virtual tour to black holes

introduction

This semester we are assigned with installation project titled 'The Extension of Space' by Mark Guglielmetti for multimedia individual project. Then we were offered to join astrophysics' project run by Anita Kocsis in conjunction with Melbourne Museum VROOM enhancement and treatment titled 'Design Around the Corner'.

I decided to work on astrophysics' project, which is really interesting to learn about, and at the same time giving concentration to the space and its' installation possibilities. In this way, I wish to expand my interest in installation art, human interaction as well as astrophysics subject.

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Individual Project Semester 2, 2005

Master of Design (Multimedia Design)
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Faculty of Design, National Institute for Design Research

contents

SUBJECT MATTER

:: Astro project background

:: The aims

:: The Black Hole story

:: SWOT Analysis - strenghts, weaknesses, opportunities and threats.

:: Imagery collections

:: Video collections

contents

THE SPACE

:: Melbourne Museum VROOM background

:: The aims

:: SWOT Analysis - strenghts, weaknesses, opportunities and threats.

:: Imagery collections

contents

THE DESIGN

:: Concept outlines, approach and possibility

:: Aims

:: Audience

:: SWOT Analysis

DESIGN AND CONCEPT DEVELOPMENT

:: User interaction system structure
:: Touch panel stucture
:: Design look and feel
:: User experience look and feel
:: Design in details- Size and dimension
:: Colour and effects
:: Typography
:: Movie clips solutions- 3D Visualisation
:: Sound/Music solutions

DESIGN RESEARCH RECOMENDATIONS

:: Touch Screen- Material and component
:: Space in details- Stereo Screen (VROOM)
:: Safety considerations

contents

TECHNICAL ISSUE AND RISK
:: 3D Visualisation Issues

USABILITY TESTINGS

DESIGN INSPIRATIONS

PRELIMINARY DESIGN
:: Early ideas
:: Dial design process
:: Development of screen treatment/possibilities
:: Button design references
:: Star study and sketches
:: X3D experiments

PROJECT TIMELINE

CONCLUSION

BIBLIOGRAPHY

subject matter

astrophysics

ASTRO PROJECT BACKGROUND

Science is interesting, particularly with astrophysics subject. Science visualisations are remains sophisticated and complex that demands designer to visualise the important information with interesting art or media approach that needs to be engaging with their audience.

Science is so important that makes its information hardly to get simplified. Because its complexity, people tend to take for granted of their aims that are supposed to educate the audience.

the aims

THE ASTRO AIMS

The aims of having Astrophysics subject for this project is to deliver the space science information to audiences with simplicity but informative. Art and science subject is applied in this project is to preserve the essential information and present them with the aesthetic of design.

It is also important to be able to visualise, to a high standard of accuracy and quality, results from simulations and models of astronomical objects.

The benefits from Astronomy visualisation are:

. To guide the exploration of complex information, leading to new discoveries

. To immerse the viewer with the data through three-dimensional projection

. To improve communication of ideas and concepts, for research and education purposes

. To captivate the general public, inspiring a fascination in the Universe topic.

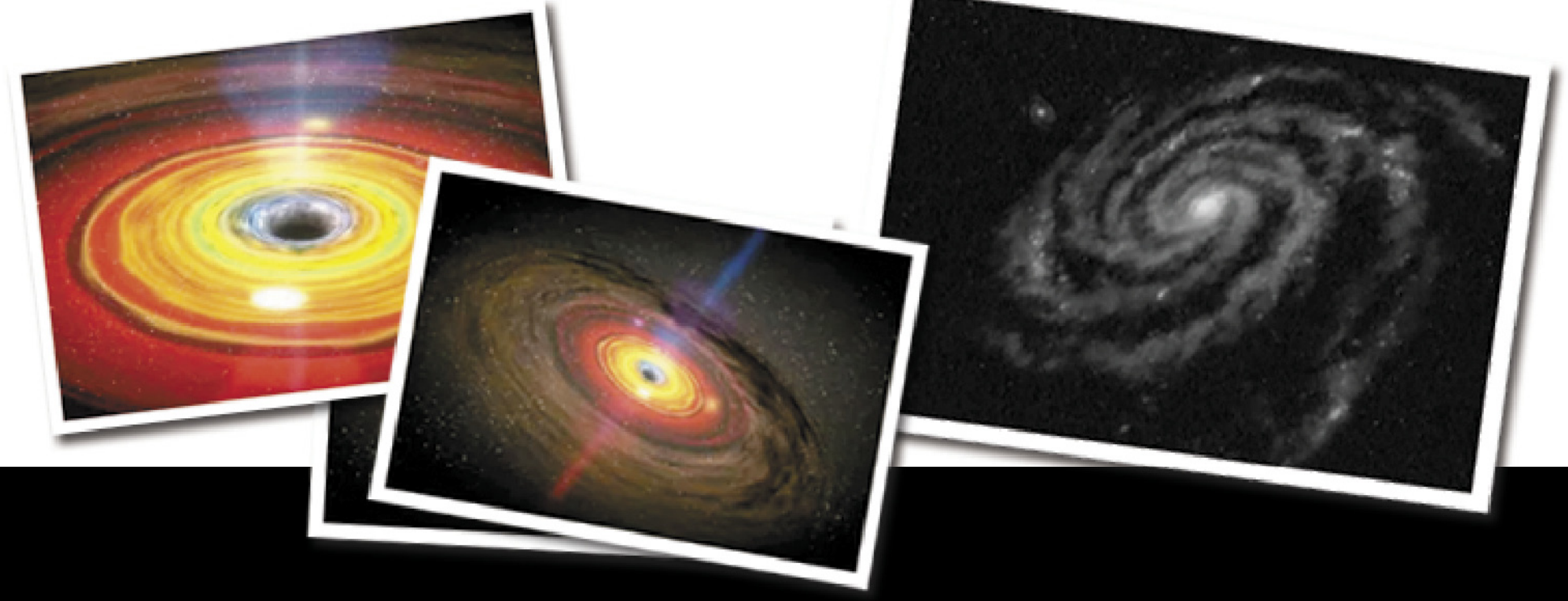
black holes

BLACK HOLES STORY

Black holes is the subject that I am interested to explore with this project. So what are they?

They consist of three sections. They are:

i. Black holes formation
ii. Black holes Anatomy
iii. Inside a black hole



FACTS ABOUT BLACK HOLES

. Black holes is the most bizarre objects in the Universe.

. They are the end state of the most brilliant objects in cosmos - giant star that go supernova.

. The super-compressed core that remains after the explosion has such strong gravity that even light cannot escape it - so the object is black.

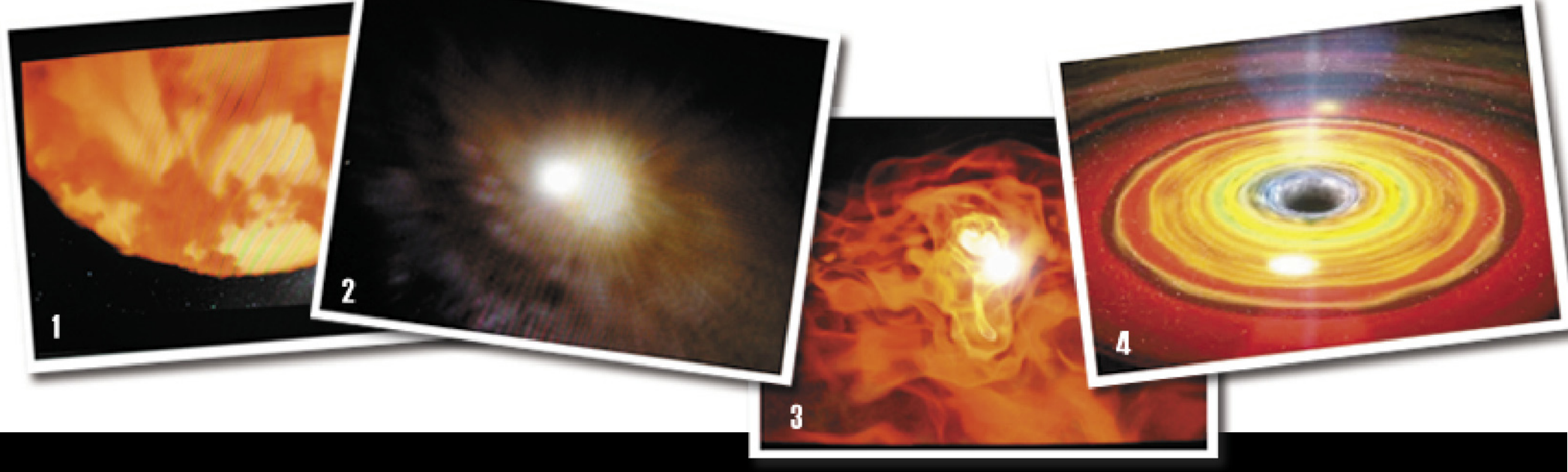
. Black holes are prison of light, where gravity is so strong that nothing can escape.

. Black holes distort space and time by the strong gravity that break down physics law at its centre.

formation
of the black hole

When supernova explodes, the star’s core is not always collapses to become neutron star.

If the collapsing core is heavier than three solar masses, even densely packed neutrons cannot hold up against gravity, and the star collapses completely to become a black hole.



THE FORMATION OF BLACK HOLES

1. SUPERGIANT
Dense core of supergiant made by helium, burning carbon and oxygen as fuel for making heavier elements like iron.

2. SUPERNOVA
An exploding supergiant that become supernova.

3. SUPERNOVA REMNANTS
Extremely hot exploded star’s remains. It can continue to glow for thousand years.

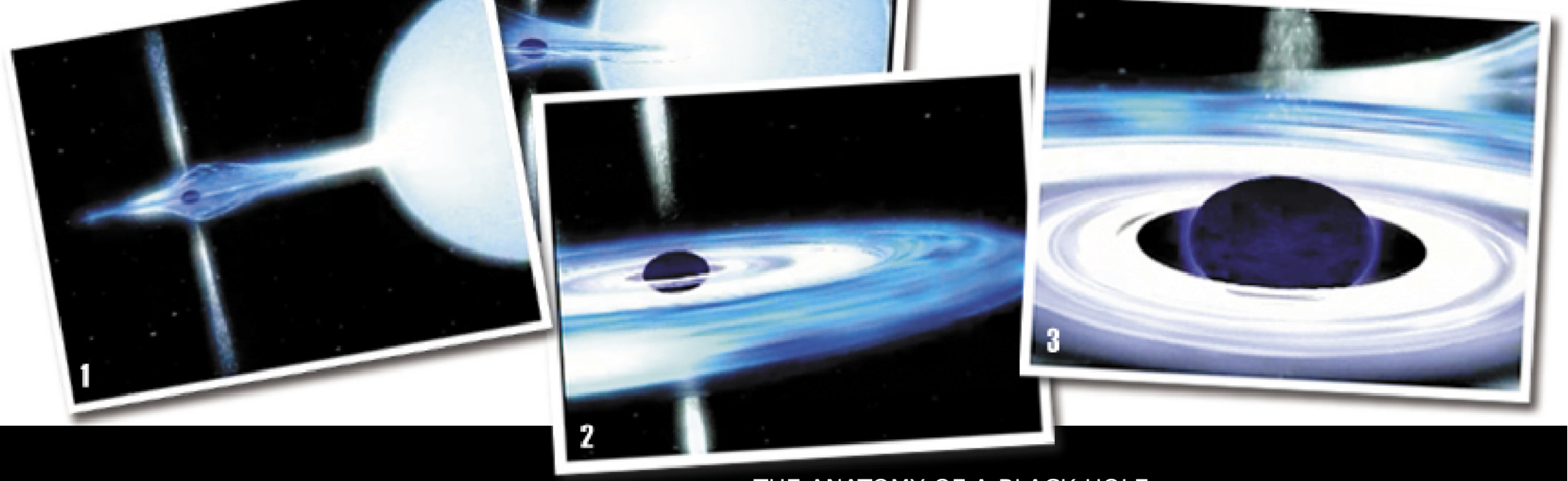
4. BLACK HOLE
Black hole forms from collapsed supercompressed core.

anatomy
of a black hole

Black hole can only be detected if they close to another star. Its powerful gravity pulls streamers of gas off its companion at high speeds.

The gas pours down forming a spiral vortex called an accretions disc.

The swirling gas is so hot that it glows fiercely. It can reach up to 100 million 0C and emit X-ray.



THE ANATOMY OF A BLACK HOLE

1. A blue companion star are being pull by a powerful gravity from the black hole.

. Gas forms a long streamer in high speeds

2. Gas pours down toward the black hole forming an accreation disc.

. Disc is dark and cold around edges. Black hole’s gravity heats it untill it glows nearer the centre.

3. X-rays emitted by supeerheated gas as it falls into the black hole.

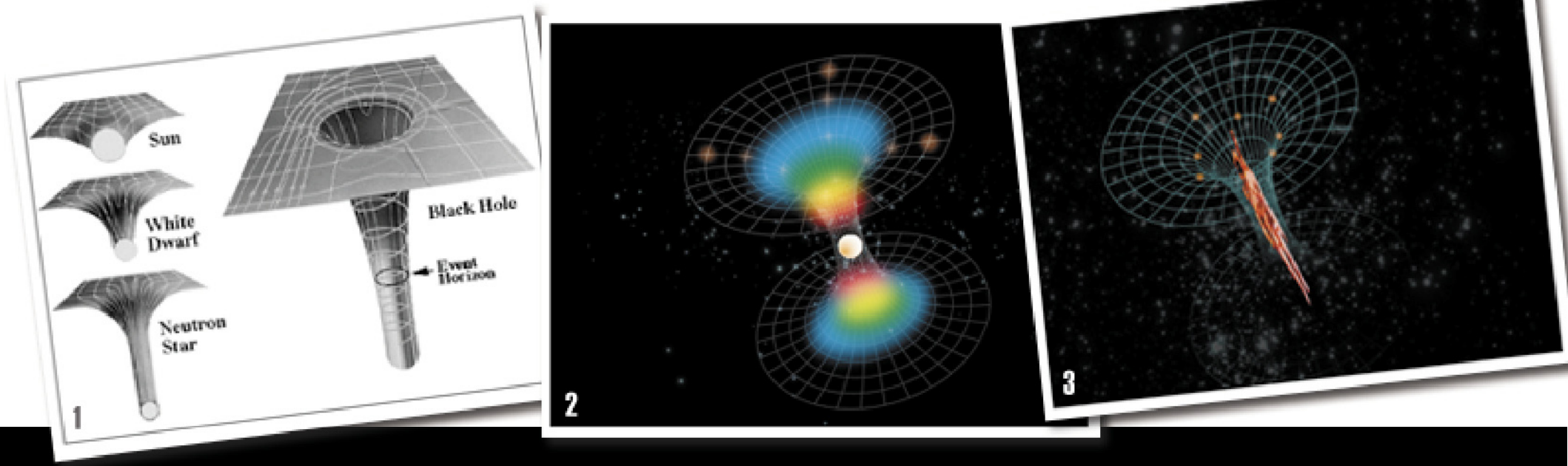
. Closer to the black hole, gas is heated to 100 million0C by the pull black hole’s gravity.

inside
a black hole

As no one can look inside a black hole, but mathematicians had explore them using Einstein’s theory of gravity-general relativity; a strange effects at the edge of the black hole and deep inside reveals.

Every object that falls into a black hole are spaghettified as the gravitational well is steeper.

The light and time is also distorted by the gravity. Massive star like a neutron star, distorts space according to Einstein’s theory.



INSIDE A BLACK HOLE (DISTORTION OF TIME AND SPACE)

1. GRAVITATIONAL WELL
Albert Einstein's theory of
general relativity - gravity is not really a force between objects, it is a distortion of space itself.

. Denser stars make gravitational wells, with steeper sides.

. The singularity at the center is surrounded by an invisible boundary called event horizon-where, light cannot escape inside it.

2. WORMHOLES
An artificial black hole, supported by some kind of antigravity substance.

3. SPAGHETTIFICATION
Objects that fall into a black hole are called 'spaghettified'.

. A fake astranauts falls with her feet first, the gravitational pulled her feet then her head.

. The gravity distorts light and time around the hole that turns the astronaut to red and her watch stopped.

SWOT

analysis of astro

ASTRO strengths, weaknesses, opportunities and threats.

STRENGHTS
Science subject has strong information facts. Subjects in science have gone through real experiment with their own formula from scientists. This is the strength of science subjects.

WEAKNESSES
Weaknesses are always appearing with the visualisations. Because scientists are not specialising in design principles and aesthetics they tend to apply poor visualization particularly with colour.

OPPORTUNITIES
The opportunities with science subject is art and design always could communicate science information through appropriate visualisations. Scientists and designers now can work hand in hand to produce exciting and engaging product through modern technologies offered.

THREATS
Because science professionals like mathematicians, scientists, doctors and other work around the rigid formulas and numbers, this environment always found dull by designers. It is also about self-preparation of working with scientists that designers are required to self-packed with science knowledge such as mathematics and physics.
The high demands from science fields make designers anxious to join them.

1. supernova remnants
2. su[erheated cores
3. star cluster
4. nebula and pulsar

the space

MELBOURNE MUSEUM VROOM

The space for this augmented project is Melbourne Museum Virtual Room (VROOM).

The Melbourne Museum Virtual Room is an innovative visualisation space for interactive and immersive environment exclusively for 3D stereoscopic visualization. It is consist of eight screens panel shaped in octagon. At this stage, it allows passive interaction with the audience.

The Virtual Room is not just about education and entertainment; it represents the latest in scientific visualisation technology and introduces the public to stereoscopic visualisation through the third dimension (depth) to create an immersive environment for visualisation of 3D datasets or images.

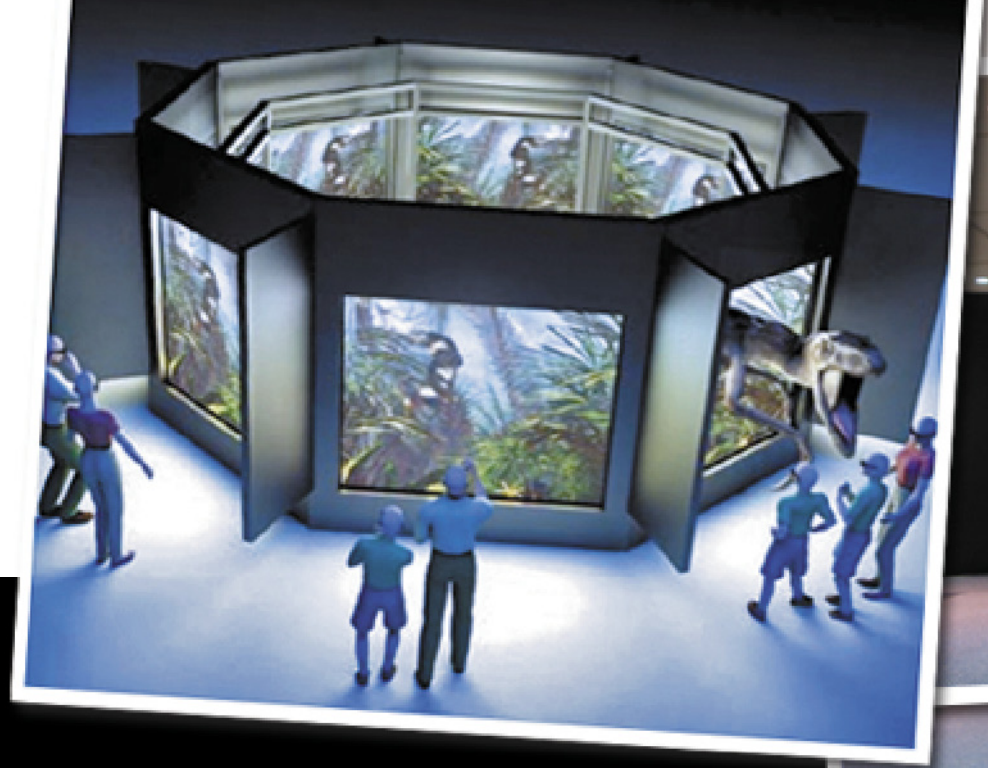
the aims

THE VROOM AIMS

The stereoscopic visualisation allows a perception of depth, which cannot be achieved with conventional 2D rendered images.

Therefore it allows many benefits in analysing complex datasets and realistic perception of real life scenes especially in science subject.[1]

1.http://vr.swin.edu.au/index.php?show=vroom



THE VROOM AIMS

The stereoscopic visualisation allows a perception of depth which cannot be achieved with conventional 2D rendered images. Therefore it allows many benefits in analysing complex datasets, realistic perception of real life scenes.
Other aims are:

. To allow audiences to experience the virtual world thorough a changing perspective as they walk around whatever is contained within the Virtual Room.

. Allow audiences to experience 3D stereoscopic visualisation through science subjects.

. Enhancing participants learning experiences and to encourage them to pursue careers in science and technology.

. To change the way people see things. Allow people see around, above, below, and through digital objects and moving images as they explore the display.

SWOT

analysis of vroom

VROOM strengths, weaknesses, opportunities and threats.

STRENGHTS
The VROOM is known as the most public attraction at Melbourne Museum. The combination of art and science of its immersive environment is the way it allows participants to experience a new way of seeing things. Which are great.

Things are display in third dimensional to allow users to see the depth. These are called stereographic visualisation where all complex data and information can be reach through the immersive 3D presentation.

WEAKNESSES
In my observation, the weakness of the Melbourne Museum VROOM is that the room is small that makes the audience feel uncomfortable to be in the room longer than 10 minutes.

The rooms is also dark without a safety light that always drives audience to not wonder around the room instead of just sitting at one spot and then walk off the room. It also resulted children with minor accident when they hit to other audiences or the screen partitions while trying to walk around the screens.

OPPORTUNITIES

The opportunities that could be consider by VROOM in order to achieve their aims are:

. Having more than one VROOM or a bigger space for user convenient.

. Consider having user interaction for example remote control or motion tracking device for the users to create engaging experience.

THREATS
IMAX is the threats for this conventional VROOM. It been said, the entertainment qualities have been exploited by main stream vendors such as IMAX. [2]
Compared to VROOM, IMAX obviously has the entertainment quality with a convenient number of sittings just like the ordinary cinema. With IMAX 3D is another new dimension to the whole electrifying experience.

Using state-of-the-art electronic headsets, complete with infrared sensors to detect the left and right eye images, the IMAX 3D experience has brought 3D enjoyment a long way from the cardboard glasses of the 1950s. The images are bigger with sharper 3D. And the sound are better .The IMAX experience is the future of film entertainment.[3]

2.http://vr.swin.edu.au/index.php?show=vroom
3.http://www.imax.com.au/about.asp

the design

CONCEPT OUTLINES

The idea is to have an Interactive Touch Panel designed for the screen to allow user interaction in relation with the moving images on the stereo screens.

