his feelings of general motivation.

**Riku** came to a few sessions in the middle of the year. He had quite different physical needs in terms of the interface, because his movements were restricted to large jerky ones. So it was not a case that he had movements limited in size, but movements limited in precision. He had become disabled in adolescence as a result of brain damage induced by solvent inhalation. Besides impairing motor skills in all his limbs, it had also damaged his memory so that he found it very difficult to focus on an activity for any length of time.

It was important that Riku could create a variety of sounds with large movements of his body, and he particularly liked air guitar gestures. Like Timo, it was good that he used both hands when playing to address issues of laterality, and also he had trouble remembering the last time he played. So as with Timo, it was important that the interface maintained a certain simplicity, and that the novelty value remained equally if not more important than the level of expertise required to play.

**Marc.** Although the study was primarily for this Master's thesis, I was accompanied on my trips to Invalidiliitto by a fellow researcher, Marc Thompson who, although he specializes in music and movement more specifically associated with piano or clarinet playing, was also interested for a time in developing digital musical instruments for disabled people. Marc provided invaluable observations, contributed to the running of the sessions, and also provided a welcome degree of moderation to the subjectivity of some of the opinions in the group. In this respect he was the 'critical friend' that has been suggested in some of the action research literature (Ainscow & Conner, 1990, as cited in Waters-Adams, 2006). In terms of action research, although he might not always have felt it, he was therefore a key participant with an important individual perspective to contribute to the combined subjectivity of the research project. His perspective was different to mine, and very much valued.

**The Invalidiliitto staff.** Over the course of 12 months we worked with a core group of four to five clients and three members of staff (Sannamari Kiiveri, Jukka Ahvonen and Jenni Kymäläinen). The staff were interested in using the Wii-instruments for therapeutic fun activities with disabled people, so it was important not only to make sure that the clients could use Wii-bändi, but also to explain to the staff how they might use it when we were not present. Sannamari and Jukka were present for the exploratory cycle and some of the progressive but, as mentioned in the previous section, there were many logistical and technical problems which limited the amount they could use the interface in my absence. Jenni brought a certain amount of fresh enthusiasm with her when she joined the group at the start of the second cycle of research. Indeed, it marked the end of the exploration stage, as the group gained confidence in the direction we had chosen.

# CHAPTER 4 - Technological Resources

The figure below outlines the overall structure of Wii-bändi, to show how Live, Osculator and the Wii controllers work together to create an expressive digital musical interface.

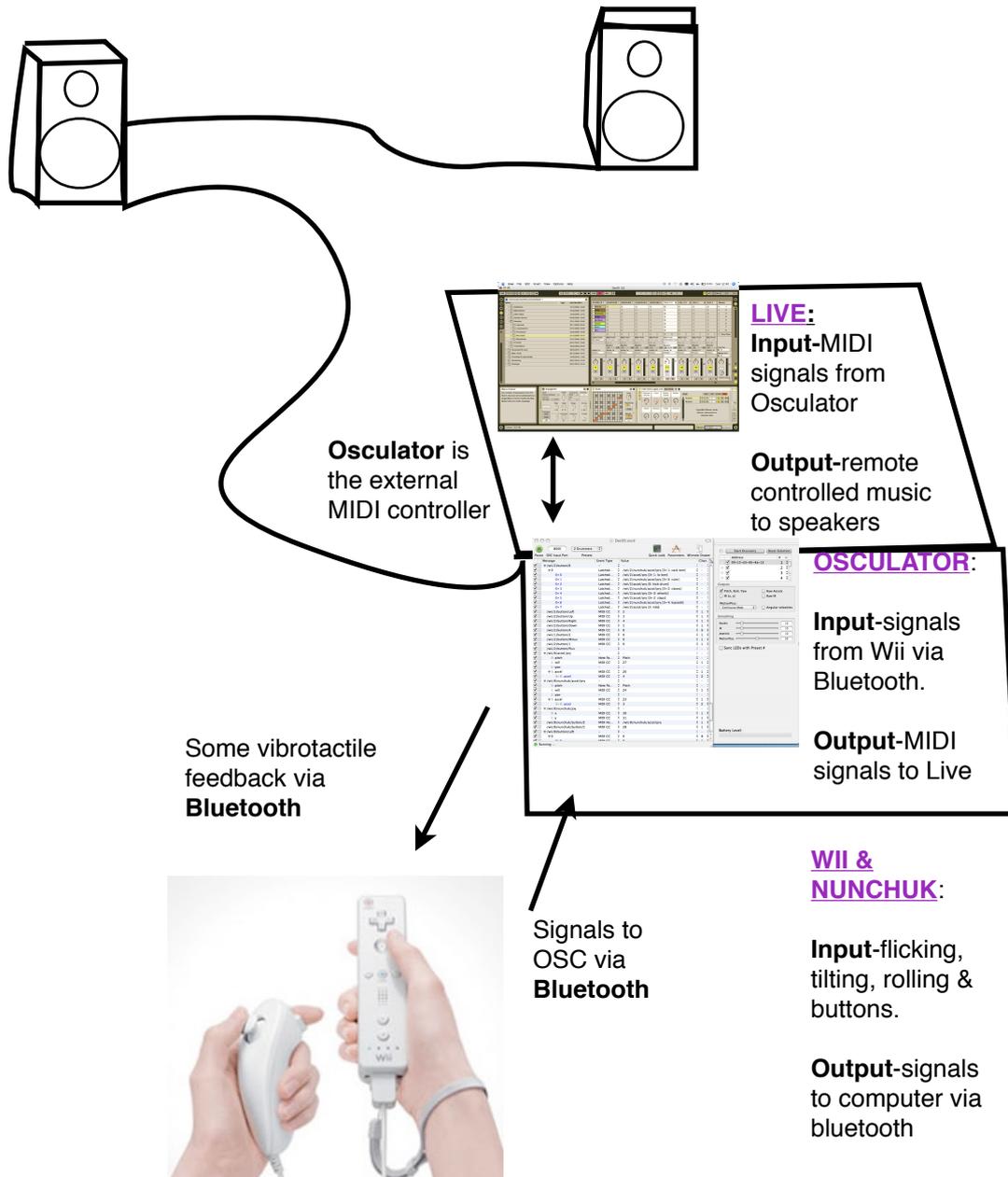


Figure 4: How Wii, Osculator & Live combine to form the Wii-bändi interface.

## 4.1 Data Collection & the Interface Hardware

As Wii-bändi was action research, limits had to be set and a boundary had to be metaphorically chalked around the cycles of research to prevent them possibly spiralling out of control. The most practical way to do this seemed to limit myself to the tools I had from the start: the two MacBook computers (with all their various issues as previously

discussed); Wii controllers (that is Wiimote and Nunchuk, without WiiFit or a sensor bar); Ableton Live Version 7; and Osculator Version 2 (including the updates within those versions). For the purposes of showing the development of this interface over the course of the three cycles, I have kept all the previous Osculator (and Live) patches made, that are no longer used in the finished interface. They are included in appendix C (data CD). Of course, with the latest version of Osculator, which is the only version that can open all of them, all the patches might now appear similar (even though the first ones were made with earlier versions of the software). Nevertheless, a closer look still reveals a progression from the simpler earlier patches to more accomplished ones at the end.

Data was collected on a video camera, and later annotated while it was edited into video footage in iMovie on the Mac, and recordings were made in Ableton Live, but also on an M-Audio digital recorder, when the recording became problematic in Live. As it stood, the audio on the video proved sufficiently good for the purposes of the thesis, but it was a good idea to have more than one form of recording in case there was technical failure.

The operating systems used on both Apple MacBooks, was OS X (version 10.4.11). Two computers were used so that one from the university department could be left in Helsinki for use with the clients (as previously mentioned), while I could develop the project further on my own at home. Three sets of Wii controllers were left in Helsinki for the clients use, together with their computer, so that they could use it at least once a week in our absence. As mentioned previously (p22), this sometimes happened, but not on a consistent basis.

Installed on the computer were the patches I had created in Osculator and Ableton Live, as were full working versions of both these programs, since the software could not be run as a stand-alone program (unlike MaxMSP for example)<sup>8</sup>. This proved a significant disadvantage, as we discovered near the start that the university computer did not accept updates as easily as my personal computer. It required university administrator passwords, which we were not entitled to have at that time.

This was perhaps the biggest logistical problem during the project, as Live and Osculator's updates have proved a vital part in the development of the Wii-bändi interface, and both versions needed to be the same on each computer. Even when I showed staff at Invalidiliitto how to open new patches I had made on my computer, and then used file-sharing facilities on the web so they could implement it on their Mac, new patches would not always work. This did not help encourage the use of Wii-bändi in our absence, as their computer had to be taken back to the university each time an update was installed. Taking the computer back from Jyväskylä to Helsinki to resolve the administrator issue was, however, only made on one occasion, as it meant the computer was no longer there for them to practise on. By the end, realistic progress was restricted to our monthly visits when they could play on the computer I had been designing on at home. Nevertheless

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<sup>8</sup> See conclusion for discussion of the advantages of stand-alone programs (p91)

some sessions *were* held in our absence, and some recordings were made with the older versions (though they are not the best).

For clarification of the terms used in chapters 5, 6 and 7 when describing the developments made to patches in Osculator and Ableton Live, please refer to appendix B (p101), where the relevant terminology is explained.

## 4.2 Wii controllers

These are perhaps the most widely known, and cheaply available, game controllers to first contain accelerometers. They also come equipped with buttons as well as a joystick, are battery-operated, and they can be hacked so that the signals are routed to a computer, instead of the game consoles they were originally designed for. The main objective was to make use of the accelerometers as fully as possible, so that musical parameters could be controlled with easy gestures in the air.

Each handset consists of two controllers: the main controller (or Wiimote), and the smaller controller which has the joystick and fewer buttons (or Nunchuk). Perhaps the latter has its catchy martial arts name because both controllers are connected by a cable, and if you so chose you could twirl it round your elbows in a Bruce Lee fashion. However, this is not the chief reason I wanted to include the Nunchuk in Wii-bändi. I wanted to use both controllers so that disabled clients, who would normally be discouraged by lack of precision in the weaker hand, might use both hands. I was further encouraged in this by the fact that staff at Invalidiliitto said that many of the clients had issues of laterality, which meant it was good if they could use both sides of their body more often.

Both Nunchuk and Wiimote use an accelerometer that can sense both linear and

rotational orientation. In figure 4.21 the three **rotational** axes are shown as *Pitch* (light blue), *Roll* (light green), and *Yaw* (yellow). The linear axes are X, Y and Z. What is not shown, is that overall acceleration (all the axes combined) can also be detected.

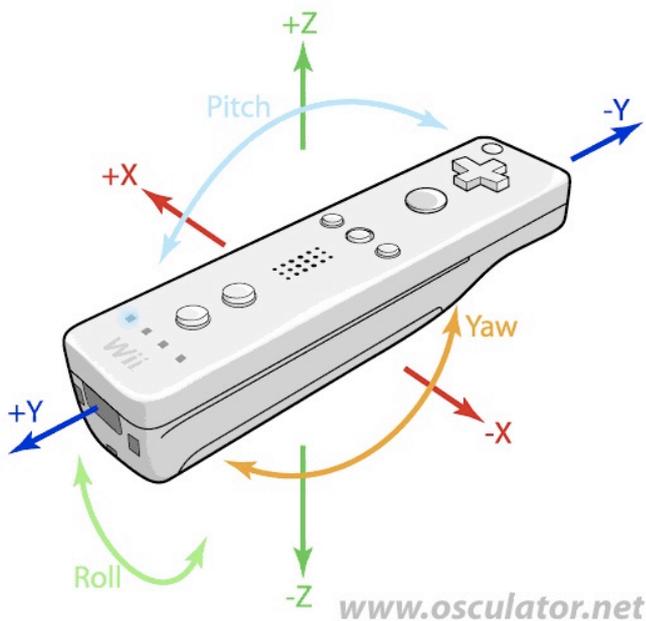


Figure 4.21: Axes of acceleration in Wii & Nunchuk controllers

In this way both Nunchuk and Wiimote measure the static acceleration of gravity when tilted, as well as the dynamic acceleration resulting from motion, shock, or vibration. In the case of the Wiimote, the accelerometer is a 3-axis iMems ADXL330, and in the Nunchuk it is a 3-axis STMicroelectronics LIS3L02AL. The accelerometer used in the Wiimote is

only very slightly different to the one in the Nunchuk, perhaps due to the difference in each controller's mass. The former measures acceleration with a minimum full-scale range of  $\pm 3$  g, whereas the latter's minimum full-scale range is  $\pm 2$  g (Wisniowski, 2006).

They both output an analogue signal which, it was hoped, adequately translates the expressivity of human gesture for musical purposes. However, after much experimentation, only three of these kinds of acceleration proved most suitable for controlling musical parameters. These were pitch, roll, and overall acceleration. For the purposes of the thesis, to distinguish the gesture from the musical parameter, I coined the term "tilt" for the gesture, instead of pitch. I used the term "flick" for overall acceleration, as this was the usual non-directional movement that was picked up by this gesture parameter. This more accurately describe the kind of gesture that the accelerometers mapped.

As can be seen from Figure 4.22 below, both Nunchuk and Wiimote have buttons that can be used with a trigger finger, usually the first finger placed to the front and under each controller. On the Wiimote this is **button B** and on the Nunchuk this is **button Z**. These buttons are about the most important in Wii-bändi as they are perhaps the easiest to press. They are certainly intuitively trigger buttons, so often they have an 'excitation role' (Cadoz & Wanderley, 2000), and trigger the musical sound itself. The other buttons used for the primary functions in the interface were **button C** (the only other button on the Nunchuk), located directly above **Z**, and **button A** (the biggest button on the Wiimote), and nearest the right thumb in the above picture. Controls of secondary importance were the **cross button** on Wii, and **joystick** on Nunchuk, as they could be easily distinguished through touch alone by the blind clients. The least important buttons were the three

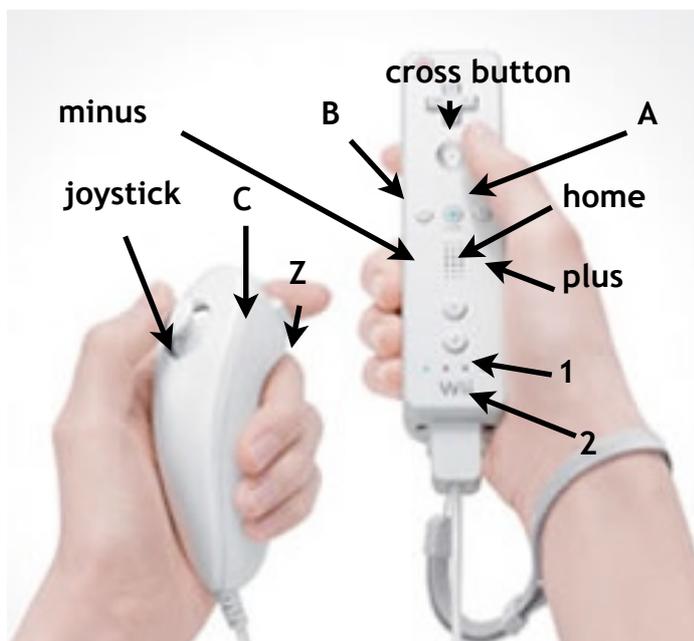


Figure 4.22: Buttons on the Wii & Nunchuk

forming a horizontal line across the middle of the Wii (**minus**, **home**, and **plus**), and **buttons 1** and **2** at the bottom of the Wii. As I wanted to keep the focus on the accelerometers and gestures, these secondary and tertiary controls were therefore generally given musical parameters that were less fundamental, and more subtle. The idea was that the clients would try those parameters only after having first mastered the fundamentals. In this way the performance ceiling was raised, while keeping the interface easy to manage on a basic level. The evolution of these changes is of course covered in the results chapters.

The buttons are used, not

only as digital on/off switches, but also like the 'shift' or 'caps' key on a keyboard, so that, when held down, the same gesture sensed by an accelerometer can trigger something different than when it was the accelerometer alone. In that respect they therefore have a 'modification' function (ibid. p10), with the accelerometer taking over the excitation role instead. This worked especially well for the drums. In terms of the musical function of 'selection' (ibid., p10), it was helpful to have continuous controllers which transmitted signals that could be gradated into a number of values. In this respect, the Nunchuk's joystick proved useful, as did the accelerometer axes (particularly tilt and roll). I also learnt to gradate mappings for the Wiimote's distinctive cross button so that up to three different values could be assigned to either the east-west or north-south axis.

The Wiimote also has a PixArt optical sensor (camera) that picks up infra-red, but I did not use it for a number of reasons. Firstly we did not have a sensor bar, and, as mentioned at the start of this chapter, I could not keep indefinitely extending the number of peripherals the interface would need. The attractive option of using candles instead (which I used in preliminary trials as they also emit a sufficient amount of infra-red) was also eventually dropped, in spite of the warm ambience they created. This was because the second and most important reason for no infra-red, was that the client would have to be facing the light source and so not be as free with their movements as they might be when only using accelerometers.

# CHAPTER 5 - Crossing the Rivers of Babylon

## (Cycle 1: December, 2008 - March, 2009)

One of the most important parts of the initial visit was making sure everyone had the same idea of what the project's aims were. With participatory action research in mind, I was keen to gather ideas to make sure I could incorporate them into my own. In line with Reason's (2003) definition of the methodology, the ideas for the interface were being chosen by me, the researcher (in the first person), and then they were personally tailored for participants, according to their suggestions and needs (in the second person). Finally there developed a pattern for usage which could be applied to other contexts with other people (in the third person). These three stages approximately sum up each of the three cycles recounted in these results, although as previously mentioned, the third stage of it (being used independently of university researchers) faced certain logistical problems. They form the bigger picture, while on a smaller scale finer details were being refined continuously between visits.

My idea was to literally start with music the clients liked, and use the software (via the Wii) to manipulate it so they could use the same timbres and sounds from the recording of a song they liked to make their own more personalized sound. The idea was to have an interface that would be capable of augmenting samples<sup>9</sup>, rather than just augmenting traditional instruments as there are already many interfaces designed for augmenting instruments (pp. 21-25, Miranda & Wanderley, 2006). This would add another dimension of novelty to Wii-bändi that might make it appealing for non-musicians.

From November 2008 to March 2009 there were five visits made. The song which dominated these sessions as the backing track, and from which everything else developed, turned out to be "The Rivers of Babylon". This was because it had been requested by Harri. For the first two months of research, Harri was our only consistent participant, so it seemed correct in terms of the methodology to go in this direction to begin with, and then as more participants joined Wii-bändi, to open it up. At this point we were finally able to 'cross the rivers' to a better interface, if not a better land. How we got to that point is the subject of this chapter.

### 5.1 Backgrounds - Musical, Physical & Moral

For the first visit in November, only two clients came to the session. One was Harri, and the other was Hussein who was a bit younger, and also wheelchair-bound. This was the only time we saw Hussein. There could have been many reasons for this (for example he did not seem to like the same music as Harri) but, according to Sannamari who was our primary contact at Invalidiliitto, the reason he gave was that he had decided it was against his religion.

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<sup>9</sup> Not to be confused with the statistical term (Chatterjee, 1968)

At this point it should be mentioned that religion, or at least morality, did actually feature quite clearly in our first meeting when we talked about musical taste, which was somewhat unexpected. Harri indicated that he was very fond of early reggae, or more precisely *rock steady*, and it was not just any rock steady, but songs which addressed more social issues like “slavery”, not just “I love you, love you baby” as he put it (video clip 5.11). He specifically did *not* want the better-known Boney M cover version of “The Rivers of Babylon”, but the original Jamaican version by the Melodians. Though other music was mentioned, we chose this in the end because Marc and I knew that genre better than Hussein’s rap, and because it later transpired that Hussein would not come again.

As we talked more about each of their musical tastes, it became clear that the music Hussein was talking about had been something he had been more fond of before a certain moment in his life (most probably the accident that had put him in a wheelchair). After this, he was left with an impaired memory, together with brain and spinal injuries. He said to us that he did not listen to it so much these days. Perhaps this was an experience that made him more aware of his mortality and was one thing that had contributed to him to becoming a practising Muslim. One aspect of this might indeed have meant forgoing music, as Sannamari reported.

Equally for Harri, growing up blind from birth, with cerebral palsy might have explained a musical perspective that was not so interested in your average simplistic love song. Beauty for him was instead something more cerebral, and perhaps also spiritual.

Harri’s first request was for sound effects to accompany the chosen backing track, and I am glad to say these remained a feature of *Wii-bändi* until the end. But another request was for dubbed vocals, and this was not so easy to accommodate, as I was trying to focus on the interface as a *musical* instrument. Furthermore, it would be hard for clients to personalize samples of a song if the vocals were kept, as this is usually the most idiosyncratic, recognizable part of the sound. Nevertheless I did try to see if when cutting them up into small enough samples they could be played in loops which would sound far enough from the original to feel like the clients’ own. This remained a feature of the *Live patches* from December, 2008 until the end of the first cycle.

