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2.1 The open work and play as composition

...E/A art music could and *should* access an audience outside of that which it generally accessed, and that based on this premise E/A art music research and artists' endeavour should devote a certain degree of its investigative energy towards addressing this issue.²³

Landy's comments reflect personal artistic motivations that influence the medium and themes explored in the interactive non-linear sound toy works presented in the portfolio. Ideas of improved access to electroacoustic music influence the choice of medium, and constrain the technologies used for human user input, to ensure that the projects can be more widely distributed and experienced. A central idea for creative exploration in this section is the suggestion that computer game related technologies and techniques offer opportunities for developing existing modes of artistic presentation and dissemination within the realms of sound art and electroacoustic music composition/performance. The compositional sound toy systems presented are developed using tools which are perhaps less often associated with the field, but their development is influenced by electroacoustic music, its techniques, themes and aesthetic concerns.

Who is the Composer?

Whilst originally intended for a very different musical context, the theories of Umberto Eco expressed in *The Poetics of the Open Work*, (1959) appear very relevant to the creative pursuits of the interactive non-linear sound toy works.

A number of recent pieces of instrumental music are linked by a common feature: the considerable autonomy left to the individual performer in the way he chooses to play the work. Thus he is not merely free to interpret the composer's instructions following his own discretion (which in fact happens in traditional music), but he must impose his judgement on the form of the piece, as when he decides how long to hold a note or in what order to group the sounds: all this amounts to an act of improvised creation.²⁴

Despite the evident differences in musical context, the notion of the open work has definite resonances with the preoccupations of *Dioxide Dissolves*, *SpiralSet*, *MagNular* and *ResOscope*.

²³ Weale (2006), pp. 189 summarises the views of Landy (1990), pp. 369-372.

²⁴ Eco (1959). Also presented in *Audio Culture, Readings in Modern Music*, edited by Cox and Warner (2004).

Eco's referral to the comments of Henri Pousseur when describing his work *Scambi* further illustrate the relevance to the interactive sound toy works, as they have been developed to provide the user with a "field of possibilities", and invite the player to exercise choice.

Henri Pousseur has offered the following description of his piece *Scambi*: "*Scambi* is not so much a musical composition as a *field* of possibilities, an explicit invitation to exercise choice."²⁵

Eco goes on to elaborate on Pousseur's definition.

The notion of "field" is provided by physics and implies a revised vision of the classic relationship posited between cause and effect as a rigid, one-directional system: now a complex interplay of motive forces is envisaged, a configuration of possible events, a complete dynamism of structure. The notion of "possibility" is a philosophical canon which reflects a widespread tendency in contemporary science: the discarding of a static, syllogistic view of order, a corresponding devolution of intellectual authority to personal decision, choice, and social context.²⁶

Eco's comments here are again intended for a different musical context, at a time predating computer based gaming and interactive technologies, and yet their significance to the work presented, and the field is apparent. The discussion of the complex interplay of motive forces, and revised vision of cause and effect are also deemed relevant, and can be related to some of the creative concerns of the sound toy projects. One simple event, at one specific moment in time has the potential for complex knock on effects on the resulting cascading field of dynamic possibilities.²⁷ It is suggested that relating Eco's theories and definitions to the field of sound toys allows them to be appropriately described and defined as open works, or open form compositions.

The sound toy projects presented provide the user with varied degrees of compositional input and control. Compositional input is multidimensional,²⁸ and the importance or significance of each input form as an element of composition is somewhat open to interpretation. Figure 2 represents the compositional structure of many of the open form

²⁵ Ibid.

²⁶ Ibid.

²⁷ This is particularly evident in *MagNular*.

²⁸ There are a number of different converging sources of compositional input. These are simplistically represented in Figure 2.

sound toy works included in the portfolio.²⁹ Compositional input contributing to the final sound output, or performance of the work can be attributed to three primary forces or agents, each dictating or influencing characteristics of the piece.

