

**The Burning Ground: A Portfolio of Compositions
with
Music and Sound Design for “gammaKhozi” the
VLS Game.**

By

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**Submitted in partial fulfillment of the
requirements for the degree of
Master of Music (Composition)
to the
Faculty of Humanities,
University of KwaZulu-Natal.**

Durban, 2005.

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PREFACE

This portfolio of compositions contains, in document format, music and sound design for the VLS (Virtual Learning Space) computer game "gammaKhozi". The intention of this portfolio is to display compositional techniques used to create "Interactive" music. The reason for choosing to use the computer game as a medium is easily understood, as the medium lends itself to the design of interactive audio. This portfolio has also been created as part of a current university project which involves the design of the VLS game.

Attached to the document, which also details scene narrative and puzzle explanations, may be found a CD-ROM disc containing the game itself and the music composed for the game to which the document makes reference. Also contained on the CD-ROM disc, is an alternative version of the compositions to the game in PowerPoint Presentation format – "gammaKhozi Version 2." It was felt necessary to create an alternative version to display a different approach to composition for the game using extended facilities and additions to the audio engine currently employed by the game. In terms of interactive audio design and implementation, the current audio engine lacks some features which could potentially enhance musical interactivity. It is for these reasons that the alternative version shows what could be achieved compositionally should some feature enhancements be implemented within the audio engine and what the results could be.

The total duration of the compositions, including the elements of the "gammaKhozi Version 2" material in this portfolio is +/- 40 mins. This time includes the un-looped background sound design elements and all the overlays and random musical clips. This time may increase or decrease depending on the amount of time the player spends in the game.

INTRODUCTION

'Virtual Learning Space' is the name of a project initiated by the University of Kwa-Zulu Natal as part of an education programme. The project's mission is to provide education in the medium of a computer game. The computer game is titled "gammaKhozi". The source code of the game will be kept open to allow for expansion and freedom within the medium. The project has been sponsored by the Department of Science, Arts and Culture of the South African Government for the development of education in this field. Heading the project is Professor Alan Amory from the School of Life and Environmental Sciences.

The project as summarized by Alan Amory: ¹

"Building on industry standards of game development and communications technologies and modern educational theories this project attempts to create a virtual learning space where learners can explore interesting worlds to solve a mystery. From the inner city, using a 3D landscape populated by players, or learners, represented by avatars, different portals to knowledge are accessed. Here in panoramic view the players explore different virtual spaces to find clues to solve the mystery. Each virtual space encapsulates a single theme represented as a micro-world. In both the inner city and micro-worlds learners can communicate with other learners using chat, audio (virtual telephone) or video-conferencing. Such devices will allow the players to create an on-line community where they can collectively discuss problems and learn about each other. The project attempts to enlighten, entertain and develop skills in young South Africans, evaluate the use of virtual spaces as viable educational tools, develop advanced software, foster collaborative research, create a product that could earn foreign currency for South Africa and educate postgraduate students in the methodologies of education and game design."

¹ Amory, Alan. Innovation Fund Application – VIRTUAL LEARNING SPACES – Harnessing The Power Of Modern Technology To Create Interactive Learning Environments. *Project Overview. II. Project Summary* p 4. 2001

As described above, the game is made up of a series of portals radiating from a central point, each with its own theme. For my portfolio of compositions, I have focused on the "Disease Portal". Here I have submitted this portion of the game with music composed by me for the purposes of my "Portfolio of Compositions."

It is pertinent at this point to outline some of the characters that occur here and describe the storyline of the "Disease Portal."

Firstly, in describing the story, Amory emphasises the importance the role a story plays in creating a motivating factor for participation in an educational tool such as the VLS computer game: ¹

"The role of the story is to provide intrinsic motivation by presenting the player with a complex problem to resolve an unsolved mystery could be used as the driving force for the game. Exploration of different content areas, that weaves material from both the humanities and the sciences, allows players to learn about the world and offers problem-solving tasks that rewards the player with clues to solve the mystery. Content areas include:

Africa - the birthplace of humanity? The answer to this question requires an understanding of the fundamentals of evolution, anatomy, taxonomy and classification, palaeontology, geology and archaeology. Debate: Can anatomy and technology define humanity?

Farming - The greatest revolution in history? To answer this requires an understanding of botany, genetics, selection, cultural evolution, geography and diffusion, archaeology, the social consequences of increased production of foodstuffs and surplus, demographic change, sedentary social existence and technology (domestication of plants and animals and metallurgy)

Seeing sound - The power of writing. Here an understanding of the environment, geography, cultures of literacy (the stylus pen and the printing press) is required.

¹ Amory, Alan. Innovation Fund Application – VIRTUAL LEARNING SPACES – Harnessing The Power Of Modern Technology To Create Interactive Learning Environments. *Story* p 11. 2001

From muscles to machines - The origins of power. Steam and electricity - the machine in the development of the industrial world, mechanics and engineering. The Machine in Context - the social demands of production, the creation of the working class and the world market, economics, geography and history. The causes and consequences of western dominance.

In the service of humanity? Disease, epidemics, cures and failures. The foundations of modern preventative medicine, microbes and the immune system, epidemics in history, vaccines and antibiotics, clean water, sewage and public health in the modern city, disease and death in the modern slum. Comprehending the universe and communicating knowledge. The electro magnetic spectrum; electric, radio, X, gamma, and light waves; and seeing and hearing electronically telegraphs, telephones and television. Information technology - The computer age. The growth and uses of the Internet.”

Point 5 describes the focus of my portfolio and analysis of interactive music making in this project. This has been termed the “Disease Portal”, which I will now describe in some detail.

COMPOSITIONAL CONCEPTS AND TECHNIQUES

Several acts (as Amory suggests) were created within each portal to structurally implement the story. These acts were then sub-divided into scenes. Although the concept of the act/scene division is cinematic, the acts and scenes are intended to be interfaced by the user in a non-linear way, by relying on user input to affect the outcome. The end result of the player/story interaction is therefore a non-linear experience. The characters described above have been designed to interact with the player *only* at the player's discretion and choices made in his/her journey through each portal. The division of the plot into acts and scenes was useful in aiding the explanation of the interactive elements in a diagrammatic manner.

Creating music for such a setting (as described above and outlined diagrammatically hereafter), required composing music and designing sound environments that projected suspense and a somewhat gloomy mood. It made sense to empathise with the environment and actually 'imagine' being there physically. So, in this instance I had to put on the shoes of a film music composer, but at the same time, had to develop and explore new techniques of writing, because the game is a non-linear medium.

In this section I am discussing my possible contributions to the computer game genre and summarizing the compositional tools, techniques and knowledge gained in the compilation of this portfolio.

Firstly, when looking at the analysis of the music from the commercial titles such as the *Myst*¹ series for example, my contribution to the genre of "interactive computer game music" is the use of musical elements to supplement clues used to solve important puzzles in role-playing adventure games. The composition of these "clue themes" and the fact that they make reference to all other elements of the gameplay, including the plot and story, is, as far as I know, a unique method of creating and implementing interactive music in this type of computer game. Interactively advanced games in this

¹ See References

genre, such as the *Myst* series, have one instance where the player has to memorize a melody to unlock a gate (see *Riven: The Sequel to Myst*). In this example though, the melody has no reference to any other musical elements heard in the game i.e. theme music for the different scenes etc.

Other musical elements common to just about every computer game such as background loops and theme music for each scene is an intrinsic quality of these games, but the possibility of the music adapting to the gameplay through user input, sets different standards of interactive music composition in these genres. Importantly to note, is that the ability for the music to change in this regard is directly dependant on the game audio engine's capabilities and features. Therefore, with regards to the game associated with this portfolio, the audio engine has features that allow for scene theme changes and specific musical element integration, but does not allow for real-time musical adaptability. In other words, once the elements are composed and scripted into the game archive, they cannot be further manipulated by user interaction.

One of the goals of achieving absolute musical interactivity is the combination of basic interactive elements, such as the ability of the software to change the music based on scene shifts, but to also adapt to specific and indeterminate user input. For example, the ideal situation in the VLS game here would have been the ability for the engine to allow me to compose just one musical phrase that could be used as a single macro-element, and then have this element change to user input, by allowing for countless permutations to be played back when called upon. A game engine with a memory that could allow for music to change when a player visits a scene several times, is also a possibility for creating adaptive music. This has been entered into by Todd Winkler, which he explains in the following: "The success of the commercial title '*Myst*' demonstrates how two devices can make this repetition bearable and even interesting: Firstly, the images and sound can be complex and highly detailed, so that on the 2nd or 3rd look, new aspects are discovered; secondly, upon returning to scenes that appeared to be static, images and sounds can be transformed to effect changes in the story." [Winkler, Todd. 1998. p. 297] For the VLS game though, I had to design several static, unchanging elements and link them thematically, which were played back as they were, unaltered, and only when a game object or "hotspot" was clicked on.

From this point of view then, the portfolio of compositions found in the playable VLS game version does not reflect the aforementioned possible aspects of interactivity by Winkler, but has rather showed ways of circumventing technological restraints to achieve as much immersion and interactivity as possible – Fig. 14 shows how this was achieved. In line with these restraints, the section on “gammaKhozi Version 2” indicates the reasons for having to create an alternative version as an attachment to this portfolio. The version demonstrates an “ideal” audio engine design and shows interactive compositional techniques possible with the implementation of such audio engine features. It also indicates a completely different compositional approach to the music design for the game.

It should also be kept in mind that the idea of a “complete” composition in the sense that there is a definite sequence of musical events making up the macro-composition, is not possible to conceive in a non-linear medium. Indeed, this particular game does have a definite plot, with a series of events that follow an order to achieve the resolution, but there will be many different player experiences of the game and therefore each macro-compositional output will be different. It is for this very reason that each element in the game has some part compositionally that relates to any one other element.

In terms of sound and music design overall, I hoped to create as realistic an environment in this game portal as possible, by using as few synthesised nature sounds as possible, given that at least 75% of the portal takes place in an African forest setting. These included, for example, field recordings of crickets, insects, water, some birds, wind etc. This should aid in providing the player with fairly realistic environmental sound information in the gameplay experience. Above all, careful attention was paid to thematic homogeneity with the plot and specific musical clues to puzzles to enhance the gameplay experience and provide user/game interactivity as far as the musical elements are concerned.

Therefore, extracting on the above, identification of several elements pertinent to composition of the music in the game were necessary. These are outlined as follows:

1. Setting of the portal – determined by analysis of the environment depicted by the graphic rendering.
2. Study of the plot and story to determine what narratives there are.
3. Identification of important puzzles and how these puzzles link to the plot and story. The puzzles lent themselves to creating further interactivity, especially with regards to music, as each puzzle could be linked with musical elements to provide the player with “musical clues” to what part of the plot each puzzle refers to.
4. It was necessary to develop ways to achieve homogeneity between the environmental sounds and the musical elements to allow for a seamless blend between the two components. In other words, it was important to achieve complementation between the environmental pastiches and the music.
5. Once design of the music for each scene was completed, testing of the music and environmental sounds with the VLS Sound Script Editor. Prior to this, a keen analysis of the editor itself was necessary. In turn, this determined how the music would react with the gamestate.

Highlighted here are some of the significant discoveries:

- i. The audio engine allows for each sound element to be looped. The loops can either be performed as a background sound or as an overlay to the background sound being played.
- ii. For the purposes of overlaid sounds, the looping facility is not a necessary feature, as the overlays are designed to imitate random environmental sounds. The overlay facility proved useful in this regard when designing the sound environment in the jungle – i.e. bird sounds were added as overlays.
- iii. The puzzle themes needed to be coded separately from the other sounds, as it was only possible to incorporate the sounds in the puzzle dll¹ files themselves. This meant it was impossible to test the puzzle sounds in the gamestate prior to the coding.

¹ “Dynamic Link Library”. This type of file is a driver file that enables certain software or hardware functions. For example, allowing the performance of certain tasks by a program to be initiated by an external input. In the context referred to in this terminology, *dll* here refers to the puzzle engine sending a command to the audio engine to play back an audio file when called upon to do so.

- iv. Resource management of the sound engine prevented frequent background loop changes i.e. from one portal file to the next. It was necessary then to compose and design only 3 or 4 changes to the background per scene.
- v. The sound engine does currently not allow for individual element manipulation by user input. This meant that once the sounds were created and archived into the game, they would be called up when needed, but will not change within themselves. This meant that to achieve “realism” I had to circumvent this problem by adding random pan and volume envelopes to each recorded sound element prior to mixing all the audio intended for each scene. This caused the sound elements to behave as if being altered from the gamestate. (See point 7 below for more details.)

6. Further to these points, several tools were used to compose and design the sound environments and musical elements for the portal.

These include:

- i. A MIDI sequencer – CakeWalk Pro Audio
- ii. A DAT Tape recorder, Sony Mini-Disc and microphones to record some of the environmental sounds such as water, birds, insects etc.
- iii. A sampler: Yamaha A5000 Professional Series Sampler – to enable me to trigger appropriate sounds from sound libraries and add effects and draw on sounds available, suitable to the setting and overall sound design.
- iv. Sound library discs – those bundled with the sampler and discs ordered off the net specifically for this project – see “Audio Material” in the “Reference” section
- v. An audio editor with effects plug-ins to record and edit the audio generated by the MIDI sequencer and sampler – CoolEdit Pro
- vi. A music notation program to realize the scores – Sibelius Music Software
- vii. A Wav audio to MP3 converter – to convert the Wav audio files to MP3 to allow the VLS Script Editor and

- engine to read the audio files. The original audio file size was also compressed in a 1:11 ratio to avoid very large audio files having to be managed by the game audio engine
- viii. The VLS Sound Script editor – used to write the necessary script for each scene and test the sound design
 - ix. Finally, the VLS pef¹ file editor and archive creator to render the script and create a working game archive with all the new material.
7. To create a sense of “reality” in each environmental sound – for example the insects, water, wind etc., each component of the environmental pastiches were edited in the audio editor (see 6.iv. above), by placing them in a multi-track session window² and creating random pan and volume envelopes to mimic the inconsistency of sound one experiences in reality in such environments. This made the sounds appear as if coming from random differing directions and help make the sounds appear and re-appear as they would in an open-air environment.
8. In order to make the theme music in the game topical and tie in with the setting, I used instruments that make references to the aesthetic of African music, by using marimbas, bamboo instruments, breathy-flutes, drums and other woodwind instruments.
9. Creation of an “alternative version” called “gammaKhozi Version 2” presented in the form of a PowerPoint presentation (see gammaKhozi Version 2 Presentation on install disc and printed version on pages 47-49 of this document), to show intended interactive compositional techniques and results with the VLS game using extended audio engine features.

To help aid my explanation further, I have included graphic prints of the scenes and detailed descriptions of each scene and the interactive music

¹ “Portal Editor File”. Filename given by VLS to the portal files that contain the graphic pictures and script commands for audio, video, animation etc.

² A feature of the Cool Edit Pro application that allows for multiple audio files to be edited and finally mixed down into a single stereo or mono track.

and/or sounds, as the case may be, employed within each one. Following this section, are scores with explanations of each theme or musical element, with references to the diagrammatic scene depictions here: (All images and tables are courtesy of VLS³)

Act 1 Description

Act:

1

(Note: Some of the features explained below have not yet been incorporated in the version of the game presented here. These include the virtual villagers, burning fire and their associated sound clips.)

In Act 1 the player has random access to most of the sites in this portal. Upon arriving in the jungle, the player can walk along a pathway before catching a glimpse of a ritualized “burning ceremony” through some dense foliage that does not allow you to walk directly to the ceremony site. Instead, the player has to continue along the path and can only access the “burning ground” after the other virtual characters (village people) have finished their ritual and have left the burning site.