It is a device designed to enhance the immersive experience to the existence stereo screen. Because if it technically configuration, user interaction device must be place at all 8 windows.

With the finger-operated touchscreen applications it is expected to assist the audience to get a depth understanding of the astronomy content.

Through their participation, the concept is hoped to interpret the information in a closer way with their own command – using interactive touch panel to browse content and rotate, panning, zooming the movie with their own wish.

the aims

DESIGN AIMS

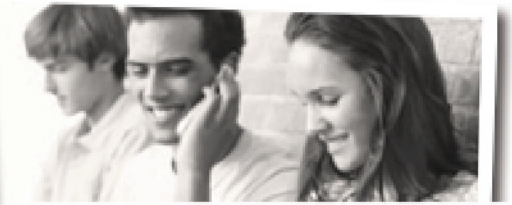
. Enhancing user interaction through interactive media for Melbourne Museum VROOM.

. Emphasizing stereoscopic 3D visualization through interactive approach in order to deliver complex information to the audience in depth.

.Reaching the audience with limitless technology through their participation and understanding.

. Investigating the possibilities of designing interactive interface to the stereo screens.

audience



TARGET AUDIENCE

General public audience is the main target particularly kids and adult at age 7 to 50.

Users with understanding of simple International English- in order to navigate through the interactive touch panel.

Kids 10-16 years old
Teenagers 17-21 years old
Adult 22-60 years old.

SWOT
analysis of design

DESIGN RECOMENDATION strengths, weaknesses, opportunities and threats.

STRENGHTS
Interactive touch panel is designed to deliver complex information especially with 3D visualization to the audience in a closer way. The strength with this interface is user now could navigate and also interact with the moving image by them self instead of being passive spectator to the VROOM. It is just like browsing a large web site in real time virtual 3D environment.

WEAKNESSES
Because the panel is proposed specifically for astrophysics material, all content is permanent. Content changes and updates are always taking into account in future design.

OPPORTUNITIES
The opportunities that can be seen in this Interactive touch screen is to apply them commercially to science and technology project as a mobile navigator or a joy pad for immersive 3D project that could be installed at any project site. With the material proposed, the electrodes patterned can always be plan according to the desired interface design.[4]

THREATS
This Interactive touch screen is costume made specially for this project, the threat is always with the existing conventional touch screens that has been in the local market.

4. http://www.qprox.com

design & concept

development

It is designed to have sleek but informative interface to cater all kinds of users from non computer literate to professionals.

As mobile installations that sit in front of the stereo screen, the touch screen is designed to be translucent with white visual cue surface. As the result of being translucent, the touch screen is not distracting the users and hide finger-prints and reduce glare.[5]

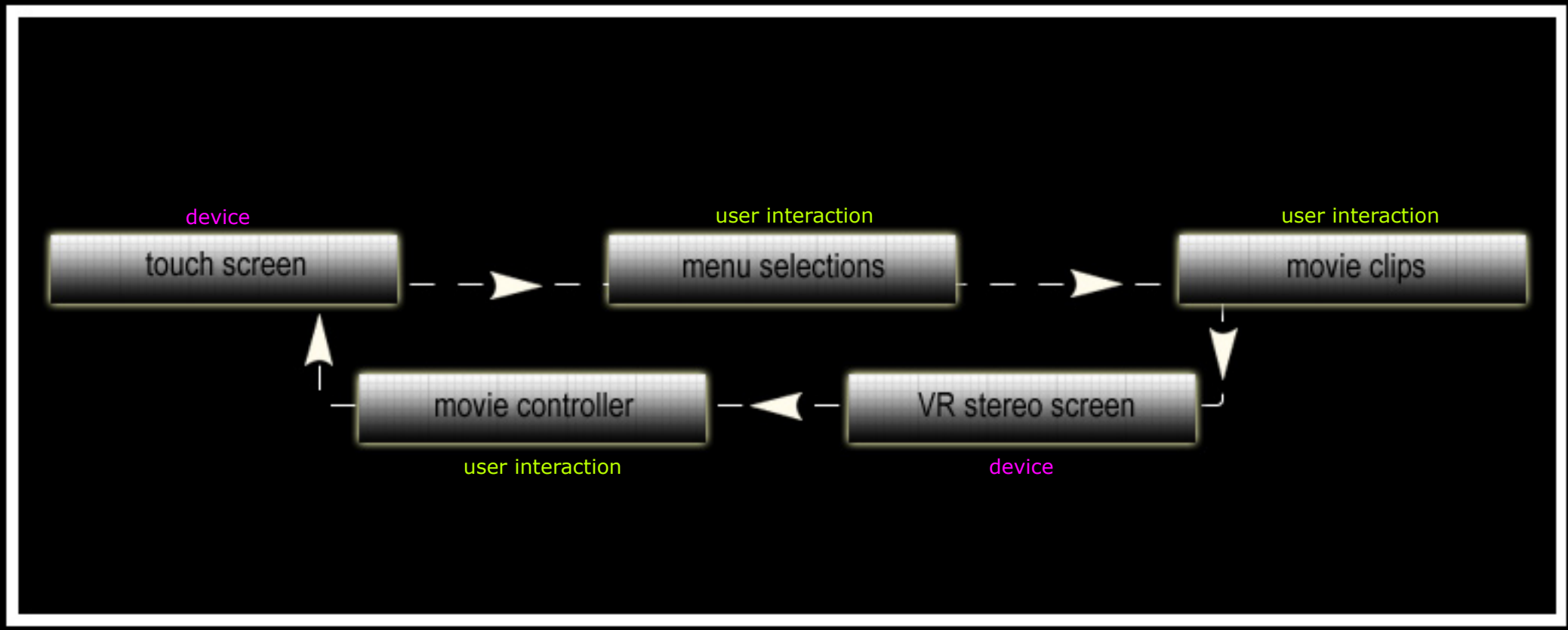
Because the room is dark the only light source is from the stereo screen, therefore users can still read and work with the panel with or without using the stereo glasses.
This is because the stereo glasses mechanism is only working on stereo screen.

Instruction by hierarchy is place in every section to allow the user follow the instruction without getting lost. However, hidden user guide is still embedded with this panel in 'Help' section on upper right hand side.
Topic selections, movie clips, movie controllers, help and volume are placed in sensors touchable area.

5.http://www.sapdesignguild.org/resources/TSDesignGL/

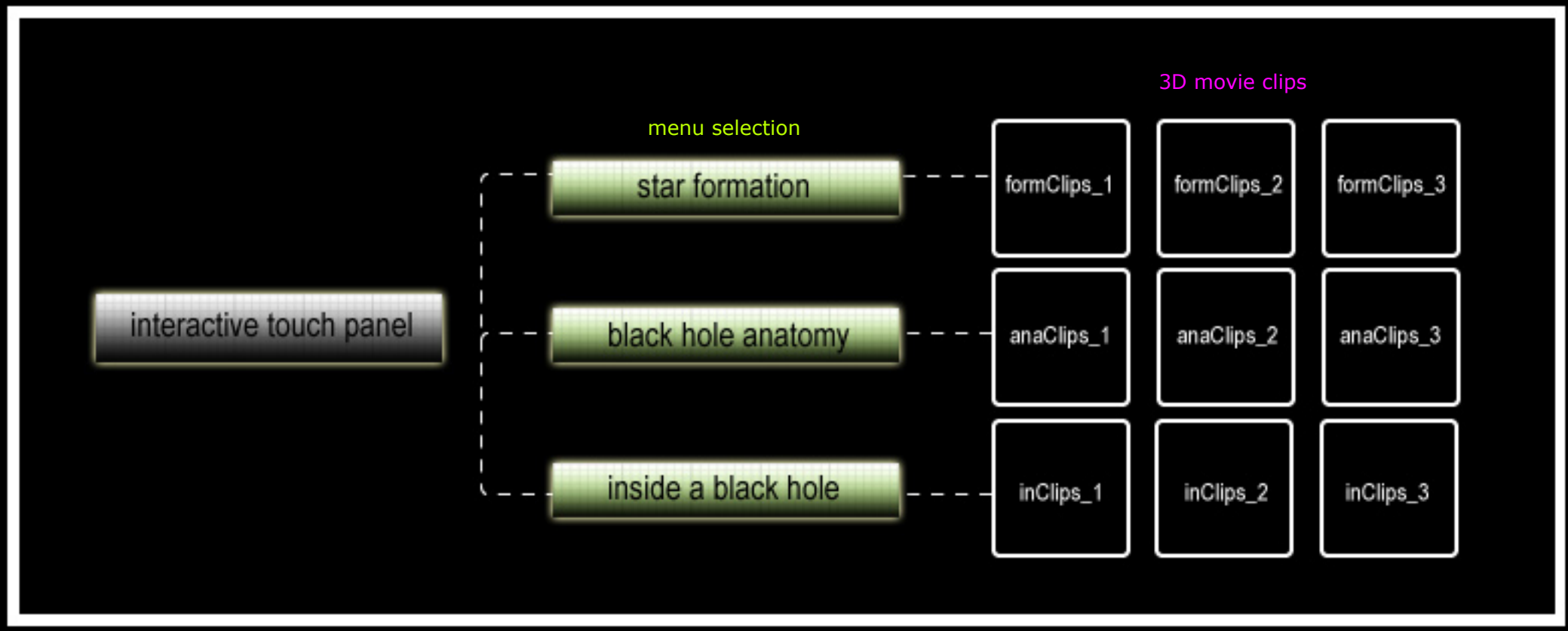
the structure

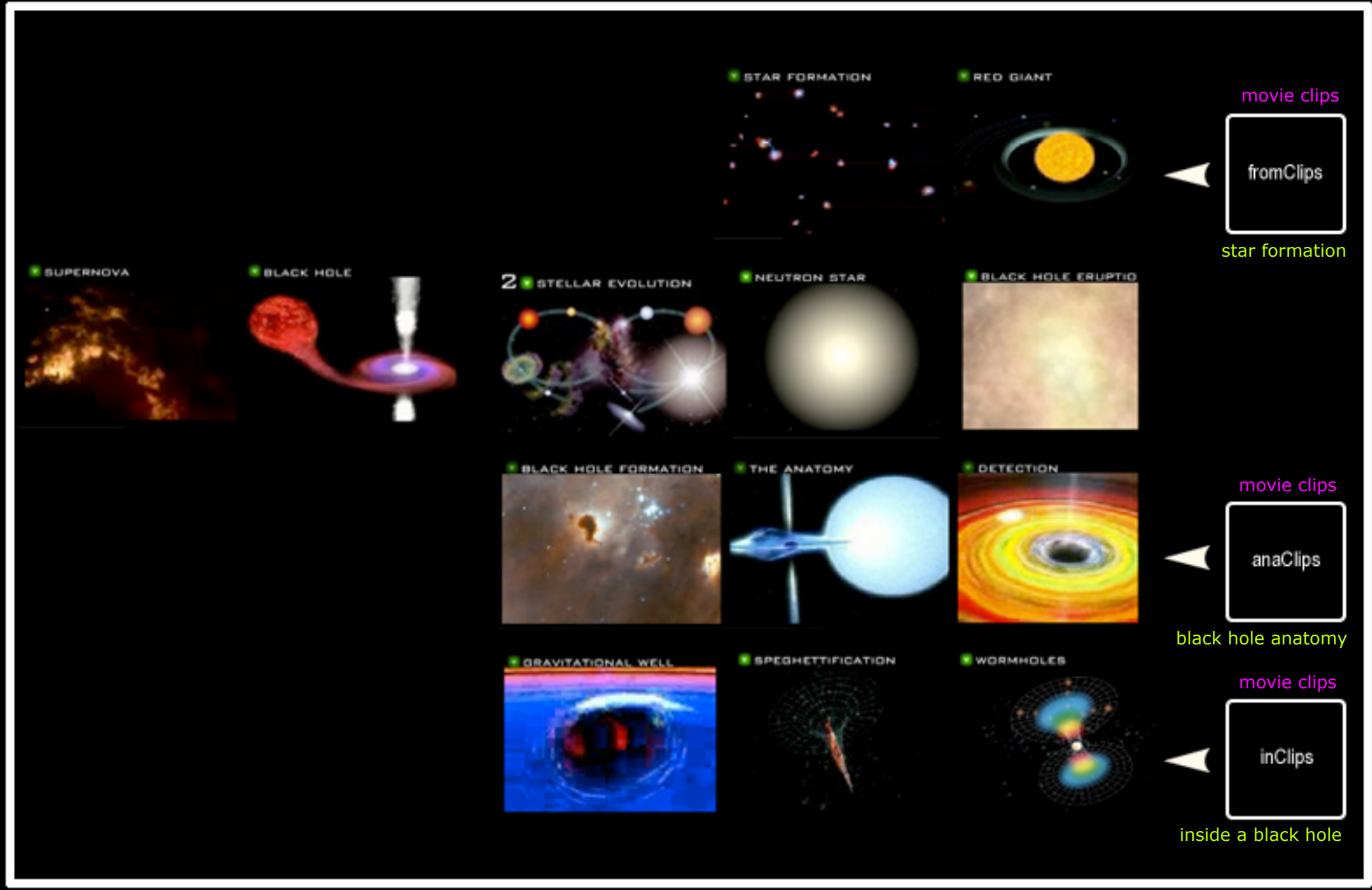
of user interaction system



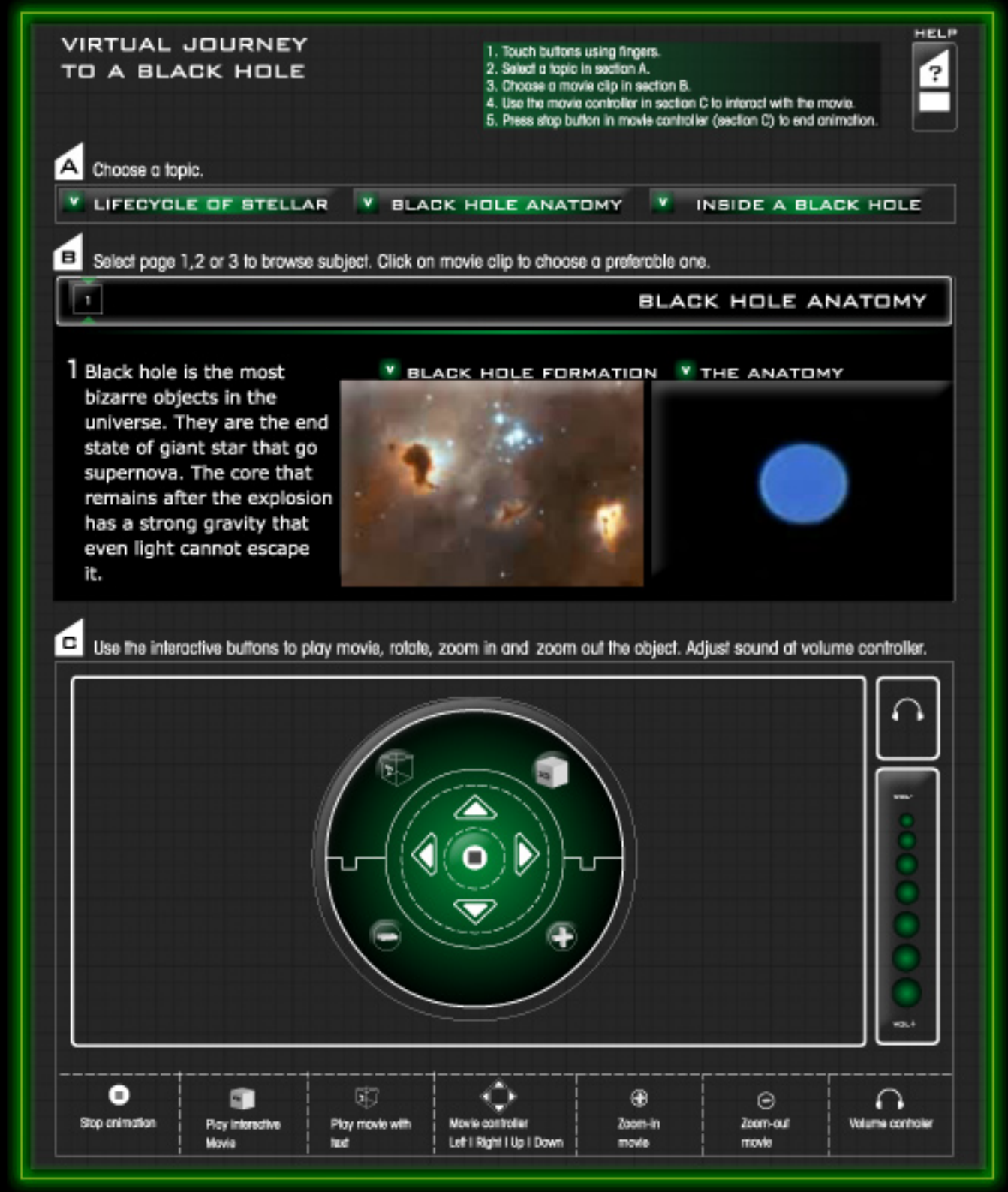
the structure

of panel content



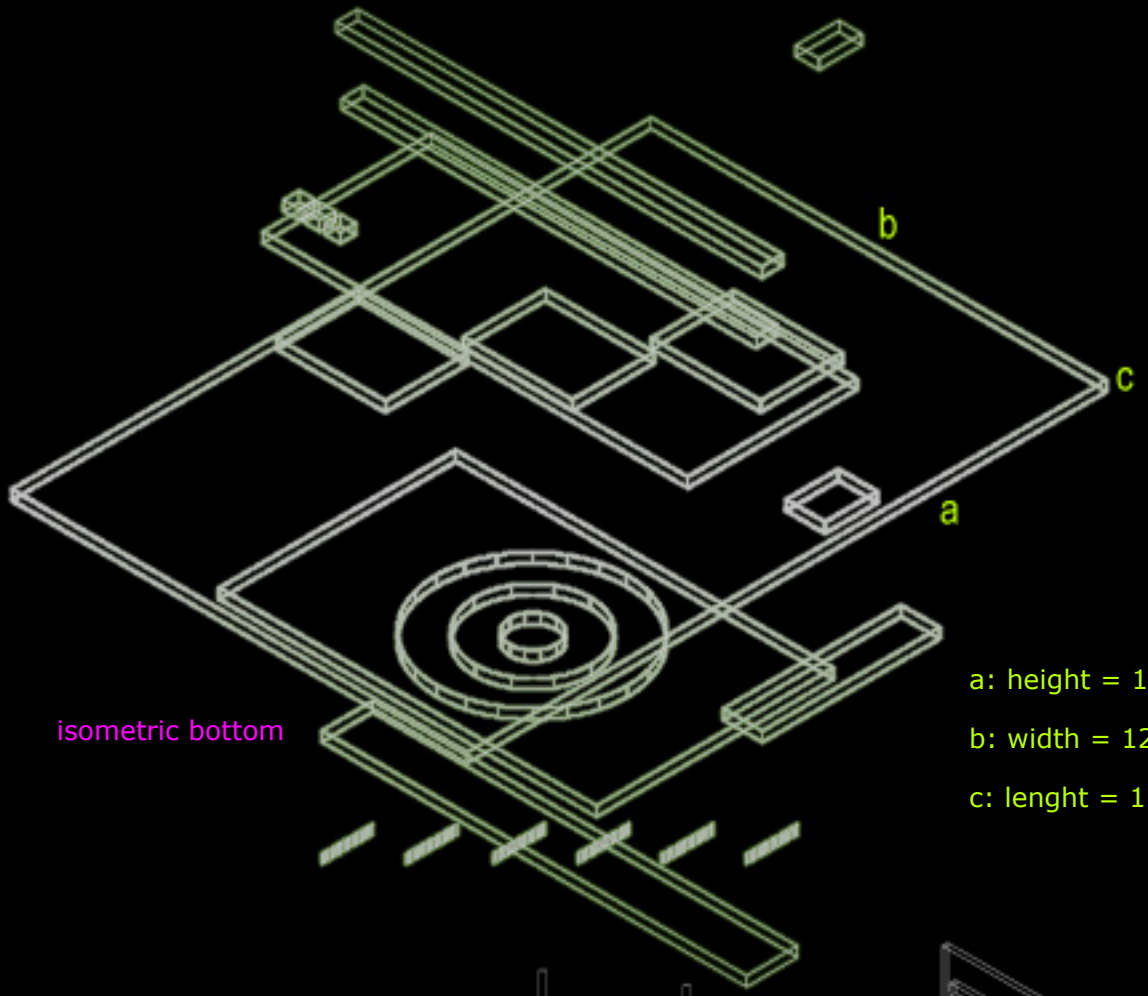

STAR FORMATION
RED GIANT
movie clips
fromClips
star formation
SUPERNOVA
BLACK HOLE
2 STELLAR EVOLUTION
NEUTRON STAR
BLACK HOLE ERUPTIO
BLACK HOLE FORMATION
THE ANATOMY
DETECTION
movie clips
anaClips
black hole anatomy
GRAVITATIONAL WELL
SPEGHETTIFICATION
WORMHOLES
movie clips
inClips
inside a black hole