Composer/Designer	- Offline
User/Player	- Real-time
Simulated Physics	- Real-time

The composer/designer is responsible for designing and creating the framework for composition, making compositional decisions during the construction of the work. Modes of interaction, sound materials, transformation processes, compositional options and constrictions, and modes of presentation and representation are all dictated by the composer/designer.

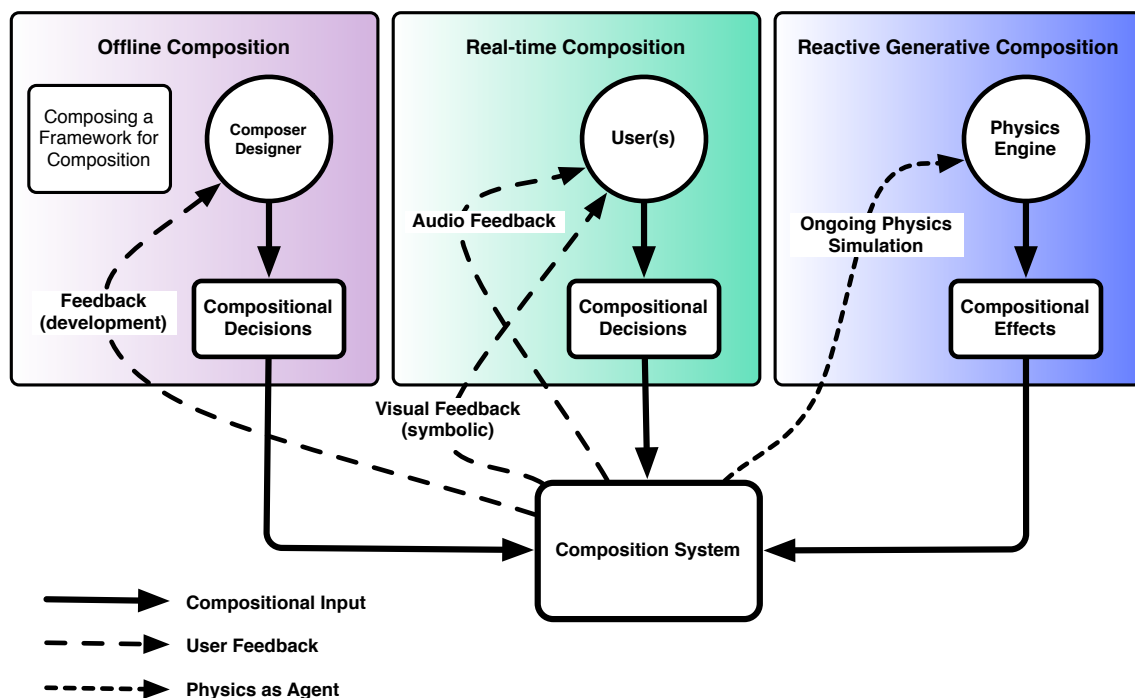


Figure 2. Designing for Composition - Three Compositional Forces

The user/player engages with the system in real-time, responding to both visual and aural feedback from the system. There is often a co-dependency between the human player and the simulated physics system. The physics engine employed in these works acts as a third

²⁹ Each project utilises a computer game engine used in conjunction with external software for sound generation, synthesis or DSP.

compositional agent, adding an algorithmic component to the system.³⁰ The algorithmic component is accompanied by symbolic representations of the algorithmic processes in the virtual visual space. These provide the user/player with some insight into this aspect of the control system, which is enhanced through play, exploration and learning. Symbolic representation of the simulated physics system allows real-time interaction between the user/player and the system in both visual and aural domains, also allowing anticipatory responses that enable the user/player to react to forthcoming events.³¹ These two compositional forces (simulated physics system and user/player) influence each other throughout play.

Is this really composition?