This burning ritual serves to alert the player to the presence of death in the village. When the burning area is explored, the game player will find a huge fire in the centre of this clearing, and the remnants of burnt items lying on the periphery of the fire place (burnt vial and piece of half burnt jewellery). The player can also find an old tree off to the edge of the clearing wherein many notches have been etched into the trunk of the tree. The number of notches relates to the number of deaths in the village. Wind-chimes (wooden) are also seen hanging from the trees in this area and the sound from these adds to the eeriness of the scene. The purpose of all of this is to add to the feeling of unease and dark undercurrents in the portal.

³ Amory, Alan and Seagram, Robert. Virtual Learning Space Project. Disease Portal Documentation. 2004

Not far from the old tree is a man-made assembly of stones. Buried in the sand beneath this clump of rocks is a segment of the key that will be used to later open the storeroom in Act 3, where the resolution of the game occurs. This is the first quarter piece of key to be discovered.

Other areas that can be explored in this act are the laboratory and the village.

In the laboratory the player will meet the intern – Carua. In the doctor's office, the player will meet Dr Meisner. In this interaction, Meisner will act in a manner to make the game player suspicious. Carua, on the other hand, comes across as likeable, open and friendly. After the gameplayer has met both the characters, they both leave, leaving the gameplayer to explore the laboratory and the office at their own will.

Adjacent to the village, the player has the opportunity to meet with the village sangoma. In so doing, the gameplayer gets a different story to what is being presented by Meisner, and it is this different story that is supposed to intrigue the player to find out more about the circumstances of the situation.

Scene Description – Part A

Act: Scene:

Graphics interface:



Sound Interface:

- FX: Bird, cicada and cricket noises in the forest.
- Interactive Music: Background theme to area.

THE JUNGLE

Dark. Ominous. Something amiss. See the burning ritual. Sounds of cicadas, insects and birds in the area.

Interactive Music/Sound Description:

In this scene, I first created an artificial cicada loop of about 2 mins by using a violin sound sample and transposing it up 4 octaves. I then layered this sound with a synthesized insect sound, also transposed, mixed down the two sounds into one stereo file and added a continuous fade in/out envelope to achieve the searing sound associated with millions of insects in a jungle.

I had to experiment with different chords of this mix to achieve a good blend with the drums heard on approach of the fire area and the theme music to the burning ground clues. In a sense, the insect loop musically provides the user with the background theme to this area. This sound also needed to change as the player moved through the area to create a realistic sound environment. To achieve this, I made different insect loops for each new section of the scene, by taking into account the proximity of the bush to the path, distance of the trees and approach to the fire area. The closer the player gets to the fire area, the player begins to here drums in the distance, corresponding to the music of the village, giving the player clues to find the other key pieces throughout the portal.

Scene Description – Part A

Act: Scene:

Graphic Interface:



Sound Interface:

- FX: Distant beating drums, cicadas, wind chimes, birds, flies.
- Interactive Music: Themed sounds linking the notches on the trees to the objects in the burnt out fire-place.

THE BURNING GROUND

Large clearing with fireplace in the centre. There is an old tree on the verge of the clearing, with lots of notches that have been carved out of the bark. Hanging in the tree is a set of wind chimes. The notches correspond to the number of dead in the village. Inside the smoldering fireplace are a number of objects:

- a human skull
- an empty medication vial
- a human bone
- the remains of a gold necklace

Each of these objects corresponds to the notches in the tree.

Interactive Music/Sound Description:

It was requested here by the game developers that the music becomes more "urgent" to signify the death of the villagers in the fire and to add tension to the scene. To implement this, I composed a musical element of a beating drum used to signify the villagers, which was added to the background and effected to sound as if coming from the village in the distance. This should aid in providing the user with clues as to the whereabouts of the village, which one can walk to from this area through the bush. It also makes reference to the villagers themselves and serves to provide clues as to the fact that some villagers were burnt in the fire area.

At this point it was decided to decrease the intensity of the bird and cricket sounds as there is less bush in close proximity. The sound of the cicadas was intensified to add to the still and hot atmosphere. It is often the case in the local bush, that in clearings, the cicada sounds seem more intense as they prefer to reside on the bush margins.

Heard every now and then, is the sound of the wind chimes. It was decided that to create continuity and mergence of the puzzle musical elements and themes with the environmental sounds, that the wind chimes could serve as a reference in each motive, as the sound is intrinsically more "musical" than the insect sounds.

PUZZLE MUSICAL ELEMENTS:

Tree notches: When each of the notches is clicked by the player, a motivic sound is played. All the lower notches incite the same musical motive, while the top notch incites a different musical motive. These notches correspond to the villagers.

Fire objects: When each of the first 3 objects is touched, the same musical motive as with the lower notches on the tree can be heard. When the gold necklace is touched, the track associated with the top notch on the tree is heard. This links the two puzzle areas (the necklace belongs to the former headwoman of the tribe who was the first to die). Each element was composed with traditional African musical aesthetics in mind, although no direct reference to these aesthetics was entered into. The use of experimental instrumentation attempts to further delineate my own interpretation of the setting with any existing musical styles.

Scene Description – Part A

Act: Scene:

Graphic Interface:



PILE OF STONES IN BURNING GROUND

Not far from the tree is a pile of small rocks that has obviously been laid there by human hands. Beneath this pile of rocks, and buried in the sand there, is a metal object which forms part of a key that will be used later in the game to gain access to the storeroom (Act 2 and 3).

Interactive Music/Sound Description:

The background loop here remains the same as for the previous scene.

However, a puzzle occurs here. Upon discovery of a piece of key, (the first of 4 quarter pieces of key to be found hidden throughout the portal), a short musical motive will play which forms part of a complete melody played when the player tries to open the locked storeroom door in Act 2. This melody consists of all 4 quarter-key melodies. The idea here is that the musical motive heard, will provide the player with a reference clue as to the future use of this piece of key.

Sound Interface:

- FX: Distant beating drums, cicadas, wind chimes, birds.
- Interactive Music: Musical element linking key in the pile of stones to the storeroom in Act 2 and 3.

Scene Description – Part A

Act: 1 Scene: 4

Graphic Interface:



Sound Interface:

- FX: Lab environmental sounds.
- Interactive Music: Thematic music.

THE LABORATORY

- Door is open. Player enters the lab.
- The player meets Carua.
- Player exposed to the **Syntech** sign and "Danger" on the lab door. This should heighten the suspense.
- The player should see that the lab is centered around disease research and testing.
- Encounter with Carua shows that he is open and friendly and not with-holding anything
- After meeting Carua, Carua leaves the lab, allowing the player to either leave the lab or explore the lab at their own will.

Interactive Music/Sound Description:

This scene required the design of laboratory sounds i.e. the sounds of the equipment in there, overhead lighting etc, forming a background 'hum'.

Over this, I composed musical elements that relate to the music heard in the 'Sick Tent' scene, to provide the player with reference to the disease orientated plot. The scene music also contains elements heard in the Doctor's office and makes reference to the wind chimes heard in the burning ground scene. This thematically links this area with the burning ground. The scene also contains the closed storeroom door, which when clicked plays a complete melody made up of the individual key motives. This provides the player with a musical clue as to the use of the keys to be found throughout the game – see Act 3 Scene 1 for more details.

Scene Description – Part A

Act: Scene:

Graphic Interface:



Sound Interface:

- FX: Office sounds – fan, computer.
- Interactive Music: Musical links.

THE DOCTOR'S OFFICE

- The office door is open – player enters the office.
- The player meets Dr Meisner who is sitting at his desk.
- The player sees the office layout and some of the certificates on the wall.
- The player should see that the office is Meisner's place of work.
- Encounter with Meisner should hint that he is not what he seems and is cautious of the newcomer (player).
- The first time the player enters the office, they can have a conversation with Meisner in the form of a text input(player) and voice response(game) interface. However, the second time they enter the office Meisner is no longer present, leaving them to explore the office surroundings at will.

Interactive Music/Sound Description:

The office is equipped with a computer, a ceiling fan and overhead lighting. The sounds of these form the basis for the background loop.

Over this, are elements of the lab theme – wind chime paraphrase, and a stretto version of the HIV motive, musically linking the doctor with the HIV plot.

Scene Description – Part A

Act: 1 Scene: 6

Graphic Interface:



Sound Interface:

- FX: Near the bridge, a small stream can be heard.
- Interactive Music: Musical links.

THE VILLAGE

- A number of villagers go about their daily chores within the village.
- Some of these villagers (village headman and the Sangoma) are approachable and the gameplayer can ask these characters questions about their circumstances and what they think is happening in the village with Meisner and all the sickness.
- The gameplayer, thus, gets different points of view from the villagers and can start to see conflicting opinions of what is happening in the village.

Interactive Music/Sound Description:

I composed a musical element of a beating drum used to signify the villagers, which was added to the background. This should aid in providing the user with an audio reference to the beating drums heard in the burning ground scene. As it makes reference to the villagers themselves, it should make clear to the player that some of the villagers were burnt in the fire area of the burning ground.

Act 2 Description

Act:

2

In the doctor's office, game players can learn about the mechanisms of cancer – the cause of the disease, the formation of tumours, the spread of cancer throughout the body, and ways to prevent exposing yourself to a greater risk of contracting cancer. There are also papers and articles concerning cancer that can be read by the players before attempting a crossword puzzle on a chess-like board. When the puzzle has been correctly solved, the panel at the bottom of the board rotates open and reveals one of the $\frac{1}{4}$ keys for entrance to the store-room. The player can retrieve this key and place it in their inventory. Whilst in the Doctors Office the player can also explore models showing the current accepted structure of HIV-1, explore the morphological differences between a virus and a bacterium, and obtain the key for the Blood Analysis Machine.

In the laboratory, game players can learn about malaria – the asexual stage of the life cycle that occurs in humans, the symptoms exhibited by humans when this asexual stage is occurring in their blood tissues, the definitive diagnosis of malaria (by blood test), and a few tips on how to prevent contracting malaria.

Also in the laboratory, the player can learn about the process of infection and the biological mechanism of HIV in the human body. Players can become familiar with the morphology of the HI virus through interaction with the HIV poster on the wall in the lab, or through interacting with the 3-D model of the HI virus which can be found in the doctor's office (immediately next door to the lab). A few articles about HIV also appear in the doctors' journal in the office.

In the medical tent, the player can learn about TB, the causative organism of TB, the symptoms of TB infection, the morphology of the TB-causing bacterium, and the infective mechanism of this disease. The player will also be alerted to possible ways to minimize the risk of contracting malaria or of catching TB. To get to the sick tents the player will have to crack the puzzle to

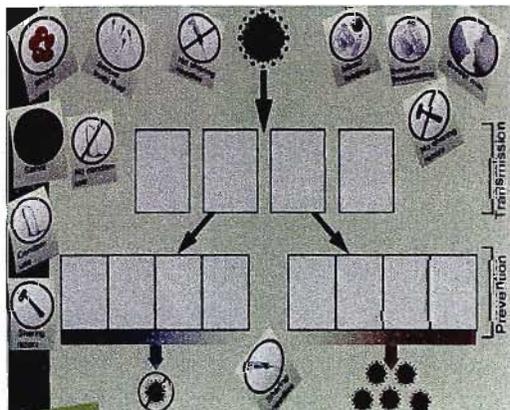
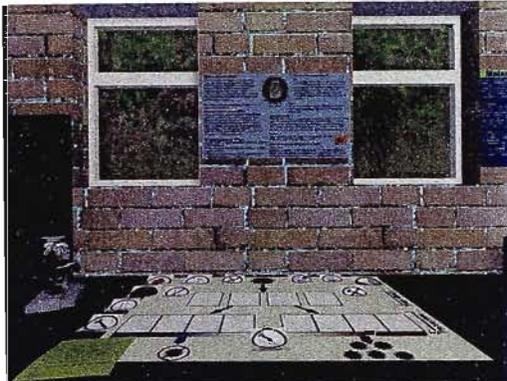
allow the bridge to be lowered, making crossing of the river possible. The code that is needed to be entered into this bridge puzzle is the 'window period' associated with HIV. This information can also be obtained in the lab.

In addition to all of these puzzles, 3 quarter keys are to be collected from the office, the village, and the sick tent to enable the player access to the storeroom in Act 3. These key pieces are to be collected in conjunction with the piece discovered in the burning ground in Act 1.

Scene Description – Part A

Act: 2 Scene: 1

Graphic Interface:



Sound Interface:

- FX: Lab environmental sounds.
- Interactive Music: Musical links.

THE LABORATORY

Through interaction with the malaria puzzle in the laboratory, players can expect to learn about the:

- Symptoms of malaria infection
- life-cycle of malaria
- protist that causes malaria
- Quarter key in the drawer of the microscope table.

Chart on the wall (malaria):

Learning objectives addressed:

- malaria life-cycle
- process of infection
- infection vector (*Anopheles mosquito*)

NOTE: The lab is “divided” into two main sections – with HIV research materials and the other with malaria research materials.

There is also a poster on the wall detailing the main differences between bacteria and viruses (the contents of this poster are backed up by the 3D models of the HIV-1 virus and a bacterium visible in the office).

Interactive Music/Sound Description:

This scene is the same as the lab scene in Act 1. This scene required the design of laboratory sounds i.e. the sounds of the equipment in there, overhead lighting etc, forming a background ‘hum’.

The microscope puzzle in this scene reveals the final quarter piece of key that must be used to open the storeroom door. Again, once discovered, a portion of the storeroom door melody will be played, giving the player a clue as to the use of the key.

Over this, I composed musical elements that relate to the music heard in the ‘Sick Tent’ scene, to provide the player with reference to the disease orientated plot.

Scene Description – Part B

Malaria Puzzle:

This puzzle consists of essentially two different interfaces.

- 1. Malaria interactive viewer
- 2. Malaria poster on the wall

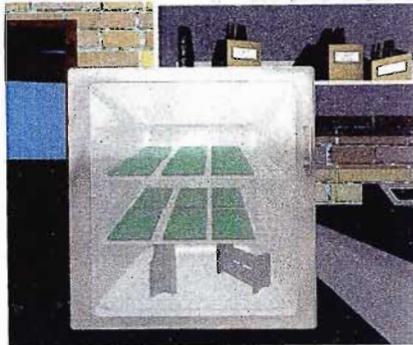
Interactive Music Description:

For this puzzle, I composed a short motive consisting of a flute sound heard in the last quarter key puzzle sound, and overlaid with the sound of a buzzing mosquito. The reason for using the flute sound, is that it relates directly to the puzzle found in the sick tents, that when solved, produces the 4th quarter piece of key to the storeroom.

Scene Description – Part A

Act: Scene:

Graphic Interface:



Sound Interface:

- FX: Lab environmental sounds.
- Interactive Music: Musical links.

THE LABORATORY

Players left to explore the lab at their own will.

HIV poster:

- identification of the HI virus
- transmission of the HI virus (body fluids and blood)

Mini-bar fridge:

- 2 sections – one containing the vials of blood and medicines; one containing the ELISA plates used for HIV testing
- has a glass door
- the glass should be frosted to show that it is cold inside the fridge

Blood analyzer:

- off to begin with/ LCD blank
- key needed to turn it on (found in Doctors office)
- When turned on, an indicator light lights up.
- The LCD says “booting”, then “ready” then “Insert ELISA plate”.
- When the plate has been inserted, LCD says “checking for antibodies”

ELISA plates: 6 in the fridge. All are manipulable by the players, but 3 correspond to the same patient at different times.

Interactive Music/Sound Description:

This scene contains the blood-analyser machine puzzle, which involves the discovery of a separate key to turn the machine on. The key itself is found in the doctor's office. To provide the player with an interactive musical clue here, I composed a short melody relating to the puzzle here and the HIV model puzzle in the doctor's office. With the player clicking on each puzzle to be solved, the same melody will be heard in both cases, providing the player with a clue as to the use of the key found in the doctor's office. Once the puzzle is complete, the player gets the HIV window period. This number is used to gain access to the sick tents through the gate at the bridge to the tents. Again here, the HIV motive heard will be played each time the player tries to access the bridge, thus giving the player musical clues as to the relevance of the blood-analyser puzzle solution.

