

# Same but Different – Composing for Interactivity

Anders-Petter Andersson, Interactive Sound Design, Kristianstad University, Anders-Petter.Andersson@hkr.se  
Birgitta Cappelen, AHO- The Oslo School of Architecture and Design, Birgitta.Cappelen@aho.no

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**Abstract.** Based on experiences from practical design work, we try to show, what we believe, are the *similarities* and *differences*, between composing music for *interactive* media compared to *linear* music. In our view, much is the same, built on traditions that have been around for centuries within music and composition. The fact that the composer writes *programming code* is an essential difference. Instead of writing one linear work, he creates infinite numbers of *potential musics* that reveal themselves as answers to user interactions in many situations. Therefore, we have to broaden our perspectives. We have to put forward factors that earlier was implicit in the musical and music making situations, no matter if it was the concert hall, the church, or the club. When composing interactive music we have to consider the *genre*, the potential *roles* the listener might take, and *the user experience* in different situations.

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## What and Why

Interactive media are increasingly becoming a significant part of our daily lives, and the extreme ongoing developments in mobile communication services are making auditive interactive media in particular important. This is a big challenge for everyone who wants to take part in the creation and understanding of the new auditive interactive media. But to what degree is it new? And to what degree does the composition of interactive music build on traditional music composition?

In this paper we want to show how the composition of music for interactive media is *similar* to, but also *different* from, linear music composition. We would like to show to what degree, we can reason and follow the *same* line of thoughts, when composing interactive music as in linear music. We want to show what perspectives, factors and conditions one has to acknowledge when composing music for interactive media.

## The ORFI Example

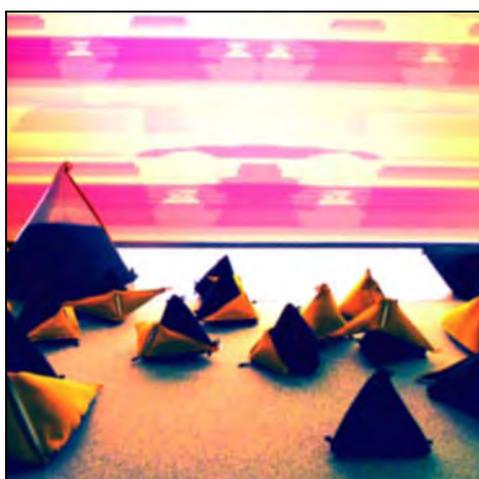


Figure 1: The ORFI landscape, the modules and the dynamic video projection.

We would like to use the interactive installation ORFI<sup>1</sup> [1] as an example, showing how we were thinking when creating the

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<sup>1</sup> ORFI is an interactive audio tactile experience environment created by the group MusicalFieldsForever (Anders-Petter Andersson (concept, music, composition rules, sound design), Birgitta Cappelen (field theory,

music for the installation. This, in order to be able to discuss in what manner we mean the compositional work is *similar* and *different* when comparing *interactive* music to *linear* music.

ORFI is a new audio tactile interactive installation (see Figure 1). It consists of around 20 tetrahedron shaped soft modules, as special shaped cushions. The modules are made in black textile and come in three different sizes from 30 to 90 centimetres. Most of the tetrahedron has orange origami shaped “wings” mounted with an orange transparent light stick along one side (see Figure 2).

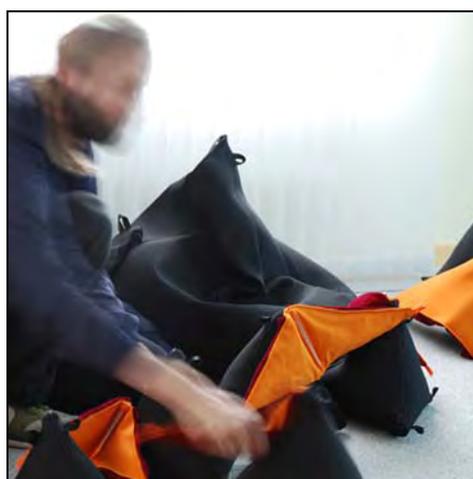


Figure 2: A user playing and interacting with ORFI's wings.