An issue that has arisen from the development of the open form sound toy works presented in the portfolio is one of definition, and how best to describe or categorise these works in a way that effectively communicates their creative interests. Frequent reference to the technology used to realise these projects, a computer game engine,³² is largely avoided in this document as the term could be somewhat misrepresentative of their creative concerns, as the term 'computer game' is loaded with social expectations of what constitutes a computer game.³³ None of the sound toy projects presented incorporate an intentionally competitive framework. There are no defined characters, no winners, no carnage, and none of the 'games' can be completed as such. Instead they are considered to be exploratory audiovisual experiences primarily concerned with sound. The works may be explored for seconds or hours at the will of the user/player. It is suggested that the term best suited to these works is *sound toys*.³⁴ This term is used as it conveys that the works are predominantly sound centric, and the term *toy* implies an intended playful experience for the user.³⁵

³⁰ See *Phya* by Dylan Menzies as an example of research exploring the use of physics systems in a sound centric context.

³¹ *MagNular* is a relevant example here.

³² *Unity 3D*.

³³ Wider discussion of the field of 'computer games' is outside the scope of this document.

³⁴ See <http://www.soundtoys.net> for an online resource of works described as 'sound toys'.

³⁵ Whilst detailed discussion of software currently commercially available for mobile platforms is avoided, developments within the field of what could be termed as 'sound toys' for mobile devices are relevant. *RjDj* is of particular relevance to the open form works undertaken here, as mobile applications are developed using tools familiar to certain fields of computer music. <http://www.rjdj.me>

Whilst the sound toys presented adopt and explore aspects of electroacoustic composition aesthetics and sensibilities, integral features of some sound toys are also relevant to fields such as multidisciplinary composition, interactivity, audiovisual interfaces and audiovisual composition incorporating trans-domain mappings, algorithmic or generative composition, and real-time synthesis and digital signal processing. A definition that best fits the sound toy works is to some degree a matter of opinion. However, as their primary creative concern is the shaping and structuring of sound over time,³⁶ they are therefore personally considered as inherently compositional, albeit within a confined compositional framework that is to some degree pre-composed by the composer/designer. Allocation of compositional parameters to external real-time 'agents' results in the works being fundamentally open and therefore of no fixed duration. The interaction of the user/player with the quasi-generative systems provide scope for varied and sometimes unexpected results, some of which may not have been anticipated by the composer/designer. The open form sound toy works are interactive or reactive systems that implement a form of dialogue or exchange between the player and the symbolically represented system.

These works aim to create a playful framework for composition in which sound is organised over time. More broadly, the central theme for creative exploration here is rooted in the suggestion that sound toys as a medium provides scope for developing existing modes of artistic presentation and dissemination of playful composition artefacts influenced by the fields of sound art and electroacoustic music. The projects presented explore elements of performance, interactivity and the allocation of some degree of improvised compositional control to a third party. For example, the composer/designer's allocation of compositional control to a non-experienced user is a primary interest of *SpiralSet*.³⁷ However, many aspects of this work are pre-composed. For example, the design and form of the 3D structure itself influences patterns of motion, thereby algorithmically determining and symbolically representing aspects of the sonic characteristics of the final synthesised output. Spectral data and its manipulation is also prepared, determining the character of the sound world. The user/player influences the directions and rates of motion in both aural and visual domains, shaping the structure of the piece within the framework prepared and 'composed' by the composer/designer. The user/player is therefore not a passive listener and plays an active and significant compositional role.

³⁶ On a micro or macro level.

³⁷ The development and completion of the *SpiralSet* project, the first sound toy designed for the portfolio, allowed a number of key compositional, aesthetic and technical issues to be preliminarily explored, informing future artistic directions and practice-led research strategies.

The sound toys are presented as open form compositions as no final fixed version exists,³⁸ with each player having their own individual experience of the work, and the sonic output being different each time dependent on the nature of the interactions. The open form sound toy works provide the user/player with scope for compositional input within a confined symbolic sonic play space. In the work *Dioxide Dissolves*, user/player input predominantly determines or structures the macro level.³⁹ In works such as *SpiralSet* and *ResOscope*, the user/player controls the micro structure of sound on a spectral frame by frame basis, and in *MagNular* compositional input results in activity at a micro event level.