Scene Description – Part A

Act: Scene:

Graphic Interface:



Sound Interface:

- FX: Soft whirring of computer.
- Interactive Music: Musical links.

THE DOCTORS OFFICE:

- Desk pad (Syntech and Nevirapine logos are present as background images on the desk pad). On the corner of the deskpad is a scribble (Meisner's) - sketch of the HI virus structure with a few minor clues on how to solve the HI virus globe interaction to retrieve the blood machine key.
- A globe-like structure (3D model) of the proposed HIV structure – with the key to the blood analysis machine in the base mounting of this globe.
- A journal documenting cancer in the top drawer of the computer desk. This journal contains a few magazine and newspaper cuttings regarding cancer and HIV (Nevirapine and breast feeding)
- The torn envelope is on the computer desk and the letter from Carua can be seen lying in front of the computer keyboard.
- On the computer monitor, the email that Meisner is sending on behalf of Carua can be seen and read.
- There is a photograph on the bureau of the late Julia Meisner (wife).
- The paperweight on the doctor's main desk looks like a bacterium, showing the bacterium structure.
- A quarter of the storeroom door key is concealed inside the crossword board on the desk.

Interactive Music/Sound Description:

This scene contains the HIV puzzle and the crossword puzzle. The former puzzle relates directly to the blood-analyser machine puzzle and eventually the gate leading to the sick tents. When the player clicks on the puzzle, the same musical motive heard when clicking on the blood-analyser machine puzzle, will be played. This should provide the player the necessary clues as to the use of the small key found when this puzzle is successfully completed. This motive is played by an ominous sounding woodwind instrument, designed to create an emotive response from the player by making potent the seriousness, sadness and terrifying nature of the HIV disease.

Also in this scene, is the cancer-crossword puzzle. When the player completes this puzzle, a small drawer opens revealing another quarter piece of key which is part of the key puzzle to open the storeroom door. When the player discovers this key, another part of the complete storeroom door melody is played, providing an interactive musical clue as to the significance and use of the key piece.

Scene Description – Part A

Act: 2 Scene: 4

Graphic Interface:



Sound Interface:

- FX: Subtle sound of running water near the bridge access point to the village
- Sounds of wind in the trees near the Sangoma hut (must appear almost supernatural)
- Sound of insects such as crickets and cicadas and birds.
- Interactive music: Musical motives, links.

THE VILLAGE:

- Inhabitants live in huts
- Close to a small stream
- There is a bridge connecting the village to the lab and burning ground
- Huts arranged in an extended circular position with the doors of the huts facing inwards

Hut interior:

- Candles burning inside the huts to fend off the mosquitoes (insect repellent candles). Each doorway is covered with mosquito netting and mosquito nets are placed over the sleeping areas.
- All hut doors left open for fresh air flow – this helps to slow the spread of TB in infected areas.

The game player has the opportunity to speak with various villagers and get their interpretation on what has been happening in the village. Amongst these villagers is the Sangoma, the local sage and healer. The gameplayer can speak with the Sangoma and get her interpretation of the village events. She releases a ¼ part of the store-room key to the player indicating to them that they need to find the other three parts themselves. The Sangoma also alludes to the importance of the information in the store-room.

Interactive Music/Sound Description:

There are 3 huts the player can enter in this area. Outside the huts, the sound design is identical to that employed and described in Act 1 scene 6 earlier on in the documentation. For the two huts within the village itself, I layered the outside sound with some new material composed to create an atmosphere within the huts. Here, the outside loop was lowered, and the water sound from the stream removed. The new material consists of the following elements:

- a marimba (I chose a marimba as it is similar to the traditional idiophones found throughout central Africa), playing short 3 note motives at random intervals and different dynamics to avoid familiarity developing with the player
- A dissonant chord – made up of major and minor seconds and thirds and derived from the wind chimes heard earlier. It is played back in a random fashion and used to create tension and suspense. Dissonance is a compositional technique often used to create tension or suspense due the “unresolved” nature of the sound. It is therefore very often synonymous with fear, terrifying or haunting emotions.
- A low drone to tie in the random musical phrases and provide further atmosphere.

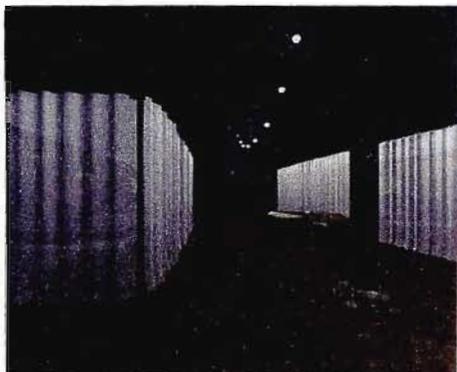
The reason for composing these different motives was to create atmosphere in the huts and emphasise the link between the burning ground fire puzzle i.e. the dead villagers. The drums in the background, which are the same as the drums heard in the burning ground fire area and outside the huts, is also heard here to create a “musical” link with the villagers.

When the player interacts with the Sangoma, another quarter piece of the key to the storeroom is discovered. Here too, a portion of the storeroom melody is played, giving the player a further clue as to the use of this piece of key.

Scene Description – Part A

Act: Scene:

Graphic Interface:



Sound Interface:

- FX: Sound of the river flowing at the bridge access point.
- Interactive Music: Musical links.

THE SICK TENT:

- The tent is constructed to slow the spread of TB – the plans for this tent construction are folded and placed in the back of the TB manual.

This plan details the precautions that have been taken in constructing the tent:

- tent constructed with open sides to prevent the flow of fresh air (prevent overcrowding in badly ventilated areas which promotes the spread of TB)
- Netting is placed over all the patients to minimize their risk of contracting malaria. This is not normally a risk to these people, but since they have been injected with HIV, they are becoming more and more prone to these sorts of diseases.
- A microscope box, showing the words “sputum slides” on it is also visible on the table next to the microscope.
- As part of the TB puzzle, players can learn about the diagnostic procedures for identifying tuberculosis, and actually stain the sputum slide themselves before viewing the structure of the TB bacillus under the microscope.
- There is a retractable/ mechanical bridge restricting access to the sick tent. This bridge is lowered if the window period is entered into the machine as a password.

Interactive Music/Sound Description:

The background loop here contains the near-by stream, a mosquito sound in the tent, and the crickets and cicadas outside.

Over this, is layered a randomly played back element that contains the same marimba sound heard in the 2 village huts, but this time playing a similar pattern to the notes heard in the wind chime element. This musically ties in the villagers, burning ground and key puzzle plots, by linking the thematic material of each element. In turn, this aids in providing continuity to the themes and creates homogeneity in the elements which is essential in maintaining the “musical” flow from one scene to the next.

Act 3 Description

Act: 3

On the store-room door is a puzzle that requires the game-player to associate images with diseases, and to enter these diseases in a particular sequence, specifically with HIV manifesting first, followed by other opportunistic diseases. When the player has entered the diseases in the correct sequence, as well as inserted the full key (made of 3 key quarters) then the store-room door opens.

Inside the storeroom the player finds a filing cabinet, a slide projector and a big wall chart on one wall.

The filing cabinet houses the top-secret documents that tell the player what Meisner is really up to – his testing regime and perhaps a document indicating the local government knowledge of what is happening, but their inaction to do anything about it because of major corruption and bribery.

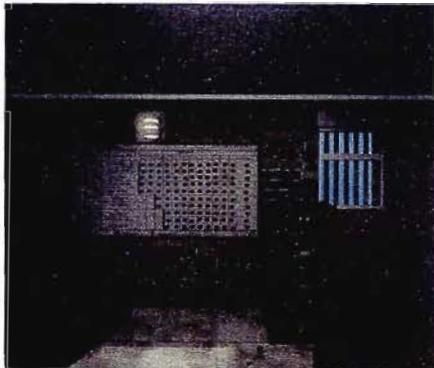
The slide projector – this is where the game player can see which patients Meisner has tested his drugs on, the dates he injected his subjects with HIV before starting to test the anti-retroviral drugs on them, and the dates they died. The first picture that flashes up on the projector is of the former 'first lady' of the village – the first woman who volunteered herself for the "good of the community". She was the one wearing the piece of jewellery the player found by the fire in the burning ground in Act 1. That was the remnants of when she was burned.

The wall chart is a huge testing schedule that Meisner has mounted, showing the HIV status of the test patients he has tested so far. There are red and yellow dots all over the chart, red indicating the HIV positive status of a patient, and yellow the HIV negative status of the patient. The key for the different status colours also appears at the bottom of the chart, making sense of the observations the player made in the laboratory earlier in Act 2. The chart is a nice way to visually show a varying length of window period between 3 and 6 months.

Scene Description – Part A

Act: Scene:

Graphic Interface:



Sound Interface:

- Interactive Music: Musical links, themes.

The Store Room:

Resolution of the game.

Outside the room:

Keypad – giving access to the room

Inside the room:

Testing schedule detailing the doctor's procedures and showing the HIV status of patients after inoculation with the HI virus. Red dots indicate HIV positive and purple dots indicate HIV negative status. A key explaining these colours is below the main area of the chart. The use of these colours on what is essentially a time-line is a nice way to the window period as being variable between 3 to 6 months.

Filing cabinet:

Contains folders about "Syntech"

3 things of importance in the filing cabinet:

- Dr Meisner is the director of Syntech
- The government knows about the testing and stays uninvolved (great bribery and corruption)
- Q33A blood testing manual - with pg 46 torn out (this page is lying under the blood testing machine).

A slide projector – this shows the game player pictures and details of patients involved in the testing programme, and gives stats like "Date injected with HIV" etc.

Shelves with boxes/ packages/ storage.

Interactive Music Description:

Previously in the game, the player encounters the storeroom door locked and closed. When this locked door is clicked on, the complete melody is heard, made up of the 4 quarter sections, which individually correspond to the 4 quarter key pieces found throughout the portal. Once the player has found all the key pieces, the player should realize that each key piece relates to the storeroom door unlocking mechanism. The idea is that this should be aided by the musical "puzzle" attached to the key puzzle. This enhances the "interactivity" of the musical elements and of the music in the portal as a whole.

SCORE SECTION

This section contains the scores for each of the musical elements composed for the game portal. Descriptions of the themes for each element are given on the scores themselves.

Figure 1 – General Background and Overlay Score

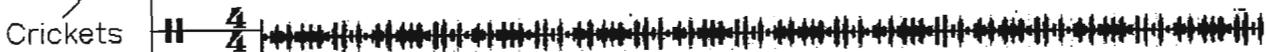
General Backgrounds and Overlays

This score is added here to graphically display some elements of the background sound design that cannot be notated traditionally. This is the case with all the audio elements that were either recorded or sampled that are natural sounds such as the crickets, cicadas, wind, water etc. These graphic realisations portray the general background loops found throughout the game portal. Some sounds, such as the birds, flies and other environmental noises are not included in this display, as they are sampled audio files that occur randomly in the game to the background loop. Other such sounds (which I termed "overlays"), that were composed for purposes of atmosphere or thematic relevance have been included. Each score is notated with a graphic of the actual audio recording of each sound element.

For the cicada loop, I first created an artificial cicada sound by using a violin sound sample and transposing it up about 4 octaves. This was then layered with a synthesised insect sound which was also transposed up. The two sounds were then copied and pasted to form a continuous looping sound of about 1 min in length. A continuous fade-in fade-out envelope was added to achieve the searing sound associated with millions of insects in a jungle. Depending on where the player is in the portal, the cicada sound changes in volume to reflect the player's relative position to areas that have large amounts of bush.



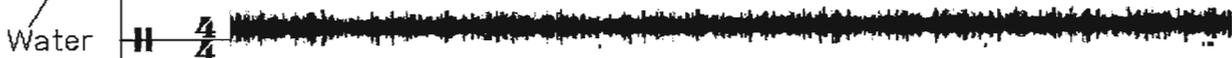
The crickets were created by recording some crickets using a mini-disc recorder. I then edited the audio recorded to create a searing, random sound in the same way as the cicada loop. Again, depending on where the player is in the portal, the cricket sound changes in volume to reflect the player's relative position to areas that have thick bush.



The wind loop was created by recording the wind at the sea side using a mini-disc recorder. I then edited the audio recorded to create a searing, random sound in the same way as the cicada and cricket loops. The wind loop is very subtle in the game backgrounds, and is merely there to add a bit of audio depth to the other environmental sounds in the portal. The wind sound only occurs in areas outside of the buildings.



The water sounds were recorded using the same device as above, over a swimming pool outlet. The sound recorded needed to be drastically altered in terms of equalisation to isolate the correct frequencies that would be heard when listening to a small stream. Once the correct frequencies were filtered out, I created a loop of about 1 min and added the random fade and volume envelopes in the same manner as with the other loops. The water sound occurs when the player is in close proximity to the stream seen in Act 2.



To create this sound, I isolated the echo trails from the individual marimba notes (see staff below). These were then pasted randomly in a multi-channel mix and layered with a drone to "tie-in" the sounds. This musical motive is designed to create suspense in the sick tent scene (Act 2 Scene 5). It also has thematic significance, in that it refers to the wind chime melody. This was done by using the wind chime melody MIDI file as a reference point for the time interval placement of each copied echo trail. Significant to, is the thematic reference to the Burning Ground, Villager's and key Puzzle musical elements. Further details may be found in the "Interactive Music/Sound Description" of Act 2 Scene 5. The sound file is played back in the game as a random overlay (sound layered on top of background loop) to the background loop.



The sounds of the marimba shown here, occur in the background loop of the huts found in the village area (see Act 2 Scene 4 Interactive Music/Sound description for further details). The notes themselves are single minims, but what you hear in the game is each note with a delay effect and a pitch bend either up or down at the end of the delay. This makes the instrument sound as if it is being played in the distance, with the echoes following. Each note was recorded with these effects, and then added to the background loop in a multi-channel mix in a random fashion, each time with different volume and pan envelopes.



The rhythm notated here is the basic drumming rhythm heard in the Burning Ground to signify the villagers, outside the village area and in the huts and sick tents. In order to create a sense of randomness and avoid familiarity with the player, I firstly recorded this rhythm using the samples of a large bass drum - open hand strikes, side hand strikes etc., and assigned the different notes to alternate samples of the drum to create a realistic drumming sound. Then, using the audio editor (CoolEdit Pro), I spliced the audio into several different sections and pasted it randomly together to achieve a feeling of improvisation.



Figure 2 – Headwoman's Theme Score

Headwoman's Theme

Act 1 Scene 2

Key of g minor used throughout portal.

The first system of the musical score consists of three staves. The top staff is for Breathy-Flute, starting with a tempo marking of $\text{♩} = 72$ and a dynamic marking of *f*. The middle staff is for Marimba, starting with a dynamic marking of *pp*. The bottom staff is for Bamboo Drums- pitched, starting with a dynamic marking of *mf*. All three staves are in the key of G minor (two flats) and 4/4 time. The flute melody is a simple, melancholic line. The marimba and bamboo drums play a complex, poly-rhythmic pattern with triplets.

Notes:

1. To remain within the setting of the game and provide Impetus to the character of a village headwoman, I listened to some African drumming to associate myself with the type of rhythm that could occur in this aesthetic. I then devised my own rhythm, keeping in mind the rhythmic quality of the existing drumming. To create a poly-rhythmic feel, I composed two separate tracks of drumming, which are played back simultaneously with the result of the two rhythms interacting with one another. On the whole though, I wanted to achieve originality with the drumming and if possible avoid any conspicuous references to traditional African drumming.
2. The flute melody here is a variation on the melody found in the harmonies of the Complete Storeroom melody. This was done to achieve homogeneity between the musical elements here and those found in the rest of the portal. It is melancholic in character - signifying the death of the headwoman.
3. The recorded audio of this element has fade-in and fade-out envelopes at the beginning and end to allow for a gradual entrance and exit of the theme.
4. As with the other sound samples used, the samples of the flute, drums and percussion was played back through a delay and reverb effects module to give the audio some acoustics.