In retrospect however, looking back at the video from this first visit, I wonder if Harri was simply asking for us to use loops of their own singing. On the one hand this would really have given the clients ownership of *Wii-bändi*, and I should have perhaps pursued this avenue as it could have meant the set-up got used more. But on the other hand, this possible use of the technology would have clashed with my intention to use audio clips of



Video clip 5.11: (0:18-0:45) EXPLORATION

their favourite song, which already used up a good percentage of the computer's CPU. Later experiences of trying to record within Live would prove that there was only so much real-time audio-file processing that could be accomplished at any one time without the sound cutting out, so recording and then using loops of those samples live would have almost certainly proved too much for the system. Here was a case where, as the researcher in charge, I would have had to completely rethink my initial idea to accommodate Harri's suggestion. The danger here would have been to completely throw the aims of the research off course.

Apart from finding out what sort of music each participant was interested in and wanted to play around with, we were particularly interested in finding out what kind of physical gestures were feasible for the clients. In the MMT concert (Reed, Tervo & Dons, 2008)<sup>10</sup>, we had used MIDI drums that were triggered by a flick, using the simplest MIDI CC kind of signal routing. However, these had proved ineffective for triggering audio samples of real drum sounds, which could sound much better and more varied. Another reason I wanted to use audio samples was because this was an important part of reproducing the timbre of the song that was to be manipulated (in our case "Rivers of Babylon").

So I decided to try out a different kind of mapping for the drums, which had occurred to me during the ISSSM 2008 in Ghent<sup>11</sup> after watching a presentation by Michiel Demey of a Wii interface (used for measuring movement), where he confessed that they 'cheated' by mapping accelerometer movements to faders on channels through which drum loops were already playing, instead of individual drum sounds. The reason he gave for doing this, was then it meant that the players were always in time with one another. For my purposes I felt this kind of set-up for the drums would be highly appropriate, and not 'cheating' in any way, as I was trying to create an interface that was easy to play for non-musicians as well as musicians. Furthermore, one gesture could trigger multiple sounds, if the flick was timed so that it played the part of a loop where several sounds were playing at once.

However, when we came to try them out with Harri and Hussein, they seemed to be too hard for Harri to flick, and besides, there was a continual pulse that didn't go away. Also sometimes there was no attack, only the decay of the beat would be caught, which we decided was unsatisfying for most people when playing the drums (they expect a sharper sound), although it did make for an interesting effect!

In retrospect, the principal reason for 'fader drums' not working was because at this stage there was no scaling page in Osculator, so the sensitivity could not be altered as necessary. Fader drums were therefore dropped as an idea as Harri's movements were

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<sup>10</sup> <http://www.youtube.com/watch?v=61BwGvudxZU>

<sup>11</sup> International Summer School in Systematic Musicology  
<http://www.ipem.ugent.be/ISSSM2008/ISSSM2008.html>

not big enough to make this kind of triggering sound convincing, so we reluctantly had to switch to trying out button drums.

## 5.2 Harri's Day

As had been agreed, for the next visit (in December, 2008) I prepared "The Rivers of Babylon" song in the background. Two sets of Wii controllers were programmed to control a drumkit each using a new triggering mechanism, and three others controlled pitched instruments (violin, harp and theremin). Harp was chosen for its sharp attack, violin for its long flowing sustain, and theremin because it was the only instrument sound we had been able to try out in November which we had all liked. With this set-up we could have up to five different people playing at the same time, although realistically I pictured pairs of people taking turns at this stage.

As it was, there were not enough people present to have even a pair playing together, let alone five people. Although I had prepared some rap samples from the song "Ghetto Gospel" by Tupac Shakur, as requested by Hussein, these would not be necessary. When we got there, we found there was only Harri present for the session so this became his day. In some ways this was a good thing, as I was uncertain the rap samples would really have gone very well as 'dubs' with the Melodians, and I myself (here I am very aware of being a subjective researcher) have no experience or, frankly, interest in the 2pac R'n'B genre of rap.

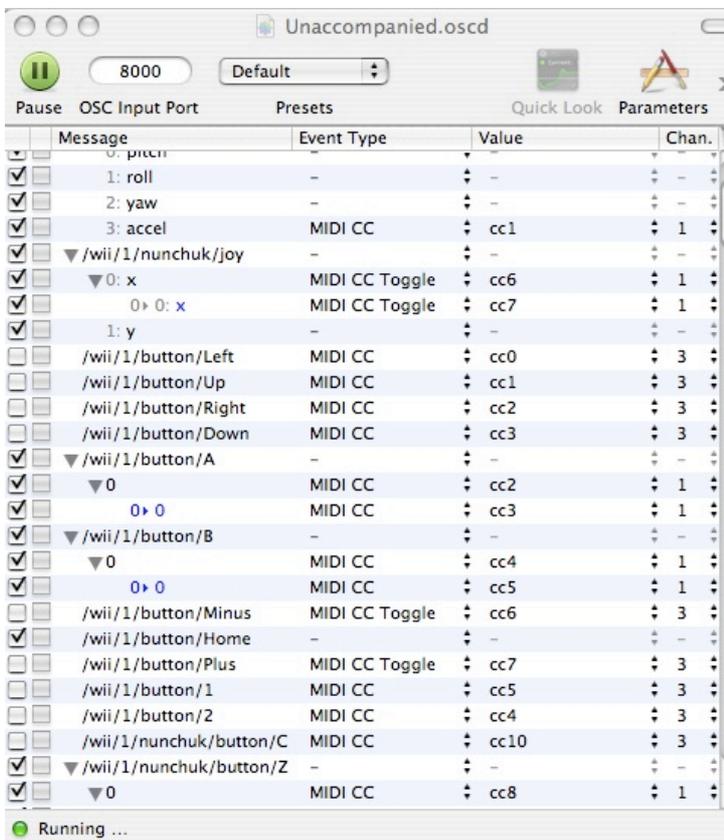


Figure 5.21: Unselecting messages in Osculator (December, 2008)

Fortunately I had prepared two patches in Osculator, so clients could choose between being vocally 'accompanied' (backing track with vocals), which they might want if playing on their own; or 'unaccompanied' (by parts of the backing track that had no singing), if the clients wanted more space in the background. The Osculator patches were identical except for the fact that the buttons which were mapped to the vocal loops were unselected in 'unaccompanied' (figure 5.21). The idea was that clients could then play on their own with the interface if they wanted, and there was no need to play in a group.

I was glad I had prepared this option when it became clear that Harri

was the only client present. However it soon turned out he had no intention of playing with the interface alone - for him this was a social undertaking. So ironically, it was in this 'single client session' that the precedent was set for the future group-oriented nature of Wii-bändi. Harri was very pleased we were there, and found it a good opportunity to steer the conversation into the main areas of interest for him. He evidently liked speaking English (he could also speak several other languages), and he was particularly keen on showing, as well as improving, his already encyclopaedic knowledge of music trivia. This outspoken nature was very welcome at this stage, as we wanted to get to know Harri, but later there was a danger that his desire to practise his conversational skills might take over the proceedings.

The pitched instruments (violin, harp and theremin) worked in the same way as they had at HAID (Reed et al., 2008) and the summer school<sup>12</sup>: they were all put through a scale effect in Live that was set to the 'key' of the song (by ear more than anything else). This meant that anything people played should have sounded to a greater or lesser degree in tune. However, the instruments were all slightly different from each other in the ways they were controlled. For example, unlike other instruments the violin's scale effect could be switched on and off, so you could have greater freedom of expression. There was of course a pay-off for this freedom, as it meant the instrument could sound horrible in the wrong hands. Another problem that this non-standardized mapping created, was they were difficult controls to remember (harp and theremin had an arpeggiator, but violin did not). Put another way, the controller in your hands for one instrument might look exactly like

another, but those same gestures or buttons controlled different parameters. This was mainly due to the fact I developed each instrument one at a time. At this stage I had not been able to see the mapping patterns which would become prototypical and therefore applicable across all instruments, even if there were some resemblances between the controls of each of the pitched MIDI instruments. These were sporadic and not yet systematic.

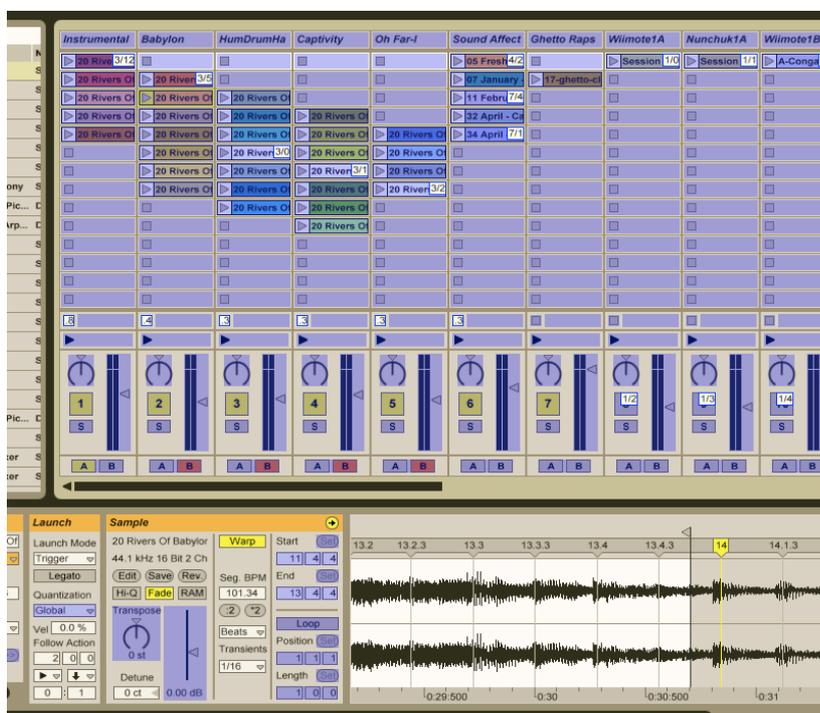


Figure 5.22: MIDI Map mode in Live (Session View)

<sup>12</sup> International Summer School in Systematic Musicology  
<http://www.ipem.ugent.be/ISSSM2008/ISSSM2008.html>

As regards the drum triggering mechanism, they were no longer fader drums, but drums which made a sound if you flicked them while holding a button down, or moving the joystick. The button or joystick would determine the drum sound, by switching on the track which the clip was located on, for as long as it was held; and the flick would trigger the actual clip. This can be seen in the numbers mapped to each drum channel's Track Activator button (  ) in the MIDI Map mode of the Live patch depicted in figure 5.22. In theory this sounded workable, but in practice it proved problematic. People's fingers would slip off the buttons, so it just sounded like a faulty connection.

Also it meant there had to be almost as many channels as drum sounds, which made it hard to alter during a session. For example, if one drum sound was too high in the mix, it was difficult to scroll sideways through roughly 30 tracks to find the corresponding track and adjust its fader. You can see from the length of the horizontal scroll bar under the channels in figure 5.22, that although 10 channels are visible, there are many that are not. You could flick between Session and Arrangement View (tab key), but even in Arrangement View, you would still have to scroll up and down a little, and not be able to see the audio clips themselves (5.23).



Figure 5.23: Arrangement View

As regards the drum sound itself, it was better than with the faders, but Harri kept stressing the need for realistic sounds, and because his fingers would sometimes slip off the buttons, the sound cutting out of course thwarted these expectations. Also there was no sensitivity regarding the force with which you flicked them: they were either on or off. In December, 2008 we therefore still had a long way to go with the drums. Because of this, I decided to focus first on pitched instruments instead as Harri was most interested in them and, after all, he was the only person present.

### 5.3 Babylon Bändi Gets 'Rumbled'

Fortunately in 2009 we started to get more people regularly coming to the sessions, and we now had our bändi. Harri, Heikki and Timo had formed the core of our group by March (they had come three months in a row). The set of pitched instruments in Live had grown to include electric guitar, saxophone, and marimba; and the Rivers of Babylon had been turned into a myriad of loops that could be played with a random degree of variation. In January I had also made the important step of labelling such loops and instruments within Live (figure 5.31), which made it a lot easier to navigate changes and the large number of channels. In February, Marc and I tried to see if we could use the 'rumble' function in the Wii, which makes it vibrate, as a way to somehow conduct, or at least play turn-taking games with the clients.

The increased number of instruments on offer meant the clients had a bigger palate of sounds to choose from but, unless they could remember what these were, and how to



Figure 5.31: Labels & role of the Clip View in the Session Window

play them, it was pointless. At this stage I tried to use instructions to make learning the controls easier, but these actually made them look more complicated, and I soon also realized that they either needed to be in Finnish, or dispensed with altogether. Customizing labels in Live really did make mapping more systematic here, so controls could be replicated across instruments.

Nevertheless, although easy-to-remember controls proved to be the most important result gleaned from the first cycle, and one which would indeed become a main avenue of research in the second (where I will cover it more fully), we first had to explore a few scenic routes before moving on and, in

some unfortunate cases, dead ends. One such scenic route was the aforementioned ‘myriad of loops’, which involved cutting up the song into samples, so it could be played in more than one sequence. This was done by making use of Live’s “Follow Action” parameter, in an attempt to avoid the listener fatigue that had occurred in previous sessions after hearing the same song over and over again.

In figure 5.31, the Follow Action panel can be seen in the Launch section on the left of the Clip View. This parameter allows you to choose in what order and manner clips in the same audio track follow on from one another. Figure 5.32 shows a close-up of the Follow Action for the clip BABYLON, located in the column (audio track) labelled Vox Chorus in figure 5.31. The Follow Action affects only the clips above and/or below it in that block. It will not apply to other clips in that column if there is an unfilled slot between them.

If we look closer now at figure 5.32, below, we can see there is a row of three boxes that define the length of the clip to be looped in terms of beats, at the end of which the Follow Action will occur. The boxes represent bars, beats and quarters of a beat from the start of the clip, so in this example we can see it is set to four bars. Below these three boxes are two further boxes with drop-down menus where you can choose one of 9

different Follow Actions to assign to each box. These consist of No Action, Stop, Play Again, Previous, Next, First, Last, Any and Other. In figure 5.32 they are set to Play Again and Next. If you wanted to make the Follow Action play the last clip in the block of clips (in this case CARRIED), you would set it to Last, and so on. If set to Any, the following clip could be any in the block, *including* the clip currently playing (BABYLON), while Other would follow with any in the block *except* for BABYLON. The lowest pair of boxes, which are separated by a colon, are where you can set a ratio of probability for the two Follow Actions that have been chosen for the boxes directly above. In our example therefore, the Follow Action in figure 5.32 is set to loop a sample of four bars in length from the clip BABYLON, and it is twice as likely to play the next clip in the sequence (WEPT), and then whatever that clip's Follow Action is set to, as play the BABYLON loop again.



Figure 5.32: Follow Actions close-up

It is this systematic randomness which was intended to provide a backing which played a song, yet at the same time would repeat certain sections more often than others. In this way there would be enough variation be interesting, but also enough repetition of certain key sections to enable clients to develop riffs of their own to play over the top. In this way it was hoped that the backing would have some aspects of procedural generative music.<sup>13</sup>

As with all action research however, this notion was immediately tested in practice and found to be wanting. There was a balance which had been tipped too far one way. I wanted to help them feel musically supported, while at the same time free to play what they liked, so that when they played it sounded great. Perhaps now, however, there was so much going on in the background, that they did not feel the need to add anything of their own. The backing was rich and varied enough, for sure, but this had adverse effects on the participants. Getting the balance between variation and conservation of the original Rivers of Babylon was proving more difficult than I originally thought.

As we can hear when listening to video clip 5.31 (from February), the clients are only making percussive accompaniments to a song which was obviously too prominent in the mix of instruments. Harri's first impression of the new backing back in January was as a song that was "stuck", not as a backdrop canvas of music that could be have something new woven into it. It was not my intention that it sound like a piece of scratched vinyl! But perhaps this was all that the 'generative' aspect of the backing sounded like to others. After a two month



Video clip 5.31: (6:54-7:48)  
EXPLORATION

<sup>13</sup> Whereas the ongoing procedure of change in Reich's "It's Gonna Rain" is controlled by the differing speeds of tape loops, here the procedure is controlled by the ratio of probability for the two different Follow Actions. [http://en.wikipedia.org/wiki/Generative\\_music](http://en.wikipedia.org/wiki/Generative_music)

trial this idea had to be either extensively modified or dropped.

In February, we also started using the Wii's 'rumble' function to lend a certain novelty approach to the issue of taking turns, as we tried to play a musical version of 'hot potato' where people only played when they felt their Wii rumble. This turn-taking is also happening in video clip 5.31, hence the minimal playing. However, as with many of these ideas, it sounded better in theory than in practice. The rumble interfered with the music and was 'disturbing' as Harri put it (video clip 5.32), since the amount of vibration was not adjustable, and sometimes the sound it made was louder than the music you could make with the Wii controller. As with the generative backing idea, we pursued the rumble function until the end of the first cycle (March), so that it also had a two-month trial, but we found that in the end it was easier to signal turns by simply speaking. 'Rumbling' would reappear later in the project, but serving a slightly different function.



Video clip 5.32: (04:33-05:42) EXPLORATION

#### 5.4 Button Drums

Lastly in this cycle I experimented with drums that were simply triggered by buttons to avoid the problems we had had with fader drums in December. In this way I could use very realistic audio samples of drums and percussion from songs I liked, not just the ones in Live which sounded sometimes sterile. Harri and Timo had also suggested that they would like a trigger that needed less movement. The fader drums had been too prone to glitch, and I could not make them sensitive enough for either Heikki or Harri to use. By using the buttons as triggers however on the Wiimote and Nunchuk (and there are many), I could use audio file samples from a wide variety of backgrounds, including particular timbres and drum sounds from recordings that I liked.

The idea in January was to make different kits, or at least groups of similarly sounding percussive instruments, which could be played with the same buttons, as some of the buttons are easier to press than others. Intuitively these were the trigger buttons **B**, **Z** and **C** as previously mentioned.<sup>14</sup> To switch between kits the cross button was used on the Wiimote, which meant there were four different sounds for the same trigger buttons, depending which direction on the cross you pressed. Up gave the client congas and cowbell, Right was springy drums with tambourines, Down was tablas, and Left was samples from a ska song which used gunshots and ricochets. All of these had some kind of kick drum layered under the other drum sounds on the **B**, so that rhythms with a downbeat could be made. There was a separate channel in Live for each combination of

<sup>14</sup> See trigger buttons in section 4.2 on "Wii controllers", p32

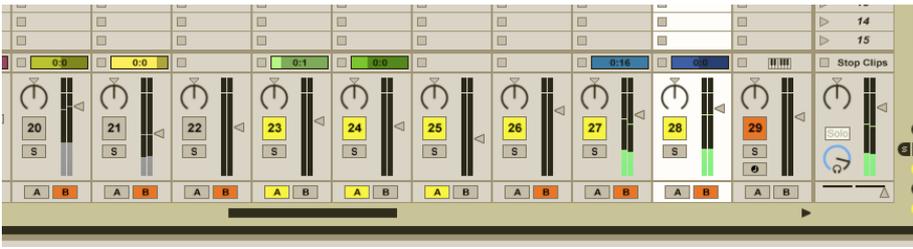


Figure 5.41: Using the crossfader to double the number of drumkits

buttons. Each direction of the cross button switched on the Track Activator for three of the tracks when held down.

I then realized

that I could use the

crossfader to double this number and switch between those tracks, if I assigned one half to **A**, and the other to **B** (Figure 5.41). There are hence 6 tracks, not three, that are activated when one of the cross buttons' directions is pressed (the Activators are yellow). The crossfader here is the grey triangle under the master channel, which is switched to the right side. This determines which three of the 6 are active. Switched to the right, it only allows tracks with **B** assigned to them play. We can also see that tracks 20 and 21 have a signal (being also switched to **B**, and triggered by button **Z** like tracks 27 and 28), but because they belong to another kit (i.e., a different direction on the cross button), the Track Activator switch is off (it is grey, not yellow) so the signal is also greyed out. Tracks 23 and 24 are also triggered by **Z**, as we can see the audio clips for each are playing, and their tracks are even activated (the buttons are yellow), however there is no signal as they have been assigned to **A** on the crossfader. This leaves only tracks 27 and 28 as they fulfill all three criteria: correct trigger button, correct direction on cross button, and correct crossfader assignation.

However, the cross button had to be *held* down in one of the four directions, if you wanted to make any sound at all with the drums, and this sometimes caused problems. Timo seemed to have physical trouble pressing the cross button while playing with the trigger buttons. In the March session, it even became clear that, when playing with it on their own, Invalidiliitto staff had been using packaging tape to hold down one position on the Wiimote's cross button (video clip 5.41). Not only did this defeat the purpose of

designing something that was easy to play, but it meant that even if Timo *had* wanted to change the kit he was playing, he was prevented from being able to do this by a piece of tape! So much for user-friendly, this had to be changed.



Video clip 5.41: (12:36-13:20)

#### EXPLORATION

The other problem was that the clients hardly moved, and moving was of course the biggest part of my attempt to make the interface expressive. The last session of the first cycle (in March) indicated nearly all of the results that have been noted in this chapter: the fact that the Rivers of Babylon backing was no longer needed; that the drums needed

gestures other than pressing buttons; and so on. But it also threw up one very positive unexpected thing: Harri and Heikki began to sing along to Timo's beat as they were playing, even if Timo was barely moving as he played (video clip 5.42). This interaction, even if it was not directly using the interface was only to be encouraged, as it showed a motivation which is intrinsic to all therapeutic activities. Timo (right) is playing the drums, Harri (centre) is playing harp, and Heikki is playing saxophone. However, the clip unfortunately ends with Sannamari putting adhesive tape on Timo's Wiimote.