Interaction Approach

The interaction approach adopted in the sound toy projects varies between each work. There are however key commonalities in the types of interaction approaches implemented. These can be to some degree aligned with theories outlined by Paine (2002).⁴⁰ Of particular relevance is Paine's discussion of interactions that do "not include any predefined pathways". This is a characteristic of all of the sound toy works presented. Whilst it may be argued that defined pathways may result in greater structural coherence, with further composed elements enforced by the composer/designer, the decision to avoid a single structured pathway through each work aims to encourage a range of potential sonic outcomes or experiences for the player.

In his discussion of interactivity Paine (2002) also introduces Wishart's (1996) theories of dynamic morphology.

Dynamic morphology (Wishart 1996) is explored as a conceptual framework for dealing with streamed data that facilitates an exploration of dynamic timbre in interactive, responsive music systems, and more broadly as a conceptual framework for the design of truly interactive systems, covering human-computer interface and sound synthesis applications.

The sound toys are intentionally open, and offer significant options for choice for the player, providing scope for varied interactions and sonic output. A linear approach with some degree of 'openness' is avoided, with a multitude of possible pathways offering varied possible

³⁸ Except *Cyclical Flow*, which is more appropriately defined as a specialist spatial composition tool.

³⁹ As this sound toy incorporates prepared fixed media resources (audio & visual) that are of a longer duration.

⁴⁰ It is important to note that the sound toy works do not 'learn' and adjust their behaviours according to user input, so in this respect to some degree they exist outside of the definitions of interactivity outlined by Paine (2002). However, differences in players' interaction style are reflected in the output of each sound toy system.

experiences of each work. The sound toys therefore become less predictable in terms of sonic outcome, with many diverging branches of possible outcome. This intended approach is informed by the notion of a “field of possibilities”.⁴¹ The player is intended to have a significant range of potential possible experiences of each work that may be quite diverse, yet these are still within a specific prepared framework for interaction that provides a play space for sonic exploration and discovery. The sound toys are designed so that the audible result of interactions can only be understood through the player interacting with the work, as there are limited direct indications of sonic outcome in the visual interface of each sound toy. Interactions and outcome are oblique and the player has no way of determining what the sonic outcomes of their interactions might be prior to play (or observation).

Definitions

With interactions often occurring on a micro level, issues of definition are introduced, and it is suggested that it could be appropriate to consider some of the sound toys presented as potentially exhibiting behaviours of an ‘instrument’,⁴² for example *ResOscope*. Is this sound toy best defined as an open form composition, composition tool, or as an instrument? It is suggested that issues of definition can be considered as a classification continuum between the three areas or definitions represented in Figure 3.

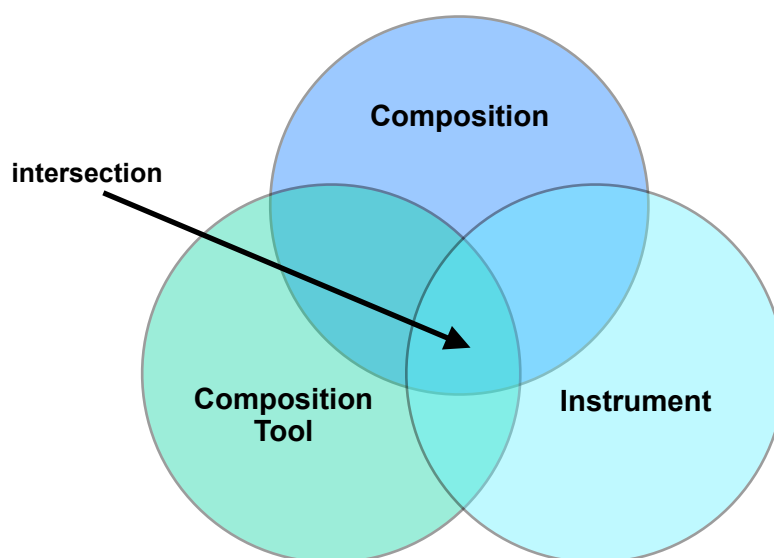


Figure 3. Intersection of Terms of Classification

⁴¹ As previously discussed.