The second system of the musical score continues the three staves from the first system. The top staff (Breathy-Flute) begins with a dynamic marking of *p*. The middle (Marimba) and bottom (Bamboo Drums- pitched) staves continue their poly-rhythmic patterns with triplets. The flute melody continues with a similar melancholic character.

Figure 3 – Villager's Theme Score

Villager's Theme

Act 1 Scene 2

Marimba *mp*

Bamboo Drum - pitched *mf*

2

Notes:

1. This theme is exactly the same as the Headwoman's theme, only there is no flute melody above it. I wanted to emphasise the hierarchical division between the Headwoman and the villagers. The drumming may therefore be viewed as an accompaniment to the flute melody in the Headwoman's theme. It's absence here denotes the hierarchical division.
2. As with the drumming found in the Headwoman's theme, the construction of the drumming here was achieved in the same manner.
3. The recorded audio of this element has fade-in and fade-out envelopes at the beginning and end to allow for a gradual entrance and exit of the theme.
4. As with the other sound samples used, the samples of the drums and percussion was played back through a delay and reverb effects module to add acoustics to the audio.
5. It is kept short to avoid any noticeable repetition during playback.

Wind Chimes

Act 1 Scenes 2, 3 & Act 2 Scene 4

WindChimes

$\text{♩} = 75$

p

Dissonant chord - made up of major/minor 2nds & 3rds, consisting of notes found in the score seen here.

Notes:

1. As with the wind chime music in the Complete Storeroom melody, this theme was sequenced by playing and recording simultaneously on a MIDI keyboard. This was done to aid in achieving the random sound associated with chimes blowing in the wind.
2. This theme is also used (as described in the "Interactive Music/Sound Description of Act 1 Scene 2), to tie in the other musical elements of the portal and make potent the reference to the plot and story behind the Burning Ground scene, where the wind chimes are first heard.
3. The theme here is intended to create suspense when the player enters the 2 huts within the village and create a musical link between the villagers and the Burning Ground. This was achieved by creating a dissonant chord from the notes seen here, recording it with a mirrored delay effect, faded in and out and placed randomly within the background loop.

Complete Key Melody - Storeroom Door

Act 1 Scene 4 & Act 3 Scene 1

$\text{♩} = 100$ End of 1st Key element

Breathy-Flute *mf*

Low Marimba *mf*

Bamboo Drum *mf*

WindChimes *pp*

Simple melodic elements that can be broken up into 4 parts.

See WindChimes Score for details.

Notes:

1. The music here illustrates the complete Storeroom melody which is heard when the player clicks on the closed Storeroom door.
2. This melody is divided into 4 sections - each section signifying a quarter piece of key found throughout the portal.
3. Each instrument heard in the game as depicted here, was used from the Sample Library and played back with a slight delay and reverb effect.
4. The music makes no particular reference to the setting of the game i.e. it is completely original in its contextualisation and the only significant reference to the setting is through the instrumentation.
5. Thematic consistency is however maintained through the use of the Wind Chime melody, which ties the Key Puzzle elements seen here to the Wind Chimes heard in the Burning Ground Scene.
6. The recorded audio contains quick fade-in and fade-out envelopes at the beginning and ending of the complete melody, as seen here, and in the audio of the individual Key Elements.

End of 2nd Key element

Breathy-Flute *mf*

Low Marimba *mf*

Bamboo Drum *mf*

WindChimes *pp*

5 End of 3rd Key element End of 4th Key element

Imperfect cadence here signifies resolution of the melody and musical puzzle.

ppp

Figure 6 – Score of Key Element 1

Key 1 Element

Act 1 Scene 3

♩ = 100

Breathy-Flute *mf*

Low Marimba *mf*

Bamboo Drum *mf*

WindChimes *pp*

Notes:

1. Shown here is an extraction of the complete Storeroom melody.
2. This is played back when the player discovers the 1st quarter piece of key.
3. The same details ascribed to the score for complete Storeroom melody may be used here.

Figure 7 – Score of Key Element 2

Key 2 Element

♩ = 100

Act 2 Scene 3

Breathy-Flute
mf

Low Marimba
mf

Bamboo Drum
mf

WindChimes
pp

Figure 8 – Score of Key Element 3

Key 3 Element

♩ = 100

Act 2 Scene 4

Breathy-Flute
mf

Low Marimba
mf

Bamboo Drum
mf

WindChimes
pp

Figure 9 – Score of Key Element 4

Key 4 Element

♩ = 100

Act 2 Scene 5

Breathy-Flute

Low Marimba

Bamboo Drum

WindChimes

Figure 10 – HIV Motive Score

HIV Motive

Act 2 Scene 2 , 3, Part C & Act 2 Scene 5 Part C.

♩ = 100

Effected Bassoon

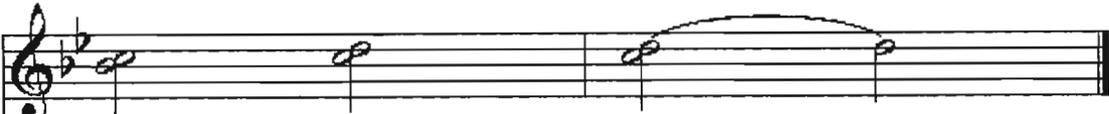
Notes:

1. This simple melodic element is used motivically to depict the HIV puzzle and plot in the portal.
2. The 3 notes signify the 3 letters of the HIV abbreviation - one note for each letter.
3. I chose the sound of a haunting low bassoon here to enhance the lugubrious nature of the HIV plot in the story.
4. This theme is used to give the player audible clues in several instances in the portal, namely the link between the HIV model in the doctor's office, the blood-analyser machine in the lab and the locked gate to the bridge over the stream leading to the sick tents.
5. The simplicity of the melody is intentional. This is done to provide the player with an easily memorable audio element.
6. The recorded audio reveals the use of a delay and reverb effect to create atmosphere in the element. In fact, the end result is a sound that is difficult to associate with an ordinary bassoon.

Malaria Theme

Act 2 Scene 1

Breathy-Flute



Audio - Mosquito



The image shows two tracks. The top track, labeled 'Breathy-Flute', is a musical score in G minor (one flat) and 4/4 time. It begins with a treble clef and a forte 'f' dynamic marking. The melody consists of a half note G4, a quarter note A4, a quarter note Bb4, a half note C5, and a final half note D5. The bottom track, labeled 'Audio - Mosquito', is a waveform showing a complex, oscillating sound pattern that corresponds to the timing of the flute notes above it.

Notes:

1. This theme consists of the same breathy-flute sound used throughout the portal.
2. The idea here was to try and create a homogeneity with the sound of a mosquito with the flute. This makes potent the relevance of the flute throughout the portal, by emphasising the "disease" orientated plot.
3. In this theme, I chose to superimpose the recorded audio of the flutes with the sound of an actual mosquito to reinforce the intention of theme homogeneity. The use of the mosquito sound in the theme to the mosquito puzzle here, also demonstrates its association with the sick tents, where in fact random mosquito sounds are present to aid in immersing the user in an environment where mosquitoes are rife. As the "Interactive Music" description of Scene Description Part B, Act 2 Scene 1 points out, the flute here also makes reference to the 4th quarter key piece musical element. The resolution of the melody here on "D" points to this.

Doctor's Office Theme/Lab Theme

Act 1 Scenes 4,5 & Act 2 Scenes 1,2,3

Breathy-Flute

The melody seen here is a stretched version of the HIV Motive. This was composed to create a thematic link of the HIV theme in the game with the doctor himself. The lab theme heard in the game is identical to the score seen here, except the HIV stretto theme is removed. It is played back as an overlay to the windchime and woodwind sounds.

Low woodwind

WindChimes - Played by Flute sound

Short chromatic motive between stretto paraphrases of HIV motive to create further tension

2

Low woodwind instrument gives harmonic support in the bass

The wind chime staff here, is the identical staff notation seen in the Wind Chime Score. For the lab theme, this makes thematic reference to the sick tents scene, as the wind chime theme is also heard there, played as a variation overlay by a marimba.

4

7

9

Figure 13 – Sangoma's Hut Theme Score

Sangoma's Hut Theme

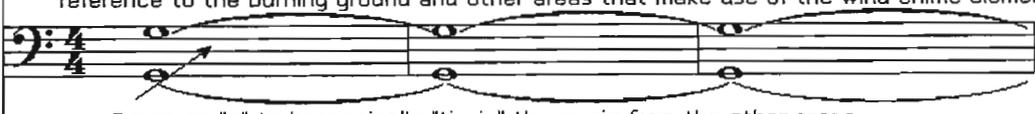
Act 2 Scene 4

Note: This score does not contain the marimba elements heard in the game - they were recorded and placed at random intervals in the final mix - see Figs.1 & 14 for more details.

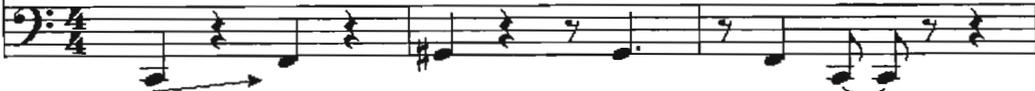
Gliss chord



Drone



Bamboo Idlophone

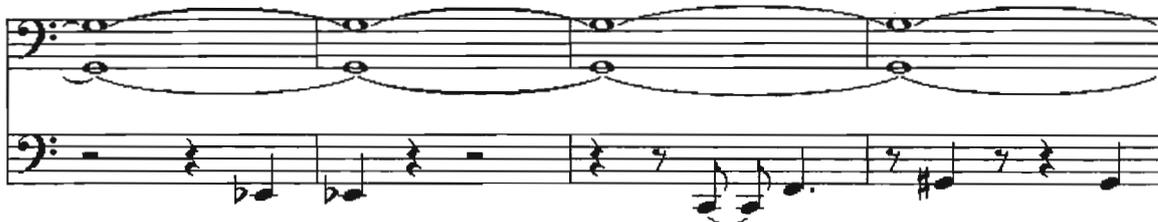


Chord here made up of notes from the Wind Chime Theme. Recorded and played back in the final mix of the Sangoma's Hut theme with continuous random pan and volume envelopes. Adds to the "mysterious and supernatural" atmosphere of the scene. Also provides thematic reference to the burning ground and other areas that make use of the wind chime element.

Drone on "g" to harmonically "tie-in" the music from the other areas.
(All area music is in g minor)

Here I chose to provide the Sangoma with a new theme partly derived from the low woodwind notes heard in the Doctor's office and lab areas - notes c, f, g are common. These notes are also derived from the "Complete Storeroom Key Melody." This is important since the Sangoma provides the player with the final quarter piece of key in the resolution of the game. The sound heard in the game is the same instrument used to provide the Villager's theme and drumming heard in the Headwoman's theme music. This creates thematic relevance between the Sangoma, Villagers, Headwoman and Lab areas, by pointing to the disease focused plot through the use of the derived notes and instrumentation.

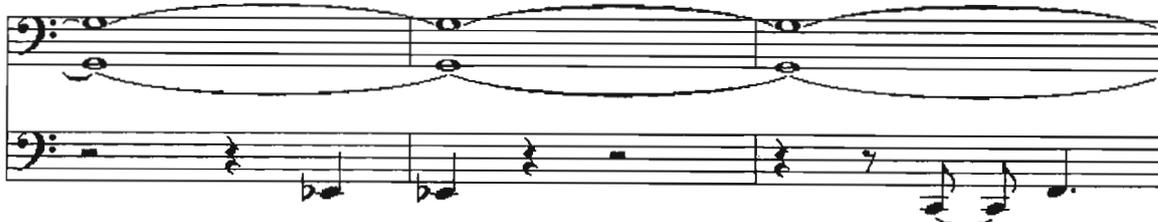
4



8



12



15

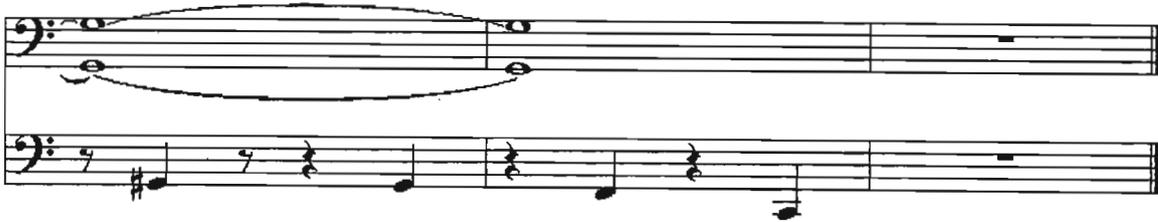


Figure 14 – Screen Print of Multi-Track Session – Sangoma’s Hut

This graphic demonstrates how each scene sound was created (using the Sangoma’s Hut mix as an example) by using multi-channel outputs containing the individual sound elements.

Each track contains recordings of the MIDI sequence tracks. The top track is the crickets and cicadas, followed by the village drums, marimba elements, drone, Sangoma’s marimba theme and the gliss-effect – see Fig. 13 for more details. The music heard in the two village huts are identical to the mix seen here, only without the Sangoma’s drum element – see Act 2 Scene 4 description for more details.

Each scene sound design was created and mixed down using the tools seen here. The lines with nodes on the screen indicate volume and panning envelopes, which I created to achieve randomness and variation in the individual sound elements. This was necessary, as the VLS sound engine did not allow for individual element manipulation from user input in the gamestate. (The nodes themselves do not constitute automation from the gamestate.)

Further to this, the ability of the mixer here to allow each track to be amplified (+/-) individually was critical in achieving the appropriate mix of sound for each scene in the game. Once the desired mix was created, a loop point was found (see yellow marker at right-edge of top wave), the tracks selected and then mixed down to render the audio for that scene. This sound was then converted into MP3 format and coded into the game archive for playback when required. Further details may be found in Fig. 13.

Disease Portal - Elements in Imaginary Sequence

$\text{♩} = 100$

The musical score is arranged in a vertical stack of staves. At the top, a tempo marking $\text{♩} = 100$ is present. The instruments and their parts are as follows:

- Flute:** Treble clef, 4/4 time. A single note is played in the second measure, marked with a forte (*f*) dynamic and a slur.
- Bassoon:** Bass clef, 4/4 time. The staff is empty.
- Tuba:** Bass clef, 4/4 time. The staff is empty.
- Claves:** Percussion clef, 4/4 time. The first measure has a quarter note marked *mp*. The second measure has a triplet of eighth notes marked *mf*.
- Sticks:** Percussion clef, 4/4 time. The staff is empty.
- Vibraslap:** Percussion clef, 4/4 time. The staff is empty.
- Xylophone:** Treble clef, 4/4 time. The staff is empty.
- Strings - 5 Group Divisi - Violins:** Treble clef, 4/4 time. The first measure is marked *mp* and the second measure is marked *mf*. The notation uses multiple staves to represent the divided parts of the string section.

5

Fl. *mf* *espress.*

Bsn. *mp*

Tba. *f*

Clvs. *mp*

Sks. *mf*

V.Slp.

Xyl.

Str. *p*

Detailed description: This is a page of a musical score for a symphony orchestra. It features eight staves. The Flute (Fl.) staff is in treble clef and contains a melodic line starting at measure 5 with a dynamic of *mf* and a phrasing slur. The Bassoon (Bsn.) staff is in bass clef and has a dynamic of *mp* with a slur. The Trombone (Tba.) staff is in bass clef and has a dynamic of *f* with a slur. The Clarinet (Clvs.) and Saxophone (Sks.) staves are in alto clef and have dynamics of *mp* and *mf* respectively, with a slur. The Violin/Trumpet (V.Slp.) staff is in alto clef and is mostly silent. The Xylophone (Xyl.) staff is in treble clef and is silent. The String (Str.) staff is in treble clef and has a dynamic of *p* with a complex, multi-measure slur. The page number '2' is in the top left, and the measure number '5' is above the Flute staff.