The “wings” contain bendable sensors. By interacting with the wings the user creates changes in light, video and music. ORFI is shaped as a hybrid, a hybrid between furniture, an instrument and a toy, in order to motivate different forms of interactions. One can sit down in it as in a chair, play on it as on an instrument, or play with it as with a friend. The largest modules, in suitable size to sit on, have no wings with sensors, but speakers instead. Every module contains a microcomputer and a radio transmitter and receiver, so they can communicate wireless with each other. The modules can be connected together in a Lego-like manner into large interactive landscapes. Or, the modules can be spread out in a radius of 100 meters. So one can interact with each other sitting close, or far away from each other. There is no central point in the installation, the *field* [2]. The users can look at each other or at the dynamic video, like a

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concept, design, interaction design) and Fredrik Olofsson (concept, music, software and hardware)) [www.musicalfieldsforever.com](http://www.musicalfieldsforever.com)

living tapestry, which they create together. Or they can just chill out and feel the vibrations from the music sitting in the largest modules.

The installation has a 4-channel sound system that makes listening a distributed experience. ORFI consist for the time being of 8 genres, or collections of rules, which the user can change between. Our use of the term “genre” has references to *popular culture*, such as music, and *everyday activities* made when consuming the music, such as dancing [3, 4]. In ORFI we explore 8 different musical genres:

- JAZZ (bebop jazz band, dancing, ambient),
- FUNK (groove, dancing)
- RYTM (techno, club)
- TATI (speech, onomatopoeic, movie)
- GLCH (noise, club)
- ARVO (ambient, relaxation)
- MINI (minimalist instruments, playing with toys)
- VOXX (voice recordings generated dynamically by the user).

In this paper we have chosen to describe the compositions in the JAZZ and MINI genres, because they represent oppositions regarding genres and therefore serve as explanatory examples. The many possibilities, such as many distributed wireless modules, and many genres to choose between, reflect our goal to facilitate collaboration and *communication on equal terms*, between different users in different use situations

### New Situations and Roles

One of the aspects we have put a lot of effort into when creating ORFI is related to the use or consumption situation. We don't know and cannot control in what situation and for how long ORFI will be played on and listened to. This differs in a fundamental way from composing music for a stage performance. In a *stage* performance one knows implicit that the audience will sit in the dark with the face towards the stage quietly listening for one or two hours. *Radio* listening is more like our situation, but here one usually knows by knowing the time, what everyday ritual the radio program is part of [5]. Music as an *ambient sound tapestry* in a home is more like our situation, but here the user is limited to turning the music on or off, or change to next tune. These actions represent a *break* in continuity of the listening experience.

In ORFI the interaction shall be a *seamless* [6] part of the music experience. The music therefore must invite and motivate dynamically to interaction. To the co-creation of the music experience. In this meaning, ORFI is more like the *improvisational musician*, but in ORFI we can not count on the user to have a professional musical know-how. It must be satisfactory to both musical professionals and people with little music competence, if we are to reach our ambitious goals.

In ORFI the audience changes continuously between roles in different situations, from being a passive listener, to a musician and a composer. Through long use the user gets deeper knowledge about ORFI's complexity and the user becomes more like the *improvisational musician*, who with his competence creates music on an instrument in real time. But the user also comes nearer and becomes more like a composer over time. The user becomes like a *co-composer*, which based on the potential, the composer and writer of the software has formulated, “composes” music by choosing and mixing music together. In this way the *real composer* who has written the software is present in the installation by continuously giving musical answers, offering new musical possibilities to the user, the co-composer. This is also a major difference between linear an interactive music composition.