⁴² The term ‘instrument’ is considered as relevant in an open work context. In Björk’s *Biophilia*, many of the individual pieces have options to be used in ‘instrument’ mode, and could therefore be classified accordingly.

So at what point may an open work also be classified as exhibiting behaviours of an instrument, in the sense that an instrument offers particular sonorities and timbral qualities, with infinite possibilities from a compositional perspective? Perhaps the sound toy works become easier to classify as open form compositions where more significant amounts of materials within the framework for composition are predetermined? Where increased player options for compositional input and influence are provided, classification as an open form composition is still considered relevant, but classification as an instrument, of some form, is also considered to some degree appropriate. As these terms of possible classification (as open form composition, composition tool or instrument) are often all potentially relevant to the works presented, a continuum of definition acknowledges that these three distinct classification areas may be intrinsically interrelated. Absolute classification is considered as somewhat open to interpretation.

Definitions of the role of the player interacting with the work are also subject to similar issues of classification. Is the end user a player, composer or participant? The roles of the player experiencing the work are multifaceted, with tensions between concepts of composition and intention sometimes evident. Equally the role of the artist creating the work also becomes open to issues of definition, as the framework is composed with intention, but the eventual outcome cannot be fully determined due to the consideration of and provision for individual interaction styles. The intended modes of interaction frequently explore and investigate the areas at which these classifications terms intersect, as represented in Figure 3. Where the framework for interaction and audiovisual elements are to some degree designed or composed, boundaries of definition and classification are often unclear and it is the intersection between these possible boundaries that are of personal interest.

Where each of the individual sound toy works may be placed within this area of intersection is different for each project. *Dioxide Dissolves* is perhaps more clearly definable as an 'open work' composition as it deals with larger prepared sonic structures, so definition as an instrument is deemed less appropriate. In sound toys such as *ResOscope*, the frame by frame interactions of the player result in a more instrument-like experience. Whilst the term 'instrument' is perhaps not the most appropriate term, there are some relevant interaction relationships implied, in that player exploration and learning of the methods of interaction and resulting sonic outcome provides scope for recreating or re-performing sonic materials in an instrument-like fashion.

Distinctions

A key distinction between the sound toy works presented and many related existing sound toy applications in this area is the degree of control available of timbre, spectrum and frame by frame control of sound over time,⁴³ providing the player with significant options for micro level control, influence and variations within a constrained framework. Whilst the sound toy works presented share some common interests with a number of sonic centric mobile applications, micro level control is considered to be a key defining feature from many existing mobile applications. Other defining characteristics include the avoidance of regular metric rhythm, priority of spectrum over tonal behaviours, sonic range and scope for variation, and no sound parameter names included within the visual play space.

There are many examples of ‘sound toy’ applications or sound centric applications available for mobile devices.⁴⁴ Whilst these devices offer opportunities for ‘casual’ sonic experiences, limited processing power⁴⁵ to some degree restricts the types of real-time sound generation processes that can be implemented. The sound toy systems implemented in the portfolio are not designed for mobile devices to ensure that computing resources do not become a limiting factor, restricting sound generation and transformation systems. *SpiralSet*, *ResOscope* and *Cyclical Flow* are designed to exploit more powerful hardware resources to provide the player with finite control over spectrum and morphological behaviours of a number of different voices/parts. In *Cyclical Flow*, both spectral and spatial features require significant computing resources,⁴⁶ with this system being designed primarily for a specialist performance environment.

Classification

Each sound toy presented can be considered as existing within a different area of intersection (Figure 3). *Cyclical Flow* is considered to be classified or positioned more towards the ‘composition tool’ area of intersection within this continuum.⁴⁷ The sound

⁴³ Except *Dioxide Dissolves*.

⁴⁴ Examples include: *RjDj*, *Bloom*, *Biophilia*, *Aura Flux*, *Sonic Wire Sculptor*, *Soundrop*, *SoundyThingie*, *Daisyphone*.

⁴⁵ At the time of writing.