Video clip 5.42: (10:13-11:53)

#### EXPLORATION

What was doubly frustrating about this, was that I had also made an Osculator patch for March where the cross button activated a MIDI CC Toggle event, so that if they found it too difficult to hold down the button, they no longer had to, as the toggle would keep it on until they pressed the same button again. The problem with this was that Timo would forget which kit he had turned on already with the cross button, and would end up switching them all on, and none off. Osculator, at this stage in its development, did not have a means for switching one signal off at the same time as switching another on.

We did get something concrete back after the March session, in the form of some questionnaires that I had given out in December. Here the clients, often with the help of a member of staff, had been able to express themselves by writing their feedback down in Finnish, which probably made it easier to present their thoughts than in a purely verbal form. Also I finally received from Sannamari written feedback about the backgrounds of each participant, what she felt they had gained from the sessions, in terms of their particular issues. This also gave an insight into the sessions she had conducted on her own with the group between our visits (the few times the interface was able to work without technical hitch). With the combined results from these questionnaires, video footage, and verbal feedback I could start the second cycle of research by making some well-informed changes to the project.

# CHAPTER 6 - Scaling Signals & Return of (the) MIDI

## (Cycle 2: April - September, 2009)

From April to September, 2009 we changed gear, the lengthy exploration phase seemed to be finally over and we seemed to making significant progress on all fronts at once. There were only four of our monthly visits made in this time, with a break for the summer in July and August, but right from the start of this cycle we already had a much more appealing interface that was becoming gradually easier to play. The research had entered a new phase in a number of ways. Firstly I had been able to systematically go through the filled-in questionnaires that had come back to me in March and take on board as many of the clients' requests and recommendations as possible. Secondly I was managing sessions better by incorporating some therapeutic warm-up activities (Wigram, 2004), and communicating better with the group. Jenni, a new and very proactive member of staff from Invalidiliitto, played a major part in this from April when she joined. Thirdly I managed to standardize controls across the pitched MIDI instruments, so that learning the gestures and controls for one instrument could be transferrable to all the others, and so there were fewer instructions necessary. Fourthly I dropped using the song 'Rivers of Babylon' as a backing track, instead replacing the concept of 'song backing' with the more traditional and indeed effective concept of 'a bassline'. This coincided with finding a way to positionally scale signals in Osculator which meant that the accelerometers could be more accurately mapped to musical parameters. The last two sections of this chapter concern the final preparations I made for the last cycle, considering the mixed results of this second cycle where so much progress was nevertheless made. The main feature of these changes was a return to the use of MIDI for drums, as well as for the new basslines. It is recounted in this chapter so that chapter 7 can focus solely on the results of the final cycle, which took the form of role plays.

### 6.1 Written Feedback and Finnish

Although clients had my questionnaires throughout the first cycle of research, it was not until the March visit that I got them back and was able to study them in any detail. I got back a total of 11 (if you count one where Harri, or at least a member of staff on his behalf, had simply scrawled 'Ravintola efekti!'). Some clients had completed a form on more than one separate occasion, and staff had each filled one out, even if they had only been present one time. The questionnaires gave feedback on sessions where Marc and I had been present, as well as the ones they had been able to conduct without us. It was also only at the start of the second cycle that I received from Sannamari more detailed written information about the backgrounds of each of the clients who had participated up to then. She also contributed her thoughts about what each participant got out of the activity.<sup>15</sup>

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<sup>15</sup> See Section 3.3 (p25), and Appendix A: "Soiton Merkitys" (p99)

Some of the recommendations I had already picked up verbally in the sessions, and some of the questionnaires were only partially filled in, but having feedback written down made a difference as all participants, not just the most extrovert, were able to express themselves on an equal basis. This was tackling the subjectivity of our endeavour head on, by asking precisely for the source of that subjectivity (people's opinions) so that we could then proceed to spread it as thinly and evenly as possible.

The questions were open and about the strengths and weaknesses of the interface so far. I collated clients' answers and came up with a list of changes to be made. They are addressed in the remaining sub-sections of this chapter, where they are also evaluated, and are as follows: the first point that emerged, was that people were generally satisfied. They had fun in the sessions and all wanted more. This gave me the confidence to begin the second cycle with more self-assuredness to better manage the sessions and move them forward a bit faster. The second point made in the feedback was that the instructions for the Wii controllers had been a little complicated at the end of the first cycle, and it was thought that perhaps translating them into Finnish, and making them simpler to understand would in itself force me to rationalize the design of the controllers, so that the same gestures would affect the same kind of parameters in different instruments. This way by learning one instrument, you could effectively learn them all. Thirdly came a request to have different songs in the background, not just the Rivers of Babylon, and to have more sound affects to play with. And finally was a request for simpler drums, so that there could be fewer buttons that needed to be held down at once. We did not want a repeat of taping down of buttons, and staff seemed to agree with me that it was better if the clients moved more than they did with the button drums, so I resolved to crack the problem of accelerometer triggered drums, and scaling signals would prove to play a major part in this.

The questionnaire had consisted of four open questions that were addressed in Finnish, to make it as easy as possible for respondents to express themselves in their native tongue. I did not want any trouble they might have had translating their thoughts to prevent them contributing. During the first cycle I had become aware that clients such as Harri, with his penchant for speaking foreign languages (he starts singing in French in video clip 5.42), was sometimes tempted to monopolize proceedings as a chance to practice his English language skills (see video clip 6.11).



Video clip 6.II: (8:06-10:07)

EXPLORATION

Video clip 6.11 is from earlier in the same session as clip 5.42, when the band are playing together quite well. But at this point, Timo is trying to continue playing the drums, in spite of Harri's best attempts to turn it into an English conversation class. I could see

## ILMARUMMUT



**ÄÄNI 1**  
Heilauta Wiitä  
kuin iskisit rumpuja



**ÄÄNI 2**  
Painele nappeja  
B & Z  
(paina nappeja nopeasti vuoro-  
tellen = rumpujen "päristys")



**ÄÄNI 3**  
Heilauta Nunchuk-  
ohjainta kuin iskisit  
rumpuja

Jokaisessa rumpusetissä on 3 eri ääntä.

Kytke setti päälle painamalla ristinaivin jotakin suuntaa kerran.

Nappia ei tarvitse pitää pohjassa.

Paina samaa nappia uudelleen, niin saat setin pois päältä.

Settejä on yhteensä 8 ja ne on jaettu kahteen ryhmään:



Figure 6.11: Control Instructions for the new 'Flick Drums' in April

I had prepared a test for Harri on one of his pet subjects (the various details of the Rivers of Babylon in all its versions), as one such occasion presented itself right at the start of our session in April. We were waiting for Heikki, and for printouts of the new instructions for Wii-bändi to arrive, because Jukka had not printed them out in advance (video clip 6.12), so after some polite small talk I could show Harri that I had done some research on his pet topic, while at the same time not wasting any valuable playing time. The new printed out instructions were also in Finnish, for the same reasons the questionnaires had been. I had been able to use professional graphic design software, courtesy of my wife, to make them more attractive and simpler to understand. I had designed them now, so that the most fundamental basic controls were at the top, and the more refined controls were at the bottom, so that it was clearer

the appeal of once a month having a 'musical' English lesson, but this was not the point of my thesis. I wanted those who were less comfortable with linguistic challenges to feel equally important in the group. With these considerations in mind, translating the answers from the Finnish when I got the questionnaires back was a small price to pay. In the first cycle of research, there had been many moments when we all had to wait for some aspect of the technology, so Harri was quite justified using up the time as he did, but in the second cycle I wanted to keep conversation to a minimum to make the most of our limited time together. I was prepared to use such conversations as time fillers only when we were unable to do anything more musical.

It was a good thing then, that



Video clip 6.12: (0:19-1:15) PROGRESSION

which controls were a priority to learn first.

Figure 6.11 above shows the instructions for the new drums in April, which required a flicking gesture to trigger the main sounds for each drumkit (downbeat and backbeat sounds), and the trigger buttons **B** and **Z** for a third sound. Once these had been mastered, the user might think about selecting a different kit with the cross button. There was no need now to hold down the cross button in the direction of the desired kit anymore at the same time as flicking or triggering. As we can see, the controls are laid out on the page according to their musical function<sup>16</sup>, with excitation functions being the most important at the top, and modifying and/or selection functions lower down, being something to be learned only after the excitation gesture has been mastered. There were now two drum Wii controllers, one with flick, and the older one with buttons so we could compare them. However, by the end of this cycle in September it was evident that only the flick drums were required, as at last even Harri was able to trigger them with small flicks of his wrist (video clip 6.13), something that had not been possible with the unscaled fader drums. This meant we could drop the second lot of (button) drums, and so I turned them into a cello instead.



Video clip 6.13: (19:28-20:36) PROGRESSION

## 6.2 Managing Sessions More Effectively

Surprisingly the positive upshot of these new improved instructions was not so much that they were actually *used* by anyone, but more the fact that in the process of making them, I had been forced to standardize and simplify controls to the point where eventually no instructions would be needed by the third cycle at all. It was becoming apparent that just as in other interactive interfaces where you want intuitive behaviour, such as dance workshops, instructions got in the way. One of Ulyate and Bianciardi's 'commandments of interactivity' also seemed to be relevant to Wii-bändi:

"No instructions allowed... must be intuitive and simple. There should be adequate feedback to for the participants to intuit if they are interacting correctly or incorrectly" (Ulyate & Bianciardi, 2002).

So the process of making instructions proved more beneficial than the actual instructions themselves. But more effective than any amount of instructions in Finnish, was a new staff participant, Jenni, who was able to interpret very quickly and effectively in the sessions and was also quick to pick up on what we were trying to achieve. She was able to use her prior knowledge of the participating clients, which was something we did not

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<sup>16</sup> see paragraph 2, p14.



Video clip 6.21: (3:30-3:46) PROGRESSION

more quickly by feeling the gestures that controlled the interface (video clip 6.21). Later on we used the same technique when Vesa, another blind client, joined the group. Overall Jenni helped keep the sessions very positive and focussed on what I wanted to achieve. With better team management, the level of fun in the sessions increased greatly, and this became very much the ‘progression’ cycle where many elements finally came together.

One way we achieved better communication in the sessions was using warm-up activities, which at first felt strange, but later provided a welcome and familiar structure to the proceedings. Clients were encouraged to express themselves to begin with in more ways than just with the Wii, for example we often began just with making a vocal noise together all at the same time to loosen up, then we would move on to taking it in turns to solo for a minute to express ‘how we are feeling today’. The others would then try and guess from the ‘performance’ the emotion that the soloing client was expressing, or else there was just some kind of feedback from those listening. For instance, in video clip 6.22, Heikki confesses to feeling confused, or “sekävä” (probably because of my attempts to explain this activity in appalling Finnish!), but immediately afterwards Harri tells him “that was not so confusing”. The overall feedback from the group was that what he played sounded quite clear, and it was even perhaps tentatively playful. In this way it became clear to clients that there was no right or wrong way of doing things, and it was just a means to break the ice every month so that people could then start playing more freely. Note that for now, Heikki was using the simplest controls: the trigger button for excitation, and tilting the Nunchuk for pitching the note (modulation). He had no need for instructions. At this stage he is only

have. For example, she was aware of Harri’s tendency to be the “expert”, and pointed out that sometimes he was actually a bit lazy, in that he expected to have everything done for him. And in retrospect there are perhaps shades of this in how he expresses himself back in video clip 6.11. Of great help was the fact that she would sometimes physically show Harri what I was talking about in terms of gestures, by moving his arm in the way I was moving, so he would understand, as a blind person,



Video clip 6.22: (5:06-6:09)  
PROGRESSION

using one arm, as he often feels that even if he tried to use his right arm, he would have trouble, and this annoys him.

Later we would see if Wii-bändi might change this. With a planned variety of activities, people were starting to listen to each other and encourage each other. Once we had begun a culture of doing this, then we were able to do far more, gradually encouraging clients to try more difficult selection and modification controls by cycle 3.

### 6.3 Standardizing the Pitched Instruments

The motivation behind standardizing the controls across the interface, was so clients could change instrument as and when they felt like it, without feeling like they would have to learn a whole new instrument. I felt this was making the best use of the wealth of sounds available in Live, and after the brief and rather disappointing foray into button drums, I wanted to use accelerometers now as much as possible. These gestures in the air are what distinguished the Wii controllers, after all, from most traditional musical interfaces.

Over the course of the first cycle, various patterns had begun to emerge: up and down gestures (in terms of tilting) seemed intuitively right as a means of modulating pitch; rolling was good for changing aspects of the timbre (a bit like a giant knob really); while flicking seemed the most energetic gesture, hence a good one to perform the function of excitation (Miranda & Wanderley, 2006) and map to the musical parameter of velocity or amplitude. Flicking was similarly the best gesture for drums, as it most directly translated a movement of emotional excitation into percussive excitation, like hitting a drum or shaking a bell. Also we had received comments during the first cycle from the staff at Invalidiliitto, pointing out that the more the clients moved, the more therapeutic it was thought the activity would be. It would enable them to feel less inhibited and depressed about their physical condition. So as flicking was a movement that could be made in any direction to control an instrument, then we should be using that gesture above all others.

Although flicking Wii controllers might resemble traditional excitation gestures in percussive instruments, it differs in one very important respect. The Wii's accelerometers have only *internal*, not external force feedback, as defined by Sinclair (2007, p1). In effect it means the player can only gauge the effect of their movements on the music, through feedback from their muscles, associating various positions with the music heard when playing. The only external force feedback possible, would be if you hit any part of the Wii or Nunchuk against an object while playing, but the nature of that object would be arbitrary, as it is the accelerometer, and not a tactile sensor generating the signal. It was quite possible that Timo was trying to find a solid object that he could reliably hit, and know that every time the same drum sound would occur (video clip 6.31). In this part of the



Video clip 6.31: (6:12-6:22)

PROGRESSION

video footage, he flicks the Wiimote onto his leg every time he wants the sound of a bottle. The irony here was that he was moving more, now that he knew the accelerometers were triggering the drums, but it was a button triggering this sound. In effect he had created a different more intuitive gesture to *play* a button, other than the usual action of pressing, and in this case it was the **B** button on the Wiimote that was hitting his leg and triggering the sound of a glass bottle being hit.

Freedom such as this for clients to develop and practise their own techniques of playing, was a big part of the second cycle of research. Of all the gestures, flicking and



Video clip 6.32: (9:30-10:43)

PROGRESSION

tilting were the ones that needed to be practised the most.

Although difficult to master at first, it was thought these accelerometer-sensed gestures could have advantages for users with limited mobility. The threshold could be set in Osculator so that, in the case of flicking, not just any direction, but any amount of movement sufficed. I needed to teach people how to get the most out of tilting and flicking, and indeed by the end of the second cycle, these gestures had been incorporated into each client's repertoire: Heikki was clearly enjoying tilting his saxophone (video clip 6.22) or harp

(video clip 6.32) to pitch it while adding some slight vibrato by shaking it gently; Timo, after barely moving when using the buttons in the first cycle, was getting used to flicking the drums (video clip 6.33); and Harri too had finally been able to trigger drum rhythms with a very different kind of small flick of his arm in the air (video clip 6.13). Riku enjoyed the noise that large movements with the guitar could make, and found it easier to stand up when playing so he could swing his arm in a big arc,



Video clip 6.33: (11:24-11:47)

PROGRESSION

in the style of a guitar legend, even if it was not particularly melodic (video clip 6.34). Vesa only joined us at the end of this cycle, but he learnt the basics quickly with the help of Janne his assistant, who could move the controllers in his hand so Vesa, although blind, could feel the movement of the gestures.



Video clip 6.34: (15:41-16:35)

PROGRESSION

The importance of tilting and flicking in Wii-bändi is illustrated below by the instructions for the pitched instruments (figure 6.31). Just as with the drums, the most important gesture was at the top. In figure 6.31, the two pitched instruments have quite different sounds, nevertheless both have this top to bottom gradation of functionality in the controllers: from excitation at the top (tilting while holding a button) to modulation in the middle (flicking and rolling) to selection at the bottom (buttons for effects). In effect, a harp and a saxophone are using the same gestures to trigger, modulate and select similar



Figure 6.31: Control Instructions for two of the pitched instruments in April

kinds of musical parameters but for very different sounds. Once clients had grasped flicking and tilting, it was hoped a realm of new musical possibilities would open up, because by mastering the basics of one instrument, it would apply to all the instruments in Wii-bändi. There was room to experiment within these basic gestures, for example I tried to demonstrate a possible technique for playing simple dyadic chords by holding the Nunchuk and Wiimote at different angles to each other so the degree of tilt for each controller would result in two different notes (video clip 6.35).



Video clip 6.35: (8:36-8:50) PROGRESSION

#### 6.4 Bass Backing & Positional Scaling

Although the drum controls had changed, and those for the pitched instruments had been standardized, the sounds controlled by Wiis 1-7 were essentially the same as at the end of the first cycle. Wii 1 and 2 were drums, while 3 to 7 were the pitched instruments. However there was one instrument that had a complete change of sound: Wii 8 had been controlling the song samples from the Rivers of Babylon and all the sound effects, but now it was a

bass loop controller. And instead of loops from the one song which could be modulated and played in any order, I recorded the bassline for three different songs on electric bass guitar, as there had been requests for more songs in the feedback back in March. So I recorded basslines from the “Rivers of Babylon” (of course), “White Room” by Cream (Heikki wanted some Eric Clapton), and “John, I’m Only Dancing” by Bowie. These were made to be in the same key, so the scale effect in the pitched instruments did not need to be changed between songs. Then they were cut up into loops so that they could be ‘played’ in some way (i.e., in a different order and/or modulated). An audio recording of bass guitar was chosen over MIDI bass at this stage, as I hoped to transmit some elements of authenticity and hopefully vitality, from the original recording of the songs, as MIDI sounds (in my experience at least) have a tendency to sound soulless.

Although there was the minor technical problem that the audio would occasionally crackle and glitch for a millisecond or two, video clip 6.41 illustrates that now, with these final additions of cello and bass, we had in principle found all the right sounds for the instruments in Wii-bändi. There is a balance between being able to hear each individual instrument, and the music that is being made together, which is starting to sound greater than the sum of its parts. With the principle sound issues resolved for the moment therefore, I could turn my attention once again to gestures. The rest of the second cycle was spent perfecting the gestures that would control the bass, and this would involve positional scaling of the flick.

As with the button drums before, triggering the recorded audio loops for the bass was easier if there was only one MIDI CC signal to switch them on, so I had initially used only buttons to trigger the bass loops. This was because the accelerometers often gave a burst of signals, which caused the audio file to have an unnatural attack as it was triggered several times within the space of a millisecond. However, the result was the same as we had with the button drums: the clients did not move enough, and so the therapeutic value of the interface was not being fully harnessed. The result was that in May and June, when Harri played the bass, which he was most keen to do as it was the newest, with barely a movement (see clip 6.41), I knew I had to incorporate flicking also to this last instrument. This was finally achieved by positional scaling so that the signal did not jam the attack of each sound envelope. In this way, the rhythmic nature of the bass was reinstated by requiring a flick to trigger the two main riffs of each song’s set of loops - one on the Nunchuk, and one on the Wiimote. In fact, to make all the continuous controller gestures effective, positional scaling was successfully used across all the instruments by the end of this cycle, not just on the bass. So I will take two examples from another instrument, the



Video clip 6.41: (6:48-8:21) PROGRESSION

electric guitar on Wii 7, to illustrate how important it became for both accelerometer and joystick signals over the summer of 2009.

In chapter 4, and appendix B I describe the basics of how the signals are mapped from the controllers, through Osculator, to Live. Here I want to particularly focus on the accelerometer and joystick signals, because these continuous controls had proved problematic in many ways up until August 2009, when I was able to scale them positionally to a much finer degree. I was still not able to use any of the linear XYZ axes in the accelerometers, but I was able to make the threshold for triggering a signal much smaller in the axes which were already in use, and in the joystick.

Equally I could tailor the output to be more precise. If we compare the scaling pages from the Osculator patch in June (figure 6.41), and the one in September (figure 6.42), we can see how this had progressed over the 2 month break between the visits.