### The Interactive Challenge

The composer of interactive music does not write *notes on paper* or mix sound samples together to a *linear track*. He creates *music* and *software* which totally or partly are the same, depending on if the music elements are programs or sound samples. This means that the composer composes *potential music*, and software that controls the *potential relation* between music elements. Music elements that will follow each other or lie as layers on top of each others and be distributed in the 4-channel system. All depending on what the user does, which never can be predicted exactly. Writing software represent a totally *different* potential than writing for an instrument, because the *computer* can *wait, remember and learn* in a more or less intelligent manner. Therefore one can write software so that the installation or the interactive medium can behave more or less like an active *actor* [7] instead of as an instrument. Playing a traditional *instrument* a musical gesture on an instrument will produce an *immediate mechanical* sound response [8]. Writing software for a *computer* one can decide that a gesture or interaction from the user, after a while will create a more *complex musical* answer. This is more like the *improvisational musician*, which after some time comes with his answer to your solo play.

In ORFI we use both strategies in order to offer multiple possibilities in all situations [2]. This means that the user interacting with ORFI gets both a *direct, immediate* answer in light and sound, as when playing on an acoustic instrument. But after a little while he gets a *complex musical* answer to *motivate* the user to further co-creation with ORFI. Examples of how it is composed will be presented under “Interactive music composition”.

ORFI is created so it continuously *invites* to collaboration in different ways and through different media and forms [9]. Since we have a very ambitious goal that ORFI shall work satisfactory for *most users in many situations over long time* it is necessary with an *open* concept of collaboration. Nothing is the right way to do something. *Nothing is wrong*. It is as right to listen and sleep in the interactive landscape as it is to throw the modules between each other while playing. It is equally right to build and shape one's own interactive landscape, as it is to concentrate and move the wings rhythmically for some minutes. To offer this amount of openness we have put a lot of effort into the design of ORFI in order to offer qualities like robustity, sensitivity, ambiguity, musicality and consistency.

ORFI has to be very *robust physically* to handle being thrown, stepped on and bended intensely. But it also has to be *robust, tolerant and sensitive* in the *software* and *hardware* to register a weak movement from a child's hand and attempt to follow the rhythm.

ORFI offers many *visually, physically* and *musically* possibilities in many situation. It tries to answer and encourage the users in different ways to musically interaction, in spite of their competence, or lack of competence, in music. This means that for some, in some genres, the lights rhythmical blinking motivates the user to rhythmic interaction. But in other situations, for other users, it is the complex dynamic graphic that gives the user a visual image, and motivates the user to create the musical narrative.

All these possibilities open up for various experiences for different users depending on the individual's competences and experiences with ORFI. It has been very important for us to design ORFI to offer *many possibilities in every situation, ambiguity* [10]. But it has also been very important to give ORFI a *clear and unique identity*. This so ORFI might act as a convincing actor in a collaboration or improvisation. The continuous *change of roles* the user can make. The *many possibilities* the users are offered. The potential infinite uses and

the *many consumption situations* make the interactive composition challenge much more complex than in linear music. The fact that the nature of interactive music composition is *software*, and not notes or samples, also makes it necessary to structure the interactive composition in another way than linear music.

## Interactive Music Composition

So how have we met the interactive challenge of composing *potential music*? How have we created algorithms and rules in programming code that regulate the relations between musical elements, the conditions for potential music? And how did we compose music that motivated both *professional musicians* and *laymen* to interact?

With concrete examples we will try to show how we have composed the music for ORFI, exemplified by the two most diverse genres.

We have chosen to structure ORFI's software and music composition into the following layers: sound node, composition rule, and narrative structure (see Figure. 3).

*Sound nodes* are the smallest musically defined elements, such as, tones, chords, or rhythmic patterns.

The sound nodes can be joined into sequences or parallel events by *composition rules*, forming phrases, cadences, or rhythmic patterns. The sound nodes can be joined into phrases or parallel events by composition rules (algorithms). The user experiences these phrases as *narrative structures* based on a genre.