⁴⁶ A proposed future development is the implementation of the game engine system on a tablet device communicating with a spectral, granular and spatial processing on a desktop/laptop system.

⁴⁷ *IanniX* could be considered as a relevant example of a composition tool.

materials used in this system are intended to be interchangeable, resulting in a shift in classification, and this project is perhaps not best defined as solely being an 'open work'.

Dioxide Dissolves can be more clearly classified as being an 'open work', and shifts away from both instrument and composition tool classification domains. Control is on a macro level with larger sections of prepared audiovisual materials. Despite this, *Dioxide Dissolves* can be classified as an 'open work' as the structure of the player's experience is open, so overall form, structure and duration are flexible, resulting in a wide variety of possible experiences of the work, and no predefined pathway is enforced or suggested for the player.

SpiralSet, *ResOscope* and *MagNular* are perhaps more closely related and aligned in terms of their possible classification, and it is suggested that these works exist more within the central intersection between the three areas of classification represented in Figure 3. However, even here there are gradients in definition between these works. In *SpiralSet* pathways are introduced, but a large number of options of possible pathways exist, with player control over path, timing, pace and repetition. Given that there is some aspect of constraint, it could be argued that *SpiralSet* can be positioned along the continuum closer to an 'open work' classification than *ResOscope*, in which the player has significantly increased option for choice, sound instigation and termination. As a result, *ResOscope* could therefore also be classified as an 'instrument'. *MagNular* may be classified as existing within the most central point of intersection of the five sound toys presented, as all of these terms appear equally relevant from a personal perspective. Classification, or positioning along this continuum is considered open to interpretation, and the viewpoints offered here are evidently from the perspective of the composer/designer.

Introducing Gaming Technologies

Game engine based technologies are presented as viable tools for the creation and delivery of sound toys and interactive sound centric works.⁴⁸ The compositional systems developed allow players access to parameters of composition, and sound worlds associated with the realm of electroacoustic music. Working with computer game technologies for sonic purposes provides the opportunity for the composer/designer to draw on existing experiences of a possible audience, and their understanding and appreciation of increasing

⁴⁸ Why would a sound artist or composer choose to use a game engine for an interactive or reactive work? From a technical perspective, the robustness of game engine technologies is an evident advantage. Collision detection and an integrated physics engine are particularly enticing. Varied artistic design options are available and interactive functionalities are flexible.

levels of complexity and interactivity now found in modern computer games.⁴⁹ The game engine's integrated physics engine has the capacity for complex virtual object interactions, which is particularly enticing from a sonic perspective.⁵⁰ A physics engine is utilised as a form of generative composition agent in some of the sound toy works later described.

Toshio Iwai's *Electroplankton*⁵¹ is a notable example of game technologies being applied in an algorithmic music composition context. In this 'game', the symbolic and playful representations of the algorithmic musical processes allow easy access and a reasonable level of compositional control for the player. From a personal viewpoint, a significant limitation is the sound palette. Despite this, *Electroplankton* significantly influenced the conception of the sound toy works presented.⁵²

Game engine software offers many possibilities for the creation and delivery of interactive sound or music works that allow the player control over compositional and sound parameters. Sound artists frequently explore ideas, and experiment with techniques that allow the visual domain to intimately coexist with, or directly control sound parameters using trans-domain mapping techniques.⁵³ Network technologies allow communication between a game engine and external sound and synthesis software, providing varied creative possibilities for a composer or sound artist, who may then use familiar tools for the development of audio systems. Integrating external, flexible and open-ended sound software enables sound artists and/or composers to work with specialist tools and techniques to explore interdisciplinary approaches for creating new repertoire.

⁴⁹ Current computer games often extend beyond the description of interactivity in the context of a car racing game provided by Paine (2002).

⁵⁰ See Mullan (2011), pp. 347-357 for discussion on physics engine integration with physical modelling synthesis techniques in a virtual environment.

⁵¹ Published by *Nintendo* for the *Nintendo DS* handheld video game console.

⁵² Further discussion and evaluation of existing sound toys is refrained from.