The first example concerns the joystick signals. Whereas in June the X-axis of the joystick on Wii 7's Nunchuk could affect a range in musical parameter of between 0.4 and 0.6 (i.e., "Out. max"), in September this had been altered to between 0.5 and 0.65. This small difference shows the significance of, not only the range, but the position of the range on the scale of values. The musical parameter controlled in Live was, in this case, the "distance" of arpeggio in the guitar. In other words, the output was spanning -4 to +4 semitones from the note being played (in June). The output values had been chosen a priori, with the idea that if the joystick was to the left, the arpeggio would make a pattern that descended in pitch,

Figure 6.41: Scalings page in Osculator from June, & September, 2009

Message	In. min	In. max	Cap	Out. min	Out. max
2: yaw	0	1.0	<input type="checkbox"/>	0	1.0
3: accel	0	1.0	<input type="checkbox"/>	0.6	1.0
/wii/7/button/1	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/button/2	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/button/A	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/button/B	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/button/Down	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/button/Home	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/button/Left	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/button/Minus	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/button/Plus	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/button/Right	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/button/Up	0	1.0	<input type="checkbox"/>	0	1.0
▼ /wii/7/nunchuk/accel/pry					
0: pitch	0.35	0.55	<input type="checkbox"/>	0.25	0.6
1: roll	0	1.0	<input type="checkbox"/>	0	1.0
2: yaw	0	1.0	<input type="checkbox"/>	0	1.0
3: accel	0	1.0	<input type="checkbox"/>	0.6	1.0
/wii/7/nunchuk/button/C	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/nunchuk/button/Z	0	1.0	<input type="checkbox"/>	0	1.0
▼ /wii/7/nunchuk/joy					
0: x	0.8	0	<input type="checkbox"/>	0.4	0.6
1: y	0	1.0	<input type="checkbox"/>	0	1.0
▼ /wii/8/accel/pry					
0: pitch	0	1.0	<input type="checkbox"/>	0	1.0
1: roll	0	1.0	<input type="checkbox"/>	0	1.0
2: yaw	0	1.0	<input type="checkbox"/>	0	1.0
3: accel	0	1.0	<input type="checkbox"/>	0	1.0

Message	In. min	In. max	Cap	Out. min	Out. max
0	0	1.0	<input type="checkbox"/>	0.46	0.35
0 > 0	0	1.0	<input type="checkbox"/>	0	0.9
/wii/7/button/Minus	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/button/Plus	0	1.0	<input type="checkbox"/>	0	1.0
▼ /wii/7/button/Right					
0	0	1.0	<input type="checkbox"/>	0.46	0.6
0 > 0	0	1.0	<input type="checkbox"/>	0	0.68
/wii/7/button/Up	0	1.0	<input type="checkbox"/>	0	1.0
▼ /wii/7/nunchuk/accel/pry					
0: pitch	0.35	0.55	<input type="checkbox"/>	0.25	0.6
1: roll	0.6	0.95	<input type="checkbox"/>	0.7	1.0
2: yaw	0.35	0.55	<input type="checkbox"/>	0.25	0.6
3: accel	0.2	0.5	<input type="checkbox"/>	0.67	0.79
▼ /wii/7/nunchuk/button/C					
0	0	1.0	<input type="checkbox"/>	0.5	0.6
0 > 0	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/nunchuk/button/Z	0	1.0	<input type="checkbox"/>	0	1.0
▼ /wii/7/nunchuk/joy					
0: x	0.8	0	<input type="checkbox"/>	0.5	0.65
0 > 0: x	0	1.0	<input type="checkbox"/>	0	1.0
0 > 0 > 0: x	0	1.0	<input type="checkbox"/>	0.5	1.0
1: y	0.98	0	<input type="checkbox"/>	0	1.0
1 > 0: y	0	0.2	<input type="checkbox"/>	0.85	0.95
▼ /wii/8/accel/pry					
0: pitch	0	1.0	<input type="checkbox"/>	0	1.0
1: roll	0	1.0	<input type="checkbox"/>	0.54	0.83
2: yaw	0	1.0	<input type="checkbox"/>	0	1.0
3: accel	0.15	1.0	<input type="checkbox"/>	0	1.0

whereas to the right it would rise. However in practice, this difference was not easily heard, and it soon became clear that the easiest feedback for the player to understand, was simply that the more you pushed the joystick to the right, the wider the range of notes in the arpeggio. By altering the position, as well as the range of the output in Osculator (in September), I was able to change this so that the values instead spanned 0 to +6 semitones from the original and the difference was easier to perceive, and therefore the control was easier and more intuitive to play.

The second example concerns the accelerometer signals. It had become clear by June that to encourage expressivity in the clients' playing, it would be a good idea to incorporate controls that would be able to modulate the velocity, loudness or some other aspect of an instrument's timbre. Tilting, or the rotational axis of "pitch" in Osculator was reserved for controlling musical pitch in all of the pitched instruments (Wiis 2-7), so this left "roll" and "accel". These two axes were actually the most easy to distinguish from one another, so their respective gestures - roll and flick - could be assigned to different modulating parameters. In the case of the guitar, there was no mapping of these axes in June (figure 6.41), while in September they were each assigned a MIDI CC event that was positionally scaled on the MIDI instrument's sustain and volume parameters respectively. The scales in place ensured that those parameters were always within a certain level, but that sustain increased when the Nunchuk was rolled to the right (clockwise), and volume increased with more forceful movements.

This positional scaling was gradually applied across all of the pitched instruments and was the last major development to wrap up this progression cycle and take us into the final period of consolidation, one where I would try and address those annoying yet significant details such as those milliseconds of audio cutting out. Little did I realise that this particular little detail would involve giving up a large part of the work done since the beginning. It was definitely the start of the final cycle.

## **6.5 'Impulse' Drums & Better Divergent Mapping**

After the last visit of the second cycle (September, 2009), I finally decided to take the plunge and adopt a radically different approach to the drums. I had been holding to the idea that real-world samples would be more effective at motivating the clients, but there had been a big price to pay. There was too much processing going on in Live for the computer to cope with recording. It often took up to 10 minutes to load, and the set would frequently crash. From this perspective the experimental / humourous novelty value of using, for example, peeling onions as a percussion sound speedily wore off.

The instrument called Impulse, in Live, looked like a suitable means for replacing the CPU-hungry drums. It enables up to eight samples to be assigned to the same MIDI channel, using the range of keyboard notes between C3 and C4. These notes could then be assigned, using the MIDI Note event in Osculator, to the appropriate Wii controls. Highlighted in figure 6.51 is the track "Nundrum 1" containing the drum sounds in Impulse

which can be controlled by the Nunchuk of Wii 1. These can be seen in the row of 8 buttons along the bottom section of the screenshot, one of which (the closed hi-hat) is yellow. They were all routed through MIDI channel 8, as can be seen from the input channel window in the centre of the track. Tilt and overall acceleration were used as the main gestures to trigger the principal kit sounds of snare drum and hi-hat respectively. Meanwhile the track Wiidrum 1, just to the right of this, controls the kick drum and ride cymbal (or other percussion) using the same gestures, but on the Wiimote of Wii 1.

The positional scaling was such, that when the controller was tilted sufficiently downwards the kick drum (Wiimote) or snare (Nunchuk) would sound, while cymbals on each were triggered by a smaller amount of overall acceleration. This meant a player could play both cymbal/percussion *and* drum sounds with one pronounced downward flick, but also *just* the cymbal/percussion could be played if the gesture was kept to a smaller tapping movement. In this way it allowed for an essential dynamic in playing drums: keeping the overall tempo with smaller movements while being able to make the downbeat (and backbeat) to determine the meter with more pronounced movements.

The trigger buttons (**B**, **Z** and **C**) were now used to change the meaning of these principal flicking and tilting gestures. One would make both Nunchuk and Wiimote play only the snare drum, with just a slight variation in timbre between the two (**B**), so that a roll or flurry could be played if required; another would make the controllers play only the toms (**Z**), so that fill-ins could be made more easily; and the other button (**C**) would transform the gestures into crashing or ringing cymbals of varying timbres.

There had been controls which performed a similar 'shift' key function earlier in the project, but this function could only be achieved within Live, as Osculator's options for divergent mapping were limited at that time. This had led to an unwieldy number of overall tracks, together with all the disadvantages mentioned previously in the earlier cycles of results. But by the end of 2009, there had been a much needed update to Osculator that specifically solved this problem. A new meta event called 'latched enable' meant that a signal which was duplicated (so that it was triggered at the same time as the original) could be sent within Osculator to disable or enable another signal. In this way the aforementioned **C** button would disable all the duplicate signals triggered by tilting and flicking that were not cymbals while enabling those that were, **B** would disable everything but the snare drum sounds required for a drum roll, and **Z** would disable all but the chosen

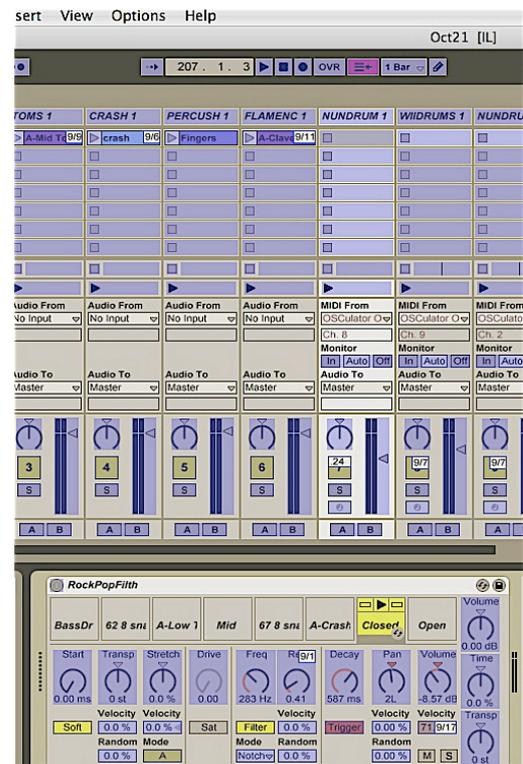


Figure 6.51: Impulse as a drum instrument

toms (figure 6.52). In the figure below, the ticking or unticking of boxes in column 1 of the Osculator window determine, not only which signals will function in the default setting (where none of the trigger buttons are pressed), but whether the meta event then either enables or disables that path. If, by default, the signal is not ticked and therefore off, then the meta event mapped to that path, when sent, will enable it. If, on the contrary, it is ticked then the meta event will disable the signal.

In some ways the drum sounds were now more conventional (or more precisely MIDI conventional) than I would have ideally liked them to be. I would have preferred to have kept at least one of the many strange samples used for the drums in previous

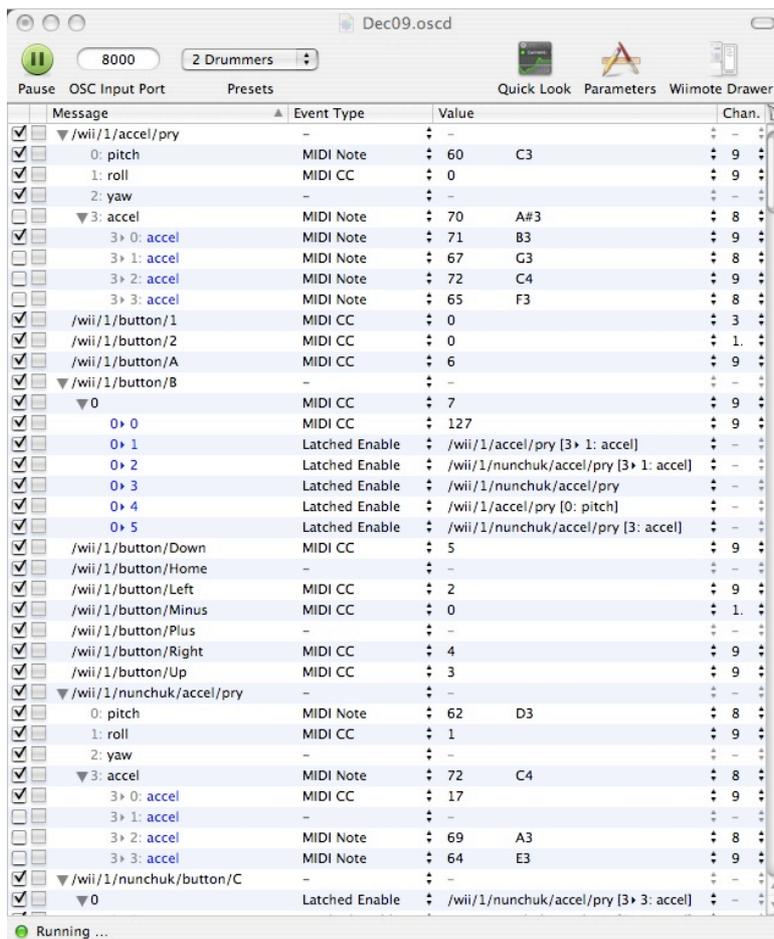


Figure 6.52: Divergent mapping using new meta events in Osculator

sessions. But perhaps, in taking a rather long and circuitous route to reinvent the wheel (or at least the drums), I had discovered just why such traditional drum sounds have certain features, and these will be explored further in the conclusion.

If the Impulse interface within Live had been used earlier, then maybe the novelty samples (such as peeling onions) could have been triggered more efficiently, and audio samples could have been assigned to any one of the 8 buttons in Impulse. However it was hard to know, without clients' input, what sound effects really would be useful. Only Harri, in the feedback in March, had asked for any: waves crashing onto a beach, and the clink of glasses. These we *did* keep in the set.

The peeling onions sound was, as Harri pointed out in September, evidently a lot of fun for me. To me this comment seemed to imply that it might not be so fun for them. Besides, these sounds had already featured in the set for the visits both in June and September, and were now irrevocably associated with Live crashing. They drew too much attention to their individual quirkiness, and perhaps kept the music from being more varied. That, and wanting to keep the focus on gestures rather than sounds, was the rationale for scrapping the samples in October. Much simpler, less obtrusive drum sounds were needed, so they could be more easily used in a greater number of musical contexts. I wanted people's

imaginations to be stimulated into role playing situations that interested them, but not forced.

With hindsight I would have liked to have kept some of these sounds, as in those two final sessions we did make up stories. We could have suggested in a role play situation, for example, that someone was flinging a catapult etc. (from the sound of another of my 'found' samples: a wooden ruler being twanged over the edge of a desk). But on the other hand, with more normal drum sounds clients were perhaps less distracted and could adapt the interface more easily to their own role-playing purposes.

## 6.6 MIDI Bass Backing & Convergent Mapping

Replacing whole song backing had been a step in the right direction, but some of the loops in its place, recorded on bass guitar by me, would not remain in synchrony with some of the arpeggiator effects on the pitched instruments. My shoddy workmanship had unfortunately made it quite hard for the clients to play, as the bass player had to constantly retrigger the start of different loops, to stay in time with what other people were playing. I had briefly thought this could work, if it was an incentive for participants to interact rather than just passively listen, but in reality it verged on the side of being too difficult for clients to play. Harri was always



Video clip 6.61: (27:07-27:56)  
CONSOLIDATION

very keen to try the bass, as he had shown in September (see video clip 6.41), but my attempt to introduce the need to make bigger gestures to play it proved largely unsuccessful. As mentioned previously, it was hard for the group to get together, apart from the times we would visit. Therefore they were, particularly over the summer in 2009, unable to practise playing any of the instruments. This was the reason why in September I had spent the first part of the session reacquainting everybody with the instruments and their controls. I purposefully left out any explanation of the bass, as the gestural means for controlling it at this time were quite different from the other instruments.

For our visit in October 2009, I had intended to focus on the drums and pitched instruments, and did not want to be sidetracked by the bass, as I had not yet had the time to make the changes intended. Nevertheless the bass still needed to figure in the background, so I decided to play it, not wanting us to get stuck with having to explain these difficult controls to one person (i.e., Harri), when we needed to focus on making music with the other *finished* instruments of the interface. Harri was still interested in the bass though, and immediately commented 'oh, it works!' (video clip 6.61 at 27:13), but this was probably because I had learnt how to play it and make the best of a difficult interface. The three basslines we had started using in September were definitely better than the one song we had been using for backing in March, judging from the feedback at the end of the

second cycle, but they were still quite hard to play if people were not getting the time to practise.

The first session of the final cycle therefore demonstrated to me that (1) the bass should perhaps remain backing, and not become yet *another* instrument, and (2) increasing the number of basslines in the set was a good idea, but this had to be without taxing the CPU any more than we already were, and (3) the same loops could be triggered by more than one controller, using convergent mapping, if the loops were sufficiently sequenced and quantized to appear seamless. With this in mind, it made sense to record MIDI bass parts as loops that could be triggered by buttons 1 and 2 on each player's Wiimote, as this seemed to answer the three requirements above as follows:

(1) These buttons were suitably far from the trigger buttons (where clients would consequently be holding the controllers), for the loops not to be *played*. Rather, it was hoped they would be pressed at natural junctures in the music, when players were listening, more than playing, and needed the means to reinstate a familiar groove that they could start playing over again. In this way the loops would remain backing, while at the same time people's fingers were less likely to slip and play them accidentally. Previously, when birdsong sound effect samples had been activated by buttons nearer the triggers, Harri had been tempted to play these rather than the more expressive gestures which triggered the instrument specific to his controller (video clip 6.62).



Video clip 6.62: (6:55-7:11) EXPLORATION

(2) As with the drums, converting the basslines to MIDI, meant the CPU was unburdened of unnecessarily large files with which to work. It meant the audio was less likely to cut out, and it made it a lot easier to quantize, sequence, or even change the bass sound itself, once the MIDI pattern had been recorded.

(3) Convergent mapping had previously caused some overly repetitive sounds in the set, when applied to sound effects like the birdsong (video clip 6.62). However, when applied to loops, as opposed to single bursts of sound, a balance was adequately struck between making the loops repetitive enough to form a framework, and yet not so repetitive as to cause annoyance.

Another purpose for convergent mapping was to allow some Wiimotes to share control of the same basslines. This proved convenient, when I found that I eventually did not have enough time (two weeks) to create 14 separate basslines before the last visit at the end of November (2 buttons for each of the 7 Wiimotes). It was also expected, considering that each bassline had to be recomposed from scratch, and had to be from a different song from all the others, yet nevertheless in the same key. I had to scrap the

basslines recorded previously on guitar, then redo or compose some more in MIDI. This was in order to provide backing that was varied, but could work at any tempo (being quantized) and with all the pitched instruments (being transposed to the same scale). As it turned out, I had completed only five such basslines by the time of the last visit, but these proved ample for our purposes (see section 7.3 below).

Ultimately, I wanted to get expressivity back into the heart of what was going on, rather than getting too obsessed by the quality of backing samples. I wanted to focus on warm-up activities that specifically targeted musical parameters which might trigger vitality affects in the clients. I thought these could first be expressed in terms of the music only, so that they might know how to make crescendos, how to make their instrument get gradually quieter, how to make a weak uneven pulse and then a strong steady one, or a quick tempo then a slow one and so on. Later it might also manifest itself non-musically in a therapeutic way.

To do this we concentrated on adjectival pairs of opposites that could be expressed in music, such as high and low, fast and slow, then soft and loud. Everyone took turns to play first one and then the other. Clients were also asked to come up with their own pairs of opposites too, some of which seemed to be harder to express in music (dark and light) than others (steady and uneven).

In practice it really meant clients had to zoom in on modulating skills such as using the arpeggiator on the joystick to play slow and fast patterns; or varying the amount of movement to play quietly and then loudly. A pitched instrument could throb in amplitude if shaken to a pulse while a note was being held. The reverb parameter, which emphasised the sustain of each sound, was also triggered by this gesture for another instrument. A pulse could be made uneven by altering the rate of the arpeggiator with a constant moving of the joystick, and then steady by holding it while simultaneously reinforcing the pulse with a regular flick of the other hand. These aspects of expression had to be technically mastered before the clients were able to accompany or contribute musically to any kind of story. Much as I would have liked it, clients were *not* told that if they move a certain way it will be interpreted by the interface as 'happy'<sup>17</sup>, but they were being shown elements of expression that would emulate some of the emotion forms that have been described as vitality affects (Stern, 1985), with the hope that this would actually serve as a better tool for learning expressivity than simply asking them to play happily and then sadly. After all, they were being asked to play simply how they felt, as had been done all through the second cycle. If this could then provide the basis for a semantic interpretation that was tailored to the client, then this could be one way Wii-bändi can be said to have had some therapeutic value.

The start of the final cycle was also marked by a simple but major physical event. We removed the large table from the centre of the room, that we had so far sat round

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<sup>17</sup> At the listener level, Friberg's pDM is an interface that uses basic emotional expression in gestures (happy, sad, angry) to control the same emotional expression in the music(2005b)

every session. Not only did this transform the proceedings from a sedentary, conference-type atmosphere to a more playful one, but it enabled Marc, myself and Jenni to more easily go round helping clients master gestures they were trying to make, as often this required physically holding a client's arm. Turn-taking became more fluid and less mechanical, as the clients got better at using the interface, and people started to feel more confident and come up with slightly different ways of expressing themselves with their instrument. These expressions (vocal as well as instrumental) could be put together, however surreal they might have seemed at first, to make a role play situation where the collective interactions created a whole that was greater than the sum of its parts.

## CHAPTER 7 - Final Results in Role Play

### (Cycle 3: October - December, 2009)

Eventually, three such role play scenarios came about, that lasted between 8 and 12 minutes each. One was in a spaceship, another in a park, and the last one was a murder mystery in a school. It should be mentioned that there were also long periods of playing in these last two sessions which did not require any form of direction or talking, as people were able to drop out, listen, come back in again and play. Nevertheless, for the remainder of this chapter the focus will be on the role play scenarios, as they seemed to have the most therapeutic benefit for all, judging by the amount of laughter and variety of expression captured on video. Besides being concrete results, in that they were tangible holistic items, and created by the group working together, the role play situations were a measure of success on another level, as I saw it, because they made the expression of certain vitality affects easier to achieve, as clients were now expressing this aspect of their emotions less self-consciously. This will be dealt with more fully in the conclusion.