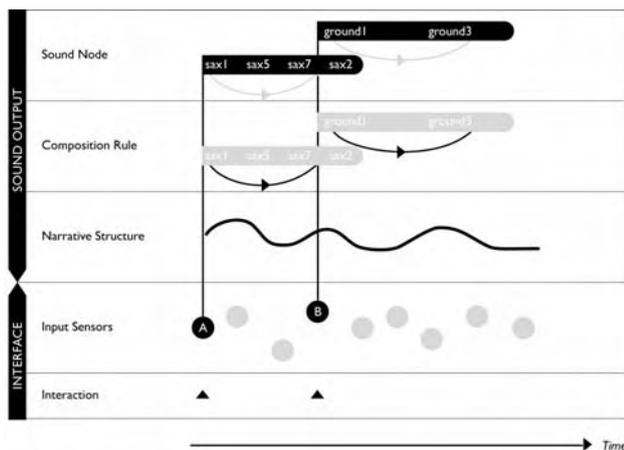


Figure 3: Structure of the interactive music composition software and interface in ORFI.

Figure 3 shows two users interact (bottom) with input sensors A and B. The composition rules written in programming code, selects the saxophone sound nodes (sax 1, 5, 7, 2) based on the users interaction. Another composition rule creates the switch from “ground 1” in high tempo, to “ground 2” in slow tempo, so that it synchronise smoothly with the pulse without creating a break. Over time the user creates a narrative structure of an 8 bar jazz blues that motivates further interaction.

## Sound Node

### definition, mediation and qualities

We call the smallest musically defined elements *sound nodes*. They are categorized into sound qualities like length, instrument, pitch, harmony, tempo, meter, etc. Based on the sound qualities and the composition rules, the program choose and creates the narrative, e.g. a melodic motif, where the expressive qualities depend on user interaction.

A sound node can be a linear sound file or programming code. We have chosen to present the JAZZ and MINI genres, to show our solutions in the two cases, sound samples vs. code.

The accompaniments (ground), horn riffs and saxophone sound nodes in the JAZZ genre are sound files. The melodic patterns in the MINI genre are programming code. The difference between sound file and programming code is that the auditive result formulated in programming code varies dynamically for each interaction, while the sound file is essentially the same each time it is played. This makes the programming code potentially more flexible, since it can vary with user interaction.

### creation of a node

Similar to traditional jazz, the blues in our JAZZ genre is composed and recorded by a jazz ensemble [11]. Each musician has recorded his instrument until the result is mixed down to a jazz song.

After recording the music, we have cut and grouped the recorded instruments into separate sound files. Then we have arranged the files interactively by writing rules for ORFI [2]. Our arrangement builds on the style's traditional "improvisation on a theme".

### nodes and node structure

In traditional jazz the musicians play on instruments with direct response only. In ORFI the user might instead play on 20 physical soft modules. When interacting each module plays three different saxophone sound samples depending on the situation. The reason for this solution, is that we wanted to be able to vary the expression from soft Ben Webster-like sound nodes within Dorian scale, to hard, growling and dissonant sound nodes outside the Dorian scale, and percussive saxophone pad sound nodes. *Which* sound nodes the program combines and *how* depend on if the users are active or passive, interact on their own or collaborate, synchronise to the musical beat or not.

### roles and experience

Similar to jazz, our interpretation has separate roles tied to the different instruments. We use the tenor saxophone in the soloist role, blues drums and walking base as accompaniment (ground), and horn riffs played on saxophone, trombone and trumpet. An important difference is that the interacting users continuously can choose to change between the role of improvisator, soloist, accompanist by choosing the module to play on etc. Therefore the roles are potential and open for interpretation more than definitely.

An example; When improvising, a saxophonist creates music from pre-composed short motifs. He also creates phrases from two contradictory curves of tension – amplitude and vibrato. The amplitude curve goes from strong to weak (>). And the curve for vibrato goes in the opposite direction from little to much vibrato (<). We use the same strategy when composing interactive music; This result in a sound node that potentially has two gestures at the same time, a *decreasing* and an *increasing* gesture. These contradictory curves of tension could potentially function as the start tone, building up a tension in a phrase, and as an end tone finishing the phrase creating a release. The user, both laymen and musicians, can choose to hear it as a *tension* or *release* depending on the situation.