⁵³ See *Audiovisual Environment Suite* by Golan Levin as an example.

Notes on Tools

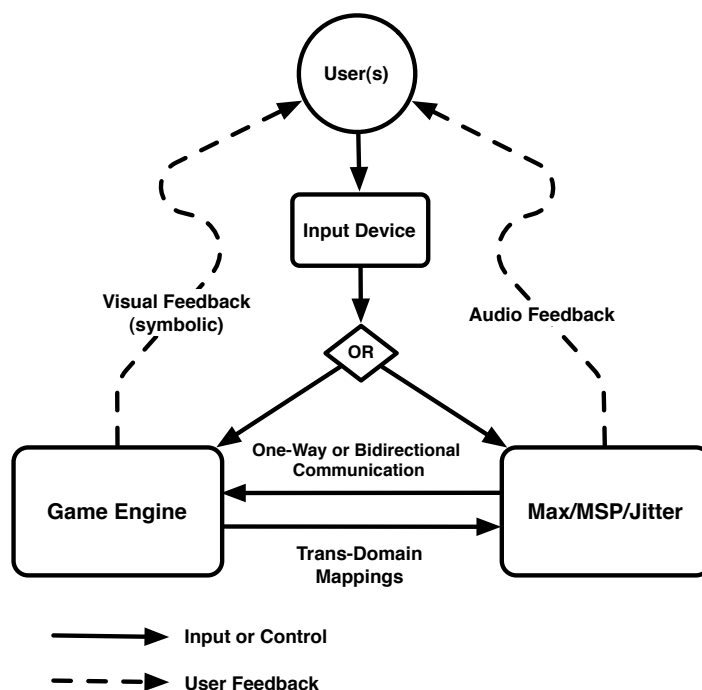


Figure 4. Sound Toy Resources & Communication

All sound toy projects, with the exception of *Dioxide Dissolves*, use the basic system represented in Figure 4 as their technical foundation. Two different software applications are used. These are the computer game engine *Unity 3D*⁵⁴ and *Max/MSP/Jitter*,⁵⁵ with one-way or bidirectional data communication between the two applications.

All sound is generated, synthesised or processed outside of the game engine,⁵⁶ using external software for sound and synthesis. The game engine's graphical capabilities are used to create a virtual environment for the symbolic control of sound. The game engine component could be considered to be an *Animated User Interface (AUI)*,⁵⁷ as opposed to a *Graphical User Interface (GUI)*, generating real-time control data for the external sound system. It should be noted that the visual components of the projects are not designed to be considered simply as a GUI, and are intended to be an integral component of the creative work, with specific aesthetic and stylistic features.⁵⁸

⁵⁴ <http://unity3d.com/>

⁵⁵ "An interactive graphical programming environment for music, audio, and media." <http://www.cycling74.com>

⁵⁶ Except *Dioxide Dissolves*.

⁵⁷ Proposed term.

⁵⁸ Aspects of the control systems, symbolic representations, and artistic style are to some extent influenced by the field of computer games.

Final Comments

The open form works are presented and defined as sound toys, and this is considered an appropriate term to describe these sonic centric audiovisual interactive composition systems. Whilst the sound toys have been developed using computer game engine technologies, common computer game characteristics such as competition as a motivation for interaction is avoided, with the intention of encouraging the participant to solely focus on audiovisual experience and sonic centric interaction. 'Computer games' as a term is also avoided as there is potential for misconception of the works, and their function, as the term may (for some) imply specific goals and a competitive structure, which could potentially become a barrier to an audience understanding the sound toy's themes, and intended interactions. Playful composition and a sound centric approach are considered to be integral themes, and these are well represented by the term *sound toy*.

The sound toys are designed as open form compositions, instruments, or compositional tools that are influenced by a number of fields relating to electroacoustic music, sound art and contemporary computer music. These projects attempt to develop personal compositional practice and interdisciplinary approaches to sound art and electroacoustic music composition. The sound toy works presented are deliberately broad in their creative concerns, yet all focus upon creating new interdisciplinary compositional repertoire.