design
look and feel



design

size and dimension



isometric bottom

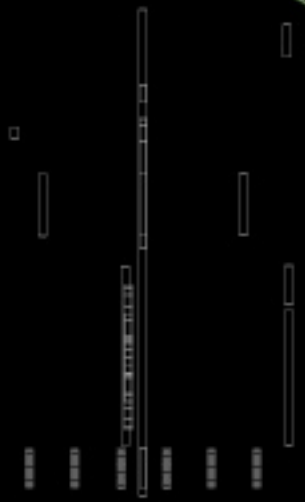
a: height = 17 inches

b: width = 12inches

c: lenght = 1inch

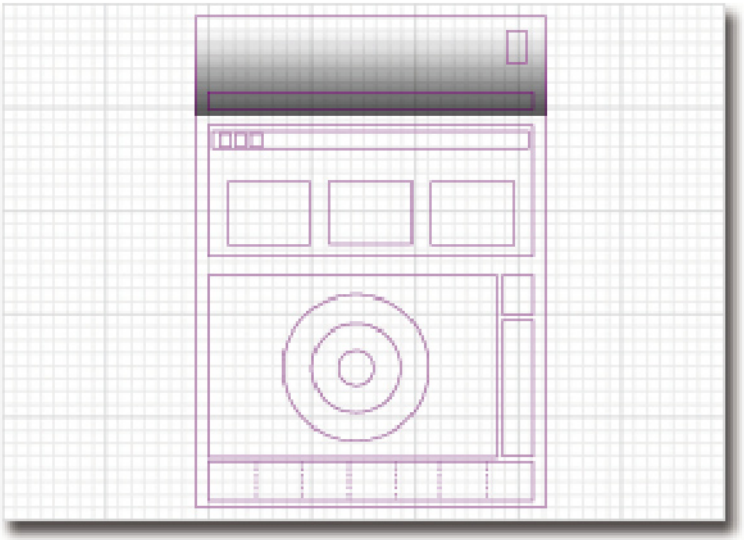
front elevation

top elevation



right elevation

isometric left



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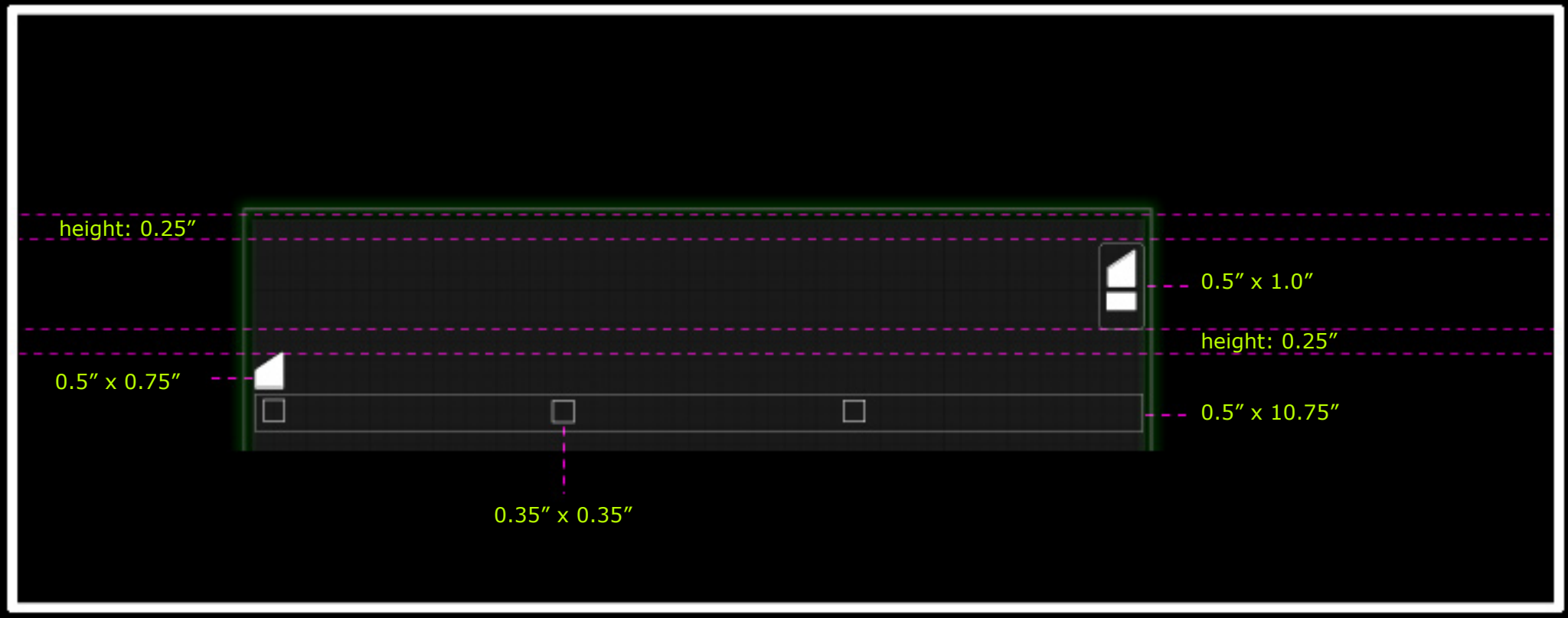

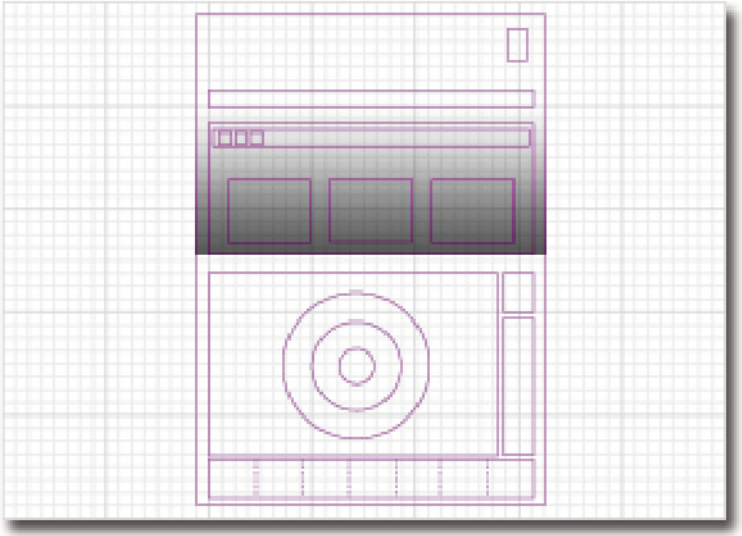

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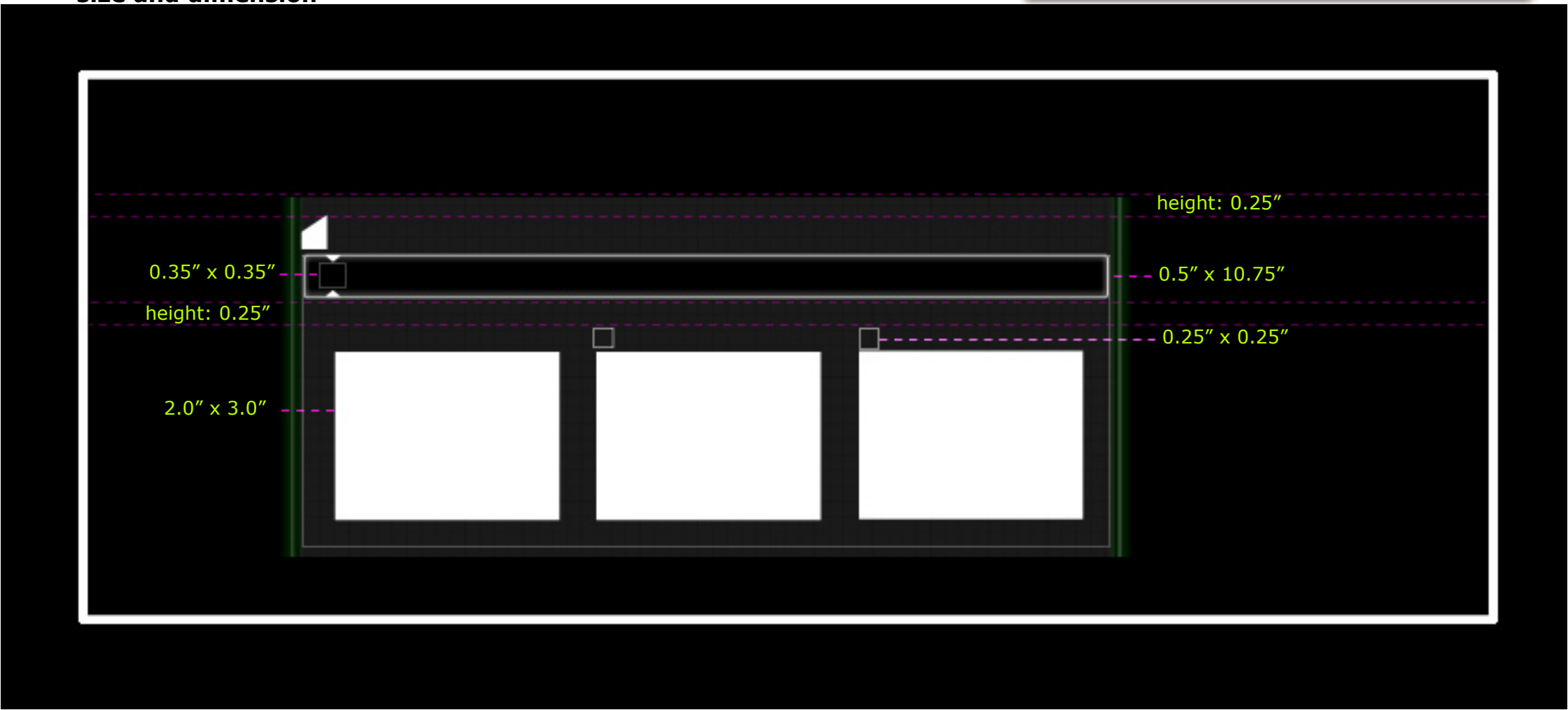
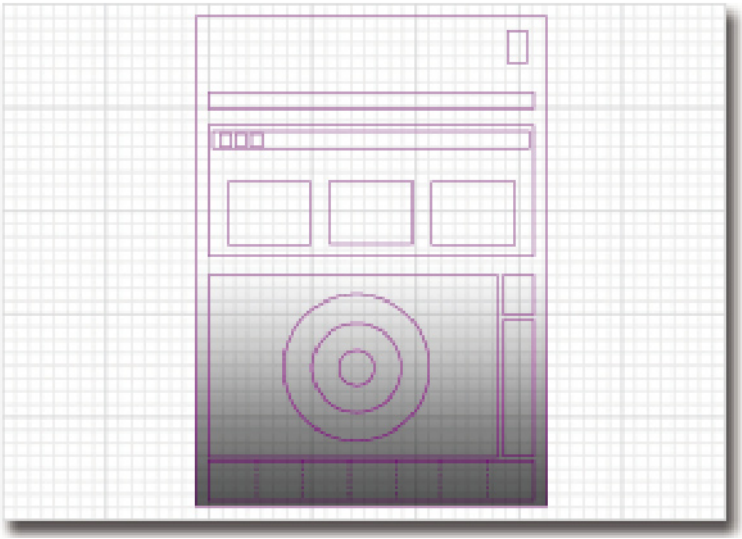
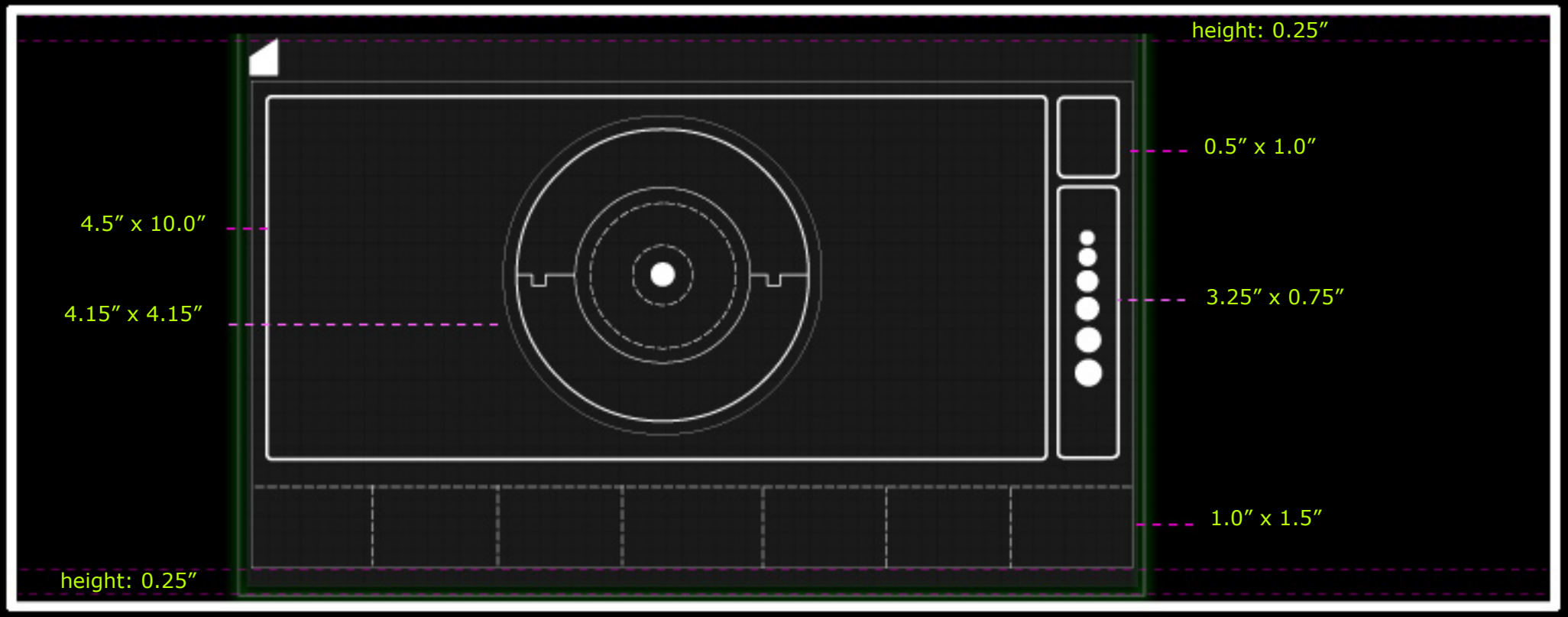
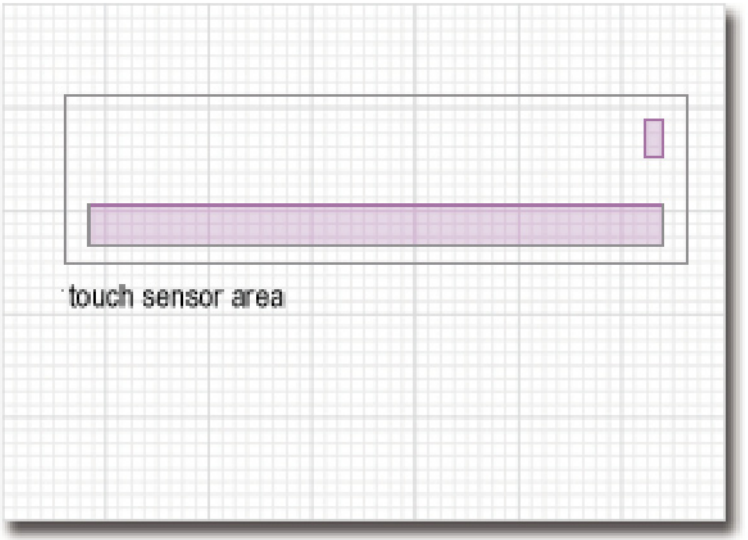