In our JAZZ genre laymen can use the saxophone's tension creating curve for other purposes than the professional musician. For instance speeding up a movement, rolling his body over the soft modules spread out on the floor, while communicating with a friend.

### response and experiences

The melodic pattern generated by the programming code is changing dynamically with the user interactions and other melodic patterns playing at the same time. So when the user

interacts, the software realise one out of many possible melodies.

Similar to playing on traditional instruments, the user gets direct response when interacting. And at the same time the user contributes to a musical whole.

The MINI genre gives immediate response in simple 2-6 notes melodic motifs. The sound nodes also contribute to a complex and musically satisfying response that motivate users to interact with others over longer time.

Similar to traditional music our JAZZ genre uses different instruments to create complex variations and contrasts between the instruments. This is also the case for groups of sound nodes, within an instrument.

#### code vs. tune

The sound nodes in the *MINI genre* are inspired by minimalist music in the style of Steve Reich [12].

Similar to minimalist music our genre is characterised by repetitions and small variations of short rhythmical and melodic motifs, rather than large-scale development such as phrasing, or sonata form. With less happening on a macro level the focus is directed towards the surface and the micro level of small changes in melody, rhythm and timbre.

What makes our MINI genre different is that every sound node is a *program* (see Figure 4).

```
SynthDef(\pattSynth, {\out= 0, freq= 440, amp= 0.1, atk= 0, rel= 0.5,
max= 40}
  var e= EnvGen.kr(Env.perc(atk, rel), doneAction:2);
  var f= EnvGen.kr(Env.perc(0, 0.01), 1, 1, 0, Rand(0.95, 1.1));
  var z= SinOsc.ar(freq*[1, IRand(0, 3)].round(1).max(0.5)+Rand(1,
1.02]), f*Rand(10, 40), amp*0.1);
  Out.ar(out, e*z);
}).store;
```

Figure 4: The sound node programming code for a synthesised, marimba, written by Fredrik Olofsson in SuperCollider [13, 14].

### Composition Rule

#### definition and mediation

Similar to traditional music the composition rule is composition *knowledge*, the composer use to create the traditional musical work.

It can for instance be knowledge about how to create relations between tones, rhythm, melody, timbre and harmony in music.

Different from traditional music is that the composition rules are *programming code* realised through use. For instance the sound files in the JAZZ genre are controlled by the composition rules in a program that consider both the musical and the interactive development over time. Another example is the MINI genre melodic pattern, where both sound nodes and composition rules are formulated as programming code (figure 4) and where the difference between sounds and rules is lacking. The result is that the music can change dynamically, and that it sounds differently over time, with different users and situations.

#### competence and experience

Similar to traditional music, a *musician can use his improvisational competences* for making music by joining pre-composed elements together.

Differently from traditional music is that a *layman* with less musical competence can interact with the program and its composition rules. The program interprets the interaction, delays and changes the response in order to make it *musically satisfying*, according to the composition rules.

The composition rules regulate the synchronisation of motifs to the pulse after every user input. It also regulates tonal and harmonic development so that they don't contradict the genre rules. Instead, the program waits for a rhythmically suitable

moment to play back motifs, and selects sound nodes that add variation to the harmony and musical phrasing.

Unlike traditional music, laymen can *communicate* with each other directly through the music. In ORFI laymen interact actively and the program responds to individual, as well as collective interactions.

An obstacle in traditional music is that it is *hard* to make music. It is hard for a layman to keep the rhythm, pick the right notes and create musically satisfying phrases.

In ORFI its different; The program and its composition rules are *tolerant*, making it easier for laymen to synchronise to the pulse. The composition rules tolerate deviations from what is rhythmically correct and synchronise motifs to the harmony and the pulse in other sound nodes. The result is avoidance of technically difficult situations. And the laymen can instead focus on *communication* and *collaboration* with others.