“gammaKHOZI VERSION 2” – DETAILS OF POWERPOINT PRESENTATION

Presentation Outline

The material seen here is a text-based version of the PowerPoint Presentation found on the CD-ROM disc. It shows the scores, audio engine design and compositional techniques used to create the “gammaKhozi Version 2” music.

The presentation content compositionally provides a different picture in terms of sound design for games and also puts forward ideas for the creation of a highly adaptable audio engine to help realise the compositional goal of achieving high levels of interactivity musically.

Subsequent to this, it is hoped that in the future, such properties of sound engine design could be implemented in a 3D virtual space.

The properties and intentions of the presentation are outlined as follows:

- This presentation shows a different musical adaptation for the VLS game. It attempts to present what other possible applications of music in the game based on an imaginary audio engine capable of generating the ideas put forward here could be. The alternative composition also attempts to illustrate a completely different approach to audio design for the game.
- One of the main reasons for having to do this is that as it presently stands, the current VLS audio engine does not allow for certain features. As a result of this, it was felt necessary to theoretically add components to the current engine that would aid in providing more musically interactive results. To this end, I have included a page on new audio engine specifications which I think would add to the musical interactivity of the game.
- Succeeding this, I have designed completely different musical material – seen in this presentation with still pictures of areas from the game and, in line with the new specifications of the audio engine. The still picture and score extracts are merely demonstrations of possible

musical occurrences in the game should the new specifications be added with the musical material provided here.

- Each page, entitled “Elements”, contains a scene picture and possible musical elements that could be played back by the audio engine triggered by certain parameters from the game state. A description of the music and parameters is given.
- Following the “Elements” section, I have included a possible macro-compositional output from a sitting in the gamestate - see “Imaginary Sequence.” This illustrates how the elements could be played back. It also shows that each element is capable of being overlaid with any other element and in any order. It also demonstrates the possibility of creating many permutations from just 3 or 4 mins (determined by tempo) of total musical material. I chose therefore to create “atonal” musical material that could easily allow for seamless blending of individual musical elements. This is in opposition to the computer game music technique of writing musical elements in similar keys to allow for merging of ideas from one scene to the next.
- The choice of instrument sounds heard in the presentation is merely one example of possibly thousands of different sounds that could be chosen to play back the material.

Presentation Content

- Audio Engine Specifications – this section of the presentation details some possible audio engine enhancements and additions to allow for the implementation of interactive compositions:
 - MIDI data capabilities – allows for musical material to be programmed as MIDI data which can easily be manipulated by the engine by certain pre-programmed parameters from the gamestate.
 - Avatar or 1st person perspective x;y position monitor to enable the audio engine play back audio based on the real-time movement of the user through the virtual space.

- Simultaneous streaming of multiple audio channels to allow for elements to be overlaid on top of each other.
 - Real-time manipulation of MIDI data so that each element could be changed depending on certain parameters affected by user input in the gamestate.
 - Real-time effects modules to allow for realistic acoustic properties to be applied to the audio depending on user position in the gamestate.
 - Tempo change parameters – allowing for any element to have its tempo altered to give the effect of the music changing to user behavior.
 - Retrograding of MIDI elements – reversing of composed elements to allow for more permutations of individual elements.
 - Instrument or patch change parameters – to allow for colourful changes in the sound output. Should also incorporate the facility of providing the composer with the ability to input a bank of sampled sounds specific to the audio design of the game.
 - Real-time panning changes – could help to provide perspective musically to the player.
- Elements – The elements section of the presentation shows possible musical element combinations for each scene and what parameters could be contained within the programming to allow for musical interactivity to take place. For example, the “Burning Ground” scene could have a parameter such as panning to the right built-in to the scene, which could trigger the “clave” element to play, indicating the player’s proximity to the puzzles. (Further details may be found in the presentation itself, which shows the scores and screen-shots of each scene.)
 - Imaginary Sequence – This section of the presentation demonstrates one possible macro-compositional output from the gamestate at any one sitting by the player. It shows how each element can easily be layered on top of any other element and also that they can be played back in any sequence. (See Score Section – Fig. 15. for an extract from the “Imaginary Sequence from “gammaKhozi Version 2.”)

APPENDIX I – PUZZLE RUN-THROUGH

Cancer Puzzle

As before, the cancer puzzle needs to take the form of a crossword puzzle where questions are asked and the answers are identified on the crossword. To indicate to the players what progress they've made through the puzzle, a progress indicator is also necessary on the bottom of the puzzle interface.

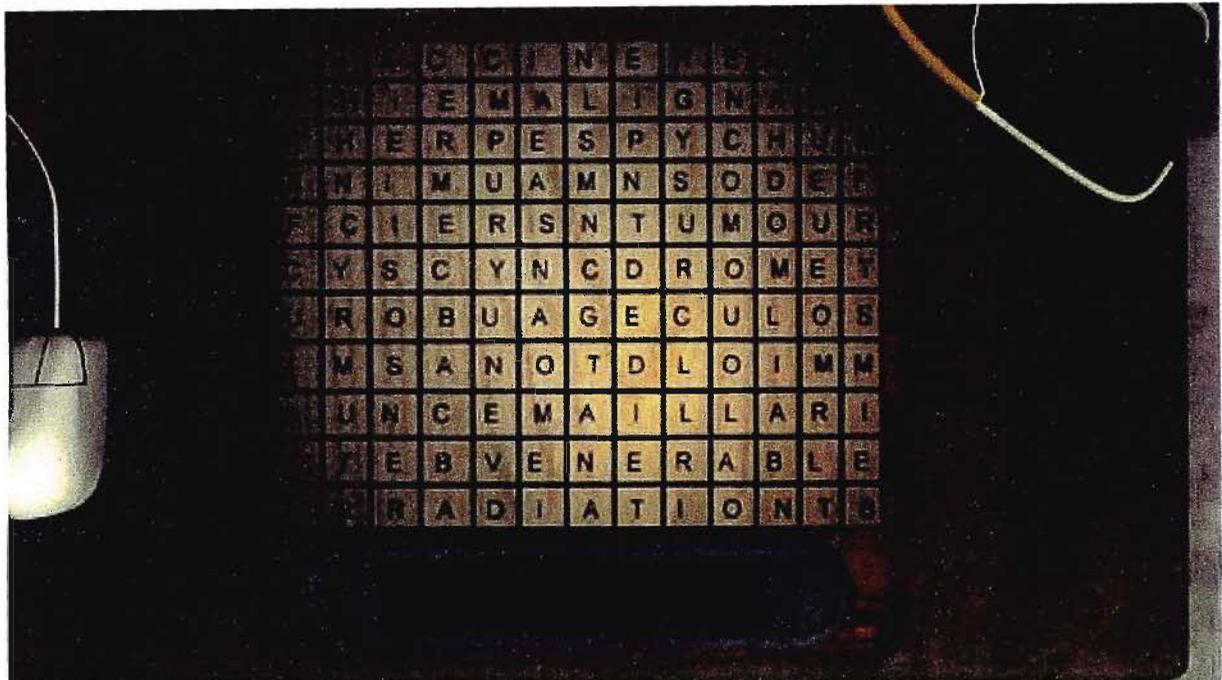


Figure 1: showing the puzzle interface with none of the buttons depressed.

In this puzzle the learners are asked 12 different questions pertaining to cancer. When each question is successfully answered, the puzzle moves onto the next question and the progress indicator advances.

The questions asked in this puzzle are:

1. What is the name given to something that prevents diseases from progressing? (vaccine)
2. A carcinogen is something that can cause _____. (cancer)
3. ___ plays a role in determining a person's susceptibility to developing cancer. (age)

4. Cancer could be described as the inability of a _____ to die within a normal time frame.
5. A lump of cancerous cells is called a _____. (tumour)
6. What diagnostic procedure is used to get 3-D scans of internal body organs? (CT SCAN)
7. Kaposi's _____ is a form of cancer often associated with HIV/AIDS. (sarcoma)
8. When cancer spreads, it is said to be _____. (malignant)
9. Cancer can be caused by a _____. (virus)
10. A natural, balanced _____ plays a role in the prevention of cancer. (diet)
11. The human _____ virus has been linked to HIV/AIDS and Kaposi's sarcoma. (herpes)
12. Under what broad category does UV light (a known cause of cancer) fall? (irradiation)

When all 12 questions have been successfully answered, the bottom panel slides open and a key is revealed which the learners must be able to click on and add to their inventory (this key is required for later use in the final resolution puzzle of the game).

HIV Puzzle

Summary

The purpose of this puzzle is to demonstrate the biological entity behind HIV/AIDS and to link the collapse of the immune system with the life cycle of the HI virus within the human body. This is achieved through the close interaction of the learners with the 3D HIV-1 model and through a simulation showing the stages of the life cycle within the human body. The model shows the generally accepted morphology of the HIV-1 virus and provides a visual aspect to the diagrams of the HIV structure which appear in readings elsewhere in the doctor's office. The life cycle simulation shows in a more animated way the manner in which HIV infects lymphocyte cells, through initially binding with their outer protein layer, and then using the lymphocytes to produce more copies of the HI virus.

At first glance the HIV model appears to be a static model simply sitting on the bookshelf in the doctor's office. However, when the learner approaches the model and clicks on the Syntech logo on the front of the model, the two doors of the model swing open and a projection of the nuclear contents of the virus is displayed inside the model's sphere. The camera zooms into the puzzle until such a time when only 6 of the model's outer proteins are clearly visible to the learners. When the camera has completed its zoom in and the viral contents are being projected, the 6 visible gp120 proteins on the periphery become green and glow slightly. These become the buttons for the puzzle interaction interface.

When the learners click on any of these buttons a specific sequence, directly related to that button, is played. Each sequence is a different part of the overall lifecycle. Whenever one button is depressed, a sequence plays. However, when the sequences are played back in the order in which they occur within the HIV lifecycle, then the entire lifecycle animation plays, the buttons return back to their inactive brown state, the camera zooms out and the puzzle doors close. Now the light on the front door of the puzzle (inside the Syntech logo) has turned green. When the puzzle is complete, the base of the HIV puzzle swivels open and reveals a key which the learners can then pick up and add to their inventory.

Stages of the HIV puzzle

The HIV puzzle is first visible from a PEF file. When the learner clicks on the HIV model from the PEF file, the puzzle is called.

When the puzzle runs, the following should occur:

1. When opened the `HIVopenPuzzle.avi` is run.
This avi takes the learner into the projection of the puzzle and shows for the first time the projection of the rotating nuclear contents within the model. The gp120 proteins now light up and should be ready for activation by the learners when they are clicked on.
2. When the learners click on a green button the sequence linked to that button plays. The order of the clicks that occur must be tracked so that when the learners click on the buttons in the correct consecutive order, the puzzle can be flagged as solved.
3. The buttons are linked to the sequences as indicated in figure 1.
4. When the puzzle has been flagged as solved, the `HIV closePuzzle.avi` file is run.
5. The learners can now pick up the key from the base of the HIV puzzle and then exit the puzzle back into the PEF file (Figure 2).

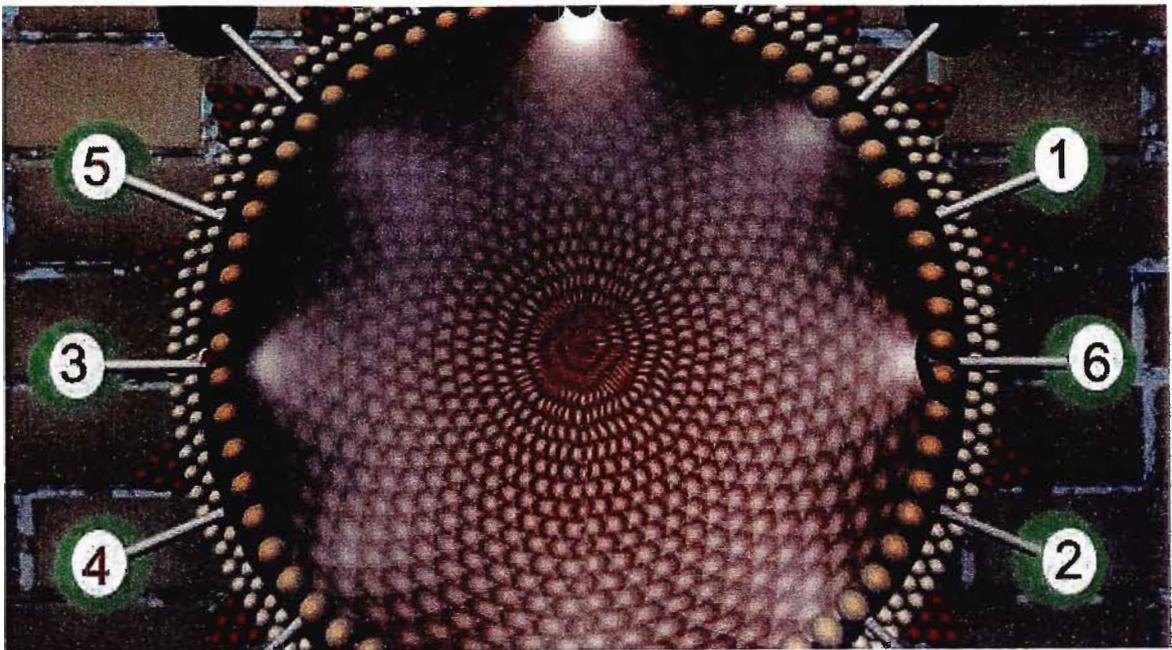


Figure 1: The gp120 proteins on the side of the HIV model are randomly linked to the sequences that shall be played when they are clicked.

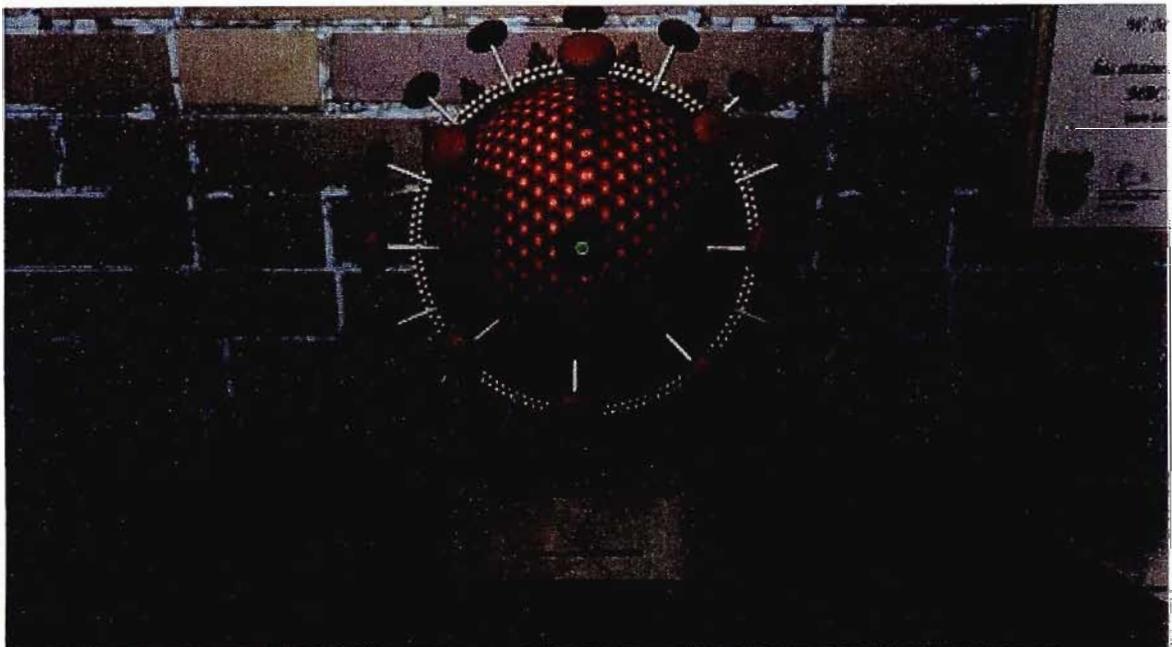


Figure 2: When the HIV puzzle has been solved, the base of the 3D model rotates open exposing a key for the learner to be able to add to their inventory by clicking on it.