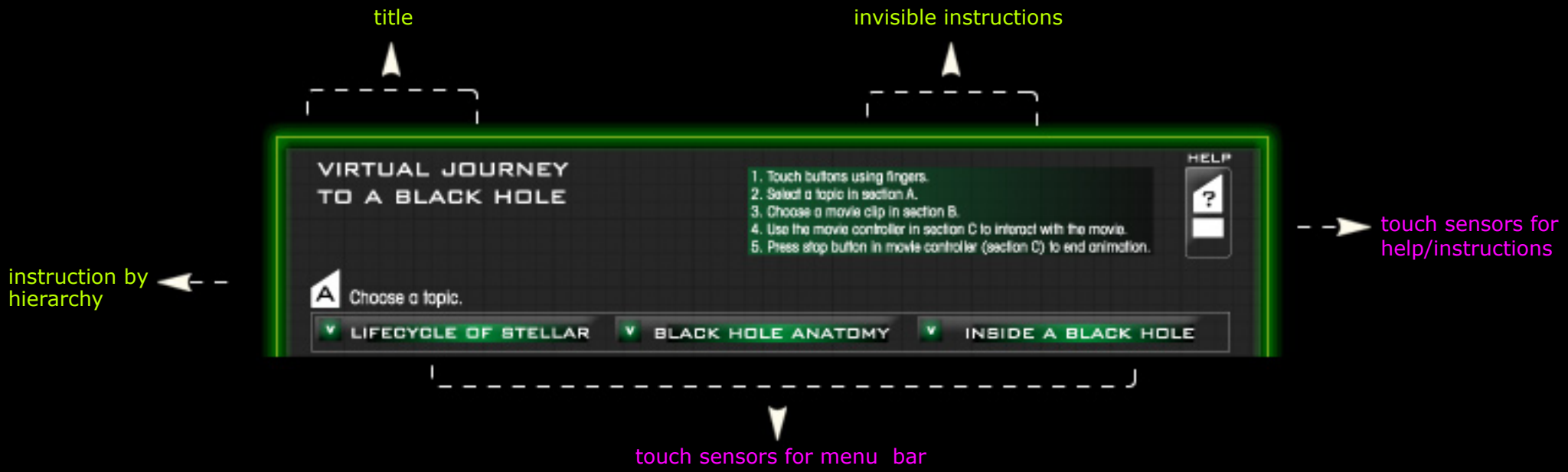


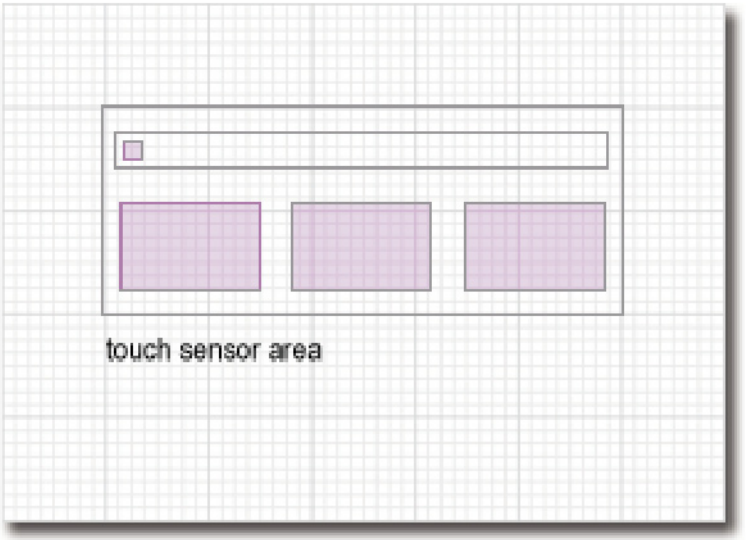
size and dimension details

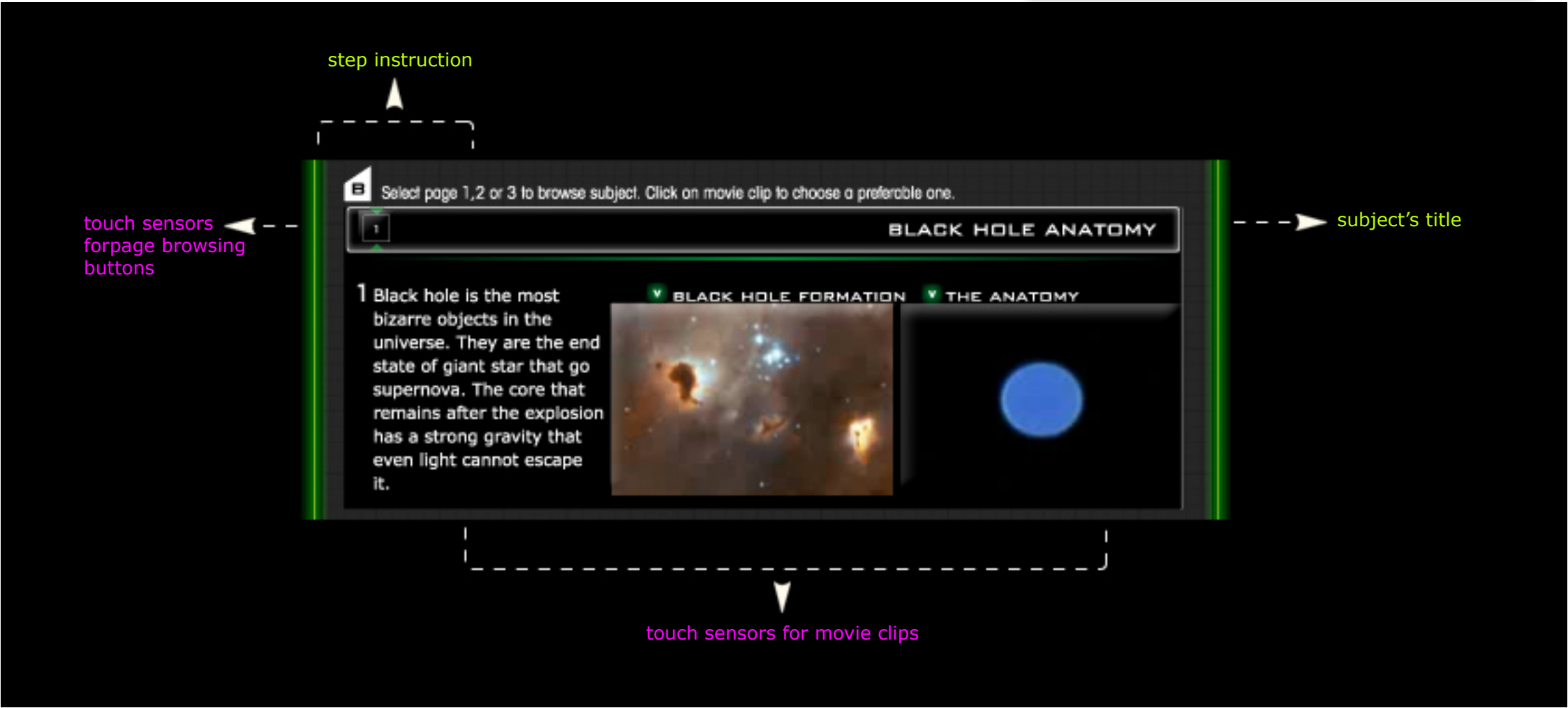


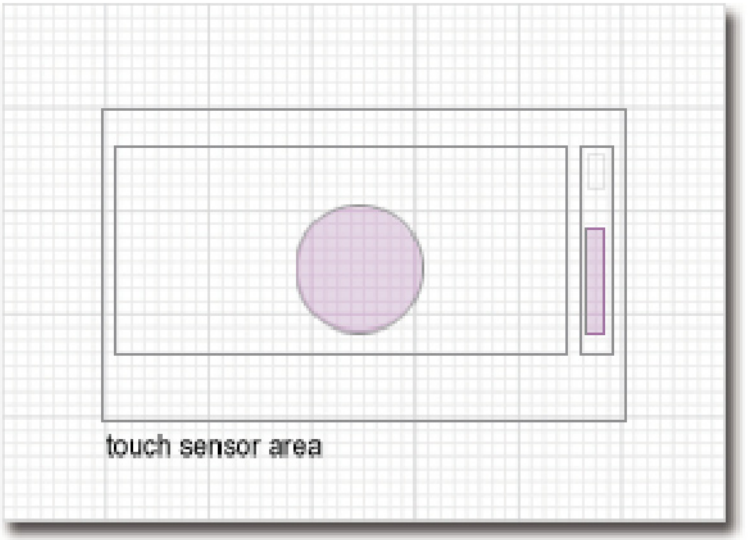
design
in details





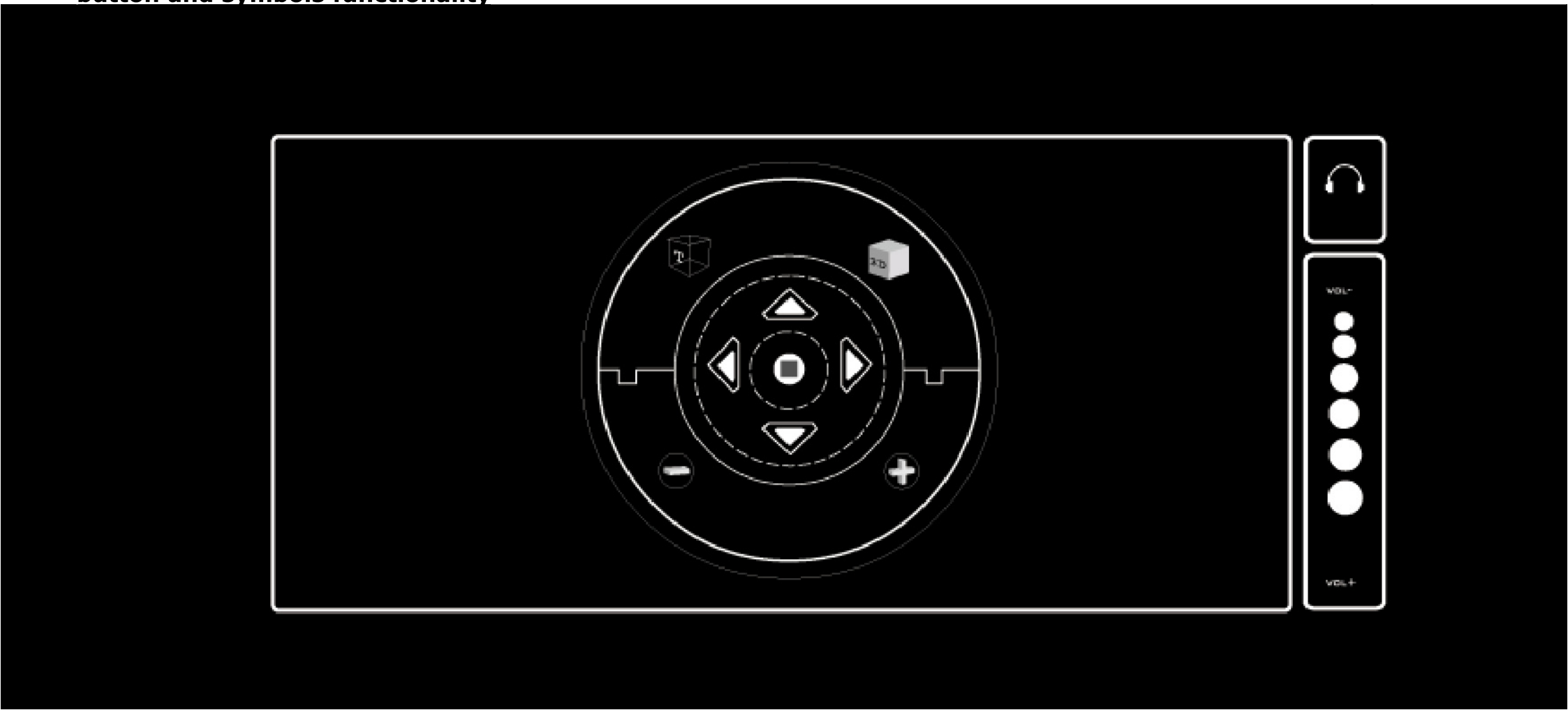

touch sensor area


step instruction
touch sensors forpage browsing buttons
Select page 1,2 or 3 to browse subject. Click on movie clip to choose a preferable one.
BLACK HOLE ANATOMY
subject's title
1 Black hole is the most bizarre objects in the universe. They are the end state of giant star that go supernova. The core that remains after the explosion has a strong gravity that even light cannot escape it.
BLACK HOLE FORMATION
THE ANATOMY
touch sensors for movie clips


touch sensor area

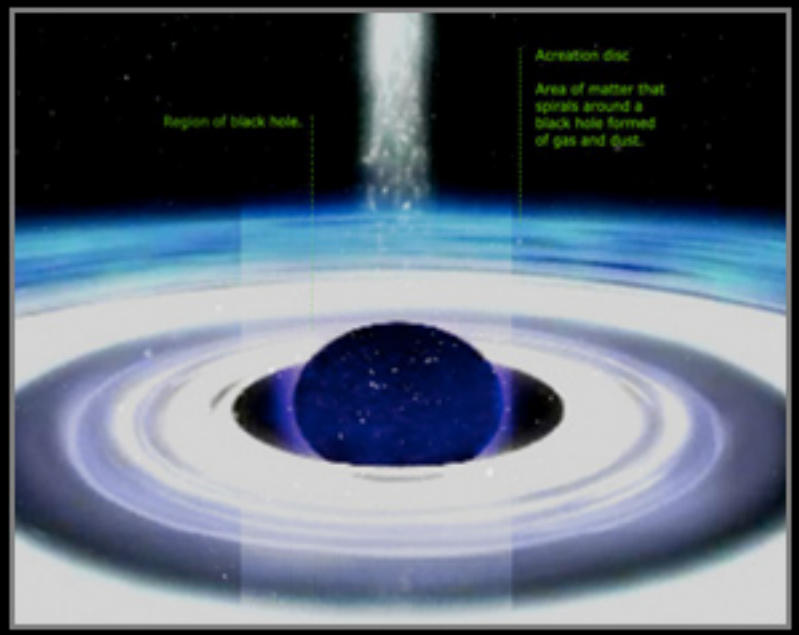

instruction by hierarchy
touch sensors for movie controller
touch sensors for volume controller
button instructions
Use the interactive buttons to play movie, rotate, zoom in and zoom out the object. Adjust sound at volume controller.
Stop animation
Play interactive Movie
Play movie with text
Movie controller Left I Right I Up I Down
Zoom-in movie
Zoom-out movie
Volume controller

button and symbols functionality



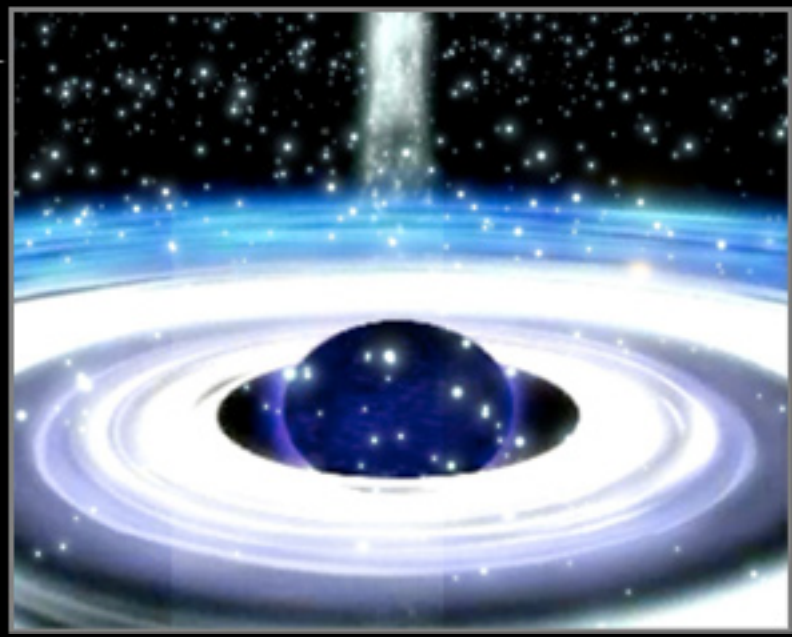
play
interactive
movie

the discriptions appear along with movie

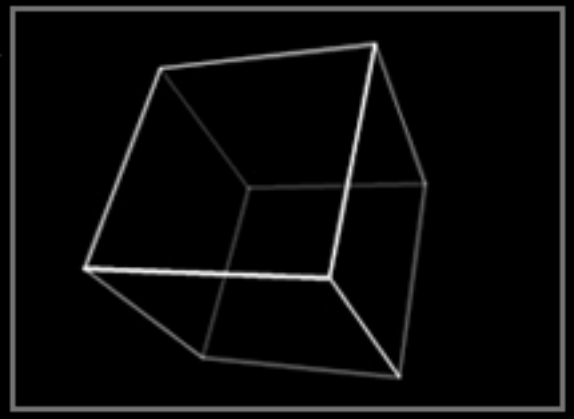


play movie
with text

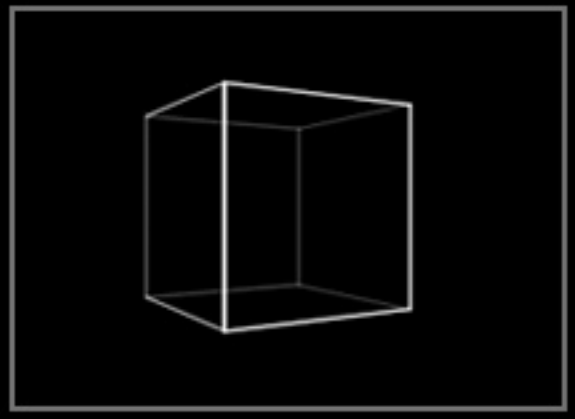
movie is showing without text

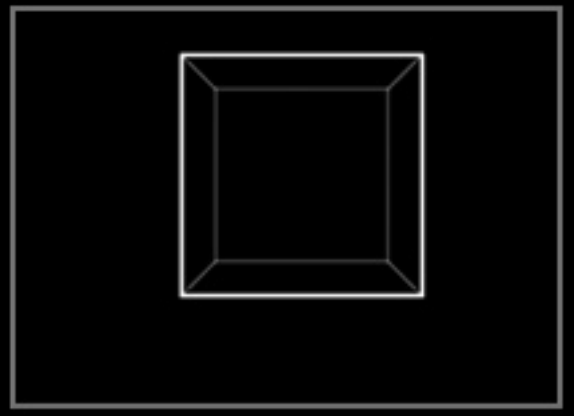


movie controller
rotate Left,
Right,Up,
Down



rotate the object for 360 degree

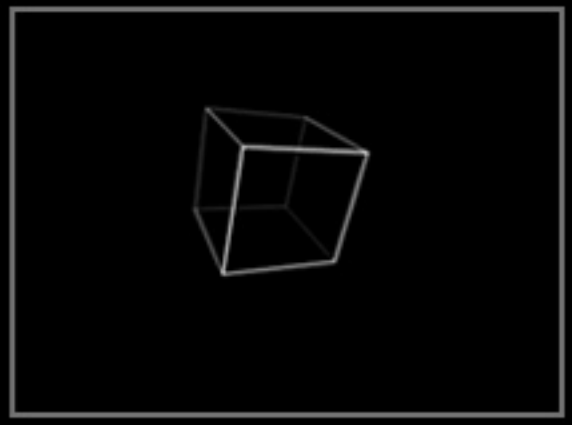




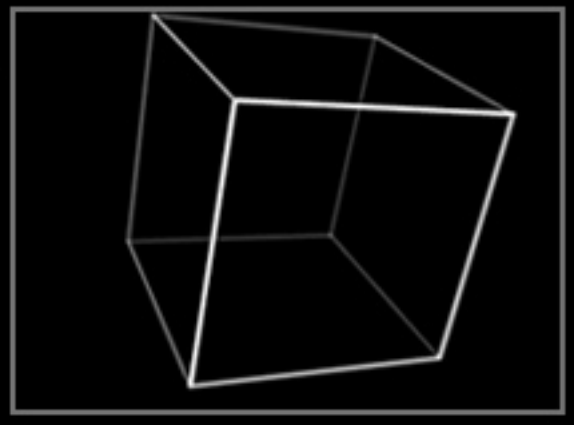
zoom-In
movie

zoom-Out
movie

zooming out the object



zooming in the object



colour

and effects

colour and effects

Touch panel: semi transparent
:Reason being is to let the light source from stereo screen to get through the panel,
therefore the interface can still be seen by users with or without stereo glasses.

Panel lining: glowing with green
:The edge is emitting a soft steady green light faintly.
It will then glow intensely when user existence is detected through motion sensors that embedded to the panel.

Sensors touch area: gradient green
:Sensors touch areas are all built in green, which is responsive to fingers reaction.
The colour will turn bright when is touch is detected.

Interface/visual cue: white
:Text and other visual cue are in white in colour to get full response from the light reflection source.

Movie clips: colour from video source
:Movie clips are in true color that programmed to the panel through technical mechanisms.

fonts

Fonts applied to this design are chosen from san serif font family, which is easy to read, and should emphasizes the design style.

Help buttons font:
9 points, Avant Garde GothicBook Condenced

User guide instruction font:
12 points, Avant Garde GothicBook Condenced

Instructions font:
12points, Avant Garde GothicBook Condenced

Movie clip’s font:
10 points, Verdana Regular

Movie bar’s font:
16 points, BankGothic Light

Menu and user guide font:
18 points, BankGothic Light

Avant Garde GothicBook Condensed

Avant Garde Gothic font family is designed influenced by the geometric sans serif faces that were popular in the 1920s and 30s.

The overall design of the Avant Garde Gothic font family is based on simple geometric shapes, with very short ascenders and descenders.

Avant Garde Gothic is useful for headlines, display work and short pieces of text, particularly in advertising.[6]

Verdana Regular

Verdana fonts are developed from the pixel. The balance between straight, curve and diagonal has been carefully designed to ensure that the pixel patterns at small sizes are pleasing, and legible particularly on-screen use.

The various weights have been designed to create sufficient contrast from one another. The bold font is heavy enough even at sizes as small as 8 ppem. Another reason for the legibility of these fonts on the screen is their generous width and spacing [7]

BankGothic Light

Bank Gothic is a font from Bitstream library. A set of square capitals developing from the interest in geometric forms stimulated by the Bauhaus, Bank Gothic was designed by Morris Fuller Benton for ATF in 1930, the same year that Georg Trump designed City for Berthold.[8]

Taking advantage of it geometric forms, this commercial font is applied in this design to emphasize the style of futuristic on the panel in a minimum way.

6. http://www.fonts.com/findfonts/detail.htm?pid=201752, 7. www.fonts.com/AboutFonts/Verdana.htm, 8. http://www.paratype.com

movie clips

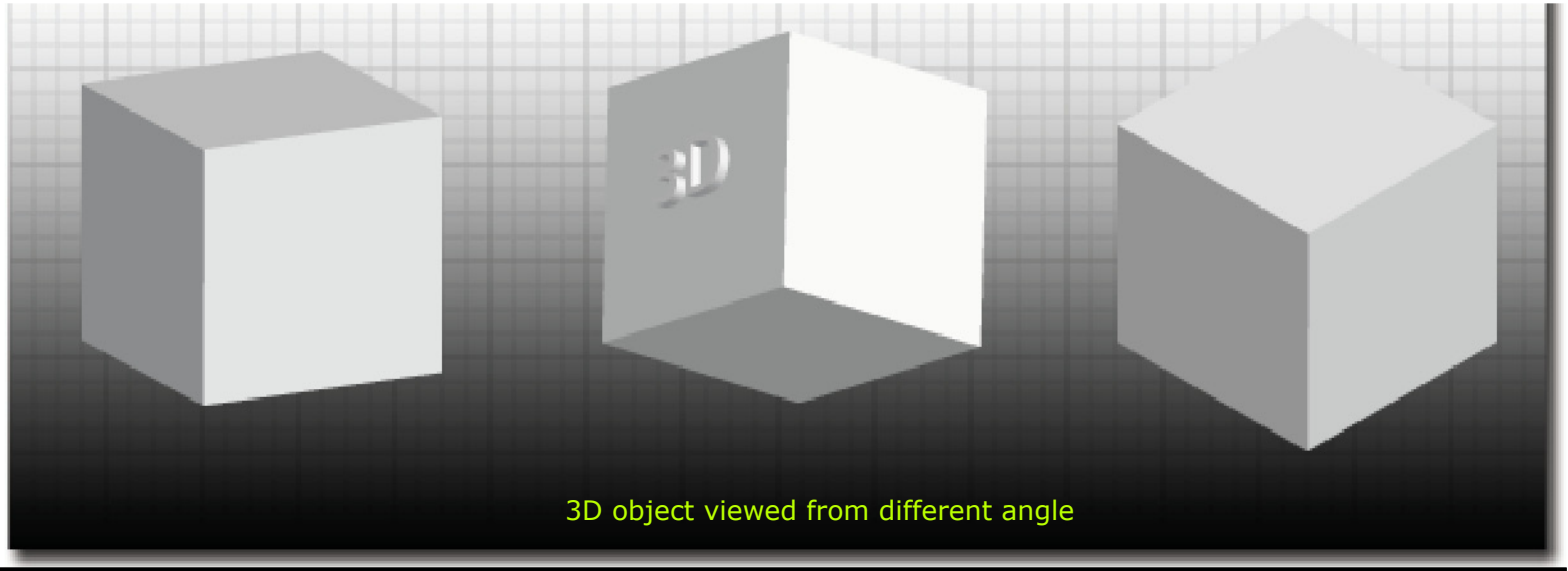
solutions

3D VISUALISATION

The actual visual for the movie can be achieved using three dimensional (3D) visualisations technique such as VRML and X3D. To produce a VRML or X3D is a massive work, which requires detail modeling technique, textures, lighting and sometimes animation. To visualize the idea, a simple example is presented clearly in the prototype's buttons functionality section using Flash API drawing scripts.

WHAT IS VRML AND X3D?
X3D is an Open Standards XML. It enabled 3D file format to enable real-time communication of 3D data across all applications and network applications. It has a rich set of features for use in engineering and scientific visualization, CAD and Architecture, Medical visualization, Training and simulation, multimedia, entertainment, educational, and more.
X3D is a considerably more advanced and refined standard than its VRML predecessor so designers can achieve the behaviors they expected.

VRML or Virtual Reality Modeling Language is a 3D graphics language used on the Web. Content can be viewed, rotated and manipulated after downloading a VRML page. For example, simulated rooms can be "walked into." The VRML viewer is launched from within the Web browser.



3D object viewed from different angle

BENEFITS AND STRENGHTS
of interactive 3D visualization techniques are:

. Visualisation helps users comprehend complex information in depth- ability to zoom-in and zoom-out each object.

. Complex astronomy visual attributes are simplified by immersive representations of 3D model and animation.

. The relationships among displayed entities become apparent and clearer - freedom to view object in 360^0 .

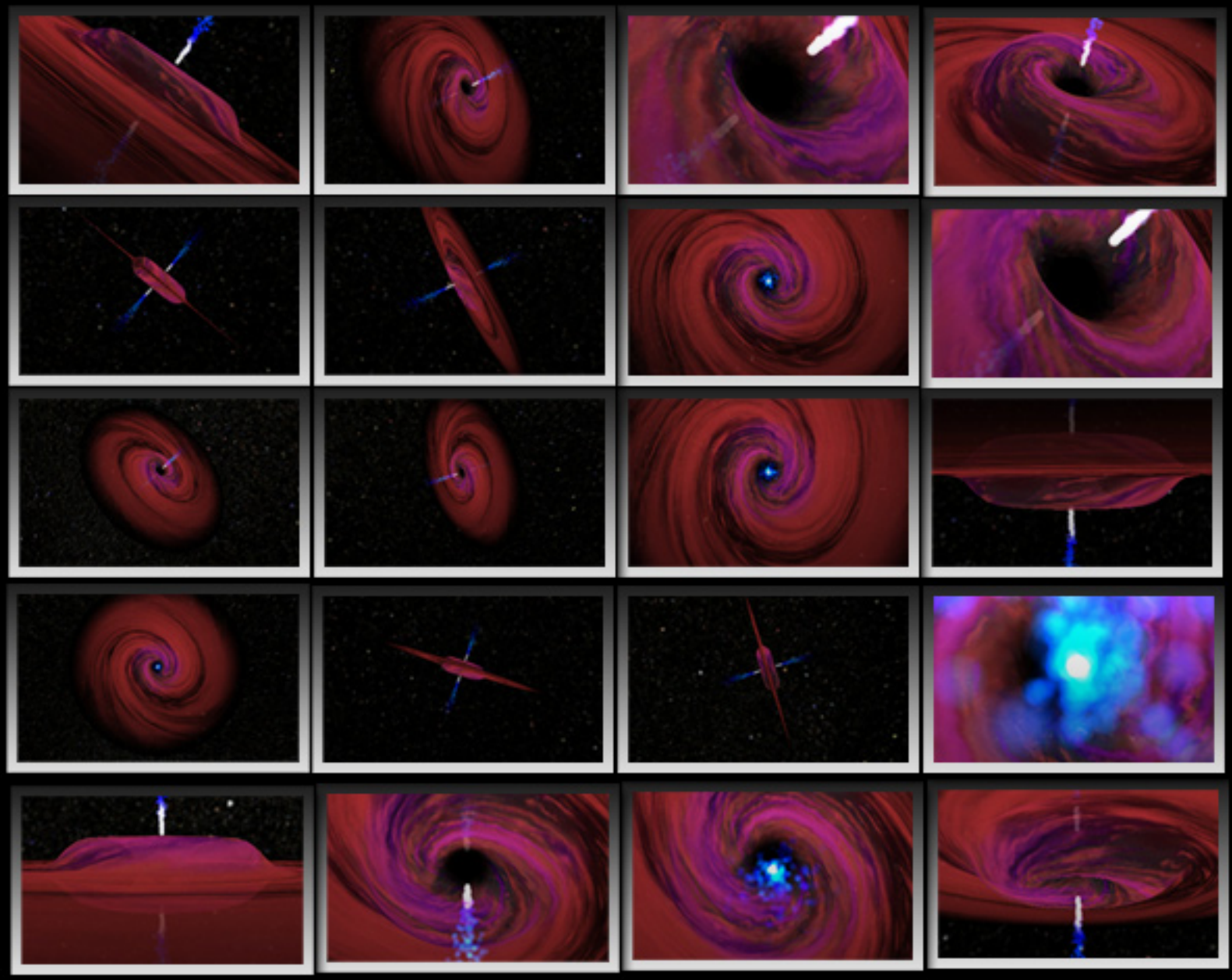
. Graphical techniques allow more direct intuitive interactions with the entities of interest to the users for all age group.

. Combination of entities, sound, imagery, motion, interaction produces interest of learning about science particularly in astrophysics subject.