#### composition techniques in JAZZ

We have been inspired by traditional cool jazz and its modal harmony, rhythmically improvised and laid back performing style of such artists as Miles Davies and Ben Webster [15, 16]. In cool jazz a saxophonist can make it sound great letting the instrument wander casually along a *modal scale*. He search his way along the *background* of drums and falling fifths of a walking base.

In cool jazz it is custom to use themes in modal scales with less chords in order to make it easier to improvise freely, with focus on *rhythm* and musical expression.

Similarly we use *Dorian* modality in ORFI, to motivate improvisation and interaction.

As in cool jazz, interactive music composition, also use effects like *growling* and dissonant saxophone with harsh timbre as a musical rhetoric technique.

Unlike traditional jazz we use *growling* and dissonant saxophone to express, stage and *dramatize* the conflict when many users interact simultaneously. For instance when many people play and tease each other, by interacting with many ORFI modules at the same time. The result is that the program creates many *growling* noises outside the Dorian scale, in addition to the user created, soft and consonant tones.

As in traditional jazz we use soft consonant *leading notes* for making musical ornaments. These motivate to improvisation, such as *call-and-response* communication, and duets between musicians.

Different is that the soft and consonant leading notes are used to express *pauses*, motivating *turn-taking* between laymen. When one or many users make pauses while in a sequence interact-stop-interact-stop-interact, etc., the composition rules create soft leading notes in Dorian scale. This in addition to the ones that the user has chosen. The result is that the user becomes aware of the silent pause between the interactions, and the relations between his own actions and actions of others. This motivates *dialogue*, imitations and play in call-and-response manner.

#### composition techniques in MINI

Similar to traditional minimalist music, the ORFI motifs borrow *polyrhythmic* techniques from Gamelan, African and Middle Ages music. Here, *polyrhythmic* and *harmonic* gaps in the rhythmic patterns, make them fit into each other, creating "hocket" patterns. This motivates improvisation and interaction. A difference is that minimalist motifs are used to express *contrasting* and *varying* responses that motivate laymen. The composition rules then vary the pattern so that the hocket effects disappear, in order to reappear when the rule for variation is active again. A difference is that the music varies with the number of users interacting, giving dub-delay effects to one user and reverb to another. The result is a blurred and distorted effect. The effect is used to separate between two individual laymen motivating them to *collaborate*.

## Narrative Structure

### definition

We use the term *narrative structure* to describe structures for connecting series of events in ORFI, creating *experience* and *expectations* about future musical output.

### role, action and expectations

The difference between linear music and ORFI's music is that the composer has to *negotiate* the narrative structure with interacting users as well as passive listeners. Similar to linear music, in ORFI there are often opposing or *contradictory expectations* about what the narrative structures mean. For example, a melodic structure driving the music forward creates expectations of *tension* and a *crescendo*. In the same piece, a rhythmic *pulse* in the ground, might create expectations of *bodily movements* and dance to the pulse. Similar to linear music it is possible for the users in ORFI to negotiate meaning, following or denying expectations about the narrative structure. Similar to traditional jazz, the narrative structure of our JAZZ genre follows the development and tension in an 8 bar *jazz blues* structure. Traditionally the blues structure is the ground for the soloist's improvisation over a repeated series of chords and a pulse. Often the soloist creates expectations that follow the convention, of playing as many rounds as he think suits him. When he feels ready to hand over to the next soloists he gives a sign, making cadences or finishing riffs. And the next person, eager to make his interpretation and show off to the audience, takes over. Building up to the moment just before the start of a new round in bar 7-8, there exists a short period of 6-8 beats where the *tension* is at top and the *negotiation* is strongest.

### interpretation and negotiation

A difference in our JAZZ genre is that the system can analyse if the user is *synchronising* his actions to the *pulse* in the accompaniment. If he succeeds, ORFI answers with *rewarding* horns riffs, stressing the harmonic, periodic and rhythmic development in the blues.