Bridge Gate Puzzle

Preamble

The purpose of this puzzle is to emphasise the fact that there is a window period associated with the testing and detection for HIV antibodies. This puzzle strive to let learners know that anywhere between 3 and 6 months after initial HIV infection they may be incorrectly found to be HIV negative. This is due to the titre of HIV antibody in the patient not yet having reached the lower limit of what is detectable in the HIV tests. Some of the complexities of the tests used are covered in other puzzles in the lab. This puzzle requires learners to enter the approximate window period time before the gate leading to the medical tent can be opened. Until this puzzle is solved, the learner cannot progress into the medical tent.

Puzzle design

The design of the puzzle interface (Figure 1) suggests two main themes, these being time and HIV. The HIV motif can be found in the main light source for the puzzle (the HIV globe in the center of the interface) as well as the background patterns around the light source. These background patterns echo the amount of HIV in the blood and relates the concentration of HIV to the time of the window period.

The time scale for the window period is suggested by the use of different phases of the moon arranged in a traditional clock theme (i.e. the smallest moon segment aligns with 1 'o clock and the full moon with 12 o' clock). The moons themselves in this puzzle refer to months.

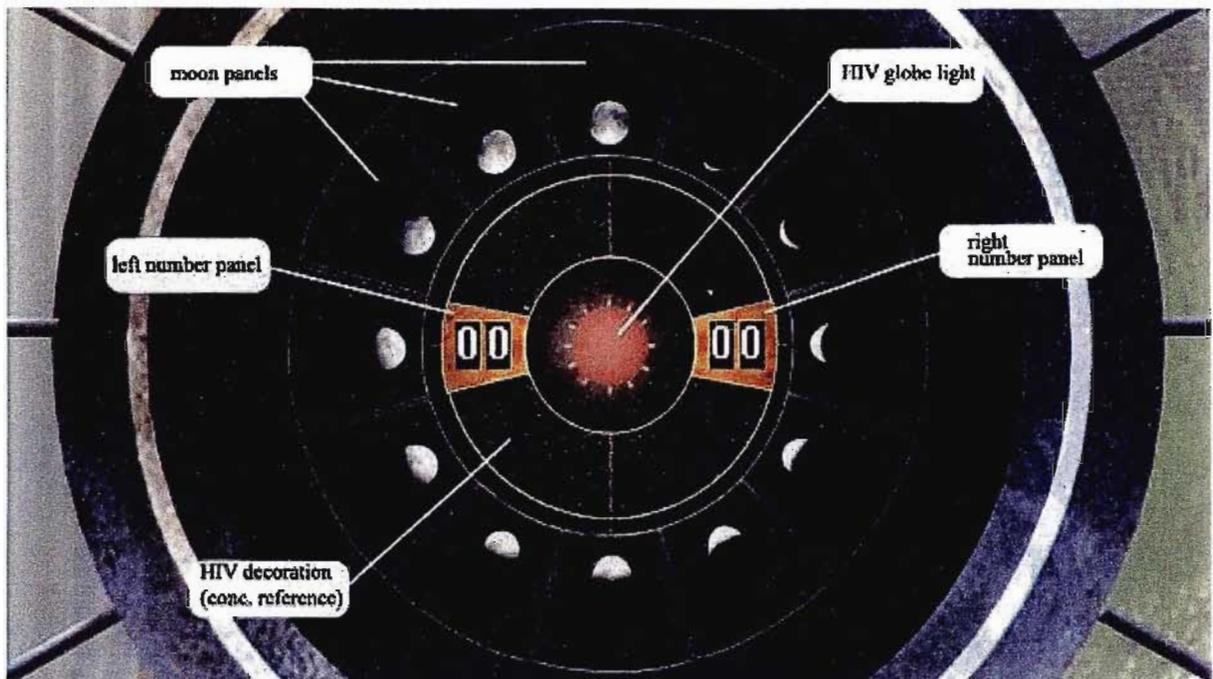


Figure 1: The interface for the bridge gate puzzle. The puzzle area consists of an outer panel where the moons sit. Each of the moons is situated on a separate panel which, when selected, is illuminated. The inner area of the interface consists of two selected panels (housing numbers) and a decoration panel showing the amount of HIV relative to the window period time. The centre of the interface is the HIV globe which provides a themed light source for the puzzle.

Puzzle process

When the player first approaches the area where the puzzle is situated in the portal they see the bridge gate itself. The puzzle interface is situated in the middle section of the gate (the centre of the HIV motif on the gate)(Figure 2). When they click on the gate, the puzzle begins with a close-up of the middle globe of the gate opening up to reveal the puzzle interface.



Figure 2: View of the gate and contained puzzle from a distance.

When the interface is exposed and ready to operate, the following procedure should be followed:

1. The learner should first activate a number panel by clicking on it. When a panel is activated the light on the panel edging lights up and glows (numbers are both set to '00' by default)(Figure 3a).
2. After activating a number panel, whenever the learner clicks a moon panel, the number associated with that moon panel is then displayed in the activated number panel (Figure 3b).
3. When the learner first activates the left number panel and then selects moon panel number 3 (3 o'clock position) both the moon panel 3 and the left number panel glow red, indicating that a change has taken place (Figure 3c). When the learner then activates the right number panel and thereafter clicks on moon panel number 6, both the right number panel and the moon panel 6 glow red. When both the number panels have been activated and show the correct numbers, the puzzle has been solved.
4. When the puzzle has been solved, an animation plays which starts out by highlighting the decorative area which constitutes the window period on the time scale (Figure 3d). Once this has been done, the camera view draws back out of the puzzle interface and then watches the gate swing open, allowing access to the medical tent area (Figure 3e).

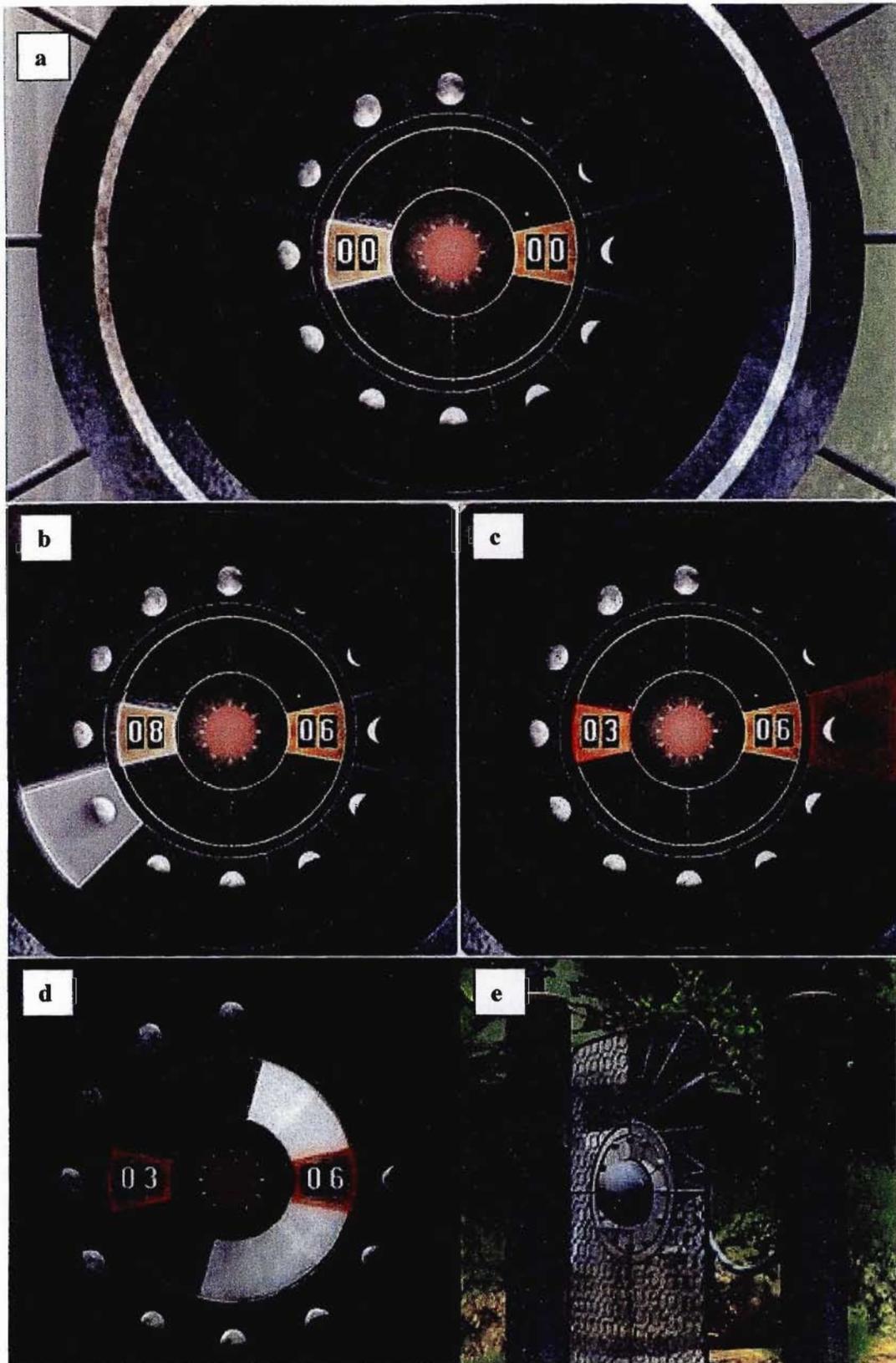


Figure 3: (a) Figure showing an activated (left) and inactivated (right) number panel. (b) Figure showing moon panel number 8 selected and the corresponding number showing on the activated left number panel. (c) Figure showing the correct combination having been selected for the moon panel and the left number panel. The moon panel and the number panel glow red. (d) After the puzzle has been solved, the time period for the window period is

highlighted with white panels in the decorative area of the interface. (e)
Diagram showing the bridge gate standing ajar allowing the learner to continue into the medical tent area.

ELISA HIV Test Puzzle

Preamble

The purpose of this puzzle is to show learners the complexity associated with testing for HIV/AIDS. The test mechanism used here is the Enzyme Linked Immunosorbant Assay (ELISA) which is commonly used to conduct AIDS tests. In medicine today a number of different tests are used in conjunction with one another when the blood sample has tested positive for HIV. This puzzle aims to show learners some of the background behind the testing procedure regarding HIV and relates this testing procedure to the biology of the HI virus, once again linking AIDS to something more concrete than myth or superstition.

An added layer of complexity with testing for HIV/AIDS is that there is a typical window period associated with the infection. During this time (from 3 – 6 months after initial infection) antibodies to HIV are not yet detectable in the blood because the level of antibody requires time to respond to the increasing HIV count within the body. This is an important consideration when getting tested for HIV infection – a negative result obtained within the window period is a false negative and can adversely impact the way infected people handle the disease and make their life decisions.

This puzzle presents information to the learners by the way of a operation manual for the ELISA plate reader which also provides some clues as to the antiretroviral testing that is occurring in the portal. The puzzle manipulation interface itself deals with the window period and the way in which this can affect the results of an HIV test.

Puzzle process

Dr Meisner has left a note (Post-it) stuck to the clipboard where the results are normally stored for the HIV tests. This note explains that during the recent reorganisation of the samples fridge where the blood is normally stored, the

labels from two of the patients ELISA plates fell off. The note also tells the learner that they can deduce which label belongs to which ELISA plate based on previous test results for each patient, the test results for each of the ELISA plates, and the time at which the blood samples were taken for testing. The only label remaining on each of the plates is the date on which the sample was taken.

In order to solve this puzzle, learners need to have access to the previous test results for the two patients concerned. In addition they need to be able to test the HIV status of the plates using the ELISA reader, and finally they need to be able to make the connection between the dates and the HIV status of each sample before they can deduce which patient the test plate belongs to.

Puzzle interactions

Figure 1 below shows the interface for the ELISA reader puzzle. Similar to the TB puzzle interface, items need to be moved by learners while interacting with the puzzle. Namely, both ELISA plates need to be moved to the open tray of the ELISA plate reader, the patient labels and diagnosis labels need to be moved to the ELISA plates when they are in their default positions, and the HIV key (obtained from the HIV 3D globe puzzle) needs to be 'inserted' into the keyhole of the ELISA reader to activate it. To provide feedback to the learner while using the ELISA plate reader, the screen of the ELISA plate reader informs the learner of what is happening while it is in use and also gives learners hints at how it should be operated.

Table 1 below lists the individual interactions that need to take place during the course of the puzzle being solved and names the files to be used for these interactions.

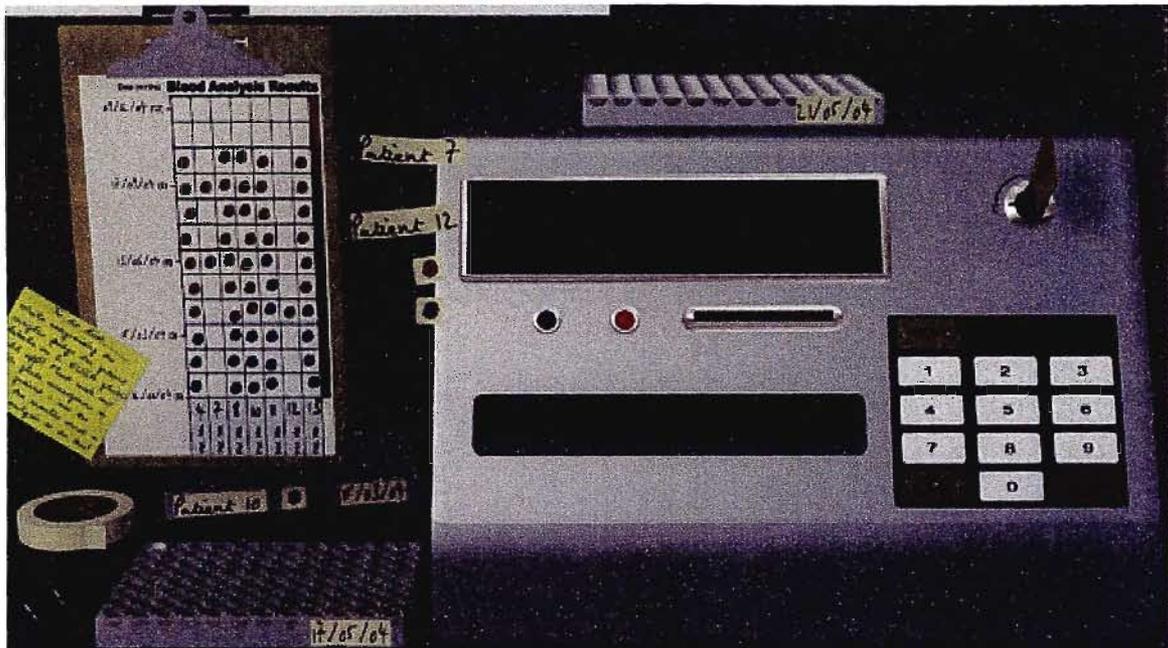


Figure 1: The interface for the ELISA reader puzzle. This puzzle requires learners to associate the patient name and status labels attached to the side of the ELISA reader to the correct ELISA plates positioned on the screen before the puzzle can be solved.

The puzzle should be flagged as solved when the following has occurred (Figure 2):

1. Patient 7 label has been placed on ELISA plate 2
2. The blue dot has also been placed on ELISA plate 2
3. Patient 12 label has been placed on ELISA plate 1
4. The red dot has also been placed on ELISA plate 1



Figure 2: Figure showing what the interface should look like once the puzzle has been solved. The labels have been correctly placed on the ELISA plates, the ELISA reader machine is off and the HIV key has been rotated to the off position.

When the puzzle has been solved, the ELISA reader machine should produce an HIV image slide from one of the front slots on the reader and the machine should then turn off (key rotates to the left signaling that the power has been turned off, but the key stays in the slot and is not retrievable again – not needed again).