3D

visualisation examples

by PlanetQuest.org



SOURCE: http://planetquest.jpl.nasa.gov/bh_launch_page.html
BROWSER (pc only): http://www.cult3d.com/

sound

and music solutions

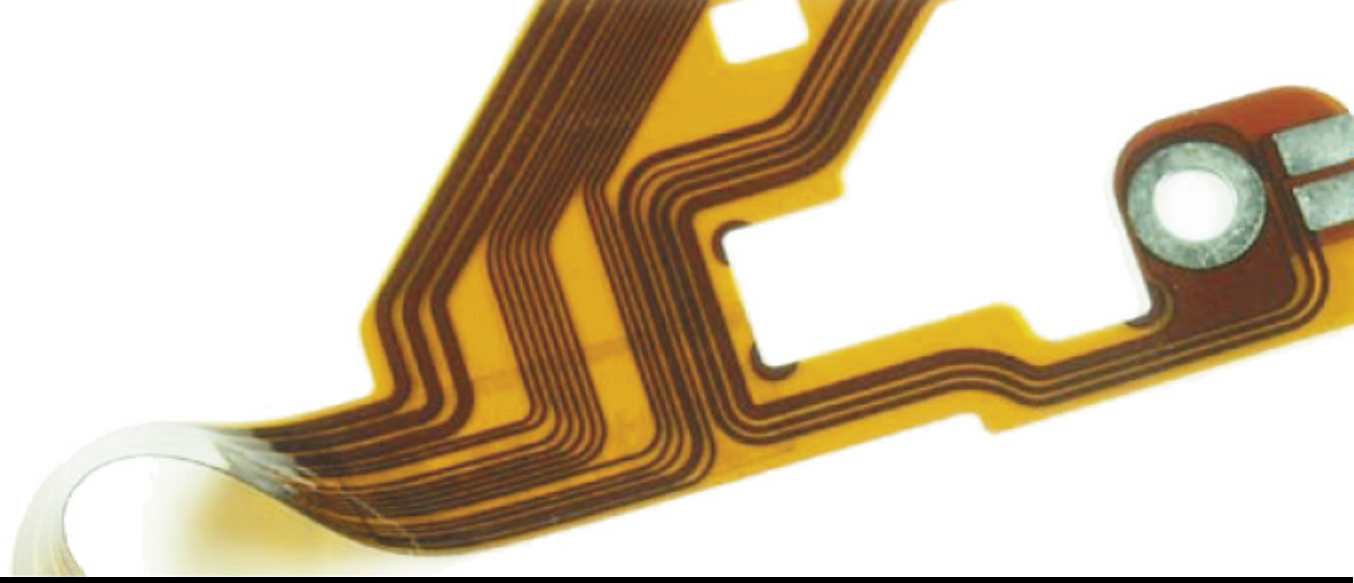
The space has no sound. The only sound that occurs are from pulsars. Radiation is beamed out along the magnetic poles and pulses of radiation are received as the beam crosses the Earth, in the same manner as the beam from a lighthouse causes flashes. As they beamed, they produce sound similar to clocks ticking.

The solutions for adding sound to the space is using ambience sound.

Ambience sound is created to emphasize the silent deep space sound. Sound and music involves in this project are created using Korg Triton synthesizer keyboard and has been manipulated using Grange band software.

design

research and recommendations



INTERACTIVE TOUCH PANEL MATERIAL AND COMPONENTS

i. Physical structure:
2X Polymethylmethacrylate (PMMA)/
Perspex(12x17x1inch), sandwiched
http://www.lucitesolutions.com

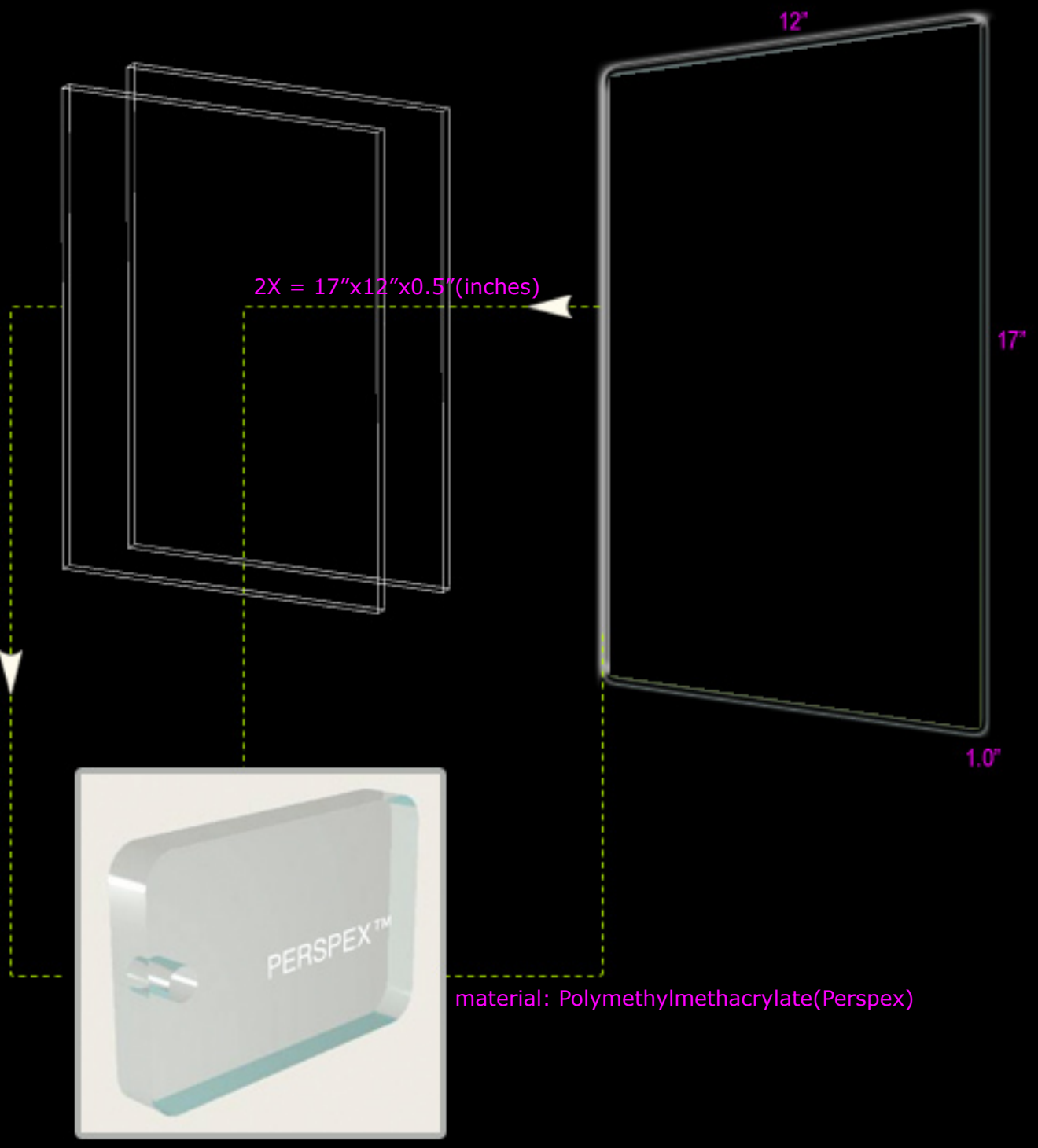
ii. Transparent fabricated switch structure:
Silicone elastomer
http://www.devicelink.com/mpb/archive/97/07/003.html

iii. Frame material:
Ultra-Thin LED Illuminated Frame System
http://www.optosign.com/prd_sirius.htm

iv. Touch sensors:
Electrodes and chips construction
http://www.qprox.com/products/qt2xx.php

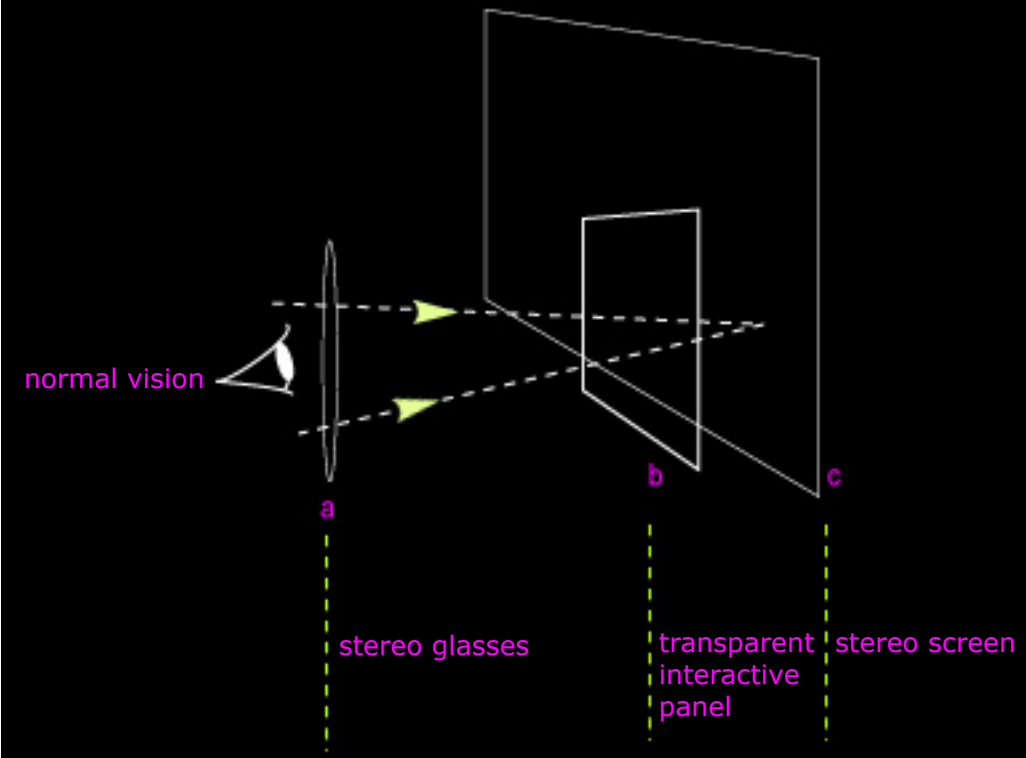
physical

structure



perspex

features



WHY PERSPEX?

. Its property as clear and transparent fabrications is suitable for the interactive panel in order to achieve undistracted vision to user while operating with the stereo screen

. Perspex is lighter than glass; it is also an alternative for safety and cost related material

. Perspex is an international material fabrication, which stands for quality, innovation and design

. It has an unrivalled reputation for product performance and creative capability

. It is the medium for durability in demanding environments and for the creative consistent quality potential.

perspex

safety informations

PERSPEX CAST ACRYLIC SHEET:
CLEARS AND TRANSPARENTS

. No classifiable hazardous ingredient
. Low toxicity under normal conditions of handling and use
. Fire-Fighting Measures
Combustion will evolve toxic, irritant and flammable vapours.

Extinguishing Media: water spray, foam, dry powder or CO2.
Fire Fighting Protective Equipment: A self contained breathing apparatus and suitable protective clothing should be worn in fire conditions.

. Accidental Release Measures
Offcuts, or dust should be collected and disposed of in a safe way.

. Handling and Storage
Handling:
These sheets are heavy and unwieldy. They should be handled with care, particularly in windy locations or out doors. If broken or chipped the resultant edges can be sharp and cause cuts to skin and eyes.
Take precautionary measures against static discharges.

Storage:
Keep away from heat. Store vertically on A-frames
Storage Temperature: below 40 °C
Storage Life: Indefinite under specified storage conditions.

http://www.gcip.co.uk/pdf/safetydata/Perspex%20Safety%20Data%20Sheet.pdf

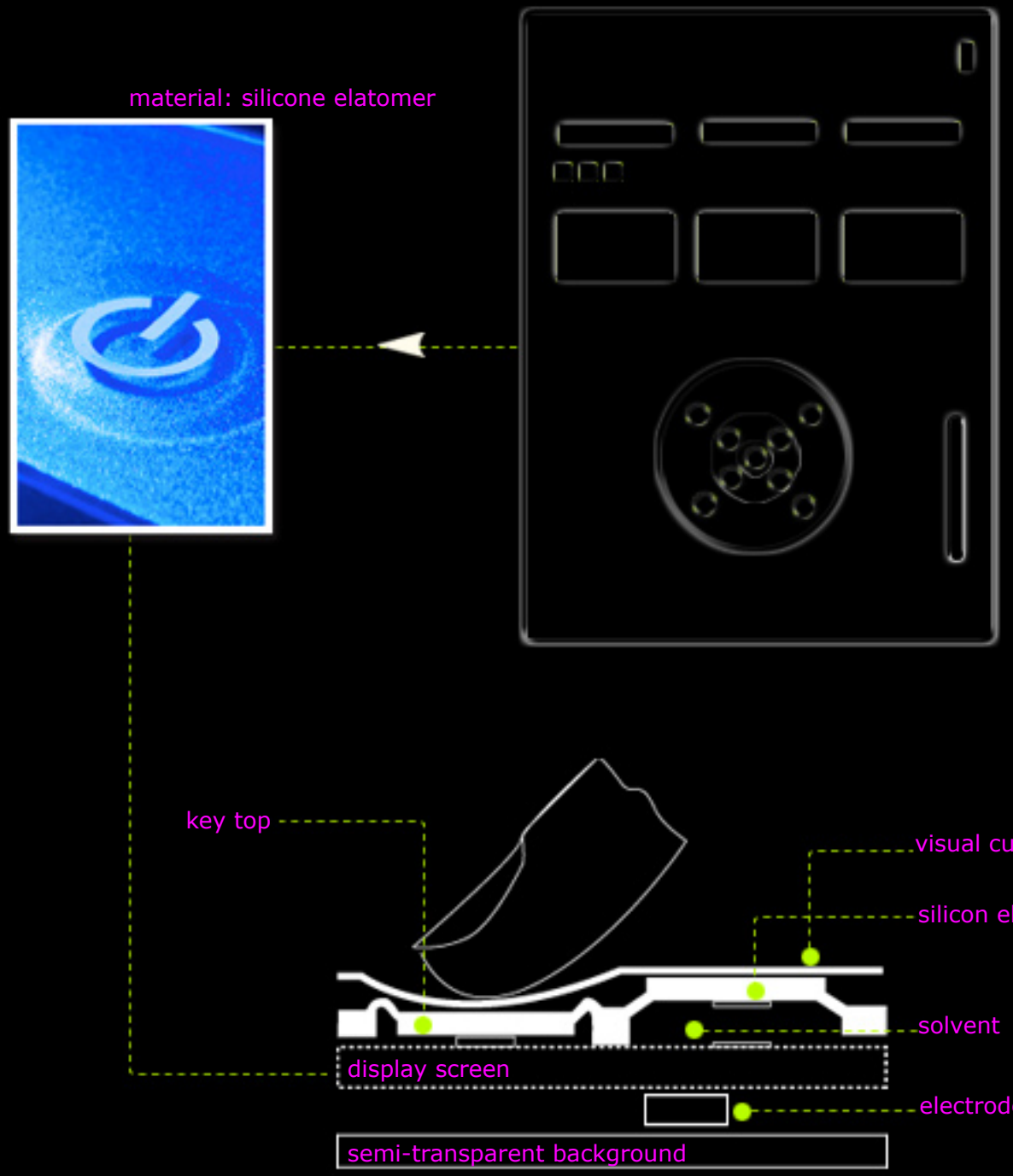
perspex specification table

http://www.gcip.co.uk/pdf/perspexdata.pdf

PROPERTY	TEST METHOD	UNITS	PERSPEX GS CAST SHEET 000/0000	PERSPEX GS IM CAST SHEET 0M14	PERSPEX XT EXTRUDED SHEET 0X00	PERSPEX XT IM IMPACT MODIFIED EXTRUDED SHEET IM50	IM60
General							
Relative Density	ISO 1183	-	1.19	1.18	1.19	1.17	1.16
Rockwell Hardness	ISO 2039-2	M Scale	102	98.5	101	65	45
Ball Indentation Hardness	ISO 2039-1	MPa	-	-	-	-	-
Water Absorption	ISO 62	%	0.2	0.4	0.2	0.3	0.3
Flammability	DIN 4102	-	B2	B2	B2	B2	B2
"	UL 94	-	HB	HB	HB	HB	HB
"	BS 476, Pt 7	Class	3	3	4	-	-
	NFP 92 - 307		M4 (without drips)		M4 (with drips)		
Mechanical							
Tensile Strength	ISO 527 (a)	MPa	75	62	70	68	50
Elongation at Break	ISO 527 (a)	%	4	-	4	18	25
Flexural Strength	ISO 178 (b)	MPa	116	105	107	90	70
Flexural Modulus	ISO 178 (b)	MPa	3210	2960	3030	2500	2000
Charpy Impact Strength	ISO 179 (c)	$kJ.m^{-2}$	12	21.7	10	50	65
	ISO 179 (d)	$kJ.m^{-2}$	-	1.2	-	5	7
Izod Impact Strength	ISO 180/1A (d)	$kJ.m^{-2}$	-	-	-	5	7
Thermal							
Vicat Softening Point	ISO 306A	°C	>110	>110	>105	>105	>105
Coefficient of Thermal Expansion	ASTM D696	$x\ 10^{-5}.K^{-1}$	7.7	-	7.8	-	-
Optical							
Light Transmission	ASTM D1003	% (c)	>92	>92	>92	90	89
Refractive Index	ISO 489/A	-	1.49	-	1.49	-	-
Electrical							
Surface Resistivity	IEC 93	$\Omega.m^{-2}$	$>10^{14}$	-	$>10^{14}$	-	-
Electrical Strength	IEC 243	$kV.mm^{-1}$	15	-	-	-	-

switch

fabricated switch stucture



silicone

features

WHY SILICONE?
Silicone is made from cross-linked polymer, which is reinforced with silica. It is used as the touch screen interface because it soft invisible physical characteristic.

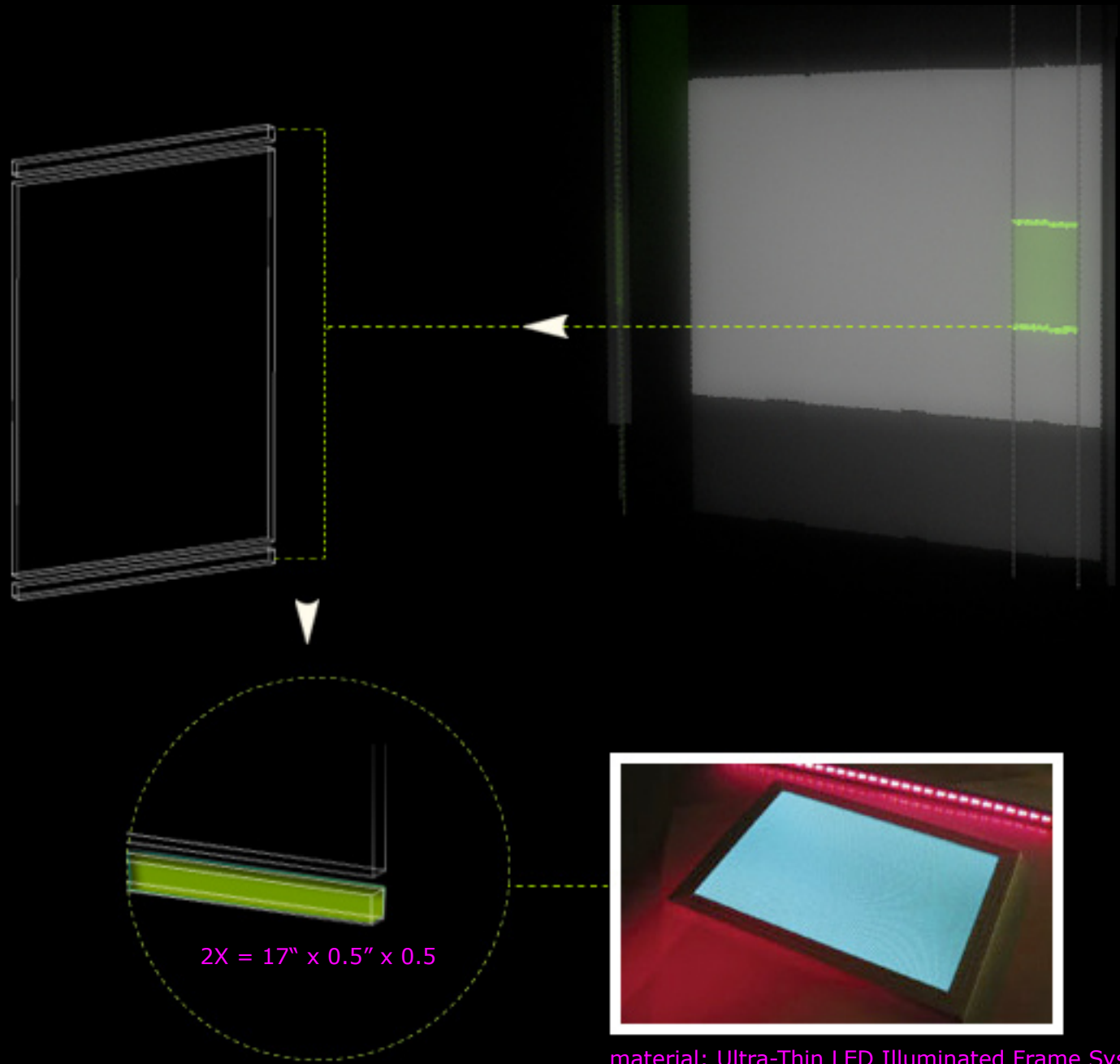
Silicone rubber is extremely easy to fabricate, particularly when compared to conventional organic elastomers. Silicone rubber flows very easily. It can be molded, calendered or extruded using relatively low amounts of energy. This ease of fabrication results in high productivity rates.[7]

. High and low temperature stability
. Inertness (no taste or smell)
. Translucent and easy to color
. Wide hardness range
. Chemical resistance
. Weatherability
. Sealing performance
. Electrical properties
. Compression set resistance

7.http://www.devicelink.com/mpb/archive/97/07/003.html

frame

material



material: Ultra-Thin LED Illuminated Frame System

LED
features

WHY LEDs?