Before this, I must describe the final changes made to the interface, which featured mostly a return to using MIDI sounds in Live, as they were far easier to trigger and less likely to cause the system to crash. To prepare for the final cycle of Wii-bändi, I was looking to consolidate the progress made in the second cycle. This meant that gestures which rewarded expressiveness took precedence over 'authentic' sounds. In other word, I had to be ruthless with the arsenal of audio samples used by the drums and bass which, in the second cycle, had been overloading the CPU so that the audio cut out. One part was to pre-record MIDI bass loops to replace the cumbersome, uneconomic audio files of bass I had recorded. The second part of resolving this issue was mastering how to use MIDI Note mapping in Osculator to activate the drum instrument "Impulse" in Live to replace the CPU-hungry audio drums. These two developments eliminated the audio cutting out periodically, whilst also bringing with them some new possibilities. The result was that MIDI sounds within Live were now used across all the instruments for the final cycle, not just for Wiis 2-7.

I had found a less random, more effective use for convergent mapping, while divergent mapping was deployed more effectively with the new Impulse drums because of some long-awaited updates to Osculator. In this way, full use was now being made of the accelerometers and trigger buttons in the controllers; of divergent mapping, convergent mapping, and positional scaling in Osculator; and of all 8 sounds in each MIDI channel.

Finally, to compensate for the reduction in real-world samples, clients were encouraged to sing, or think of role-play situations (if that was easier). This, after all, seemed more 'live' than any amount of samples you could put in a DAW (even one called Live). At last, with the technology working at an optimal level, the interface was proving to be a vehicle for therapeutic musical role-play (with sound effects), which in three cases

captured on video, evolved into a story that we enjoyed creating together, and are described in this chapter.

## 7.1 Different Planets, Rumbles, & Instrumental Improvisation



Role Play 1: 'Different planets' (6:20-17:56)

### CONSOLIDATION

The first 'spaceship' scenario (role play 1) was during the penultimate session in October, 2009. On this occasion there was Timo (drumkit 1), Harri (theremin), Vesa (drumkit 2), Janne (saxophone), Jenni (guitar) present, plus myself and Marc facilitating. It started with Vesa's assistant Janne playing a gently see-sawing two note melody on the saxophone, while there was a quick brainstorming in Finnish by Jenni with the group as to what the music sounded like. Soon Harri was talking about David Bowie's 'Space Oddity' in English, and he thought it funny to think we might quite literally, and not

metaphorically, be 'floating in a tin can' as the lyrics describe. This seemed like a good start, and a flow of ideas began in the group. Suddenly, as one note was then held for longer than previously by Janne (who had possibly just then realized how fragile our spacecraft was), Marc, Harri and I simultaneously expressed alarm as if something had gone wrong with the ship (7:53). What were we going to do? As Vesa and Timo were on drums, and at this point just listening, Jenni and I pointed out that perhaps some repairs needed to be made to the tin can spaceship. Indeed, drums could start hammering the can back into shape if they felt like it and, judging by his smile on the video, Vesa *did* feel like it. Soon he was 'hammering' with a clave percussion sound (8:44), and a little bit later on he started to sing at the same time 'it was just a little accident, we've got to go on...' (8:58). This perhaps had more meaning to him than just a joke, after all he had himself become disabled due to an accident (see p.21 above). As Vesa continued his line of thought, the reason we had to 'go on' was because there was some 'good-looking girls'. 'In space?' asked Marc and Jenni simultaneously while laughing. Harri seemed to go along with this too, giving a burst of uncontrollable laughter and repeating incredulously after the other two 'in space?' (9:09).

Looking at the video, you can see that Vesa had not planned to say this. It just came out, and the result was positive: we all suspended our disbelief. At this point I found myself reiterating what had just happened, hoping to stimulate more ideas for the next part of our story, by saying 'OK, so there are some good-looking girls in space...' (9:17). There was a slight risk doing this, if the plot became too love-oriented, that Harri might take offence - he had after all expressed a dislike of 'love you love you, baby' songs, as he called them, at the start of the project (see p.38 above), and sure enough Vesa went on to

say the girls were 'very sexy' (9:20). There was also the consideration that Timo had kept a low profile so far, and we did not want him to feel left behind. So it is understandable that on the video I look relieved when Marc intervenes with 'OK, so maybe the engine's working now and we can have some more engine sounds' (9:30). This was a great opportunity for the drummers (Timo and Vesa) to implement some of the expressivity we had been working on earlier (fast/slow; steady/unsteady; quiet/loud etc.), and as Marc moved the camera to focus on Timo, I suggested he could put the ship into 'hyperspace', now that the engines were fixed. I'm not sure if Timo understood what I said, or was even listening to me (due to his disability or otherwise), but he was definitely listening to the music and what the others were playing. Even if he did not increase the tempo, he began to make a much more steady rhythm which at least sounded like the spaceship was moving forwards again, and was actually more appropriate (9:44). Meanwhile Vesa had stopped his erratic explosions on the snare drum and was focussing on just the singing.

Now we had a groove of sorts in place, it was time for Harri to do some theremin over the top. Perhaps this sound could represent the communication signal with earth? In the Bowie song, Major Tom is trying to communicate with ground control on Earth, but the signal's gone. Could Major Harri make things take a turn for the better? As a cue, Marc suggested '...and now we have to fix the space antenna ...with the theremin' (9:52). Everyone was now playing something, albeit rather chaotically, but Harri was singing too while playing now, continuing the Bowie idea by adding the lyrics from the song 'take your protein pills' (10:21) while Vesa was chanting 'ground control to Major Tom'. Meanwhile Timo was playing a solid rock rhythm, Janne was continuing with the see-saw saxophone, and Jenni was playing jagged chords on guitar. In future role plays we used only one set of drums, as this sounded better, but as this was the first time a role play had actually properly taken off, I did not want to interrupt the flow for any reason, and so we continued.

We had now reached a sort of plateau, where everyone was playing but did not know what to do next, so I asked Vesa more about the girls in space:

'Were they floating in space?'

'Oh no, they've gone!' he replied. Just then, Harri piped up with a question for Vesa that was characteristic of Harri's preference for all things of *cultural* importance (10:55): 'Are they like Greek goddesses, the ladies?' but this did not get picked up as a lead by anyone else, so the music continued for a while without an accompanying plot as such. However, Vesa soon began to resume speaking rhythmically over the top, trying to explain that the women in space was just an idea, and that we had to go on.

At a certain point (11:38), Timo started to play a crash after every bar or two. He was using his leg as a surface on which he could bang button **Z** of the Nunchuk, and he would repeat this several times later in the video of this session (at 29:27 and 36:38). It was a technique he had developed in an earlier session, but that time with the Wiimote and button **B** (see p.54, video clip 6.31). Vesa seemed to hear this while he was explaining 'something new, there must be something else...'. Timo's crash seemed to punctuate what

he was saying, and make him want to *repeat* it. I think this was an important musical dynamic that showed the interface was effective. If clients could hear each other and respond confidently enough to know that they could repeat a phrase (musically or lyrically), then it could also be therapeutic. Vesa's movements also began to now be more in time with Timo's.

At this point it is interesting to note how our terminology for important facets of group dynamics, such as turn-taking, had morphed to fit fluidly with the role play in question. In the case of the spaceship role play, 'going into hyperspace' seemed to have become the easiest way of signalling to someone else in the group that it was their chance to lead the proceedings if they chose. And now it was Harri's turn, as he rose admirably to the challenge, by using the Nunchuk joystick to switch his arpeggiator to the fastest (most 'hyper') rate on the theremin (11:58). At the same moment on the video, Vesa starts grinning with his tongue sticking out slightly to one side while nodding, which I take to mean he was happy that someone else had found 'something new', which he could work with. As it looked like he was about to vocalize again, I offered to try and use Vesa's controllers to drum with this new fast pulse that Harri had started on the theremin, so that Vesa would be free to focus on words. But before I had a chance, Timo was already making big flicks with his drum controllers, so I just followed his lead. Meanwhile Vesa started singing about 'Major Harri' (12:43), and began to clap him as if it was the start of a jazz solo. The video data reveals that Timo then responds to this very natural gesture of Vesa's by playing the (flamenco) clapping sample on his controller over and over (13:15), which further ups the ante of the proceedings until Vesa feels the urge to stand up saying louder and louder 'oh yeah' and that Harri has got to 'go on'.

It could be inferred from this, and later role plays in the final cycle, that Vesa seemed to be playing a character that was loosely based on our preconceived stereotype of a rock'n'roll superstar of the late '60s or early '70s, like Jim Morrison or Remu Aaltonen for instance, hence the frequent utterances of 'oh, yeah' and 'go on'. With Harri's theremin solo, and Timo sending bursts of flamenco clapping over his solid rhythm, the overall volume had grown during the time Vesa was standing up. I stopped my extra drumming at this point, aware that we had reached a crescendo, and thankfully Jenni seemed to get the message and simultaneously stopped her jagged guitar chords, reducing it to a gentle arpeggio. The timing was such, that Vesa came up with a new idea and we heard that we had come across 'a planet' (13:46), as he nonchalantly spread his right hand before him as if to show us this new world. He repeated 'yes, a planet, planet X' and made a sort of X shape with his forearms. The X was an invitation for the group to give it a name, and going back to his previous theme, he asked us for 'a girl's name'. Marc suggested Elsa, but Vesa had a different idea: he suddenly gestured straight at Marc (14:35), remembering that earlier in the session Marc had mentioned he had just got married:

'You're married, hey?'

'Planet Noora' obliged Marc, getting the hint.

‘Noora,’ Vesa was again clapping his hands, evidently pleased with the sound of this name, ‘yes, planet Noora’. He was also moving to Timo’s drumbeat while he said this.

‘Planet Noora, alriiight!’

‘And it’s full of Noorans’ said Marc, going one step further, which caused Harri, Jenni and myself to laugh too. At this point Harri, with a big grin on his face, was now nodding at the same time as turning his head from side to side, in a way quite similar to Stevie Wonder (15:08). He really seemed to be enjoying this too.

‘And she’s so beautiful, is that right?’ inquired Vesa further.

‘Oh yeah. Yeah, she deserves a planet’ conceded Marc. Jenni now decided to move things on a bit:

‘What does it look like?’ she asked (15:20).

‘Well, you can say that’ replied Vesa, gesturing to Marc with a broad grin now on his face. But here Harri decided that he should have a say in the turn of events:

‘Well, at first it was a desert, but then it becomes something...’

‘Something very beautiful’ added Vesa, still standing up, but now tucking his shirt into the back of his trousers.

‘Yes’ agreed Harri.

There was then a musical interlude as Timo and the guitar had started up a stronger rhythm again. The group at this point seemed to be splitting into two, with Marc, Harri and Vesa wondering if there might now be a whole solar system of planets out there named after women for our role play, while Timo, Jenni, Janne and myself were happy to provide musical backing for these whimsical musings. Suddenly Vesa, still standing but now with shirt tucked in, seemed to have come to a decision, or at least remembered the word in English that he was looking for (16:38).

‘No, the next planet is very dangerous’

‘Next to Planet Noora?’ asked Harri.

‘Yes, next to Noora there’s a planet very dangerous’ explained Vesa.

‘Is it very hot?’ I asked

‘Or maybe it’s very cold’ suggested Harri.

‘It’s very hot.’ decided Vesa spontaneously, ‘it’s very hot, and the name... its name is... something like a...’ but there is an interruption in the video at this point because, as Timo was being altogether less vocal than the others, I thought he might like to change his instrument if he wanted, and Jenni explains this to him in Finnish.

When the video resumes, Vesa is still standing up, and Marc reminds Vesa of where we got to in the role play (17:27):

‘We were just about to name the evil planet’

‘Evil planet? OK, then it will be Rock... Rokkanen’ replied Vesa,

‘Rokkanen?’

‘Yes, that’s my... er’ said Vesa, tapping his chest to indicate that was his surname, and Marc laughed.

‘Yes, you named it after yourself, OK’

‘Don’t mess with me’ he continued, punching one fist into his other hand.

‘You talking to me...’ he added, and we all laughed.

‘Well, I’m not so hard’ he then finally confessed to us (17:54).

There was a break at this point from which this particular role play was unable to resume as, for a number of reasons, we focussed on other concerns for a while.

Firstly, Timo was trying out the harp to make a change from the drums, so this meant the focus was less on Vesa for a while. Secondly, while changing his instrument we inadvertently came across a development I had started working on, in the train to Helsinki that morning. I had intended to uncheck the signals concerned, so it would not interfere with our session, as it was a work still in progress which might only be ready for the final session in November/December, but I had yet to complete this final step before leaving the train. This meant I had to explain what I had been trying to develop: namely to use the rumble function again, but differently from the way we tried in the first cycle.

This time the intention behind using the rumble was to provide an incentive for clients to make more movements. By doing so, they might trigger a haptic rumble, or vibration in their Wii which would simultaneously trigger a rumble in someone else’s. I had hidden the trigger for the signal in a different gesture on either the Nunchuk or Wiimote of each set of controllers. The idea was that it would encourage exploration of every single gesture the interface responded to. It was an extension of the ‘hot potato’ game that had been mooted earlier (see p.45 above), but this time it was the clients who were in control, not the staff member or facilitator acting in some kind of conductor role. Jenni was very enthusiastic about the rumble idea, even if in practice it was not working exactly how I had envisaged it. After briefly describing just this idea, I decided we should continue playing and not waste any more time explaining in detail something that was, in any case, not yet ready. Instead I think the rumble option could be addressed in future studies.

It was not needed here: the role play seemed to have unlocked something in the group, and there was some good playing for the next half hour, without any accompanying story, where members of the group were able to play in turns, in duos, and together, until we were ready for some more words, and the next role play scenario. In this time Marc, Jenni or myself were able to address each person’s needs according to their style of playing. There were enough people playing and enough flow, with the relatively discrete loops, to see for example that Timo was trying to play hi-hat without triggering the kick drum on his Wiimote. I was able to show him that if it was held upright when he flicked it, the tilt dimension (which triggered the kick drum) would not be activated, but the overall acceleration (and therefore the hi-hat) would (38:20).

## **7.2 Down to Earth & In the Park**

Now that people were more in tune with how they could control the finer nuances of their instrument, I felt we were ready for another role play at the end of the October session. After all, we might have had to reacquaint ourselves with the interface yet again for the final session, as many sessions before had proved, so I wanted to capture the ease and



Role Play 2: 'In the park' (40:30-48:19) CONSOLIDATION

familiarity that the clients were already showing. So for this role play scenario (role play 2), and incidentally for the first time since the beginning of the project, I was behind the video camera. I was aware of the highly subjective position I was in, so tried to film each and every member of the group at some point in the proceedings. Equally I tried to involve everyone in the story with the occasional question or suggestion that might trigger a reaction, be it musical or emotional, or better still both. This role play was the shortest, and it takes up the last 8 minutes of video footage from

the penultimate session. The video is mostly continuous, except for just after the start of the role play, when there was a small break as the tape had to be changed. For the duration, Timo was playing drums again, Vesa was mostly being vocal (but also had the cello), Jenni had the theremin, and Janne was on the guitar. Harri had the bass, but soon was only using it for sound effects as there were some issues of synchrony (as previously explained on p.63).

To begin with, up to the point where the video tape was changed, Harri was successfully triggering and holding down a bassline sample from the Clapton song, while Janne was playing a guitar arpeggio over the top. Meanwhile we, or more precisely Vesa (since he had been so forthcoming in the first role play), were deciding where our role play would take place. We had offered up the idea of the sea, when Harri activated the sound of the sea on his Wiimote, but this did not elicit any significant response, and nor did the suggestion of a ship, let alone a pirate ship (my own idea, which I hastily dismissed realizing it was more suitable for a group of young children). Eventually Vesa stamped both feet on the ground while sitting in his chair, to emphasize the point that this time it should be on the ground, and not in space (41:16), and this seemed to coincide with the moment when the music seemed to be building up successfully, while anchored in a solid bassline triggered by Harri. The solid basis to the music might possibly have made his down-to-earth suggestion seem more fitting than if it had been unaccompanied.

People were evidently quite prepared, now they felt able, to continue playing whether there were words or not, so while Vesa was then thinking of where 'on the ground'

the action should take place, Jenni decided to come in with some bursts of theremin that went very well with Harri's bass. I was trying to encourage music as much as words, saying

'Something's started already... just start singing Vesa if you want, I think we've got a song already' (41:20)

This was to try and take some of the significance of only words away and to encourage those playing to keep going. I was pleased here, that not *all* the group were hanging on Vesa's every word. Harri managed to get the bassline from Clapton's 'White Room' playing again for a moment, after it had dropped out for a while (whether this was voluntarily or involuntarily is hard to tell); and once he had worked out how the loop went, Janne added a strummed guitar chord with a big movement of his Wiimote arm, perhaps as a cue for Timo (41:33). This was in addition to the arpeggio that he was already playing on his Nunchuk. However, Timo had stopped playing when the bassline had started. Perhaps he knew the original song in which the main drum rhythm starts only after this introduction, when the main bassline begins. If this was the case, he could have nevertheless done some fill-ins, as in the original's introduction. Perhaps then, he was waiting to see what Vesa came up with, or then again perhaps he was uncertain of if he could drum in time with that part of the bassline. Finally, the other possibility was simply that he had zoned out for a bit due to his difficulties concentrating (see p.23).

Because it sounded good, Janne repeated his guitar chord gesture again. Vesa responded to Janne's cues, even if Timo did not. Vesa decided, after the first chord gesture (41:37), on London as our location; then when asked what was happening in London he replied

'Just hanging around...'

A single note from strings playing in the background can be heard at this point (41:40), so Vesa must have started playing too, contributing to the atmosphere of suspense. And it was not until some further suggestions from myself, great suspenseful playing from the group, and Janne's second chord (42:04), that he decided on a park in London, rather than the Underground.

It seemed clear that the rest of the group (bar Timo) wanted to play, and were happy to leave Vesa to decide on 'the plot' as it were. At one point however, I was unsure if Vesa was talking about his character in the role play, or about how he was really feeling when he said he was hungry after I had said that perhaps a squirrel appeared in the park, and then asked him to describe it:

'So what sort of squirrel is it though?'

'I'm pretty ...pretty hungry' (42:16)

As it was the very end of the session, just before lunch, it was quite possible that he really was hungry - in the video he was looking quite withdrawn at this stage, compared to earlier on. Or it could have been part of the role play, it was hard to tell, so I carried on and tried to be more assertive, hoping to it was the latter:

‘A hungry squirrel? It’s a lunch time squirrel, and he’s seen you eating your sandwiches...’

‘Oh, damn’ started Vesa, evidently going along with this idea, and then Marc joined in to make sure there were no misunderstandings:

‘Are you hungry for the squirrel?’

Just then on the video Timo, for some reason, starts finally drumming (42:20), answering Jenni’s bursts of theremin with bursts of kick and snare drum.

Meanwhile the Vesa dialogue started up again, this increase in the flow of energy perhaps partly influenced by the drums at last starting:

‘You want to eat the squirrel?’ I asked, getting Marc’s drift. At this point Harri burst out laughing, and we were all suddenly in the role play again (42:37).

‘No, no, no, but I’m hungry, then I see that he’s eating my sandwich.’

Everyone here gives an appropriate gasp of outrage at the squirrel’s behaviour.

‘The squirrel?’ checks Harri, positively delighted,

‘But was it a nice sandwich, or was it a disgusting sandwich?’ I ask,

‘It was very great... but I don’t have much money anymore,’

To reiterate, in order to make sure everyone is following what is going on, I check again:

‘So you like that sandwich? And you wanted to eat it...’

‘Yes’

‘...otherwise you’re going to go hungry.’

The guitar arpeggio was still going, even if Harri’s bass loop had long since stopped. We can see from the video that Harri is nevertheless trying to trigger something, as his hand is moving the joystick on his Nunchuk to no avail (42:06 and again at 42:44). This part of the interface *definitely* had to be changed in time for the final session.

‘But what do I do?’ continues Vesa, open to suggestion.

‘What are you going to do?’ I throw back at him, then I suggest something concrete: ‘Start playing, maybe, you have to earn some money by playing your instrument in the park...’

Vesa agreed and started moving, but the single note on his strings did not change, perhaps because he was keeping the trigger button depressed, and not reapplying pressure to the button again only after changing the angle of tilt. Janne meanwhile had stopped the arpeggio on the guitar, instead playing the occasional strum with the Wiimote.

Perhaps because Vesa couldn’t change his instrument’s note, he was focussing more on the singing. He started singing about where he was hanging out in the role play, but it is hard to make out on the recording. The last part of Vesa’s words can be made out though, as he sings it in a higher-pitched tone (43:15):

‘The sandwich... is... gone awaay’

‘Was it... was it stolen by the squirrel?’ asked a chuckling Harri.

‘Yess’ replied Vesa ominously, ‘yes, you can go on... what do I do?’