HIV Transmission Puzzle

Introduction

This puzzle aims to help learners put knowledge concerning the transmission of HIV that is found in the game into a framework which identifies effective strategies for halting the spread of HIV. The puzzle identifies two levels involved in the spread of HIV, namely the transmission (the puzzle names the ways in which HIV is spread) and prevention strategies.

The puzzle rests on the premise that Meisner has told Carua to make a pictorial poster detailing ways in which the villagers can stop the spread of HIV within their village. All the pictures necessary to create the poster have been cut out and it's up to the learner to organize these into a plausible structure. Open slots have been left into which the pictures can be inserted.

Puzzle interface

The puzzle interface is in the form of a poster lying on the lab workbench (Figure 1). The learners must drag the correct images into the correct slot in order to solve the puzzle. The pictures are split into 3 categories, namely the transmission of HIV, the prevention and the propagation of HIV. Learners are required to identify the ways in which HIV is spread and then distinguish between strategies that would stop the spread and those that would propagate the spread.

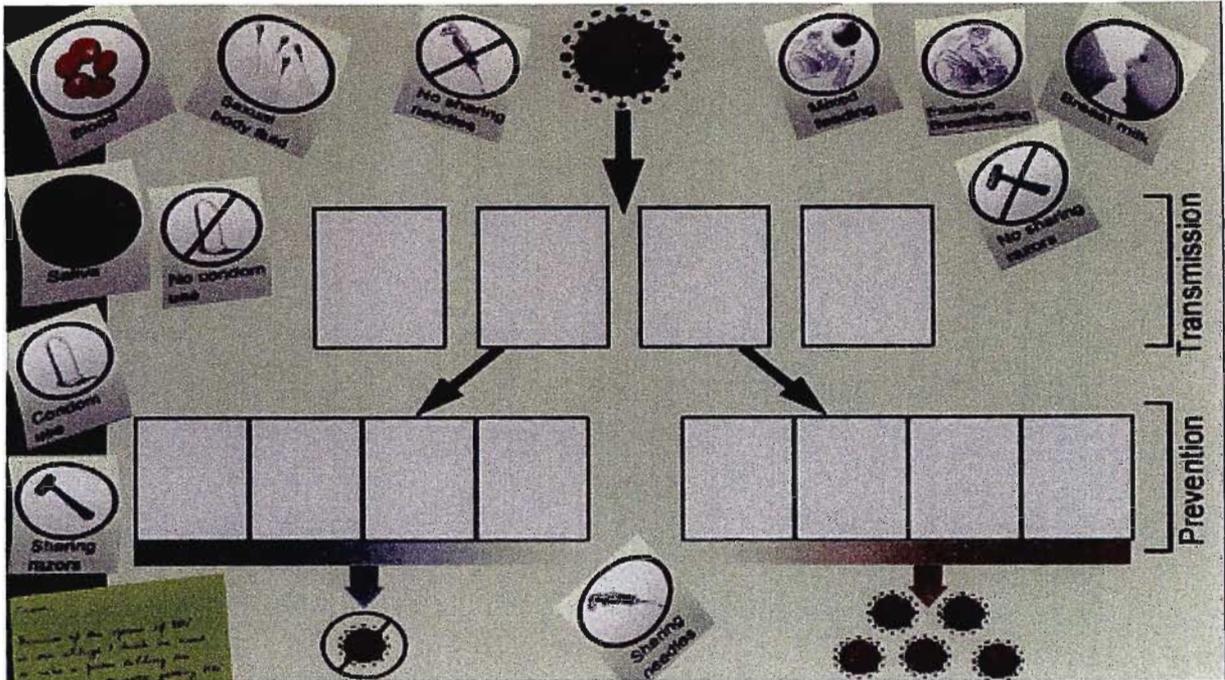


Figure 1 The interface for the HIV transmission puzzle.

The three different categories are expressed in the 3 main areas of the poster (Figure 2). The pictures belonging to each category should be capable of being placed in any slot within that category (i.e. each picture can have 4 possible correct slots). The prevention and propagation slots are also smaller than the transmission slots. This was done on purpose to help the learners differentiate between these categories.

When learners click on and hold down the left mouse button over the instructions in the bottom left of the puzzle interface, a large version of the instructions should display closer to the camera (Figure 3).

When all the pictures have been placed in the correct categories, the HIV key motif plays and the final key quarter appears in the player's inventory.

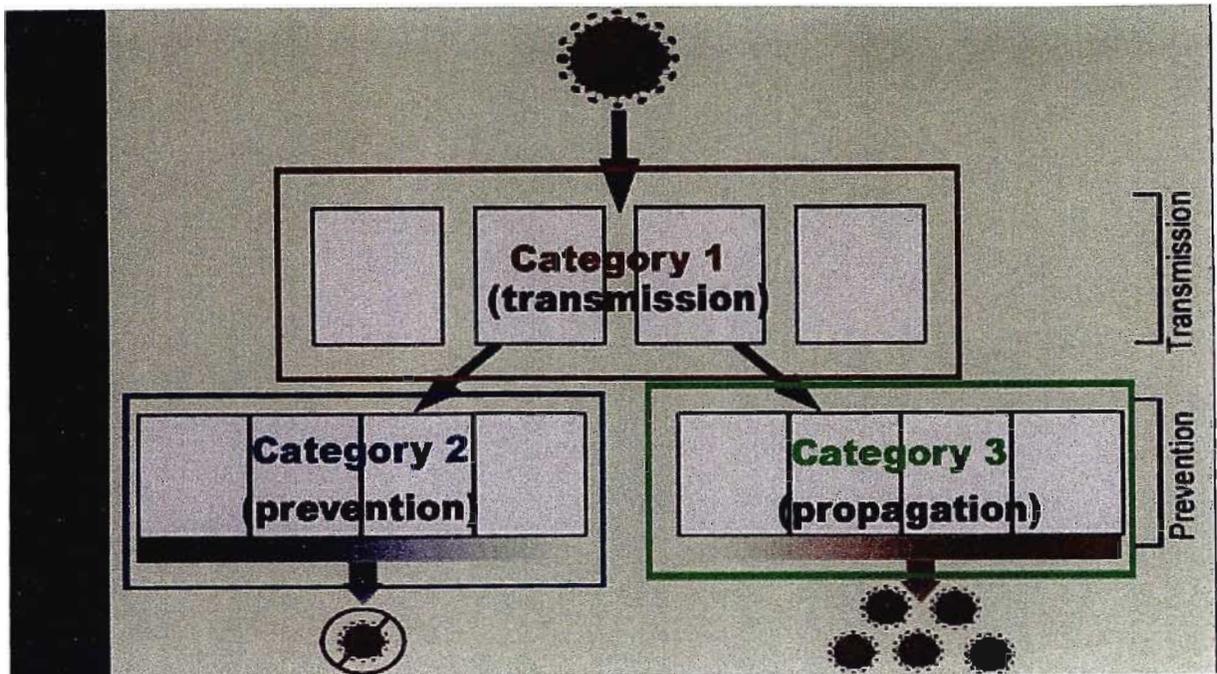


Figure 2 Different categories in the poster.

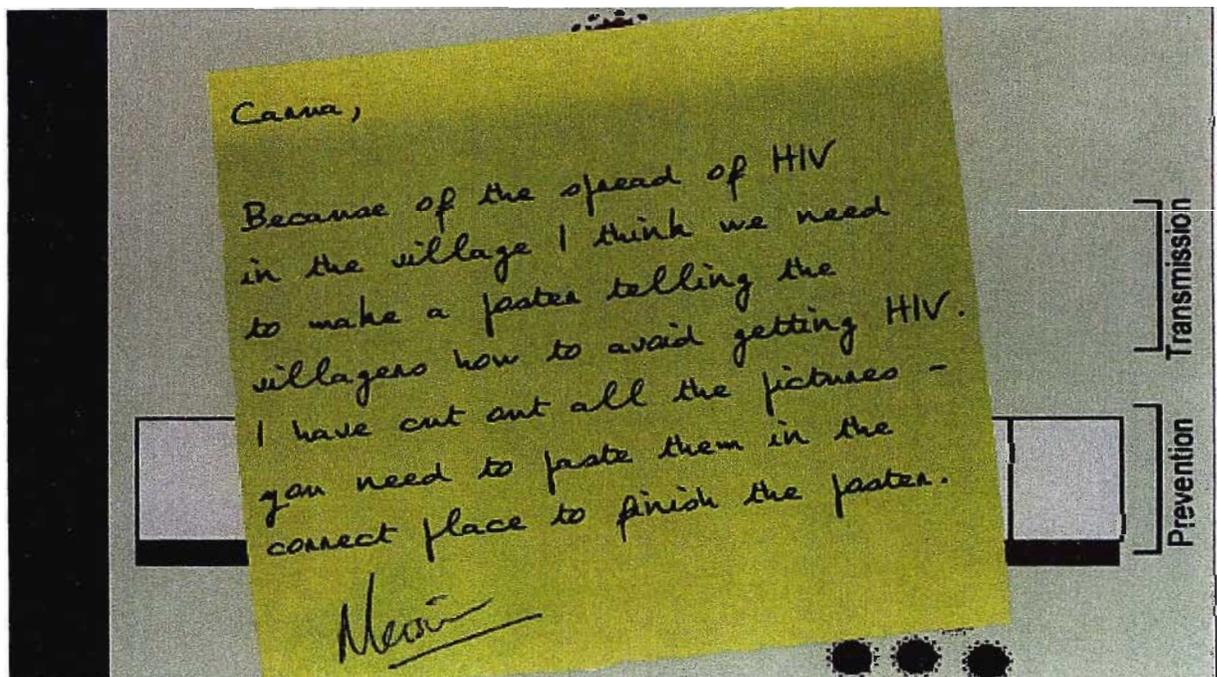


Figure 3 The instructions for the HIV transmission poster.

Malaria Puzzle

Preamble

The purpose of this puzzle is to help learners consolidate some of the information they have seen regarding malaria in the portal. Concepts included in this puzzle are linking the stages of the lifecycle to the symptoms which manifest in humans. A huge emphasis is being placed today on prevention of this disease and the puzzle also links prevention measures that can be used and are being used by researchers in an attempt to control the disease.

Puzzle process

In this puzzle learners are required to link the 3 different concepts together by using a picture panel display and a slider bar (Figure 1). The 3 concepts are displayed along the left side of the panel and pictures appear at random on the right side of the panel. What the learner needs to do is link the concept on the left to the appropriate image on the right. This is done by first clicking the selector button immediately to the left of the concept image, and then by dragging the slider on the right of the panel until it is flush with the correct corresponding image on the right.

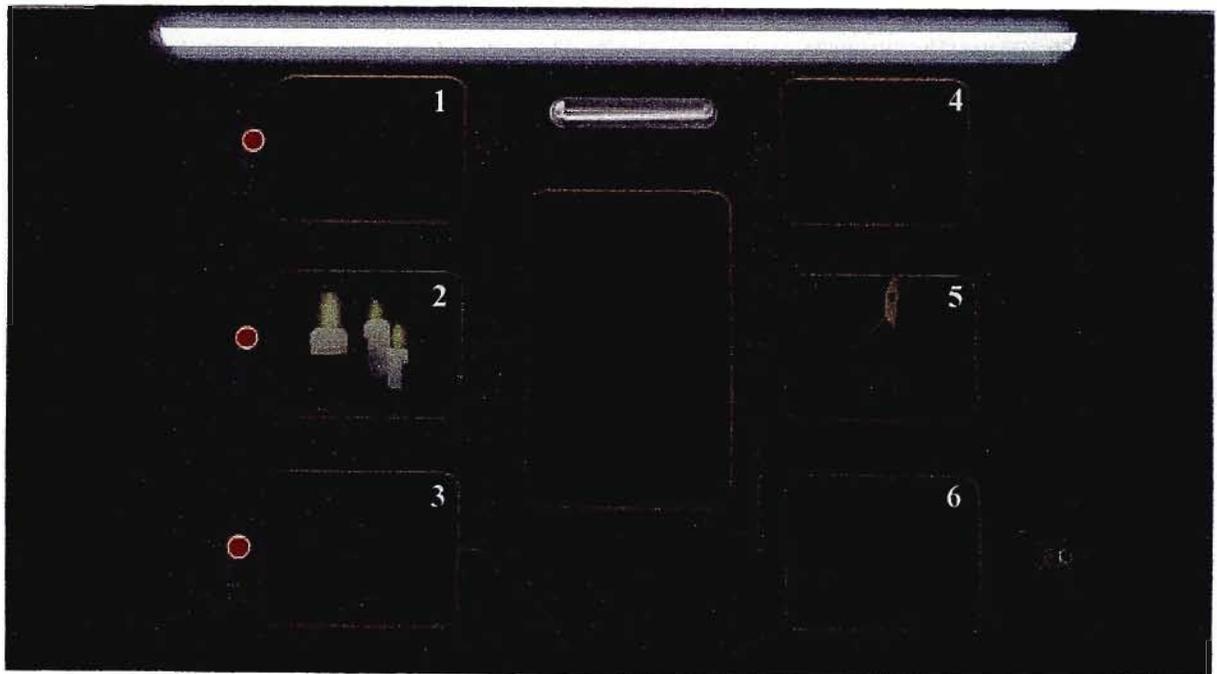


Figure 1: The panel display for the malaria puzzle. The concept images are displayed down the left side of the panel while the linking images are displayed in an unrelated order down the right hand side of the panel. Only

when a concept button on the left is selected does the slider area glow green. The pictures have been numbered for descriptive purposes.

With each combination of concept image and image chosen on the right, a shape is illuminated in the central screen area. When a concept is correctly matched with the corresponding picture then the shape that is displayed stays visible in the central console, even when other combinations are entered by the user. The purpose of this is that when the 3 concepts have been linked correctly the shapes that are displayed make up an outline of a merozoite – one of the asexual stages of *falciparum* in humans (this stage is important and distinguishable because it is directly correlated with the appearance of malarious symptoms).

Once the puzzle has been solved and the correct outline is showing, a picture of a stained merozoite fades in behind the outline, making it obvious that the outline refers to a biological agent. Immediately after this fading in of the image, a slide is ejected out of the panel interface which contains a picture of the merozoite. This is the malaria slide that is necessary for the solving of the final resolution puzzle.

When the correct combinations have been entered (i.e. comb16, comb24, comb35) then the complete tracing image is shown (Figure 2).



Figure 2: the combination of 3 different shape displays to give an outline of the merozoite image.

Tuberculosis Puzzle

Preamble

This puzzle aims to assist learners in making the connection that a biological agent normally invisible to the eye is responsible for causing tuberculosis. This realisation, coupled with the literature showing the hardy nature of the tuberculosis bacterium, should enlighten learners that TB can be found almost anywhere and although one cannot see it, one should always be aware of cleanliness and the possibility of contracting it. The puzzle also aims to show learners the morphology of a typical tubercle bacillus and, through this display, to again emphasise the morphological differences between viruses and bacteria. Finally, this puzzle gives learners an appreciation of the complexities of dealing with an invisible agent, and also provides insight into the methods used to diagnose tuberculosis. The procedure followed in this puzzle is in accordance with the World Health Organisation diagnostic procedures for tuberculosis, and also opens an avenue to alert the learners to the increasing level of multidrug resistant tuberculosis and the appropriate treatment to counter this effect.