LED or Light Emitting Diodes (LEDs) abilities are:

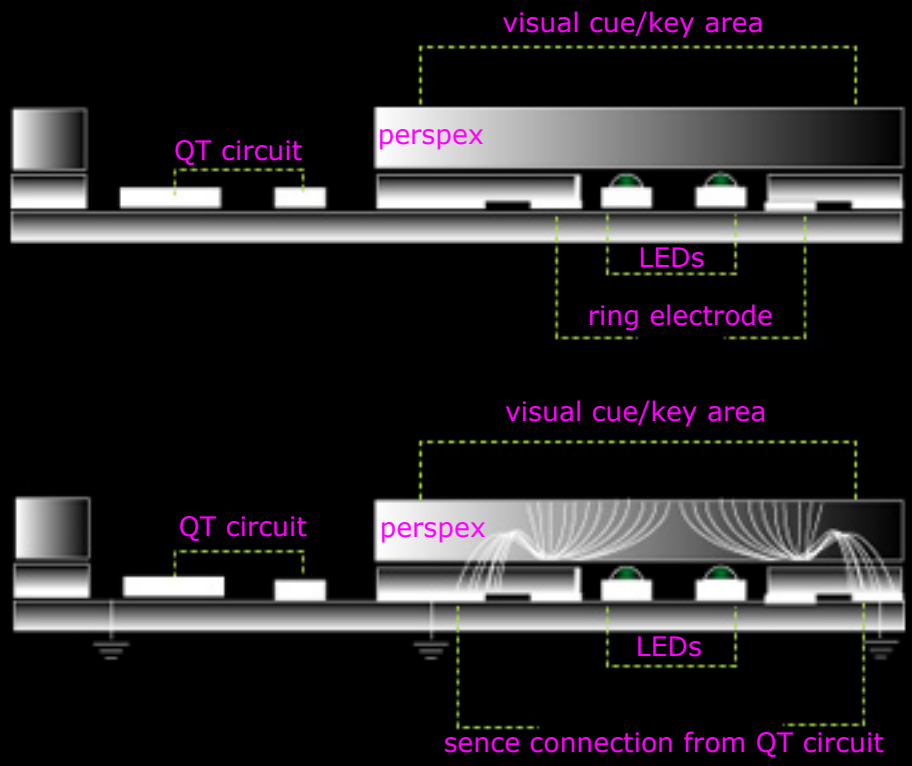
.High intensity LED technology for maximum brightness

.Ultra low power consumption

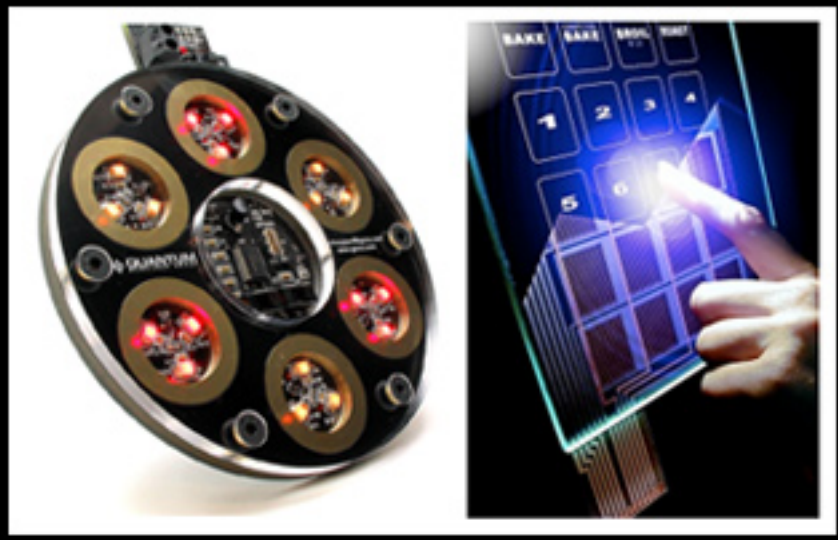
.Extrusion allows industry standard image sizes,
to be mounted behind tough Polycarbonate fascia

.It can either slowly cycle through 16.7 million colours

touch
sensors



material: QTouch sensing electrodes and chips construction



touch
sensors

ABOUT THE TOUCH SENSORS
Through the research, I found that QTouch™ design sensors is almost meet the requirement that I want for the interactive touch panel.

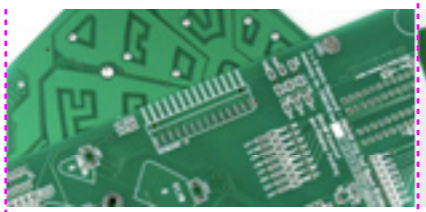
QT sensors is designed for touch controls, especially with those electrodes and QT chip designs are on one PCB (printed circuit board) that is bonded to the back of an operator panel such as plastic or glass. It can be applied on any touch sensors design interface at any thickness and size.

It is simple electrodes works by emitting a pulses electric field through a control panel behind. While a finger on the panel will cause the capacitance of electrode to ground to increase (about 0.5F to5pf) due to extra combination of the human body to the surrounding environment. This increases capacitance is processed to output signal result. [8]

This technology uses patented charge-transfer methods to sense this slight increase in load capacitance, even on high background capacitance electrodes.

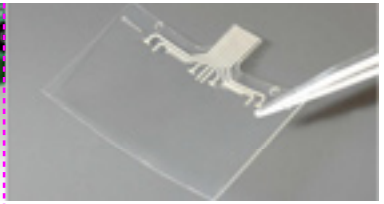
8. http://www.qprox.com/products/index.php

Flex circuit (KaptonTM polyamide)



FR4 (2sided epoxy-fiberglass)

CEM-1(1sided paper+fiberglass base)



clear ITO on PET with silver connections

TOUCH SENSORS FEATURES:

i. Electrodes constructions

The electrodes must be electrically conductive and connect with rear of the panel.
Types of electrodes or PCB that can be use are:
.CEM-1 (1sided paper + fiberglass base),
.FR4 (2sided epoxy-fiberglass),
.Flex circuit (KaptonTM polyamide)
.clear ITO onPET with silver connections.

ii. Panel thickness

The panel thickness is important as its epsilon (dielectric constant) play a huge part in determining the strength of electric field at the surface of control panel. Types of panel that are considered:
. Glass that has epsilon range from 7.6 to 8
. Plastic panel (up to 10mm) with the epsilon range of 2 to 3

iii. Electrodes and key shapes and spacing

Almost any shapes and sizes are tolerant with QT's chips.

iv. Solving water film problems

. Quantum's charge-transfer methods have evolved to suppress most water related problems that can cause to false detections.
. AKS (adjacent key suppression) is also designed to avoid multiple key pressing signals.

http://www.qprox.com/downloads/latest/index.php

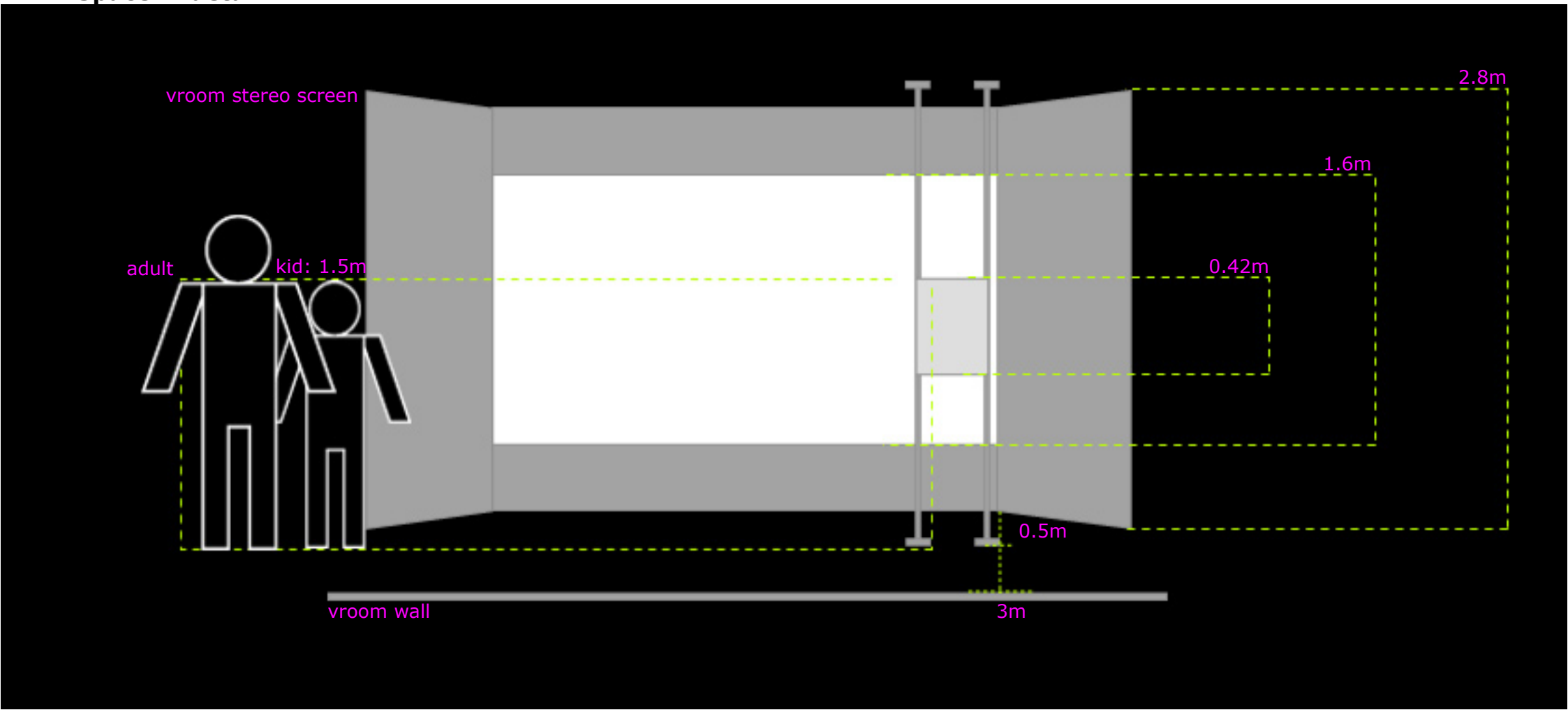
Qtouch™ specification table

http://www.qprox.com/downloads/latest/index.php

Features	Quantum Product	Others	Comments
Number of Chips Required per Panel	1 Circuit/ Panel	1/ Key + Controller	Cost, reliability, complexity
16-Key Panel	1 chip	16 chips	
32-Key Panel	1 chip	32 chips	
48-Key Panel	1 chip	48 chips	
Board cost - 32 key panel @ 50K / year	US$7.50	US$15	PCB based control panel with bonding adhesive
Who controls design project?	You	Them	Flexibility and ease of modifying and specifying the design
Who owns artwork?	You	Them	
Who makes it?	Anyone	Them only	Freedom to shop around for best deal
Evaluation Boards	✓	no	Fast evaluation of technology and application design/ development is essential
Development Time	Weeks	Months	
Host Interface	Serial or Matrix (depends on part)	Matrix only	Serial allows low pin-count, reliability, FMEA compliance, and is much less expensive
Signal Processing Basis	Firmware	Hardware	Hardware changes are not possible
PCB layers required / Material	1 / CEM-1	2 / FR-4	CEM-1 is very inexpensive
Moisture Suppression	✓	no	
Any Key Shape or Size	✓	limited	Design freedom - mix key sizes and shapes on a panel
Customer-Variable Key Sensitivity	Setups-Based	no	Fine tune for desired response on a key-by-key basis using serial communications
Adjacent Key Suppression	✓	no	Suppress moisture film effects, suppress multiple keypresses on tight keys
Spread-spectrum operation	✓	no	Strongly suppresses noise; performance to 50V/m with no false detection
Noise Sync Feature	✓	no	Reduce / eliminate low frequency noise
Detects Component Failures & Circuit Faults & reports them	✓	no	FMEA compliance

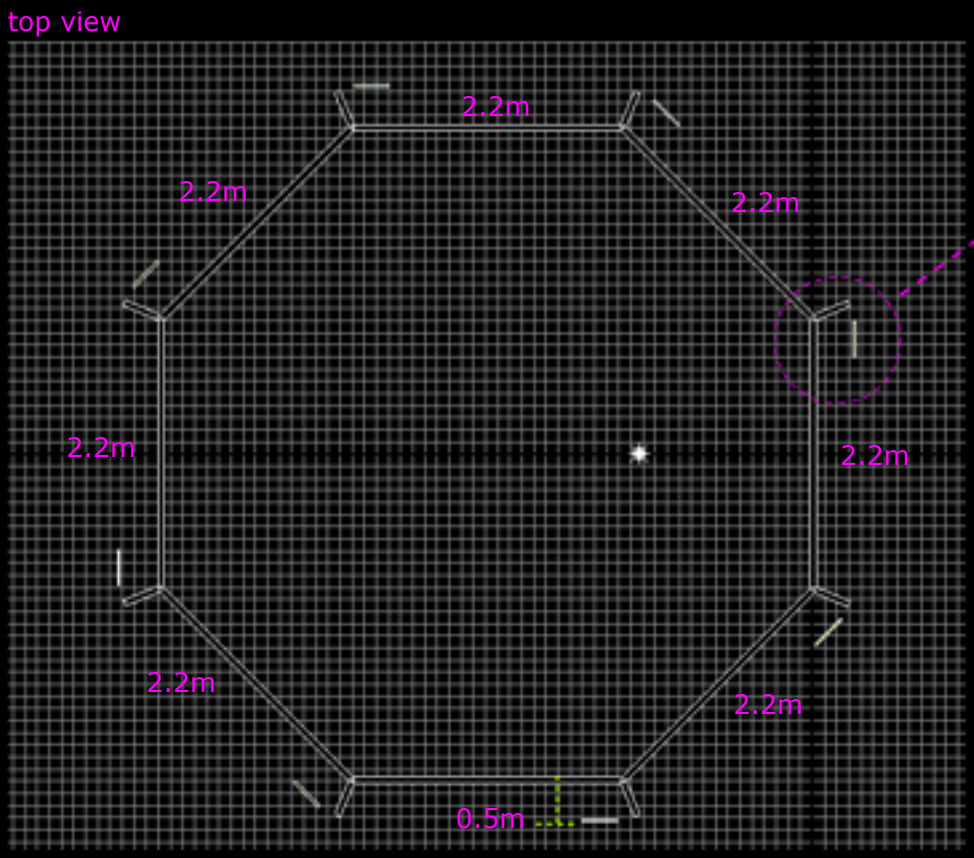
VROOM

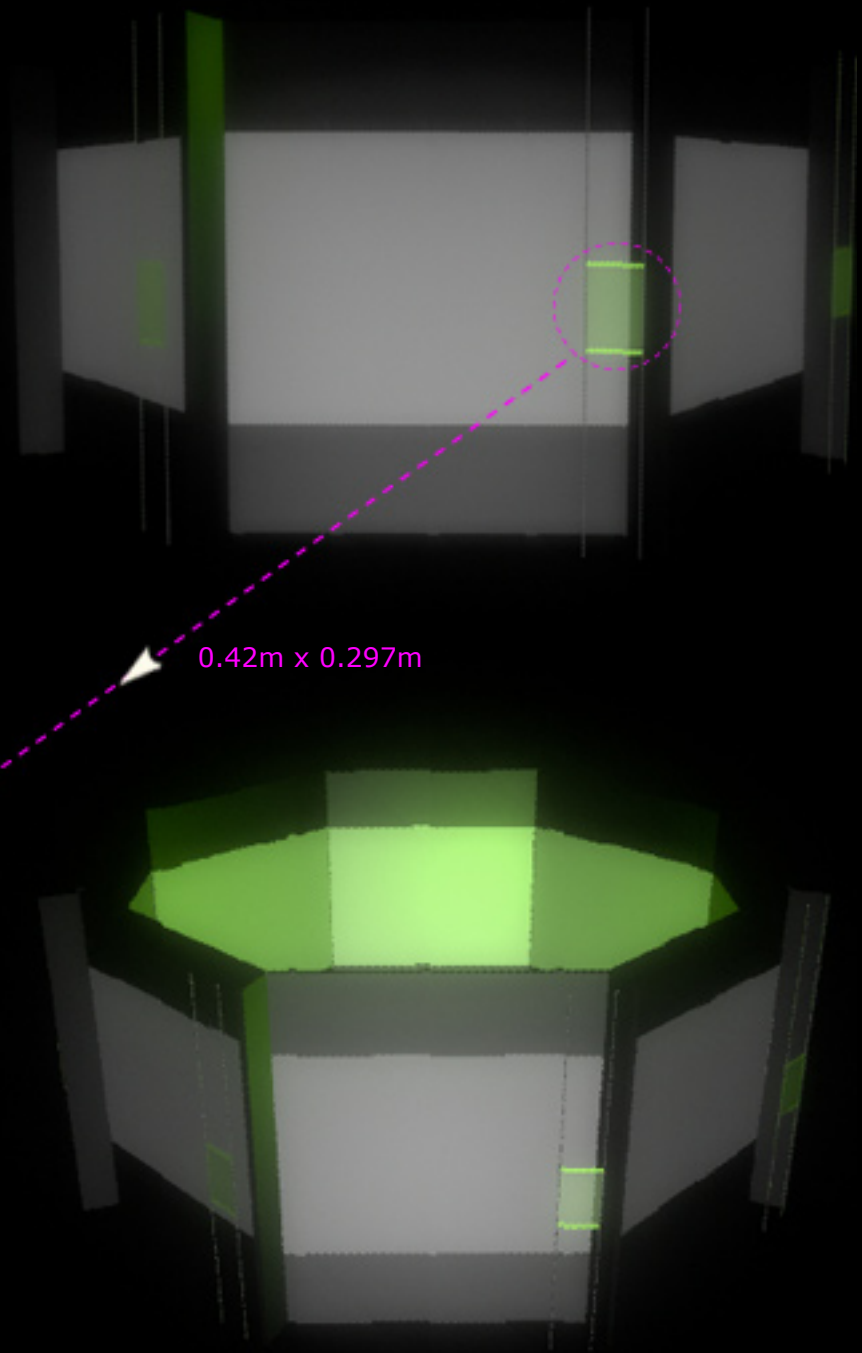
Space in detail



The interactive touch panel is positioned in front of each of the stereo screen.

. Distance from the stereo screen and the touch panel : 0.5m
. Distance from the stereo screen to the end wall : 3m
. Touch panel height from floor level : 1.5m
(minimum standards eye level for kids age from 10-12yrs old)





safety
considerations

OVERALL SAFETY CONSIDERATIONS
As the target audiences are mainly kids, safety is crucial. Safety materials has been consider such as panel material that made by Perspex, silicone and LED.

All this material is considered as low toxicity, low power consumption, which is safe for children. The uses of silicon are to cater the kids with its soft invisible physical characteristic. The sensors technology is also important as it allow the users to use the panel smoothly.

The panel’s arms/poles are mounted to ceiling and floor and can be adjustable if required (staff assistance is required t adjust the height of the panel).

technical

issue and risk

TECHNICAL ISSUE AND RISK
3D Visualisation Issues (base on my study report)

3D visualization is crucial. Reason being is it needs details modeling and textures as well as animation.

In this project, I spent most of my time trying to model and animate using MAYA 3D software. But it was time consuming. As the alternative, I end up creating with Flash API drawing using scripting which, I have to separate it to another page of prototype for not to confused you.

However, I still take the risk of experimenting with 3D. Without any assistance or a proper 3D class, base on my little experiences, I come out with some 3D model and animations that I include in the prototype to visualized the concept of my design. Although I find that the idea is best shown using VRML or X3D.

I wish I had the ability to produce as perfect so I would be able to communicate my concept well.

usability
testings

USABILITY TESTINGS
This section provides a critique and analysis on interface design and its functionality. The following areas are being considered:

. Outlining results from a usability test conducted on participants

. buttons funtionality

. other strengths and weaknesses of touch panel and VROOM.

PARTICIPANTS
The 7 participants were asked to operate the touch panel using the prototype. They were ask to navigate around the movie clips sections and run the button to test the efficiency of the buttons.

4 of participants are all from Melbourne, Australia; age 27,,36 and 40. One participant is from California, USA age 32. And 2 other participants are from Kuala Lumpur, Malaysia age 9 and 10. The reason for this is to have comments and feedback from different age, language and background audiences.

Anis and Sabrina, age 9 and 10 are the participants from Kuala Lumpur; their mother has conducted the test. They are both study in primary school and have English for their second language since they were 4years old.
A CD with the prototype has been send to them through post. Because they dose not have Internet connection, the feedback has been made through a telephone communications. Each participant was asked to observed and interacted with prototype.

Dave, age 32. He is in California, USA and work as a musician. The prototype is sent to him and the feedback is taken via messenger. Although he is a StarTrek fans but he dose not have any background with multimedia or interactive media accept for music software and instruments.

Zac and Zul both was multimedia student from Australia. Both are 27years old. They both are familiar with interactive media and games.

Husband and wife, Mr.Fuad and Mdm.Sabariah, both are 40 and 36years old. They are permanent resident of Australia for 15years. Mr.Fuad is a manager of Malaysia hall and is familiar with multimedia technology. However, Madam Sabariah is not very familiar with interactive media except for DVD remote controller. They are all tested during their visit to my place.

Anis (female-age10, Kuala Lumpur)

1. She is comfortable with the panel design and instructions arrangement, like a soft drink vending machine
2. She dose not have difficulties to read the instructions
3. She had no problems browsing movie clips.
4. She had problem operating with movie controller /buttons
5. It took her awhile to operate with the buttons and find it a bit confusing especially with new icons for 3D movie and movie with text, zoom-in and zoom out.
6. After awhile she familiars with the concept and found it interesting and enjoys the overall concept.

Sabrina(female-age9, Kuala Lumpur)

1. She feels the panel is a little bit tricky - a bit prim and proper to kids
2. She dose not have difficulties to read the instructions
3. She enjoys browsing the movie clips.
4. She had problem operating with movie controller /buttons and find it a bit confusing especially with new icons for 3D movie and movie with text, zoom-in and zoom out.
5. However, she familiars with the sound and rotation button.
6. She found the panel is interesting and entertaining and hope to have it in Malaysia Petrosains,Twin Tower.

Dave(male-age32, USA)

1. He is fascinated by the design and concept
2. He dose not have difficulties to read the instructions
3. He enjoys browsing the movie clips and found it interesting.
4. Because he always works with music software and instruments, he understands the button icons by button's instructions and had no problem operating with them
5. However, he said it would be great if the panel size could be slightly bigger and mobile – like a navigator device
6. Overall he found that the panel is a great idea to view complex information that driven by the users.

Zac, female- age27 and Zul,male- age27 (Australia)

1. They thought the idea is great and have lots of opportunities
2. They dose not have difficulties to read the instructions
3. They agreed that the instruction need to shown as step by step as designed.

4. New approach for the animated movie clips browser is great and interesting
5. However, they reckoned to reduce text, as it seems to distract their visions
6. Overall they found that the panel is a great idea to approach a conventional VROOM either in Melbourne or rest of the world.
7. They agreed that audience should be exposed to complex data and also complex interactive interface in order to avoid technophobia or vrphobia.