Another difference is that the blues accompaniment with drums and base in our JAZZ genre can be used to negotiate the narrative structure. This is often made by users playing and craving for more *musical variations* of a certain riff. We have found that the accompaniment in addition can motivate two users playing a *game*, *dancing*, or a person laying down *resting* without focus on the music.

Another difference is that the accompaniment is divided into three ground beats in *different tempi* creating possibilities for the user to start, stop, change tempo, play together with horns, etc. It increases the *possibilities* for the user to negotiate what and how strong the narrative structure should be. When interacting, the active users actions and the references to activities like dancing, playing, creating music etc. produce, uphold and nurture a narrative structure that potentially invites other users.

### genres and experience

The traditional *minimalist* narrative structure follows the development on a *micro level*, with fewer expectations on large form structure development. It is almost a contradiction that anything relevant should happen on the macro level in minimalist music. Instead the expectations should be directed towards the micro level and the *tiny variations*, we can hear if we sharpen our senses.

A difference in our MINI genre is that the system organise the *synchronisation* of the melodic patterns to the pulse. The synchronisation is freeing the user from the responsibility to keep track of the beat. Instead, we have found, it creates possibilities for the user to focus on the *communication* and *improvisation* with others.

The biggest difference, however is that it the user can *choose* to *negotiate* what *role* to play, and if he wants ORFI to be a

tolerant minimalist *sound carpet* to sink down into, or a *melodic toy* to throw and play with, or an *improvising partner* and active actor, continuously inviting and motivating to communication.

### same and different

We have tried to show how we have composed music for the MINI and JAZZ genres in ORFI. We have found the comparison between traditional popular music and its application to interactive music to be very successful. Much of music's expressive qualities, variation and repetition techniques are the same in interactive and linear music. A great deal of traditional knowledge about analysis and composition of music can be transferred to the interactive music.

Differences we found in the design of ORFI are primarily tied to user expectations and structures in composition rules and narrative structures to support those expectations. Our experiences are that the interacting users need immediate response to be able to orient and find their way, as well as more complex response in order to get motivated to continue interacting over time. We often found that musically complex structures or processes found in traditional music could strengthen other situations with laymen interacting and playing alone and in collaboration with other people.

## Add Perspectives

In our paper we have tried to show what we believe, are the similarities and differences, between composing music for interactive media compared to linear music. In our view, much is the same, built on traditions that have been around for centuries within music and composition. However, our main conclusion about the new auditive medium is that we have to *broaden our perspectives*. We have to put forward factors that earlier was implicit in the musical and music making situations, no matter if it was the concert hall, the church, or the club. When composing interactive music we have to consider the genre, the potential roles the listener might take, and the user experience in different situations.

The consumer situation in interactive media is *dynamically changeable*. Interactive music consumption can take place at *home*, in the *street*, at *school*. It doesn't need to be static, predestined and hierarchical, with the professional and recognised musician on stage and anonymous audience in darkness. In the concert hall or the club the sound comes from a centrally placed sound system. In interactive media, however, the sound can be *distributed* and *mobile*, so that it moves and follows the persons interacting.

The persons consuming the sound are not passive listeners anymore, but active users, able to dynamically *shift between roles*, by choosing position in space, relations and roles to other people and the music. The user can take part in changing the sound experience in real time, based on the rules the composer has created as a potentiality in the software. This differs in a significant way from the jazz improvisator or the professional musician. The fact that the composer writes *programming code* is an essential difference. Instead of writing one linear work, he creates infinite numbers of *potential music* that reveal themselves as answers to user interactions in many situations. This might be like an *instrument* responding to a musical gesture, or a competent and *intelligent actor* answering musically in an improvisation session. But everything has to be formulated in advance as rules in the software. The challenge is to create music, through user interaction, that *motivates* to further *co-creation* of the music and moving image narrative. Everything has to be formulated in advance, based on *genre* and music knowledge and competence in *social behaviour*. It's all about broaden the perspective to look wider, further and deeper.

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