This was an invitation from Vesa for Harri to take over, but Harri needed some prompting even though he seemed amused and eager to participate, so I tried to help. Janne's guitar arpeggio had now been replaced by Jenni playing a theremin arpeggio. After a small, pregnant pause in the dialogue, I suggest:

'So maybe somebody else comes along into the park, maybe... maybe Harri, you come into the park.'

'It's me...' says Vesa, obviously acting his part.

'Do you see Vesa in the park, looking a bit sad, because the squirrel's eaten his sandwich, his delicious sandwich?' I ask, but then I realize that we need to try another way to get Harri involved. Timo has stopped drumming again after I say this.

'What was in your sandwich, Vesa?

'Sausage or...' asks Harri, at last able to join in,

'Yeah sausage, and some cheese and...'

'Some vegetables or...?'

'No, no, not vegetables, that's too healthy.' (44:06)

It would seem Harri was fishing for an answer like this as Vesa's response made the whole group laugh again. I remarked at this point how good the single note on the strings was. I was thinking, though could not say this out loud, that it seemed to provide a centre around which all the other instruments could play in short bursts while all this dialogue was going on.

'But there was maybe some... french fries in the sandwich?' offered Marc,

'Can't be' objected Harri,

Oh yes,' teased Vesa,

'...and chocolate?'

'No' Harri interjected with a hint of disappointment this time (44:16), indicating this was definitely a suggestion too far by Marc. Then there was a little silence, so I tried another approach.

'Sounds like it must have been a big squirrel to want to eat all that... it's a *giant* squirrel in fact'.

'True, true...' agreed Vesa.

'What colour was the squirrel? Was it red or grey?' I continued,

'Erm, black' came the assured answer, together with a very big grin on Vesa's face (44:32).

'Black! Harri... maybe Harri, do you want to be the black squirrel, or do you want to be another character in this story?' I now asked, evidently getting a bit carried away with this breed of squirrel that I actually had never heard about.

'Do you want to help? Do you want to help your friend?' added Vesa.

'Yes, Vesa I will...'

Harri understandably preferred to be a passer-by that could perhaps help, rather than be the squirrel. And just as he confirmed this, there was the sound of a repeatedly

neighing horse. It is not clear who was triggering it in the band (perhaps Harri as he was keen on sound effects), but it was anyway at the perfect moment (44:55).

‘Are you on a horse!?’ I asked,

‘Yes’ replied Harri,

‘You’re riding a horse.’ I said, checking to make sure.

‘Are you a policeman?’ inquired Marc,

‘Well, might be...’ said Harri, thinking about it,

‘You can catch the squirrel and save the sandwich.’ suggested Marc, but it is a bit hard to make out these words exactly at that point in the video footage, as Janne gets more active on the guitar at the mention of police, and Timo drowns the dialogue out with some loud strikes on the snare drum (45:15), then says something in Finnish explaining what he did.

The music was definitely linked to the dialogue here, as Jenni explained immediately after (45:20):

‘Timo said that he was going to shoot the police’

‘OK’ said Marc laughing.

‘Was that... was that you?’ I exclaimed, pointing an accusatory finger at Timo. ‘He went tsh-tsh-tsh-tsh-cha. He shot the police. Timo shot the police. Do it again, let me see you do it.’

Timo obliged, with a big grin on his face. He was using the **Z** button on the Nunchuk, with hardly any movement, which was a pity, as I had wanted loud sounds like this to require more movement.

Meanwhile the neighing horse continued (perhaps Timo had accidentally shot the horse), so Jenni decided to swap her theremin controllers for Harri’s so he could play something more musical. Janne’s guitar here was no longer an automatic background arpeggio, but rather a manually controlled series of rhythmic jabs on the strum sound. This provided a less trance inducing, and a more edgy background which suited the recent violent turn of events in the role play. Against this Harri could now play some ghostly theremin, having after all been shot by Timo. Vesa started to say now that he was ‘really sad’ (45:32). But it seemed more to do with the passing of his sandwich rather than the policeman.

In terms of the expressivity of the interface, what is clear from the video data here, is that Vesa seemed to try and express himself with his instrument rather than just words. His expression was now glum, and both his hands hung down either side of his chair. The end of each sentence ended with a gentle movement of his controllers that in turn triggered some melancholic string sounds:

‘I don’t have any instrument to... I’m feeling... I’m feeling’

‘Timo, what can we do with him? He’s feeling... he’s feeling... like that’ I said, indicating, with the video camera, Vesa’s gestures and expressions. Marc was watching,

and laughed at this point, obviously agreeing that there were no words that would adequately match the musical expressivity of Vesa's maudlin performance.

'Can you make him feel better with your drums?' I asked.

'I'm feeling very bad' Vesa at last admitted.

'Can you bring him up, bring it up tempo?' I suggested to Timo. Marc at this point started to make some small, quick movements with his hands to indicate to him visually a faster tempo, in case he had not quite followed what I was talking about.

'Maybe a quick beat, fast beat' said Marc, as Timo was looking more his way than mine.

'Give him a cheerful beat, otherwise he's going to fall asleep and maybe never wake up, because he's so hungry' I added. Timo immediately started moving his hands, not using the buttons I was pleased to note, but the accelerometers. It was done slowly at first, then suddenly quicker and for a sustained period of time until the strings were stronger in volume again (46:08-46:36). During this time Jenni, who was directly in front of Timo, was showing Timo a fast beat with her own hands too, and Janne also increased the rate of his strums, so in fact the whole group tried to 'resuscitate' Vesa.

'There you go, here he comes. Here comes some help. Is it helping? Is it waking you up?' I asked Vesa, to which he raised and nodded his head.

'It's an ambulance man' I added,

'Oh yeah' affirmed Harri

The music was rising in tempo and volume, and I commented that the 'strong strings' were back. Vesa was now making much bigger movements, as was everybody else, and Marc stepped in to help remind Vesa where the arpeggiator controls were so he could play a suspenseful string pattern accompaniment if he wanted, that would show his return to form. There was a brief lull, as we all tried to listen for Vesa's strings, and sure enough (once Marc reminded him how to activate the arpeggiator on his Nunchuk) the strings were there, full of suspense and energy (46:55).

There is an edited gap in the video footage here, but when it resumes, Vesa's string arpeggio pattern is still going - the kind you get in the thriller genre of film soundtracks when there is a chase or some kind of frantic activity - and Vesa is speaking with a correspondingly anxious tone, asking Harri to help him.

'Help me Harri, help me!'

'I think you have to go and help him again... Timo' I suggested, as again he had stopped playing and was just watching.

'Are you going to help him?' I asked

'Um... he shot Harri,' pointed out Marc

'Timo, you mustn't shoot people!' I added, laughing.

In defiance, the music seemed to build up to a crescendo and finale, Timo now playing full strength again, and Janne increasing the frequency of his jagged strums to coincide with the strings (47:28). Harri declared here that he could no longer hear the

pattern, or arpeggio that was still being played on the strings (perhaps though this because his character was 'dead'). In fact, on the video recording the strings can be heard perfectly well. But so can everything else as everyone plays with more force. Vesa was now shaking his left arm as fast and hard as he could to make the loudest string sound possible.

'What do you do? What do you do?' asked Vesa

'Do something!' he added

Then he gradually slowed his movements down and said at the same time:

'I'm so tired, I can't run any more' (47:57)

'Well take it slow, nice and easy' suggested Harri, and the role play ended on a loud single note (whose it was, did not seem to matter at this point), and that seemed to calm everybody's actions to a stop at the end (48:19).

### 7.3 Murder Mystery Finale

The last of the role plays recounted in this thesis took place in the second half of the final session in late November, 2009. Again, the dialogue was mostly led by Vesa, but this time the music was more melodic, as I had fixed the bassline backing so that it was MIDI like the drums, and there was a selection of loops to choose from (for both drums and bass) over which more drum sounds, and the other instruments could be played. It seemed I had succeeded in simplifying the interface for our purposes, as it did not take long for everyone to reacquaint themselves with the controls and master the new developments. This was handy, considering we had only the first half of the session before newcomers would join the group to watch and/or participate.



Role Play 3: 'Murder Mystery' (1:03:13-1:13:40)

CONSOLIDATION

So by the time the role play started, more than half the occupants of the room were audience, which made the dynamics of interaction slightly different. It was altogether a pleasant development, as an earlier goal had been to end our visits with a show performed by the group in front of the rest of Invalidiliitto, but as this had been logistically too difficult to organise, this was the next best thing to a 'live performance'. Even with the table moved out of the way (as it had been for all the visits in the final cycle of research), the room was however, a little bit overcrowded.

The role play itself ran for roughly 10 minutes (1:03:13 - 1:13:40). During this time, there was a total of 8 clients, 3 staff, plus Marc and myself in the room, although only 4 or 5 people could use the interface together at any one time. It was therefore a little bit harder to get started than in the earlier role plays. For example, we began by suggesting a submarine as a setting for the action, but this was not accepted by the group (1:03:40), then the staff member who came in with the new clients, most of whom were spectators at this point, suggested (in Finnish) that they sing a Christmas song. This also met with disapproval, as did the idea of hill walking in Lapland. It was not until Vesa suggested a murder that we could move on. At this point Heikki had the cello, Vesa the saxophone, Timo and Harri had both sets of drums, and a newcomer at the back had the fifth set of Wii controllers.

For a brief moment after the suggestion of a murder mystery, Jenni thought we had a technical hitch, as she said the light on Harri's controller was not working, which would have been terrible but it was a simple case of turning it on which Marc dealt with speedily:

'Alright! Alright! Alright! Alright!' said Vesa, in a rock'n'roll drawl, who was obviously relieved that nothing was wrong after all and that we could continue.

'So Vesa, what were you saying?' I asked.

'It is a murder.' he replied decisively, and then went on to say

'There is one of us, who is the murderer, but none of us know who is the murderer'(1:04:35).

I repeated this out loud to the whole room to see if there was general agreement.

Everyone at first seemed a bit unsure until Jenni rephrased it to make it sound like an Alfred Hitchcock thriller (in Finnish as well, for all those who could not understand English). At this point there were several people who seemed to like this idea with cries of 'Yeah!' and 'Dial M for Murder'. But not everyone was 'switched on'. Timo can be seen in the video focussing very intently on his mobile phone, rather than the session, and Harri could not help hitting his crash cymbal regardless of what anyone else was doing (1:05:05). This is what happens in a room full of instruments and people who are waiting. It was time to move forward before chaos descended, so I asked Vesa to play something on his instrument.

'OK, Vesa let's see what you can do. Play something and we'll see if you're suspicious.'

Since Vesa had come up with the story, it felt like he should start by trying to describe the setting, either with words or music, or even preferably both.

Thankfully, at the same time, Jenni told Timo to put his phone away (1:05:34), which he did. Now Timo could get to grips with the fact that there were drum loops, and not just drum sounds to play along with on the drum controllers. These would be in sync with the bassline loops, that could now be triggered by every player by pressing buttons **1** and **2** on any Wiimote, as previously mentioned (page 64). No longer was bass an instrument to be

played by one person, but backing that could be operated by many using the same buttons on any Wiimote, thanks to convergent mapping.

Timo started drumming over a samba loop that he had chosen, but he seemed to be having some trouble. Everyone was waiting for him to form a rhythm on top of which they could play. This anticipation among the others for things to get started is confirmed in the video when, after some thought, I say:

‘Let’s get a bassline started shall we?’ and Harri immediately answers:

‘Yes’

So I showed Timo how to start a bassline loop from his Wiimote (1:06:17). By chance, the bassline he chose happened to be from Black Sabbath’s ‘Paranoid’, which seemed to set the scene perfectly for a murder (albeit in MIDI, and with a touch of samba). Meanwhile Harri had stopped randomly hitting the crash now.

‘So where... where did the murder take place, Vesa? Was it in a spooky house?’ asked Marc, accompanied by a chuckle from Harri.

‘No’ came the reply.

‘Or a spooky cottage?’ ventured Marc.

‘Nope’

At this point I thought Vesa might want to focus for once on playing, rather than words. Indeed, with the bassline and drum loops started, the rest of the room did not feel the need to wait on Vesa’s every word. Heikki started making big movements with his good left arm and Nunchuk, to make sweeping bursts of cello. I was hoping that focussing on playing rather than words might even help ideas form as well as give others a chance to express themselves, so I cut in:

‘Why don’t you play? I want to see if we can guess...’ (1:06:34) I said. Then, just as I gently lifted the hand that Vesa was holding the Nunchuk in, he came to a decision.

‘It was in a school!’

‘In a school, OK...’ said Marc, probably wondering where this was going to lead. I asked Vesa to play again, and this time he started immediately, perhaps because I had now physically shown him the movements required to make his saxophone play. This relaxed the focus on words for a while. A period ensued where Marc kept the camera trained on Vesa, who was moving his Wiimote arm around in a circular motion while suggesting possible suspects in the school, but the music was louder. Vesa’s gesture was making a drone on the saxophone that he also accompanied with a slow arpeggio, using the joystick on the Nunchuk.

Then, as if he was not already doing enough, Vesa began simultaneously using his controllers to trigger birdsong with the **minus**, **home**, and **plus** buttons. The other people who had controllers at this point were Harri and Heikki, but judging from the video footage, they had both stopped, so this threefold playing by Vesa temporarily compensated for the lack of accompaniment from other people in Wii-bändi. I was busy meanwhile getting the fifth set of controllers to work again for the newcomer at the back, while Marc was holding

the video camera. Five remained the maximum number of Wii controllers that Osculator was able to map simultaneously to the interface. During this time the music died down a little therefore, and talk had resumed about the suspects in this murder mystery:

‘Could it be a woman?’ asked Harri twice.

But Vesa was not giving anything away:

‘It could be a lady, or it could be a man, nobody knows...’

‘Kuka on murhattu?’ asked Jenni, trying to establish at least who the victim of this murder was.

‘Was it a teacher, or a student?’ asked Marc, continuing Jenni’s line of enquiry.

At this point I got the marimba/flute working again, and crossed the room to hand it back to the newcomer at the back.

‘A student was killed,’ continued Vesa.

‘Oh no, bad story...’ said Marc, hoping someone else might lighten things up a little.

‘A theologian’ said Harri, with some conviction.

‘A theologian was murdered?’ checked Marc, with some incredulity.

‘Yes’ replied Harri decisively.

It was only after handing back the Nunchuk and Wiimote to the newcomer, who started playing the marimba/flute, that I noticed both Heikki and Harri also needed their controllers reactivated. Also having two drummers at this point seemed unnecessary, so I made sure to offer Harri another instrument if he wished. First, Marc updated me on the plot as I had been focussed on showing the marimba player how to operate the Wii and Nunchuk, and not listening to the plot.

‘A student theologian was murdered in the school’ Marc informed me (1:08:35).

‘Yes,’ agreed Harri, laughing, ‘...and one of his friends wants vengeance’

It seemed the priority here was to get everyone playing together, and return to the plot only after this was done, but with so many people in the room it was hard to keep track of everything simultaneously. I felt the need to draw attention to the way people were playing:

‘I’m glad somebody’s playing marimba, anyway’ I said, not wanting to add to the plot any further for the time being. The marimba player can be seen on the video at the back of the room, in front of Jenni, trying all sorts of different gestures. Meanwhile Vesa was continuing with his circular movements:

‘Look at this, circular saxophone playing ...great!’ I added. Then there was a minute where everybody seemed to be playing and listening to the music they were making (1:09:00 - 1:10:00). The bassline, together with ever changing drum loops seemed to be holding things together, and yet they were not intruding, and there were big gestures from Heikki, Vesa, the marimba player, and even Timo. Only Harri seemed to be relatively inactive, every now and then hitting a crash with the **B** trigger button of his Wiimote. The bassline just then happened to be from the ‘Rivers of Babylon’ (MIDI version), so to get Harri more active, Marc and I decided to start singing the song to encourage him to join in,

and before long not just Harri, but most people in the room, seemed to be singing (1:09:35 - 1:09:50).

After this welcome musical exploration, it seemed like time to return to the plot. I suddenly remembered Harri's questions earlier in the year about a William Wallace version of the Rivers of Babylon, and about his insistent curiosity about the religious message in the song as well as its Jamaican sociopolitical context. Perhaps the 'theological student' that Harri had suggested earlier in this session might very well have been inspired by his own interests in that field.

'Was the student theologian studying the Rivers of Babylon?' I asked (1:09:58),

'Yes,' said Harri, 'after the performance.'

'Wait! Wait!' called out Vesa...

'There's been an accident!' he continued loudly. 'Someone is dead. There's blood in the street!'

'In the school?' asked Marc tentatively. At this point Timo was playing drums with very regular and distinct gestures. A cascade of marimba accompanied him, together with occasional bursts of strings when Heikki lifted his left arm.

'Help! Help! SOS! SOS!' continued Vesa, still with the Rivers of Babylon bassline in the background, and everyone else playing over it, everyone except Harri, who seemed to be passive again because his controller was not working.

'Nobody will help me!' protested Vesa.

'Who's the police?' asked Marc, perhaps remembering that Harri liked the theremin, and right on cue, Harri said:

'I'll take the theremin... because it symbolizes the police.'

As Marc was filming with the video camera, I was free to move among the players checking and, if necessary, changing their controllers. So I quickly took the controllers in his hands, and gave Harri a pair of controllers set to the theremin (1:11:15).

'Help is on the way!' said Marc reassuringly, but by the time Harri had got his controllers, Vesa had locked his saxophone into a rapidly pulsating arpeggio that sounded a little like he was in an emergency condition on some sort of life support system. I say this, because he was accompanying this 'musical expression' with being slumped in his chair with his head hanging down in front of him, until it was finally almost touching the ground (1:11:39). Timo seemed to see this and his drums became more ominous, almost like the rhythm from a well-known funeral march, and yet this variation to the rhythm was still working well over the Rivers of Babylon bassline. Marc decided at this point to give Harri his cue for a theremin solo:

'OK, the police is coming, let's hear the police siren'

Harri then played his part on his Nunchuk and Wiimote, mostly on the buttons, but with some shaking for a bit of tremolo, and tilting to get the right pitch. At the same time Jenni had taken the cello controllers from Heikki, who seemed happy to have a rest, and was letting another newcomer by the door have a go (next to the one who had already

been playing the marimba). Vesa was now completely silent, while strings, marimba, drums and theremin trilled over the bassline, drum loop and his 'dead body'. He was still slumped forward, and I was tempted to see if he was going to play any more saxophone, otherwise I would take his controllers and give them to someone else who was not currently playing.

'Are you alright, have you been killed?' I asked, just so that he was aware of having been noticed, and in case he wanted to now move on (1:11:56). At this point however, while remaining stooped forward, he started playing one note on the saxophone without any change, as if his life support was now giving no reading because his heart had stopped. The problem was it was drowning out the rest of the music that the others were making. I tried to catch his attention but he remained immobile, playing dead.

'Vesa... Vesa, are you still playing saxophone, or can we let someone else play it?' There was no answer and the one note drone from the saxophone continued, so I decided to take action (1:12:17).

'OK, can I take that off you now you're dead?' I asked heartlessly. He remained impassive so I carefully took the controllers from his grip and gave them to someone who had not had a go yet (they only had a few minutes left before they had to leave).

Vesa stayed stooped for a while longer, but gradually sat up with a smile, at just the point where the bassline had changed from the Rivers of Babylon to the more murderous Nirvana song 'Aneurysm' (1:12:35). Perhaps it had signalled the right moment for a change to him. He was up again asking who could have committed the murder. The new staff member had a suggestion, perhaps because the echo effect on the marimba made it sound like big drops of water in a tunnel:

'Sounds like the murderer is in the sewers, you know, water escaping... (1:12:52)'

'Yes, it's an alligator' called out Jenni, at exactly the same time I came up with something completely different:

'Yes! It's the people in the underground... is it the diamond thing... the diamond thing you were telling us about?'

I was looking to Jenni for further explanation at this point, as she had mentioned a piece of local news on this subject at the start of the session, when she heard how we had been delayed. Luckily she understood immediately and was able to fill everybody else in on the story in Finnish. We were delayed coming, because we had to walk to the next metro station. The one at the train station had been closed due to flooding, after thieves had apparently used a diamond drill to bore a hole into a shop from the underground and hit a water mains. They had apparently not yet been caught, and perhaps this was also the lucky fate of the murderer in our role play. Vesa would not give up though, he still wanted to know the murderer.

'Because I'm dead. I'm dead, and you have to make it right. Who killed me?' he asked the whole room one more time, with a flourish of his hand, but no one was listening any more. The role play was over - it seemed to have been decided that the murderer

would remain unpunished, and the case would remain a mystery. In addition, Timo had to leave and so did a couple of others, so it seemed like the natural juncture for a break (1:13:40). Spontaneous conversation broke out everywhere, as people took a pause from playing.