Mr.Fuad, 40 and wife Mdm.Sabariah, 36 (Australia)

1. They thought the idea is good
2. They dose not have difficulties to read the instructions
3. They agreed that the instruction need to shown as step by step as designed, but the help sections need to sit permanently so that users could see all the time
4. New approach for the animated movie clips browser is good so that user could see the animation before proceed them for a bigger view
5. However, they reckoned to have the panel in mate finish like the ordinary touch screen panel
6. His wife is fascinated by the movie clip controls, and wishes to have them installed to her DVD controller to view all movies in stereo visualization.

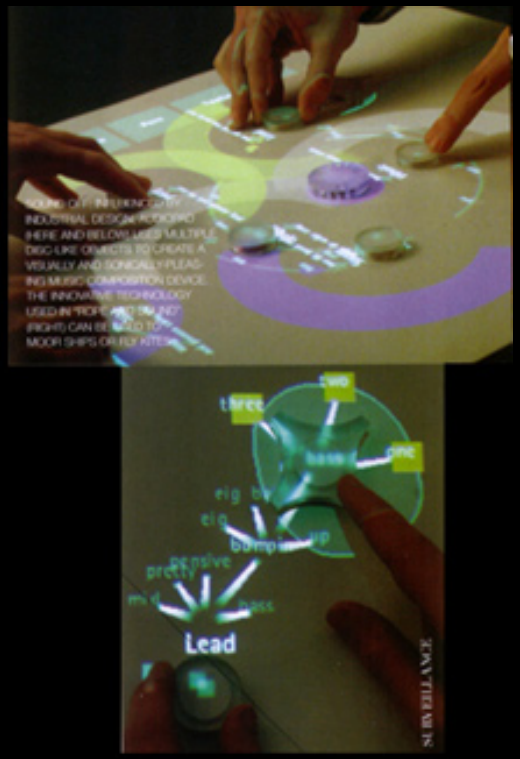
Naza, 28 (Australia)- currently working with HPArchitect Melbourne.

1. He likes the idea
2. They dose not have difficulties to read the instructions
3. Well structured and like the new approach for VROOM
4. He wish the VROOM is bigger so that it can have much more possibility for the touch panel and also to the audience to move around freely
5. He thinks that the VROOM space needs to reconstruct. Because of it size, users are fascinated to the animations but, the aims of delivering complex animation is achieved if audience could have more space to move around and view the screen from far and near
6. Overall the idea and concept is interesting.

design
inspirations

1 Audiopad
source: Surface magazine#55, pg55

Insfluenced by industrial design, this audiopad uses multiple disc-like objects to create a visually and sonically-pleasing music composition device.



2 Jun Rekimoto, Brygg Ullmer, and Haro Oba, DataTiles: A Modular Platform for Mixed Physical and Graphical Interactions, CHI2001, 2001
http://www.csl.sony.co.jp/il_e.html#rekimoto

The DataTiles system integrates the benefits of two major interaction paradigms: graphical and physical user interfaces. Tagged transparent tiles are used as modular construc-tion units. These tiles are augmented by dynamic graphical information when they are placed on a sensor-enhanced flat panel display.

They can be used independently or can be combined into more complex configurations, similar to the way language can express complex concepts through a sequence of simple words.

3

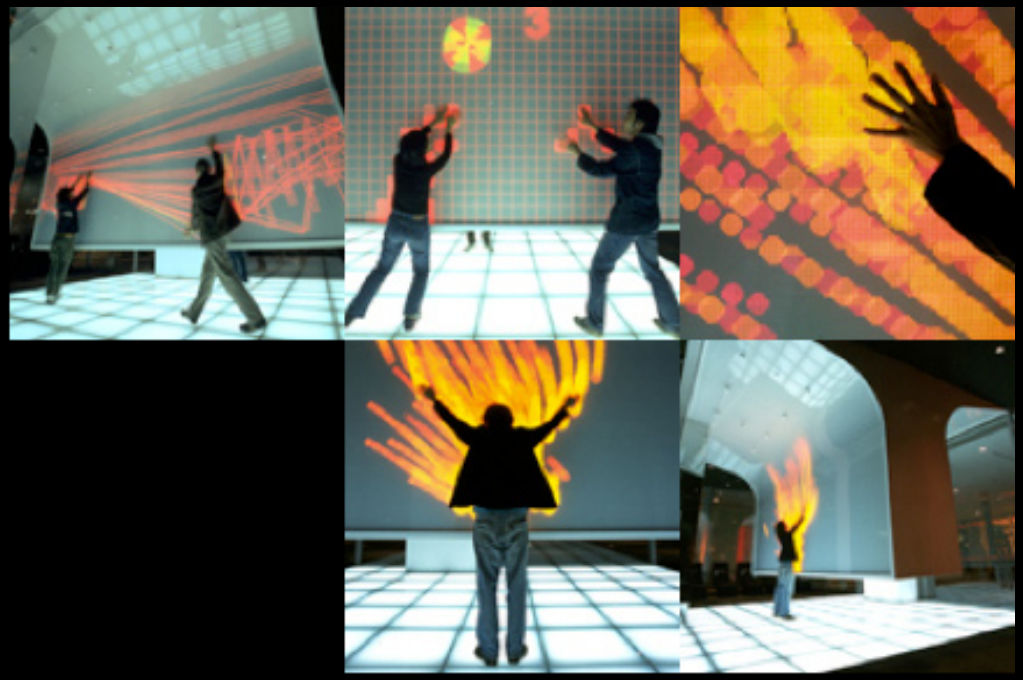
Klein-dytham architecture
Bloomberg ICE
Marunouchi, Tokyo 10.2002
http://www.klein-dytham.com/index.php

A pure white element in the space allows clouds of information to condense. Something like an icicle suspended from the ceiling where data magically forms. Ice of couse is pure and very cool, but ICE can be also interpreted as Interactive Communication Experience

In its resting mode with no one interacting with it stock tickers are expressed in a fun and easily understandable way. If the stock is up the stock sign swells - if it drops the stock shrinks and drops below the line.

When ICE is approached, the infrared sensors behind the 5.0m x 3.5m glass wall detect your presence and you begin to interact with the data. You don't actually have to touch the glass - the sensors dectect you from about 500mm away.

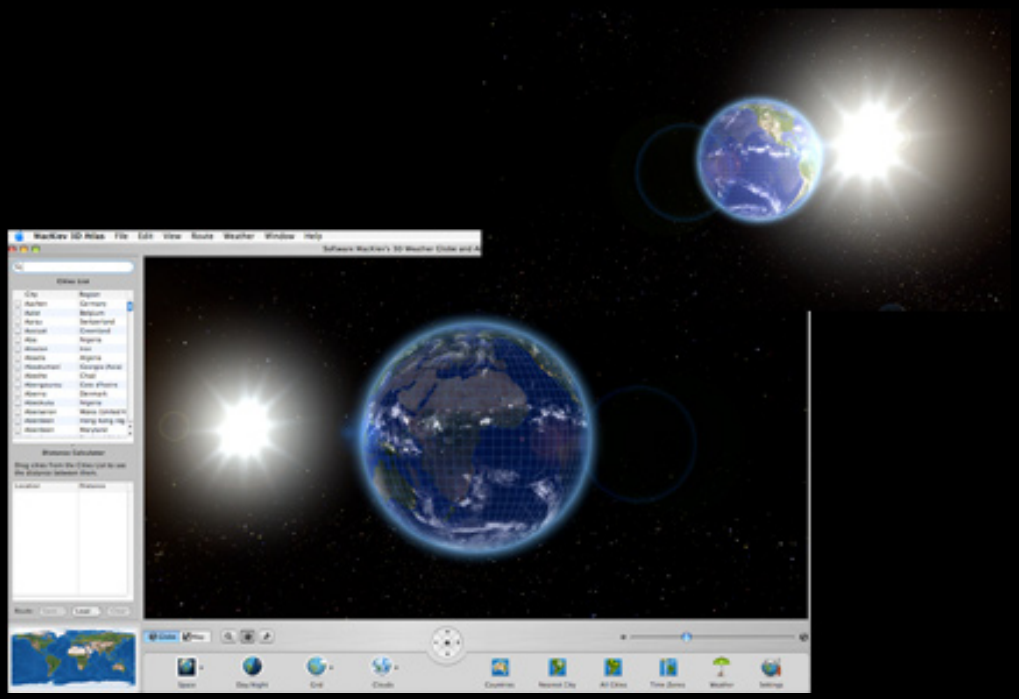
A menu scrolls down the screen giving you 4 play options, a digital harp, a digital shadow, a digital wave and digital volley ball.



4

Mac-Kiev 3d weather and globe

Interactive atlas and weather information around the glode -it allow users to view the information in 3D, day or night mode.

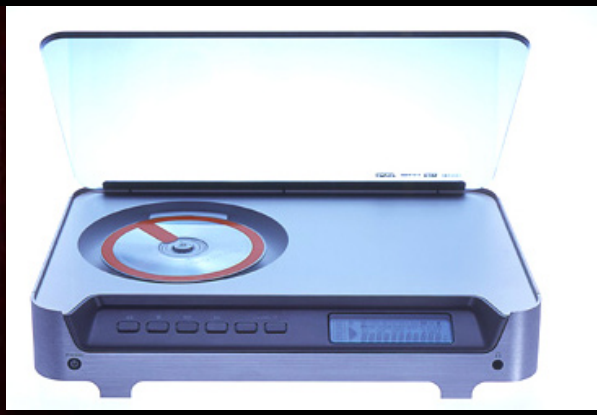


5

BoboDesign Ltd

http://www.designboom.com/snapshots/london_02/perspex.html
http://www.bobodesign.co.uk/marriageofmaterials/site.html
http://www.momentum.ch/pro01.html

These projects by uk designers bobo design Ltd, group of design associates. They have created works using perspex, which challenge the way we traditionally view materials and their interaction. From crystal clear perspex sheet and block, to the latest shades of perspex pearlescent and perspex frost, including the recently launched perspex frost hot colours, unveiled for the first time at 100% design 2002.

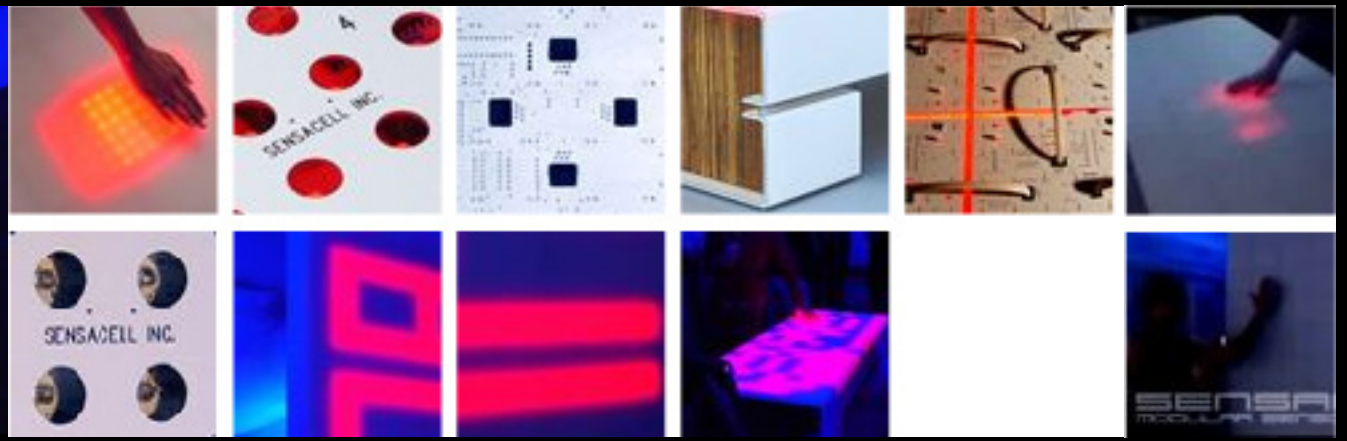


6

Sensacell technology

http://www.sensacell.com/

Sensacell system is a human interface technology. It is ideal for smart architecture, interactive multimedia,retail entertainment, and a host of exciting new applications. Sensacell modules can be assambled to form interactive sensor surfaces of any size or shape from single module to 1000's of square feet, providing absolute sensing resolution down to 3 inches or better. The 6"x6" Sensacall is a clever combination of advanced sensors, smart-networking technology and solid state LED lighting.



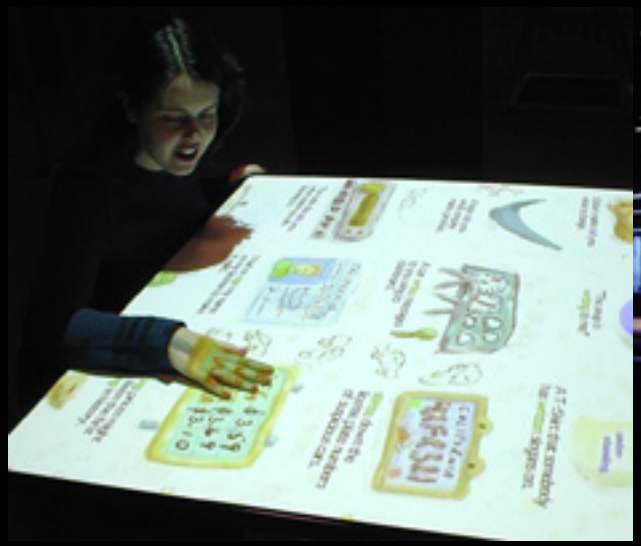
6

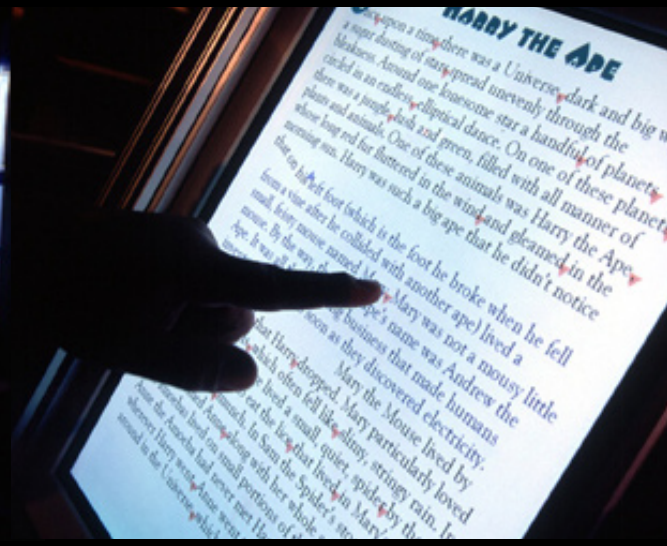
Onomy Labs designs
http://www.onomy.com/blue/interactives.html

Onomy Labs designs creates evocative interactive systems that enable audiences to experience the future. They work with the most advanced technologies, as they emerge fresh from the lab bench.

Onomy Labs creates signature exhibits. Their designs can provide an interactive centerpiece for lobby, gallery, university, or research project. Onomy Labs fuse the four major creative disciplines of art, science, design, and engineering to create robust and easy-to-use interactives that engage, educate and entertain.

Onomy Labs design methodology includes techniques for modifying the cultural context of the new devices they develop. Their interactive systems are found around the world in research labs, corporate briefing centers, theme parks and museums.





7 Touchy-Feely Screen

http://www.technologyreview.com/articles/05/09/issue/forwards.asp?trk=nl#

Touch screens greet tourists at museums, shoppers at checkouts, and even drivers on dashboards. In spite of the name "touch," though, they don't feel like much-just flat, boring glass or plastic. But press a virtual button on a screen from San Jose, CA's Immersion, and you'll feel the same satisfying clack you'd feel pushing a key on a keyboard. The device works by tricking your sense of touch. Precise motors vibrate the top layer of the display. The vibration varies depending on which graphic you touch. An on-screen visual response and an audible click or buzz add to an illusion that overrides your perception of the display's hard surface.

8 Sajjadah

http://www.sonerozenc.com/upload/index.php

A sajjadah (the persian word for 'prayer rug') that uses an electronic compass module, mini LEDs, fibre optics & LED light embroidery to display the direction towards Mecca by varying the brightness of the light panel, while the patterns themselves provide for an atmospheric experience of a mosque. [sonerozenc.com|via gizmodo.com]

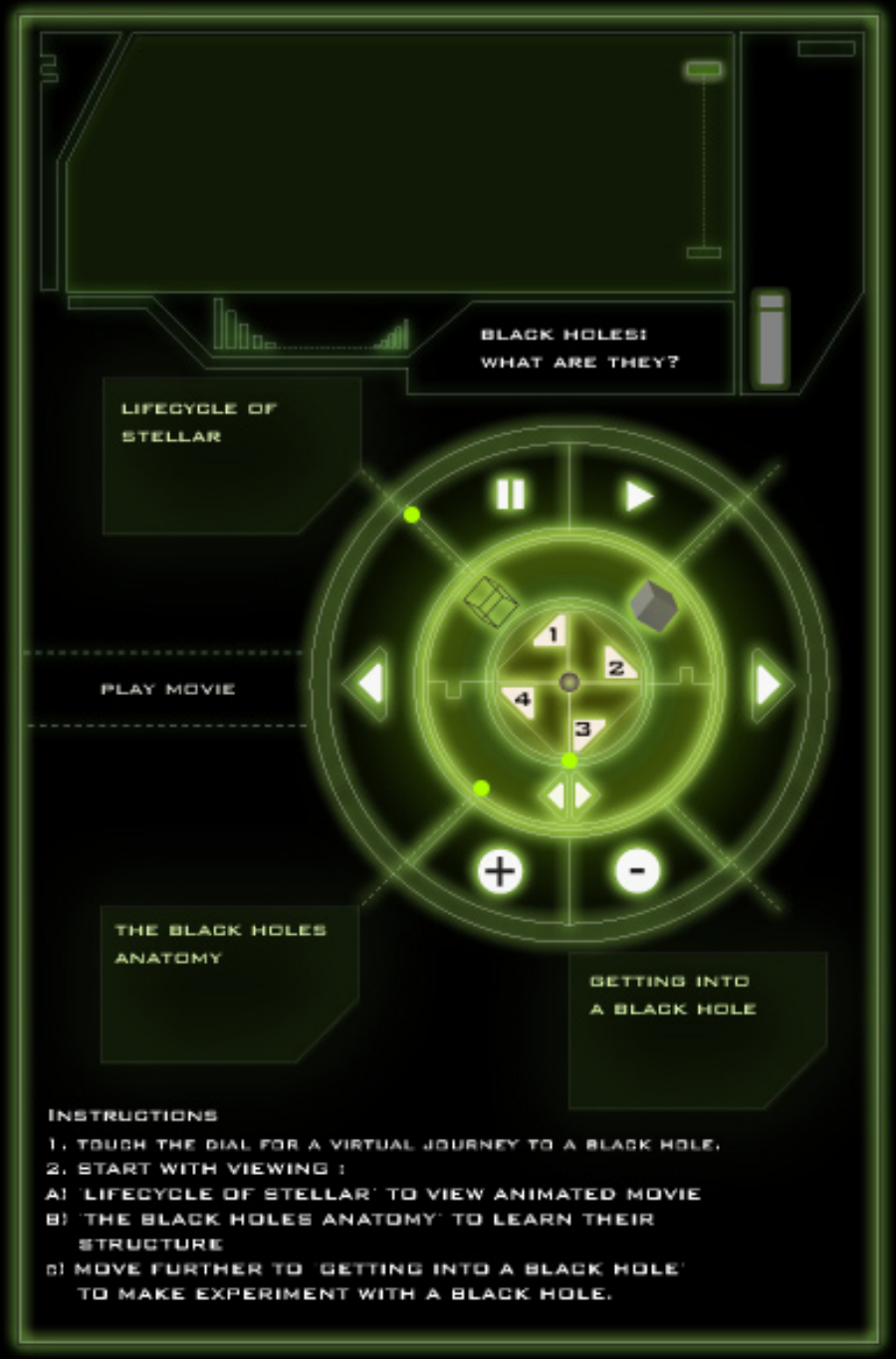
9

Tenori-On
http://infosthetics.com/archives/interface/

A ‘visible music interface’, or a digital music instrument featuring a 16x16 matrix of LED lights, allowing even non-musicians to play sounds & improvise intuitively. each LED light also functions as a touch-sensitive switch that is capable of emulating related sounds when touched. when users push a switch a short time, a ripple of light & sound spreads out. when a switch is held longer, the light dot & sound will be played repeatedly (looped). several tenori-ons can be wirelessly connected & synchronized. [yamaha.co.jp|via we-make-money-not-art.com]

preliminary

design and process



PAUSE MOVIE	PLAY MOVIE	LEFT VIEW	RIGHT VIEW	ZOOM IN	ZOOM OUT

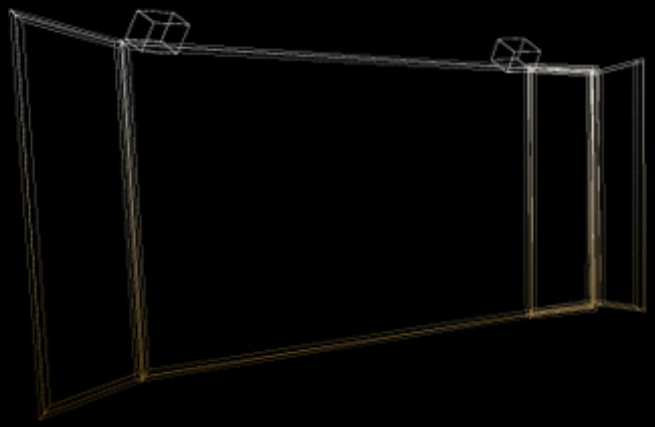
VIEW STRUCTURE	FULL VIEW ANATOMY	STEP 1	STEP 2	STEP 3	STEP 4

dial
design process

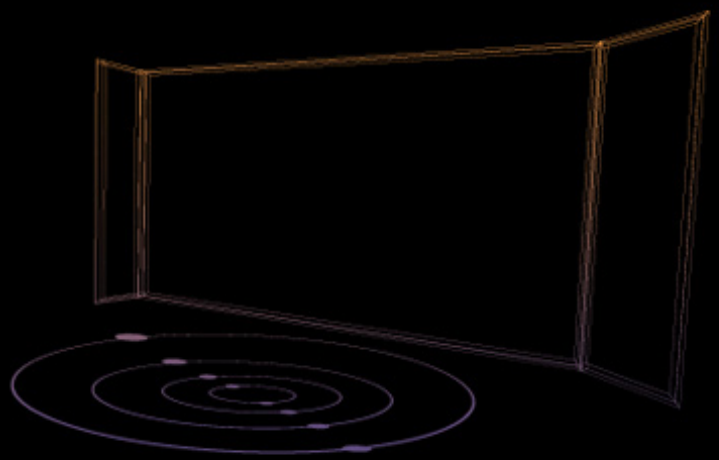
idea

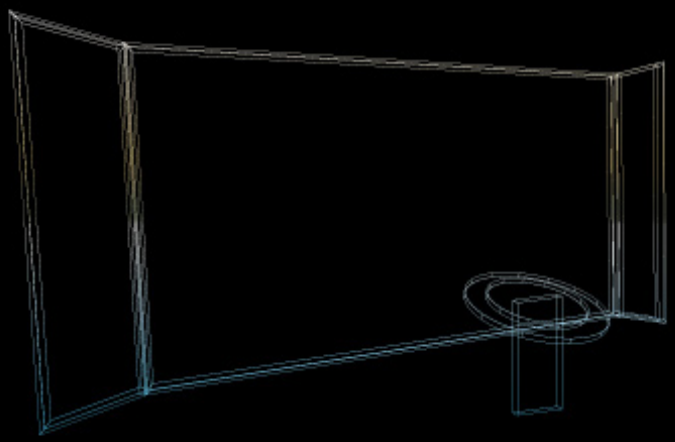
development of screen treatment/possibilities