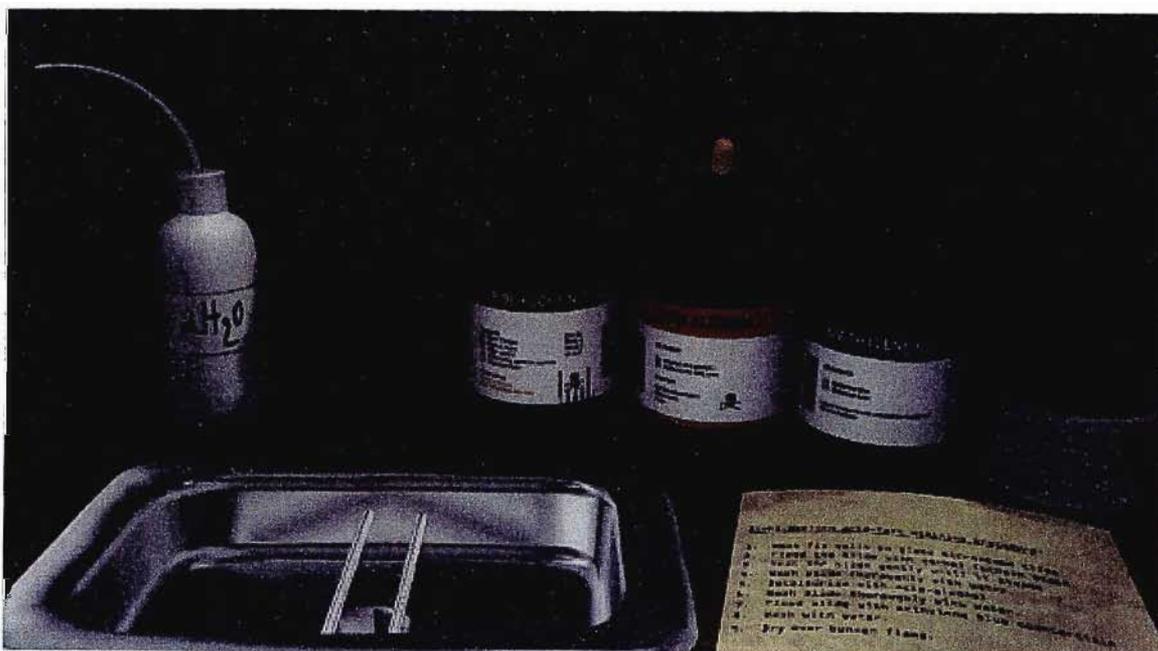


Figure 1: The puzzle interface for the tuberculosis puzzle showing the various stains and anti-stains, the Bunsen burner, distilled water and the instructions detailing the Ziehl-Neelsen stain technique used in the DOTS treatment strategy.

Mechanism of puzzle

In this puzzle the learners have to perform the Ziehl-Neelsen stain and counter-stain technique to make the TB bacterium on the slide visible. At the start of the puzzle it appears that nothing is on the slide located on the drying rails over the sink. The player has to read the stain instructions and then follow them accurately in order to solve the puzzle.

For this puzzle to be achieved, the following interactions must be possible:

1. The learner must be able to read the staining instructions while attempting the puzzle. By clicking and holding down the left mouse button over the instructions, a close-up of the instructions should appear. This should display the instructions directly in front of the learner (closeupStaining.bmp)
2. The learner must be able to click on each of the stain bottles. When a stain bottle is clicked, the dropper related to that stain bottle (identifiable through the colour of the dropper bulb and the colour of the liquid in the dropper) becomes available above the bottle. The learner should then click and drag the dropper to the slide in the basin. If the blue dropper is dragged to the slide, the pool of liquid displayed on the slide should turn blue. Likewise if the red dropper is dragged to the slide, the liquid colour should turn red and so on.
3. When the distilled water bottle is clicked, an animation is overlaid showing the distilled water bottle being poured over the slide in the basin. This is the only practical way to display this sequence. Once water has been poured over the slide the liquid on the slide should turn clear (waterslide.bmp).
4. The Bunsen burner is off by default. When the gas switch on the side of the Bunsen burner is turned on, an animation showing the burning flame is displayed above the Bunsen burner. When the switch is clicked a second time the flame animation disappears. To flame the slide, the learners must be able to drag the slide to the flame and hold it over the flame temporarily.
5. The learners should also be able to pick up the glass slide at any time and place it into their inventory. If, however, they pick the slide up before the stain procedure has been correctly completed, then nothing is outwardly visible to the eye on the slide. When the full staining

procedure has been followed, the slide can be seen to contain something. However, only on later inspection under the microscope can learners see the TB bacterium on the slide.

The procedure for the staining technique is:

1. flame the slide over the Bunsen burner
2. Pour Carbol Fuchsin on the slide
3. Heat slide over the Bunsen
4. Wash with water
5. Pour acid alcohol on the slide
6. Wash with water
7. Pour methylene blue on the slide
8. Wash with water
9. Heat fix over the Bunsen Burner

Viewing of the slide under the microscope

This part of the puzzle requires the players to step away from the original puzzle interface and to approach the microscope which is next to the staining apparatus on the table to the right. The learner is required to select the slide from the inventory and place it on the microscope stage.

When the player enters this puzzle, they are shown the default screen for this puzzle (microscope off – no slide.bmp). Because the user has a choice of either inserting their slide onto the stage of the microscope or rather turning the microscope on first without inserting a slide, a number of images can follow the initial default image for this stage of the puzzle (Table 3).

Once a slide has been placed on the stage and the microscope has been turned on, the learner must then look into the ocular lenses. If the staining procedure was correctly carried out, the learner can see some of the TB bacilli on the slide. A magnification reading also appears on the right side of the interface – 100x and 1000x magnification. The first magnification displayed is 100x. When the learner clicks 1000x, the picture they are seeing changes to a

close-up of one of the TB bacilli. This function relates the size of the bacillus to its morphology as well.



Figure 2: A view that the player gets when they look into the microscope and have placed a stained slide on the stage. This is the high magnification image of *Mycobacterium tuberculosis*.

Once the player exits the view of the microscope, if they had just viewed the correctly stained slide then a drawer on the side of the microscope opens exposing a picture slide for the player to pick up and place in their inventory (Figure 3). Once the slide has been retrieved, the animation showing the closing of the drawer plays.

If the player has not viewed the stained slide, the drawer remains closed and the player does not get an opportunity to retrieve the TB picture slide.

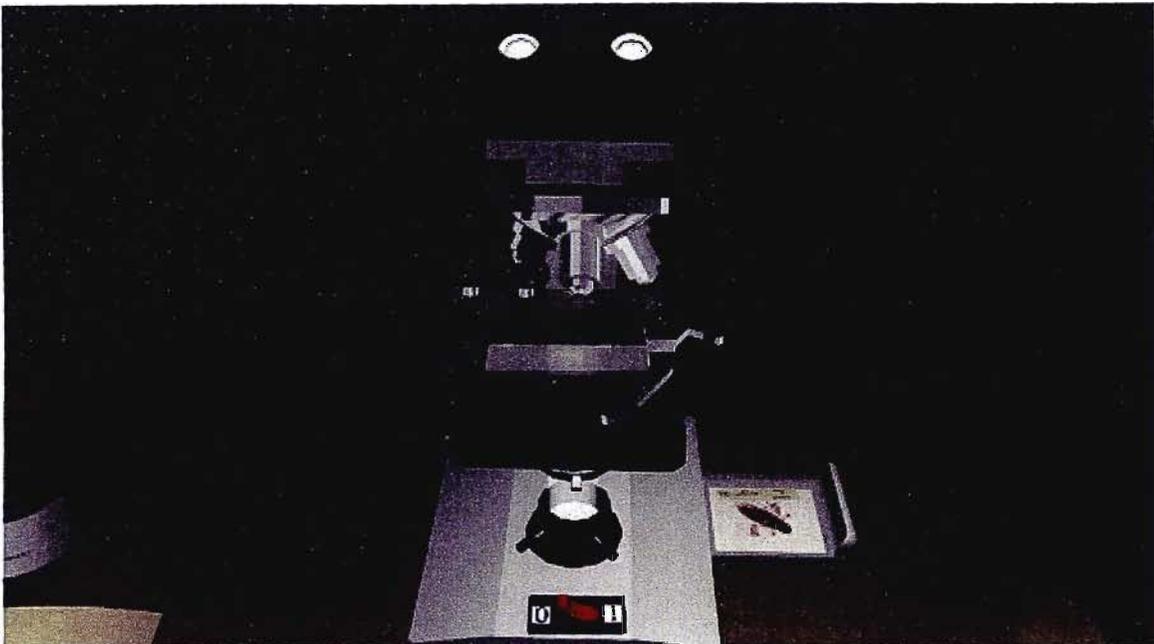


Figure 3: A hidden draw on the side of the microscope opens when the player has finished viewing the correct stained slide from the first part of the puzzle.

Resolution Puzzle

This puzzle is intended promote the linking of some of the concepts explored in the game, in particular the concept of immune dysfunction caused by AIDS and the link between this and the resultant opportunistic infections that are characteristic of the AIDS condition. The puzzle needs to be solved before the learners can open the storeroom door and progress to the final resolution of the game.

The learner is required to explore the game environment and, in the process of this exploration, to acquire certain items from different areas within the game. The player is required to collect 4 quarters of a master key which is needed to turn the puzzle on. In addition to the key parts, the learner is required to collect a slide shot from each major information domain within the game.

The four quarter keys are found in the following locations:

- Burning ground at the base of the tree
- Inside the cancer puzzle in the doctors office
- Inside the sangoma hut
- Inside the medical tent around the tuberculosis puzzle

The four slides are available to the learners from the following locations:

- HIV slide – from the blood analyzer machine in the laboratory
- Cancer slide – at the back of the cancer journal in the doctors office
- Malaria slide – after the completion of the malaria puzzle in the laboratory
- Tuberculosis slide – in the back of the book detailing tuberculosis information

Puzzle process

When the player encounters the puzzle they are faced with a blank interface (Figure 1). What the players are required to do is insert all the necessary key pieces into the key slot to turn the puzzle interface on. When this has been done, all the text entries read “none selected”. The players are now required to scroll through the different text captions and align the correct text name to the correct picture (e.g. picture of TB bacterium to the text reading “Tuberculosis”).

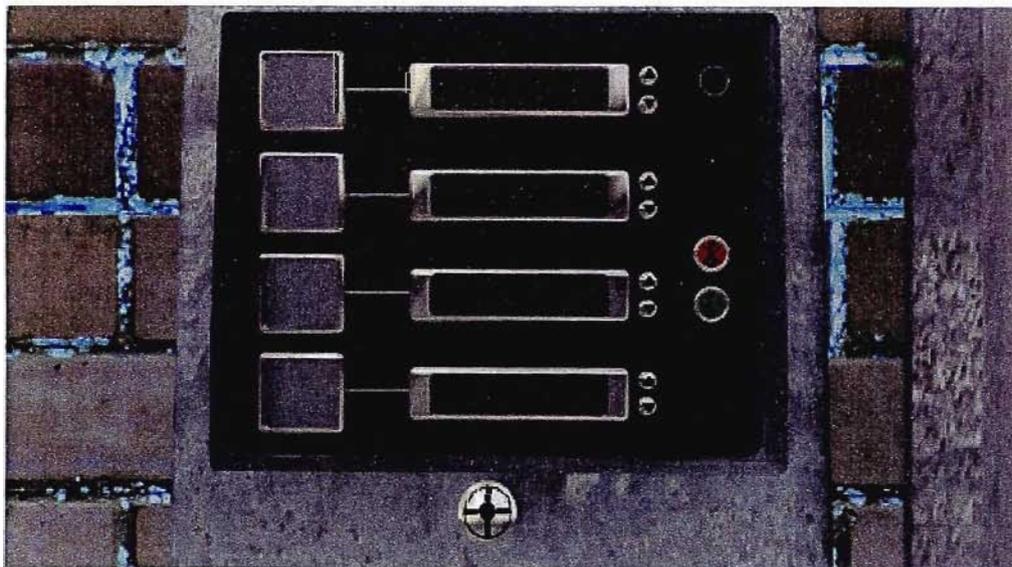


Figure 1 The blank storeroom puzzle interface.

In order to solve the puzzle the players have to put the HIV text in the top slot with the corresponding HIV slide alongside, before then listing the other opportunistic diseases in any order below (each with their corresponding slide next to the text) (Figure 2)

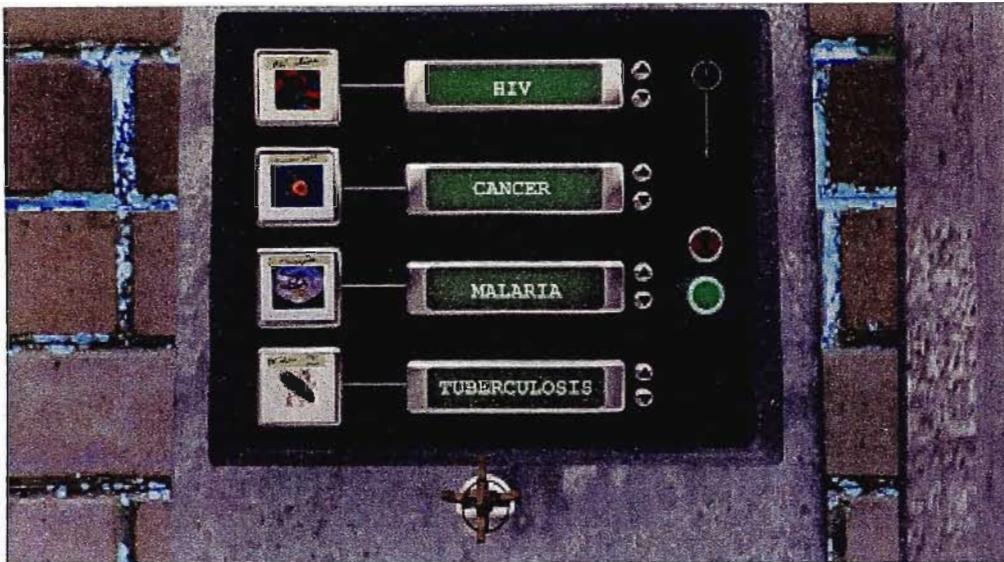


Figure 2 An example of a situation where the puzzle would be solved – the keys have been correctly inserted into the key slot and the diseases have been listed with HIV appearing first on the timeline with the other diseases and their corresponding pictures appearing after HIV on the timeline.

When the puzzle has been solved the green light glows and a sound of the storeroom door opening is heard. The player can then move back from the puzzle interface to see the storeroom door standing open allowing them access.

The final resolution puzzle requires the following steps to be completed:

1. Insert the complete key, piece by piece, into the key slot to turn the puzzle power on
2. Turn the top spinner so that it reads "HIV"
3. Insert the corresponding HIV slide into the picture slot provided alongside the HIV spinner
4. Turn the other spinners to anything except "HIV" and place the correct corresponding slides alongside the spinners in the picture slots.
5. When the puzzle has been successfully completed, the red light is extinguished and the green light illuminates. Out of the players line of sight the door to the store-room opens for the player to access the store-room.

APPENDIX II – CD-ROM CONTENT AND INSTALL INSTRUCTIONS

CD-ROM Content

The CD-ROM contains the Disease Portal from the VLS game: “gammaKhozi”. This section of the game incorporates the recorded compositions of this portfolio as intended to be played back in a computer game scenario. The CD-ROM also contains a link on the install page to a PowerPoint Presentation which demonstrates an alternative version of the compositions to the game, based on enhancements and additions to the audio engine of the original VLS game.

Minimum System Requirements and Install Instructions:

Minimum System Requirements:

Pentium 4 or Celeron equivalent PC running at 550Hz.

256 MB Ram

Windows XP Home or XP Pro with Service Pack 2 installed.

Direct X 9.0

Graphics card with min 4MB on-board Ram.

Sound Card.

CD-ROM drive.

600MB Hard Drive space.

Install Instructions:

1. Close all currently running applications.
2. Place CD-ROM in CD-ROM disk drive and close door.
3. CD-ROM disc is a self-install disc – “gammaKhozi” Install screen will appear.
4. If you do not have Direct X 9.0 or are unsure, select menu option number 3 before installing the game.
5. Select “Install gKhozi” from menu option 1.

6. To view the PowerPoint Presentation of "gammaKhozi Version 2", select menu item number 2. (Microsoft PowerPoint must be installed on your machine to view this.)

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