This particular role play was significant in two new ways. To begin with, it was the first time that only clients had played. Neither Marc, I and the staff members only facilitated by making sure the Wii controllers worked, and that everyone had a chance to play. After all, this was the last day the university computer would still be available for Invalidiliitto's use, so we wanted as many people to try it before we had to take it back to Jyväskylä. And secondly, this session led to a conversation afterwards, between myself and Vesa that led me to believe it had had some therapeutic effect, beyond just a feeling of well-being. First he felt like showing me the large scar on the top of his head from the accident he had



'A Last Jam' (1:17:00-1:23:00)

#### CONSOLIDATION

It could well have been the musical part of the session, and not the role play part which triggered this however, as after Timo and the newcomers had left the room, Harri, Heikki and Vesa kept playing, with sporadic contributions from Janne, Jenni, myself, and Marc. Only music was played for the first four or five minutes, and then there was Vesa's and my conversation which did not seem to interrupt the flow of the music. In fact the music seemed to help conversation and provides yet new implications for future possible uses of the interface (1:17:00 -1:23:00). With these implications in mind, we can now finally turn to the concluding chapter.

experienced in 2002, which his hair had quite completely covered all through our sessions together (1:20:37), then he proceeded to tell me all about why he was in Invalidiliitto, and how the accident had happened. 'And now, I'm really happy' (1:22:10) he went on to say, along with the fact that he was presently studying, and possibly had a 'woman-friend' at school there (in Espoo).

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## CHAPTER 8 - Discussion & Conclusion

### 8.1 Discussion

One definition of *therapeutic* is “having a good effect on the body or mind; contributing to a sense of well-being”<sup>18</sup>. In that respect, Wii-bändi could be said to have succeeded. It was instrumental in bringing together a small group of disabled people, with a variety of special needs, and giving them a motivation to do something together, because it was most importantly fun and possibly even creative. The end result was not only the role plays described in the previous chapter but also music. There were even recordings of songs, that clients enjoyed giving a name to. For example in May, 2009<sup>19</sup>, Heikki called one of our recordings ‘Elegia’. But recordings were few and far between and were harder to evaluate than the videos, and because role plays were the closest thing we could get to a performance, they were possibly the most tangible vehicle for showing the many expressive ways the interface could be used, and especially its therapeutic aspect. This was because people had to use the interface to express themselves specifically in relation to others in the group, and in so doing the interface could be assessed more effectively than if it had been played just for the sake of playing. In these latter sessions, it had become plain that an exterior goal like this was not only desirable, but necessary.

From the preceding chapter, it might seem that some clients - perhaps the most extrovert, like Vesa and Harri - were able to gain a lot more from the interface than others in the group. However, the less extrovert clients were still able to exert their will in the group context also. By having an instrument each, and therefore being part of the group, they could contribute or withhold one aspect of the music. Vesa might have been coming up with most of the stories, but he was quite aware that he needed the others to agree or react to what he was saying. This natural dynamic for interaction, which used the otherwise neutral vehicle of music, meant that it was very clear at any time if the balance between verbal and non-verbal (musical) interaction was being tipped too much one way or the other. As facilitators, the staff at Invalidiliitto and ourselves were able to easily perceive if the balance needed to be redressed at any time, and Wii-bändi provided an alternative means of expression for the less vocal in the group. Of course, language was also a factor in the nature of the sessions, and perhaps if we had all spoken Finnish fluently, the role plays might have been a lot more varied.

Expressivity was at the heart of my attempt to create an effective interface using the Wii controllers. That is why I began this research with a great interest in finding theoretical links between emotion, music and movement before embarking on the project. Vitality affects provided some useful pointers in this respect. Dynamic aspects of the music that might convey more physical than semantic feelings seemed most important. In the field of

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<sup>18</sup> definition taken from the Apple Mac application ‘Dictionary’ (2005).

<sup>19</sup> see appendix C for the ‘Elegia’ Live patch and the audio recordings part of the DVD (appendix D) to listen.

neuroscience there has been evidence to show that emotions provide a way of being conscious of our inner physical state (including the physical state of the brain) so that we can manage an effective level of homeostasis (Damasio, 2003). This in turn allows us to react accordingly with the outside world and, as a very important part of self-consciousness, gives us a sense of who we are. More precisely, emotions are a way for us to be conscious of the many different kinds of physical reaction in each bodily feedback system (neural, hormonal, etc.), all of which operate at different speeds. For this reason it is important that our emotions are based on physical sensations that surge, crescendo, peter out, waver, and so on, much as Stern describes vitality affects. What is most telling, in the context of an expressive musical interface, is that they have dynamic attributes of flow (attack, amplitude, duration etc.) much like music itself. Indeed, I would argue that in the same way that emotions detect and reflect differences or similarities between the rates of two different bodily feedback systems in terms of flow, our emotions detect discordance or harmony between a bodily feedback system and certain musical features in a particular passage during the same window of time. The emotional effect of the music depends on how the bodily feedback system's flow compares with parameters in the music. Some feedback systems might match the flow of the music, others will not, and this will determine the level of emotional intensity (in terms of musical dynamics) and whether the emotion has a positive or negative valence (in terms of timbre and harmony).

The motions, or gestures, associated with musical expression are one of the clearest indicators of the dynamic nature of the emotions which a piece of music induces in the player or listener. For music to be therapeutic, the dynamic or physical aspect that it shares with emotions should be expressed quite literally as well as metaphorically as much as possible. To 'feel moved' or not, as the case may be, is fundamental to the emotion experienced in the music. How you actually move or not however, is another question. Mirror neurons tell us that the same parts of the brain fire when we watch a movement as when we make that movement (Rizzolatti et al., 1996), so if we want to stimulate the emotion that triggered our gesture in others, it probably helps if we make that movement. Wii-bändi was a *group* interface, therefore imitating the gestures of others was to be encouraged, hence they were standardized.

If, through easy musical (not only rhythmic) gestures, people can find the right flow of expression which effectively communicates whichever bodily feedback system is most resonant with the music, then the interface must surely be therapeutic as well as expressive. There is no need to cross the semantic gap and label the gesture or part in the music as, for example, 'happy' or 'sad'. Instead it is perhaps more accurately described, and on a more fundamental level, in terms of the vitality affect it evokes, such as 'explosive' or 'drawn out'.

Although I was not able to empirically prove the physical nature of the three-way correspondence that I have described here, I hoped the Wii-bändi interface would provide a flexible and adaptable musical instrument for future research into whether there is a

neurological basis for this link between music, the vitality affects it induces, and the gesture that might give a physical shape to this emotional form. The key was that each extreme of a musical parameter would correlate with each extreme of a gestural continuum (i.e., extremes in interval could correspond with large and small gestures; tempo with gestures that were fast and slow; and volume with strong and weak movements).

Future members of groups using the interface could volunteer to be measured in terms of neurological data to see the precise nature of such correspondences between specific musical parameters, specific gestures, and self-reports of the various vitality affects experienced. Wii-bändi could therefore be the platform on which to neurologically test the validity of the correspondence, for example, between high energy gestures, surging vitality affects, and music that becomes louder, to name but one example. This future research could be done using a combination of MIDI data from the Music Therapy Toolbox, the Motion Capture System (and its Toolbox), and the Musical Gestures Toolbox (Jensenius, Godøy & Wanderley, 2005), with neurological data from EEG.

The accelerometers in the Wii controllers, although only allowing for very basic gestures, nevertheless benefited from the fact that they relied on empty-handed gestures, that is to say movements through the air. It was hoped that this would encourage the clients to move, in spite of their particular disability, to feel confident, and even to feel free to some degree. Wii-bändi tried to provide control of those musical parameters which could best evoke vitality affects, with gestures standardized across the instruments that could be easily learnt because they could be quickly automated, and therefore made without thinking too hard. And yet at the same time there was room for individual styles of playing, such as Timo's way of hitting the Wii against his leg to drum (see p50 and video clip 6.31.)

In terms of ease of control, however, there was an opposing factor to standardizing the gestures across the interface. Clients had different physical disabilities, such as Heikki with his limited movement in the right hand, or Harri only being able to flick with his wrist or whole arm, but not from his elbow. Also the personal history of each member of the group, and the instruments they used to play (if any) before becoming disabled was a big influence on how the controls were tailored to each client. I would have tailored the instruments much more individually, had clients wanted to stick to one instrument each, and we had made a specific plan to play a show before the rest of the Porslahti home at Invalidilitto. However, in the spirit of action research, I had to respect the majority decision in the group, which was to use the interface for playing in the present moment of each session only. This was perhaps because the frequency of our sessions was not sufficient to allow for anything more ambitious, and besides sessions devoted to the present moment seemed to have greater therapeutic value (Stern, 2004).

The practical nature of this thesis also meant there was an inevitable degree of reinventing the wheel, of needing to find things out for oneself through experimenting, and

for double-checking assumptions such as why most percussive sounds have a sharp attack, or why one-to-one mappings between single drum sounds and single gestures sound bad. Ways of enabling polyphony (more than one sound at a time) seem obvious in retrospect, but they only became truly established in the second cycle of action research, when so much progress was made after other methods in the exploration cycle had failed.

Another such discovery was that instruments with sharp attacks could not have their velocity manipulated heavily with the faders, as they changed timbre, e.g., a harp became more like a bowed than plucked instrument. Instead a different musical parameter (which had a dial as opposed to a fader control in Live) was chosen to correspond to the gesture of greater movement. In this case an increase in reverb, rather than velocity, was therefore the parameter that was chosen to be triggered by greater movement.

Unlike more traditional musical interfaces, there was no culture of skill that might have intimidated users of an interface such as Wii-bändi. But this also meant that clients had to start with no previous experience in terms of learning gestures for playing the instruments. This was one reason for using learning schemas from the educational context to inform the choice of gestures picked for the interface. There was some degree of clients trying to play air guitar, air drums, or even air cello, but mostly it was previous knowledge of traditional computer game controllers, rather than traditional musical instruments, that had affected the gestures initially tried by the participants. The controllers still had a lot of buttons on them, as well as a joystick, and these sometimes seemed more attractive to use than gestures through the air.

One other way the research could have gone, in a therapeutic sense, would have been to incorporate the meta-level of music performance control that Live offered. This would have enabled clients to record what they had just played so that it could then be controlled in the same way as a backing loop. Or a client could have a piece of music in the background, chosen for its emotional salience, which could then be looped at the particular point which triggered certain emotions. They could then interact with it musically by playing another instrument with it from the interface. This would be an attempt to create a platform for combining the best aspects of passive and active music therapy, and the points at which they touch. Again, this avenue of research was not within the scope for this particular thesis, but given a different group of people, might have been possible. However, within the scope of Wii-bändi, I could have extended the number of basslines available to 14, had time-limits allowed me to further explore a kind of 'augmented karaoke' where the boundaries of active and passive music experiences would also have been blurred.

If the interface relies on empty-handed gestures and not the actual object being hit or manipulated, as briefly mentioned above regarding video clip 6.31, the interface could be developed artistically through playing unusual objects live, so that certain objects could be made to correspond visually with really incongruous sounds. Although this could also be quite arbitrary, with a nevertheless clear enough pattern to these visual and auditory

isomorphisms, it would be interesting to see what objects clients might have wanted to associate with a particular gesture or particular musical sound.

## **8.2 Conclusion & Feedback from the Clients**

Using Ableton Live, Osculator and Wii controllers I was able to create an expressive digital musical interface that was put into practice for a year in one Invalidiliitto care home in Helsinki. This thesis has been an account of the limits within which this interface operated, and hints at some ways in which future research could possibly use it.

One should not underestimate the importance of clear and frequent channels of communication between all participants of an action research team. We could have found a way so that Wii-bändi was more accessible to more people for longer periods of time. For that we needed a reliable system that needed minimum supervision, an interface that could be shared more easily, so that in time we might have earned greater commitment from the staff (already very busy with many other concerns) to use it more regularly.

Although I was in frequent communication with Sannamari and Jukka via email and on the phone, we all came to the same conclusion: administrator passwords were a hindrance to progress. Perhaps if we had been able to work with clients nearer to Jyväskylä, updates could have been made more easily, we could have visited more often within the same time frame and, as a consequence, tried out quite a few more ideas. Better still would have been able to create a piece of stand-alone software, or patch, in MaxMSP based on what I had learnt using Live, so then it could be used on any computer without having to install all of the software that was used to originally make the patch.

But there was also a lot of very positive feedback, as I mentioned earlier (p45). And later on, from Jenni, we heard that Timo's memory for how the interface worked seemed to improve over time. Heikki was able to overcome his conviction that he was useless and it was no use trying, to actually trying the full range of instruments, and not just the saxophone he started out with. The piece that he entitled 'Elegia' had him playing the harp. Harri enjoyed the verbal element that role playing brought to Wii-bändi. And best of all for me, was that Vesa felt able to share with me the story of how he came to be in Invalidiliitto, while at the same time talk about the present and how very much he was looking forward to the future. The feedback at the end was therefore very positive.

However, from the discussion, and indeed this whole study, several practical conclusions should be drawn. Firstly, with hindsight, there are significant technical problems that could be easily avoided by researchers embarking on a similar project in the future. Secondly, all the possibilities I have mentioned, that were not explored in this study show that there is scope for an interface like Wii-bändi to be used in its present state by music therapists who want to try something different for a change. I would like to end the thesis by presenting these findings in the form of two checklists: one to ensure optimal technical performance, and the other to suggest possible ways of working with the interface as a therapeutic tool in its present state.

### **8.3 Technical Checklist** for Future Developments of a Live/Osc/Wii interface

- Avoid administrator password issues from the start
- Try and use the interface locally, so that updates can be easily made on all computers being used
- Keep CPU load light so audio does not cut out
- Do not load samples directly into clips on the set (uses a lot of CPU)
- Load samples via Live instruments such as Sampler and Impulse (uses much less CPU)
- Experiment with controlling very varied samples (e.g., ones with different attack rates) via aforementioned Live instruments, not mixer settings (like channel faders)
- Samples should be WAVE or AIFF file quality (so they can be warped more easily to fit a tempo or key change)
- Experiment with matching the Scale effect on all MIDI instruments so that if one changes they all change with it
- Experiment with positional scaling when mapping Wii controllers (via Osc & MIDI map mode in Live) to continuous controls on aforementioned Live instruments
- Use convergent and divergent mapping to alter how each instrument inter-relates with itself and others in the interface (e.g., polyphonic drums)
- Use the extra CPU available to experiment with recording (recorded loops could then be played)

### **8.4 Recommendations for Future Usage** of Wii-bändi in its Present State

- Could try using Wii-bändi with other types of client (such as children)
- Begin session with warm-ups that involve listening and turn-taking activities so that the group get to know each other
- Start sessions being quite prescriptive to make sure clients are getting optimal use out of all the interface controls by creating small but fun exercises
- For example each client could take a turn to record a loop on their instrument, which then forms the backing for a song that everyone step-by-step joins in with, until all instruments of the interface are playing simultaneously. Then one by one each client can stop playing
- Try to keep the same group of people together so that people can find their own way of playing after a few sessions
- Become more open-ended as sessions progress and open up the floor to suggestions of other ways to use the interface (e.g., using a microphone for vocals if they want)
- Encourage imaginative role play, giving clients the chance to pick a therapeutic subject of their choice which the music then has to express
- Freely associate sounds and instruments to ensure an unusual plot, perhaps incorporating incongruous objects to hit, if people wish!
- Share copies of the recordings (with their consent) so each member of the group gets to keep something
- Listen!

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## APPENDIX A: Written Feedback

Appendix A is Sannamari's written feedback, from March, 2009, on the sessions that she had attended during the exploration cycle. She calls it 'soiton merkitys'. It therefore represents what the sessions 'meant' at that time to the participants as she saw it, from her perspective as somebody who worked with these people every day. It also marked the end of that cycle, providing me with the basis for making future developments tailored to this specific group of people. At the time Vesa had not yet joined our group, but when he did that, in turn, signalled the start of the final cycle of development.

### Soiton merkitys

#### Heikki:

Soittaminen Wiillä on Heikille sekä fyysistä sekä psyykkistä harjoittelua. Heikki on ollut ennen vammautumistaan muusikko ja on vammautumisen takia joutunut luopumaan soittamisesta sekä siihen liittyvistä rooleistaan. Hän on tuonut aiemmin ettei voi enää soittaa mitään, sillä sormet eivät toimi. Hän on soittanut pianoa, mutta on kokenut koskettimien olevan liian painavia soittaa. Vammasta johtuen voimat sormissa ovat heikentyneet, jonka Heikki kokee hyvin raskaasti. Heikillä on hyvin "sairas kuva" itsestään jonka takia hän ei koe onnistuvansa missään ja hänen ajattelunsa on masentuneen oloista.

Wii soitto on harjoittanut hyvin hänen käsien käyttöä ja hienomotorisia toimintoja. Hän on samalla saanut mahdollisuuden palata aiempaan muusikon rooliin eri instrumenttien tuoman melodian kautta, tärkeää on että hän on saanut itse tuotettua esim. saksofonin melodian. Wii soitto on Heikille musiikki- ja toimintaterapiaa samaan aikaan. Heikki kokee silmin nähden iloa ja onnistumista soittaessaan, hän nauraa sekä hyräilee kappaleita. Wii antaa Heikille onnistumisen kokemuksia, jotka vaikuttavat voimauttavasti hänen elämäänsä. Onnistumisten kautta hän saa toivoa sekä mahdollisuuden unohtaa hetkeksi vammaisen- roolin. Wii soitto tarjoaa Heikille motivoivan, terapeutin ja tarpeeksi haasteellisen harrastuksen.

#### Harri:

Harri on ottanut Wii soiton hyvin henkilökohtaisesti. Hän puhuu siitä paljon äidilleen ja pitää wii projektia hyvin tärkeänä osana tämän hetkistä elämää. Koska musiikki on suuri osa Harrin elämää tarjoaa Wii musisointi hänelle uusia haasteita sekä onnistumisen kokemuksia. Hän kokee Marcin ja Alexin hyvin tärkeinä henkilöinä elämässään ja kyseleekin lähes viikottain "When the boys are coming again?" :) Harrilla on heikko käsien motoriikka, johon hän saa hyvää harjoitusta Wii soiton kautta. Harrin ollessa sokea ja hahmottaessaan elämää pitkälti suullisten ohjeiden sekä äänien avulla, antaa Wii-soitto hänelle uusia haasteita ottaa vastaan uuteen laitteeseen liittyviä ohjeita. Näen Wii soiton

Harrinkin kohdalla musiikki-toimintaterapiana, sillä hän saa mahdollisuuden tuoda musiikillista tietämystään ja osaamistaan esille tarkoituksenmukaisessa ympäristössä jossa hän saa tuottaa musiikkia ja laulua. Samalla tapahtuu kognitiivista oppimista ja muistikapasiteetin harjoittamista.

### **Timo:**

Koska Timon vaikea aivovamma rajoittaa hänen lähimuistin kapasiteettia, tästä johtuen Wii soittokerrat ovat hänelle aina uusi juttu :) Timo on aiemmin ollut rumpali ja on ilmeisesti jättänyt tuon harrastuksen vammauduttuaan. Hän on aina hyvin innostunut soittamaan Wii- rumpuja ja muistelemaan entisiä ”biittejään”. Rumpujen soitto vaikuttaa kehon molemminpuoliseen samanaikaiseen käyttöön. Timon käyttäessä käsiään samanaikaisesti mutta eri liikkeillä, harjoittaa kehon käyttöä sekä toimii aivojumppana. Timo joutuu käyttämään molempia aivopuoliskojaan tuottaessaan kehon molemminpuolista liikettä, jolloin aivot saavat myös hyvää ”liikuntaa” :)

### **Riku:**

Rikulla on hyvin vaikea aivovamma joka on aiheutunut liuottimien imppauksesta sekä päihteiden käytöstä. Aivovamma vaikuttaa hänen muistiinsa ja yleiseen käytökseen. Hänellä on suuria vaikeuksia keskittyä annettuun tehtävään sekä seurata ohjeita. Ryhmässä hänen on vaikea pysyä muiden mukana sillä keskittyminen herpaantuu hyvinkin pienistä häiriötekijöistä. Aivovamma vaikuttaa myös hänen motoriikkaan ja liikkumiseen. Hänen kehonhallinta on jähmeää ja kömpelöä. Samoin kuin Timolla, Rikullekin kehon molemminpuolinen käyttö on aivojumppaa. Riku nauttii soittamisesta paljon, mutta harmikseen unohtaa pian soiton jälkeen sen. Rikun omaiset toivovat päivätoiminnan tuovan Rikun elämään elämyksiä ja sitä Wii todella hänelle tuo. Riku nauttii soittamisesta hyvin paljon, hän saa soittaessaan mahdollisuuden tuottaa ääntä sekä käyttää myös kehoaan (esim. kitaran soitto, jolloin hän nousi seisomaan tuolilta ja soitti kitaraa seisten).

Kaikille edellä mainituille asiakkaille Wii soitto on vuorovaikutuksen- sekä ryhmässä toimimisen harjoittelua,. He joutuvat huomioimaan muut soittajat; odottamaan vuoroaan, neuvottelemaan instrumenteista joita haluavat soittaa sekä matkimaan muiden soittoa. Wii tuo kaikille soittajilleen iloa ja haasteita, vammasta riippuen sitä voi soveltaa hyvin toimintaterapiaan. Näen Wii:n käytön hyvin kuntouttavana ja terapeuttisena esim. lasten parissa joilla on oppimisvaikeuksia (kognitiivisten taitojen harjoittelu, kehon hallinta , ohjeiden noudattaminen, ryhmässä toimimisen harjoittelu jne), fyysisesti vammautuneiden asiakkaiden parissa (käden kuntoutus, kehon käyttö jne.) sekä kaikkien niiden asiakkaiden kanssa jotka osallistuvat ryhmäkuntoutukseen/terapiaan jossa tavoitteena on esim: ryhmässä toimiminen, toisten huomioiminen, vuorovaikutus, kehonhallinta/liike, kehollinen ilmaisu jne... Mahdollisuuksia on hyvin monia!!! :)

## APPENDIX B: Osculator & Live Terminology

Appendix B describes in more detail the interface *software* used. Osculator and Ableton Live are the technological resources most referred to in this thesis, and an understanding of how they work is vital to understanding the development of Wii-bändi. I have left the section references as if they were part of chapter 4, even though they are now in a separate appendix. This is so that figures can be understood more easily as part of the technological resources section, and yet not break the flow of the thesis by being placed in an appendix. The aim is to allow the thesis to focus specifically on the development of Wii-bändi earlier in the text, rather than details about the software that might be unnecessarily distracting for certain readers.

### 4.3 Osculator

Osculator is an application which provides a graphical user interface (GUI) for mapping signals from controllers with various kinds of sensors to a computer. It is a piece of open-source software and was used in this study to track all the various outputs from the Wiimote and Nunchuk. These signals were then converted by the application into something that could be read as MIDI information and then sent to the sound producer (Live).

Over the course of the past year or so there have been many updates to Osculator, and to take these into account has had repercussions for the whole of the interface.

Unfortunately however, as it is not a code-based interface, some mappings could not be copied and pasted to other Wii instrument settings within the same Osculator patch, and so it was quite time-consuming to manually reproduce mappings through the GUI every time there was an update. Nevertheless after all this had been done, the result was worthwhile.

Figure 4.31 shows what the main window looks like in Osculator when you open the program (depending on what was saved the last time). The “Wiimote Drawer” button in the top-right corner has been used to open the panel on the right. At the top is a

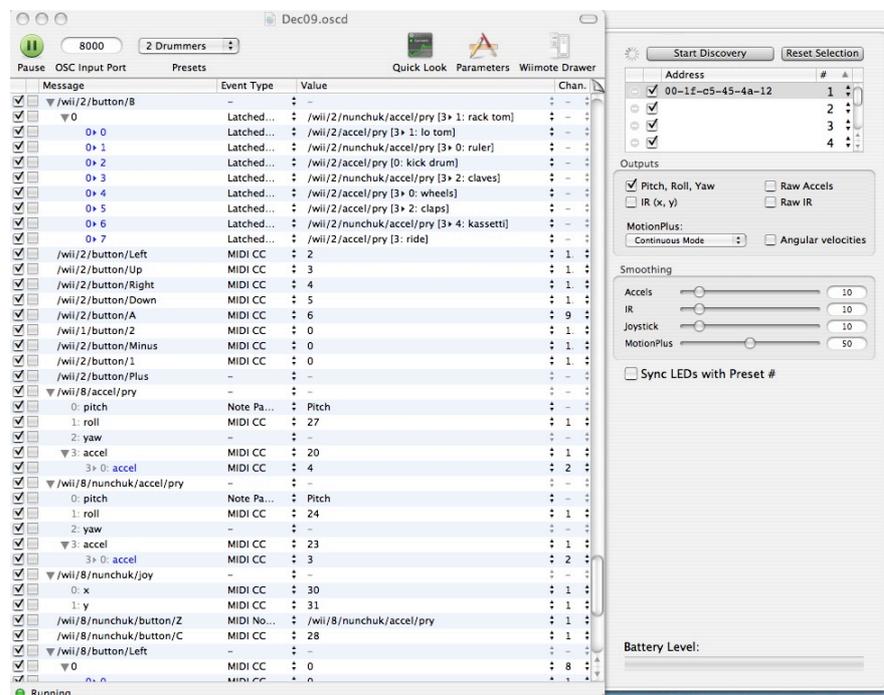


Figure 4.31: Osculator's main window

toolbar with a button that can pause the connection between controllers and computer (handy when in the middle of changing mappings in Live). This stops the Wii accidentally assigning an accelerometer mapping to a musical parameter when Live is in MIDI Map mode<sup>20</sup>. In this toolbar there is also the (incoming) port number, a drop-down menu for presets, the Quick Look button, the Parameters button and the Wiimote Drawer button. The presets are handy if you want to change all the mappings with the press of a button while playing. The Quick Look button shows on a simple amplitude/time graph the amount of signal being received from the Wii sensors for any one dimension of acceleration, when that is highlighted from the list of signal messages below the toolbar. The Parameters button provides a sub-menu in which you can adjust, among other things, how the input signal is processed. For our purposes this button was only used to make sure the setting was “emulate pitch bend wheel” as opposed to “repeat note as long as it is active”, as this allowed for smoother sounds with a greater variety of timbre, than the static pulse which permeated every sound on the latter setting. Finally, the Wiimote drawer allows you to connect the Wii controllers to Osculator via the computer’s bluetooth connection. This is the most important part of the toolbar to begin with, as this gets everything started (the panel which is open, on the right of figure 4.31).

Here you can see how many controllers are successfully connected at any one time. Although it ostensibly allows for 8 controllers (that is 8 pairs of Wiimote and Nunchuk), it was found that 5 was the maximum that could operate at any one time, perhaps due to limitations as to how many bluetooth devices can be connected to the Macbook without interference. Lower down in this panel you can also edit which outputs are received from the controllers. In my case I unticked all the boxes except “Pitch, Roll, Yaw” as these were the only dimensions that, through trial and error, were found to be useful. If other boxes were left ticked, their messages would have joined the list in the main window below the toolbar. This would make it unnecessarily long and harder to navigate, as well as pointlessly using battery power in the controllers, especially in the case of infra-red (Troillard, 2009). Further down the panel, the “Smoothing” section allows for adjustments to the sensitivity of the controllers. After experimenting with this in the first patches I made, I realized the settings can not be differentiated for each of the Wii instruments, so it was not so relevant. Rather it determines a global setting for all the Wii controllers used by the Osculator patch. In earlier versions used in the course of Wii-bändi’s development, this was available only for the accelerometer and infra-red sensors and was simply called “Sensitivity”, but current versions also include slide adjusters for the joystick as well as the Wii MotionPlus. Finally, at the bottom of this panel is a very useful bar that shows how much battery power is left in the Wii controller.

The main whiter part of the window is taken up by a list of rows and columns. The rows are the different signal messages and events for every control parameter on each of

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<sup>20</sup> see following section 4.4 on Live



controllers can control more than one musical parameter. To enable this divergent mapping, columns 4,5, and 6 are then altered for mapping to the extra musical parameters. Divergent mapping will be explored in greater detail in the results chapters, but for the purposes of this chapter, let us focus on the basic role of the remaining columns.

The Event column (4) designates how the signals are routed onwards to Live. In figure 4.32 we can see three kinds of mapping event used in Wii-bändi. The first is a simple MIDI CC event, which uses individual MIDI values to map a signal to a musical parameter. This is good for on/off musical parameters, or divisions within a continuous controller. The MIDI CC event requires a value (0-127), as well as a channel (1-16) to be assigned from columns 5 and 6 respectively. Then it is mapped in Live using the MIDI Map mode (see section 4.4 below). Of all the kinds of mapping, MIDI CC is understandably the most used as there is a total of 2048 (128x16) possible combinations available. The second kind of mapping event is MIDI Note, which in figure 4.32 is used by Wii controller 1 to trigger MIDI drum sounds. This instrument in Live has drum pads which are already assigned an individual MIDI note (0-127) so, unlike with MIDI CC, they do not need mapping from within Live. As long as column 6 has been assigned the same MIDI channel number (1-16) as in Live, then it should work.

The third kind of mapping event is for MIDI instruments that require a continuously varying parameter. In Wii-bändi this is done using two events: MIDI Note w/ Params, and Note Params (“params” evidently stands for parameters). As with MIDI Note, MIDI Note w/ params is assigned the same MIDI channel number as in Live, so that (in our case) the accelerometer can be used to control the musical pitch of the Live instrument. MIDI Note w/ Params turns the instrument on or off by routing the signal to the relevant accelerometer dimension only when its green light (column 2) is on. When you select this event for mapping, it changes the drop-down menu in column 5. Instead of revealing a list of MIDI values, it now shows another list of signal messages. From this list, the input which will be used to map the note parameters is chosen. In figure 4.32 the Z button on the Nunchuk of Wii controller 7 is routed to the rotational axes (pry) of the Nunchuk, and of these messages, it is the “pitch” (ie. how much you tilt it) which determines the musical pitch of the instrument, as this is the only one of its rotational axes with the Note Params event assigned to it. This is the first example of routing signals within Live: pressing Z activates the path for the Nunchuk’s accelerometer to be mapped to Live.

At the top of the column on the very far right, is what looks like the upturned corner of a page. If you click on this, it takes you from the Main Window to the Scalings page (and back, if you click again). Figure 4.33 below, shows what the Scalings page looks like for the same mappings as shown in figure 4.32. Replacing the Event, Value and Channel columns are settings so that each signal’s input and output can be scaled between 0 and 1. This determines which part of the music-making gesture is relevant, in that all those readings which are outside the input and output minimums and maximums are not

processed. This is perhaps the most important feature in individually tailoring different sensitivities for the gestures required to control the musical parameters. In figure 4.33 for example, the button C on the Nunchuk of Wii controller 7 is mapped to a dial in Live,

Message	In. min	In. max	Cap	Out. min	Out. max
▼ /wii/7/nunchuk/accel/pry					
0: pitch	0	1.0	<input type="checkbox"/>	0	1.0
1: roll	0.6	0.95	<input type="checkbox"/>	0.7	1.0
2: yaw	0	1.0	<input type="checkbox"/>	0	1.0
3: accel	0	0.6	<input type="checkbox"/>	0.6	1.0
▼ /wii/7/nunchuk/button/C					
▼ 0	0	1.0	<input type="checkbox"/>	0.5	0.6
0 ▶ 0	0	1.0	<input type="checkbox"/>	0	1.0
/wii/7/nunchuk/button/Z	0	1.0	<input type="checkbox"/>	0	1.0
▼ /wii/7/nunchuk/joy					
▼ 0: x	0.8	0	<input type="checkbox"/>	0.5	0.65

Figure 4.33: The scalings page in Osculator

where we only want values in the middle to be activated (therefore output is set at 0.5-0.65). In another example, when rolling the Nunchuk, we only want an angle of about 30° to be effective from the positions of about 1 o'clock to 2 o'clock, as this is how much people want to comfortably twist their wrist, so the input is set at 0.6-0.95. Meanwhile the musical parameter in Live is only effective at the top end of the scale, so the output is set at 0.7-1.

The direction of effective gestures can also be changed by swapping the minimum and maximum values around (on either the input or output, but not both together or they will cancel each other out). This changes the polarity of the mapping so that, for example, in the case of the x axis of wii/7/nunchuk/joy, moving the joystick to the *right* triggers an *increase* in a musical parameter, not a decrease which could be counter-intuitive and quite possibly confusing. Of course the mapping in Osculator depends very much on the directions and scalar values of the musical parameters in Live's interface, so without further ado we should now look at Live.

#### 4.4 Ableton Live

This is the DAW that was used as it has an easily mappable set of controls in it, that are clearly laid out. Together with this MIDI-mapping capability, a large number of the controls are also quantizable, which basically means they can fit patterns together easily with a certain degree of customizable automation. Live also allows for audio samples to be triggered, as well as MIDI instruments, so it encouraged experimentation with real-world recordings and a variety of genres of music that were not necessarily "electronic" (which is what MIDI usually entails).

There are two main windows in Live, but as previously mentioned, recording within the program proved problematic as it slowed everything down, so the Arrangement window (where the recording timeline is) was less important and will not be dealt with here. It was the Session window, seen here in normal and MIDI Map Mode, that were the most used windows in Wii-bändi.



Figure 4.41: The Session view in Live

The list in the upper left section of figure 4.41 is the file browser. Here you can find and drag files into your set, from anywhere in the computer. During the project I experimented with all sorts of audio files (from songs, sound effects, field recordings and so on), that were easy to access and try out in this manner. In MIDI Map Mode (figure 4.42), the file browser becomes a list of mappings already made in the set: useful for keeping track of available MIDI values to assign in Osculator.

The biggest section (central to upper right) shows columns dedicated to audio and MIDI tracks. The boxes in each column here are empty slots for either audio samples, or recorded samples of MIDI instruments (they could be inserted from the Arrangement View). In the case of Wii-bändi, the clip boxes were only used for audio samples or loops to be triggered by the controllers. Each track has a pan knob, a volume slider, an activation button and solo/mute buttons. The A and B buttons at the bottom of this section allow for the tracks to be assigned to one of two groups (or buses) which can then be switched between, using the cross-fader control under the master channel strip.

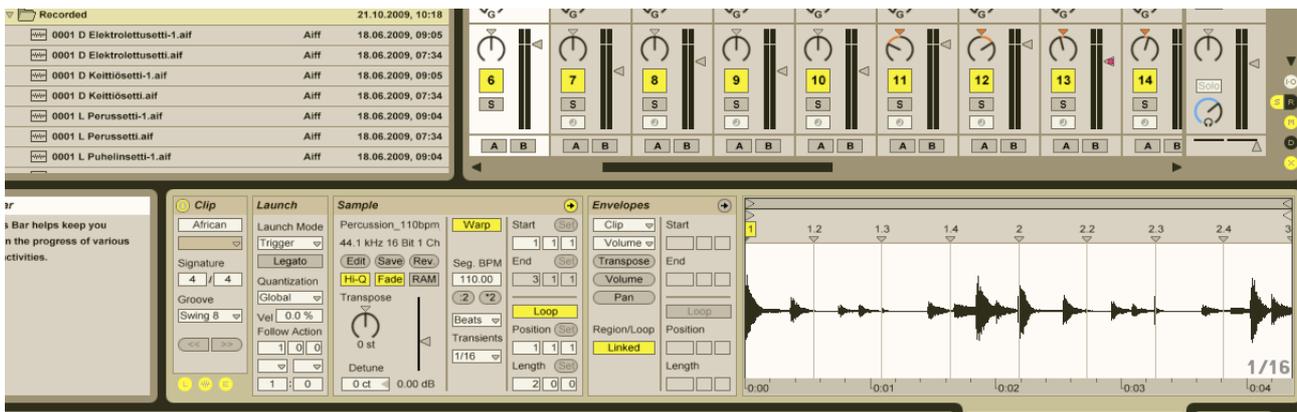


Figure 4.42: The Clip View in Live

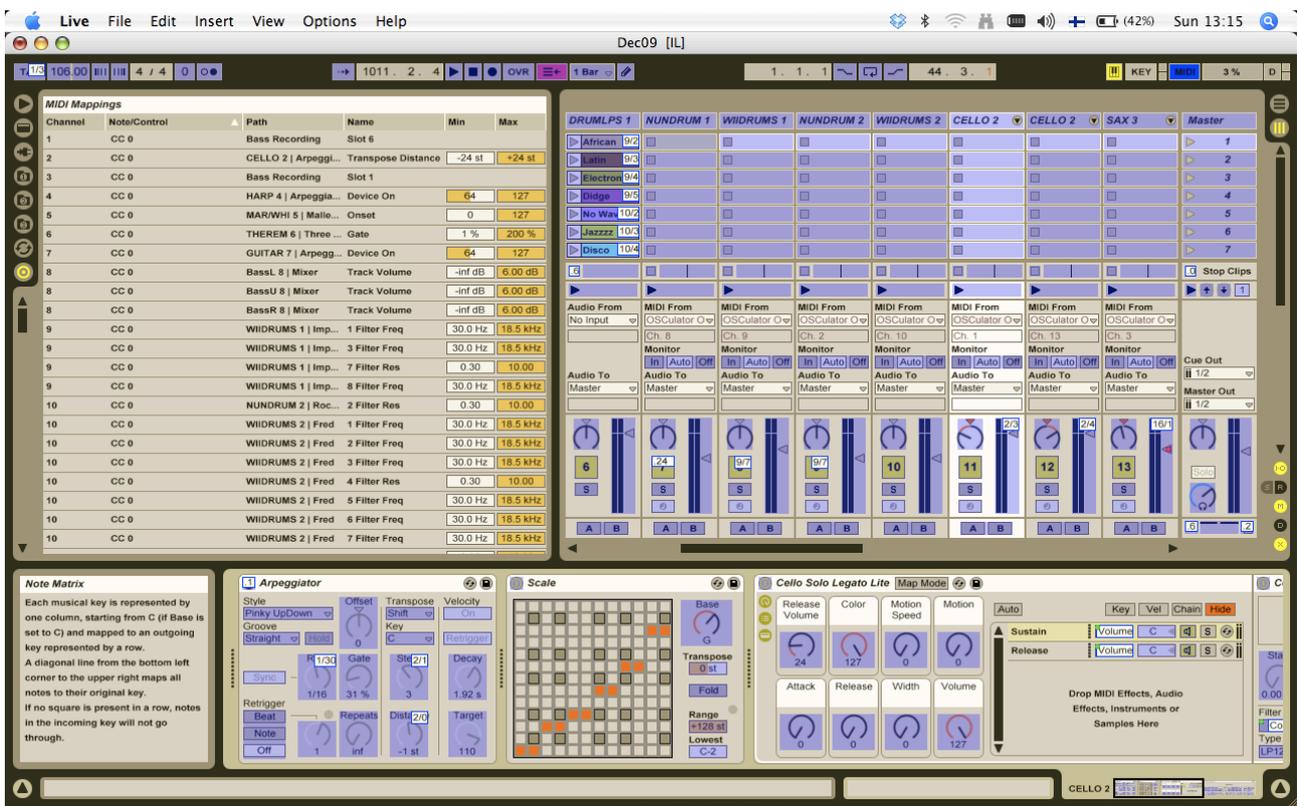
Directly above the channel strips are the routings for the tracks. On the MIDI tracks the input is 'from' Osculator (selected from a drop-down menu, having been set up previously in the preferences pane). The MIDI channel number (1-16) is then chosen to correspond with the instrument's controller channel in Osculator. On the audio tracks however, there is no input, as these tracks are being used as empty vessels in which to place pre-recorded samples (or clips) that are to be triggered by the Wii. Both audio and MIDI tracks are then routed 'to' the master channel.

The box in the bottom left corner stays the same whatever the view or mode. It can be hidden, but it is a very handy information box that fills with text explaining all the different knobs on the control surface of Live, as soon as the cursor passes over them. Considering the large range of instruments, effects and automation available for mapping to the Wii, it was a great help. To the right of the information box is the area where you drag MIDI effects, audio effects, instruments or samples (again these can be accessed from the file browser) to make your MIDI instrument sound. In figure 4.41 this section shows the inserts for the MIDI track called CELLO 2. You can see, from left to right, some characteristic MIDI effects used in all the instruments in Wii-bändi (Arpeggiator and Scale), and the MIDI instrument itself. Audio effects could also be added to the right of the instrument if required, but as they use a fair amount of CPU power, I preferred to access these effects through sends, and not inserts.

This lower section, showing the components of a MIDI track's instruments and effects, however disappears and is replaced with the Clip View when one of the audio clips is double-clicked. Within this view (figure 4.42), you can control how the clip is launched, how loud it is, whether it is quantized, transposed, warped to fit with the global tempo, and how it follows on from other clips in the track, as no clip can play simultaneously with another clip from the same track (column).

In MIDI Map Mode (figure 4.43) you can see that there are little white boxes across some of the controls which have numbers in them, albeit not very visible. These appear

Figure 4.43: MIDI Map Mode in Live



when MIDI CC messages are successfully mapped from Osculator to Live using the Wii. The first number stands for the MIDI channel, the second for its value. When you click on a white box after it has been successfully mapped, it will highlight its path in the MIDI Mappings section of the screen (where the file browser usually is). In the last two columns of this section you can see the minimum and maximum settings for the controls, which reflect the output values from the Scalings page in Osculator. The MIDI instruments usually have macro-controls which can be opened up to reveal the controls in greater detail, as with the cello in the example. In figure 4.43 we can see in the bottom right corner a pair of mappings to the volume knob of the macro-controls. In the same way as the macro-controls are assigned to parameters across a bank of inserts (which make up the cello), the Wii can be mapped to directly control more precise parameters within the instrument and bypass the macro-controls if so required.

The purpose of this appendix is to simply explain the basic layout of the Wii-Osculator-Live set-up so that the account of changes made, is perhaps easier to understand in the results section.

## **APPENDIX C: Old Osculator & Live Patches**

Appendix C is a data CD containing all the past Osculator and Live patches that were used in the development of Wii-bändi. These can only be opened on a computer that is running Osculator and Ableton Live software. They show in detail how the interface changed from month to month, and sometimes from week to week.

## **APPENDIX D: Video Footage**

Appendix D is the DVD attached to this thesis, which contains edited video footage from all three cycles of research conducted between November, 2008 and December, 2009. The aim was to make a video for each cycle of research, in which all the significant events of the sessions contributing to the development of the interface feature. The DVD is chaptered so that each video clip example mentioned in the main text can be easily found.