track motion camera

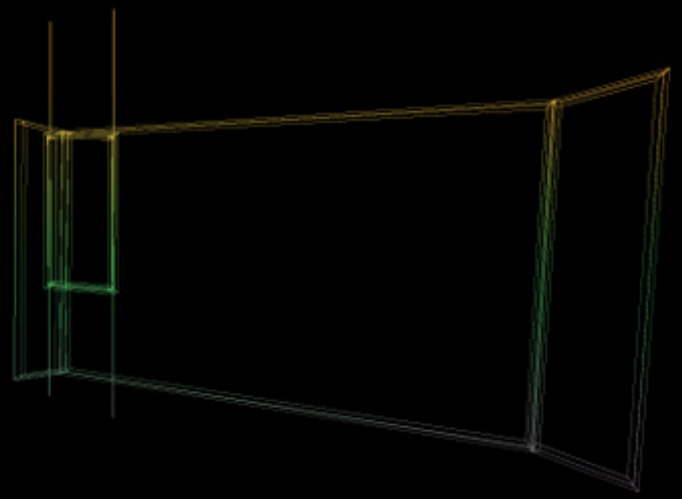


lights sensor of black hole





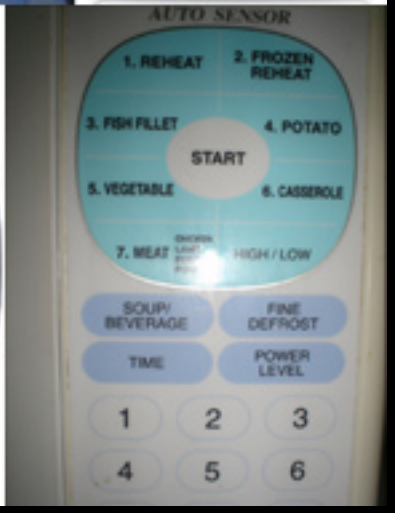
lower place metal touch panel



transparent thin perspex touch screen

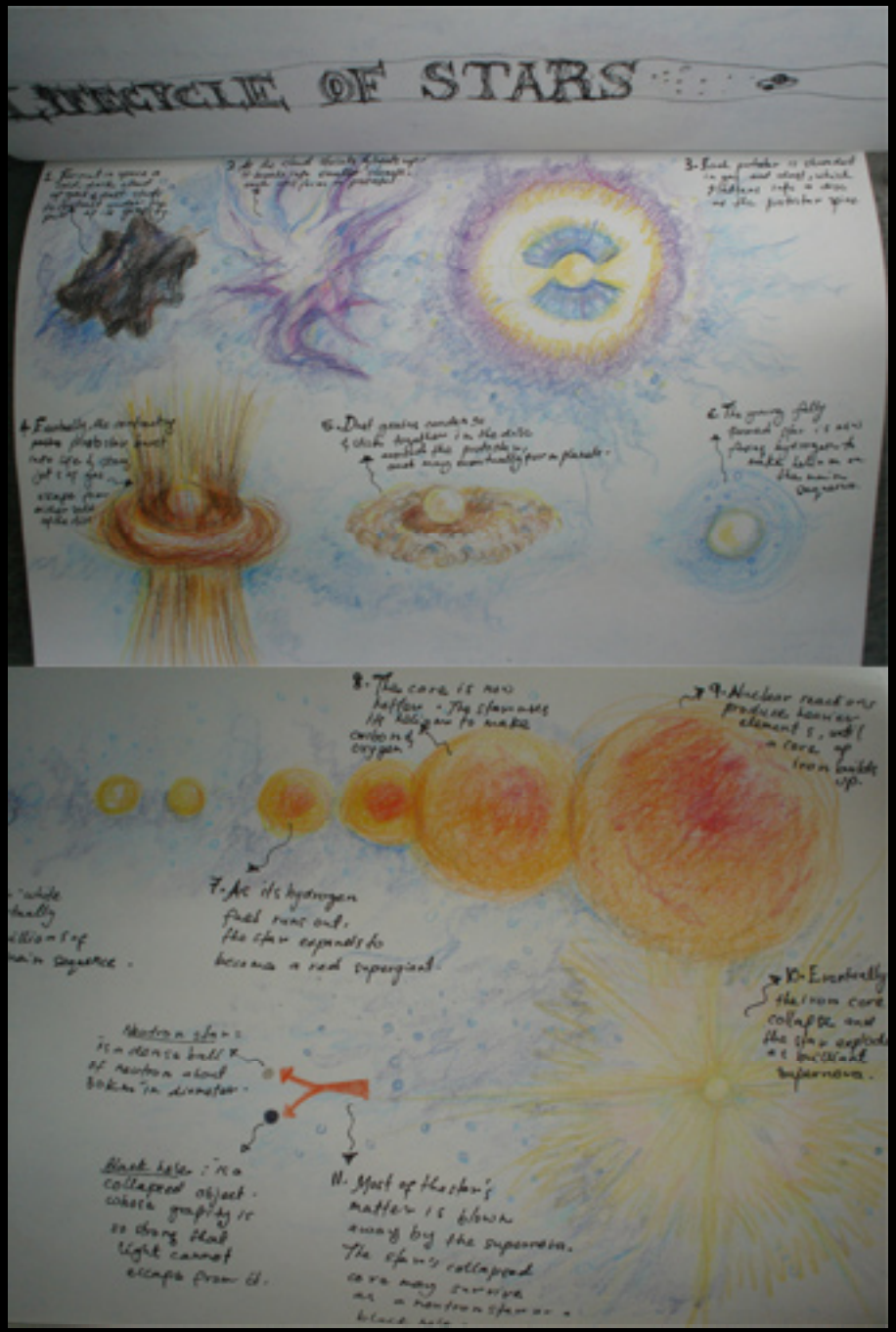
button
design references

Observation has been made through button interface of a few devices such as Sony Clie PDA touch screen, Ipod wheel tuning buttons, microwave, Portable Sony Playstation and Korg keyboard buttons. Observation is made to study size and icons of each device and how it communicate to the user.

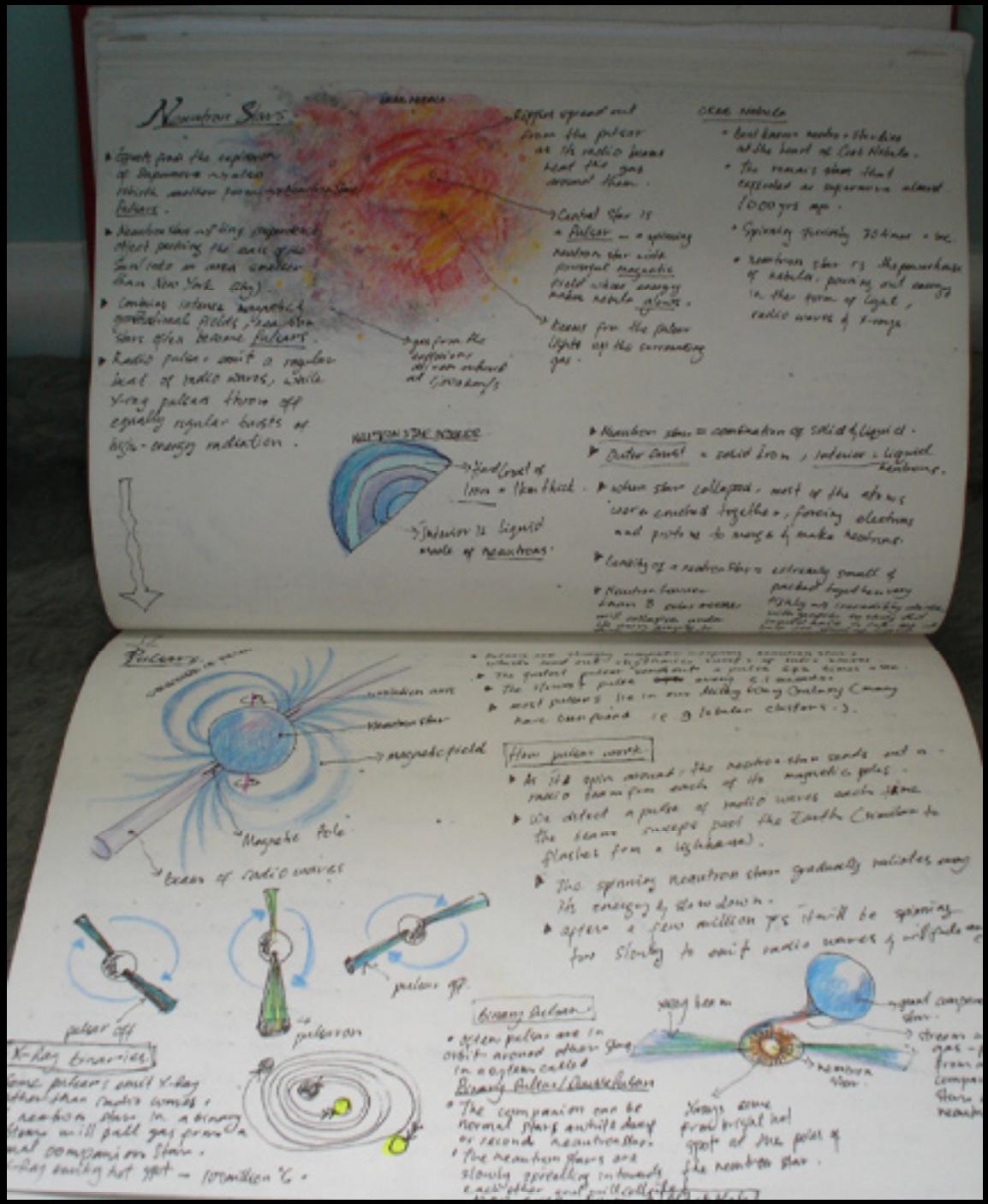


stars
study and sketches

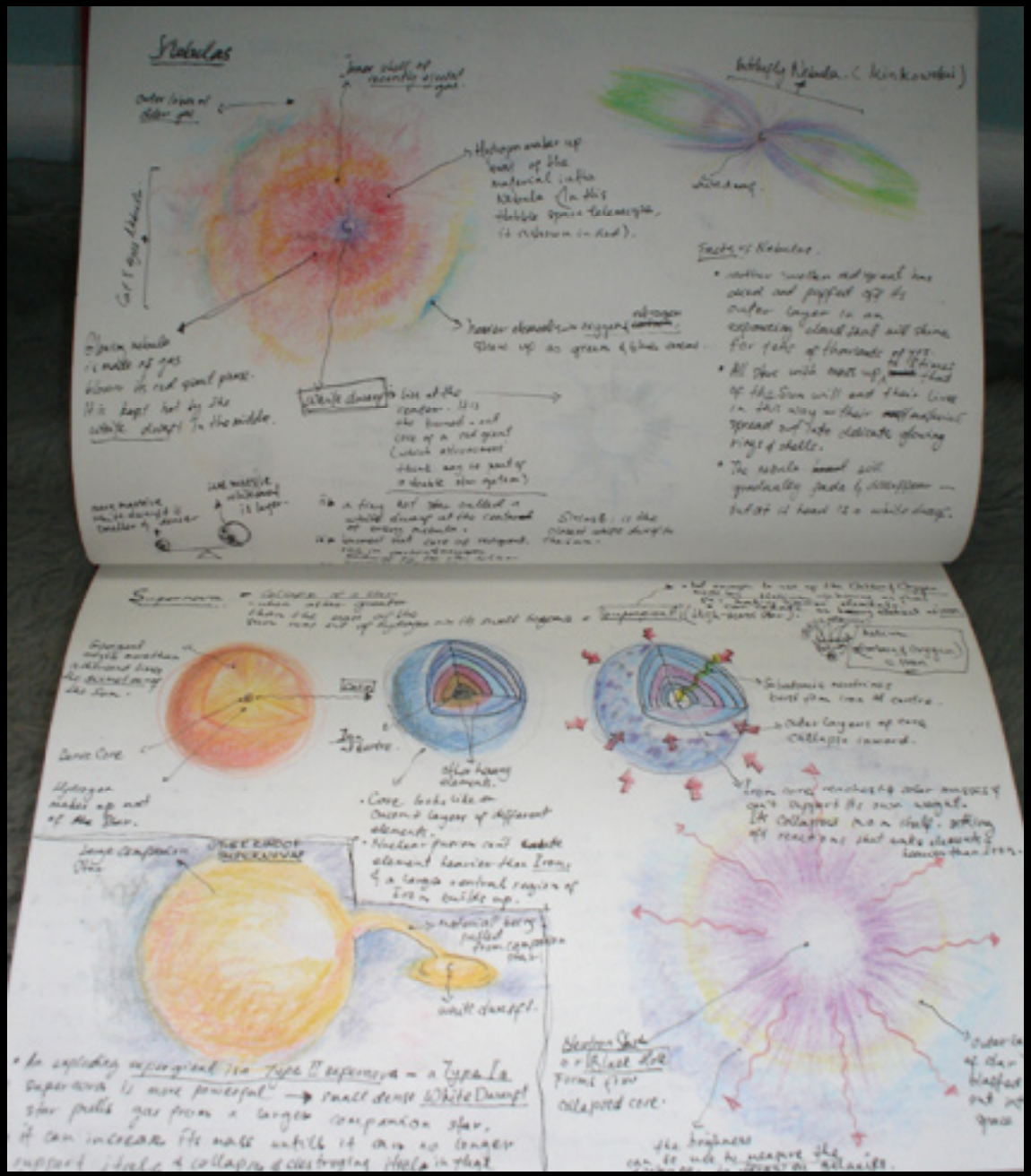
Sketches and drawing helps to study of the understandings of stars and galaxies formation and it physics law. Encyclopedia is used to get an accurate reference of images and terms.



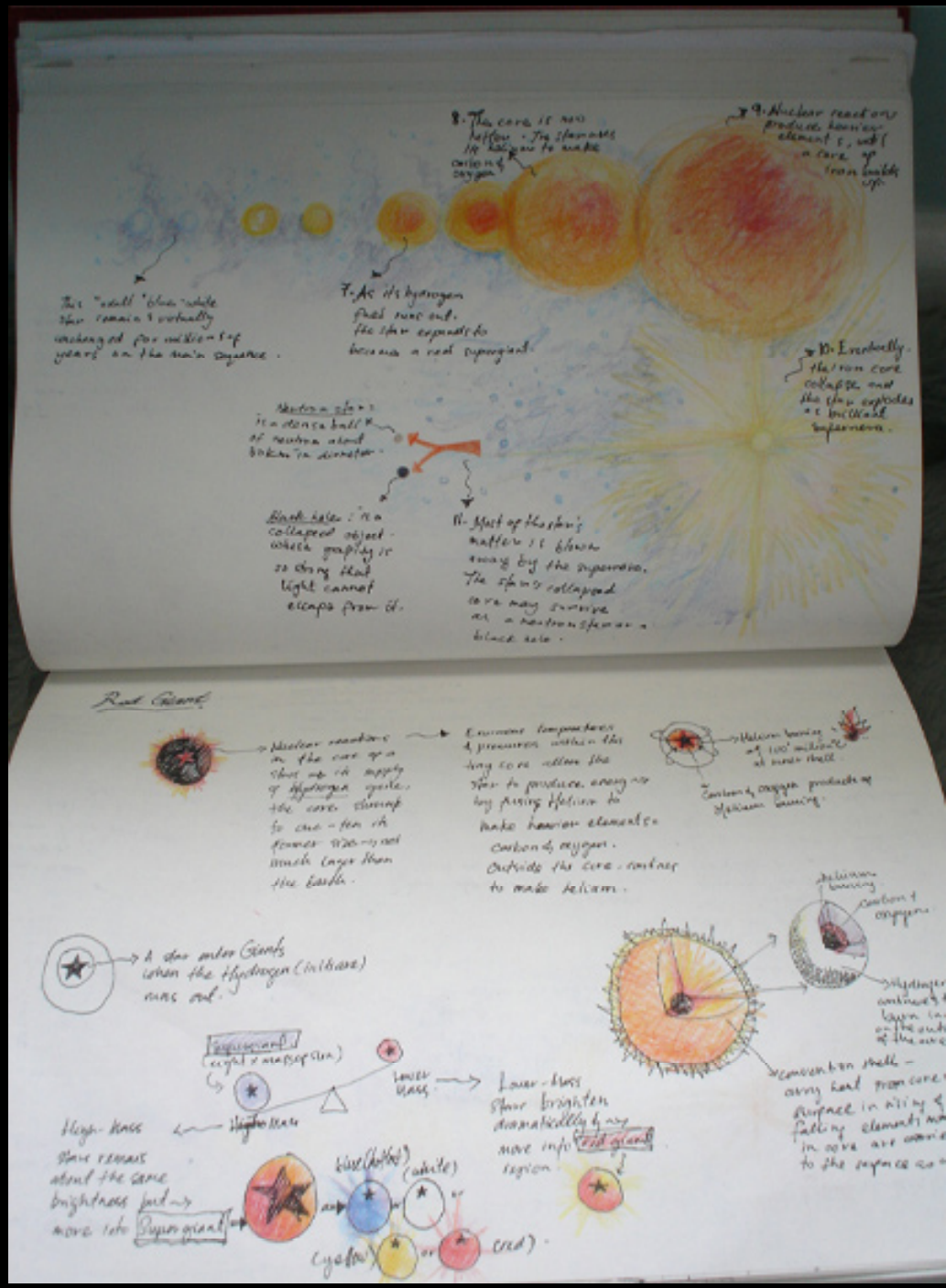
study of neutron star and pulsars



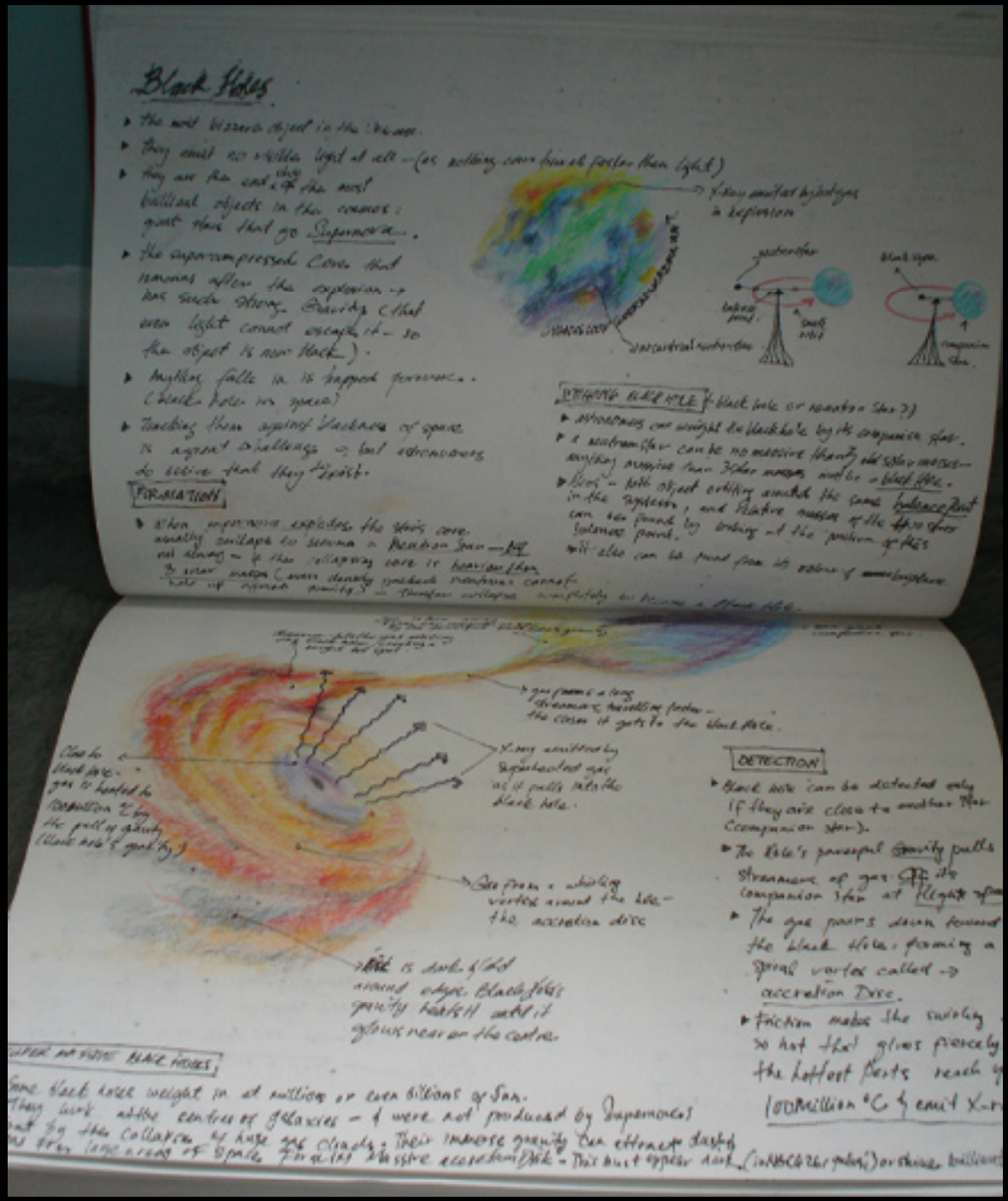
study of nebula and supernova



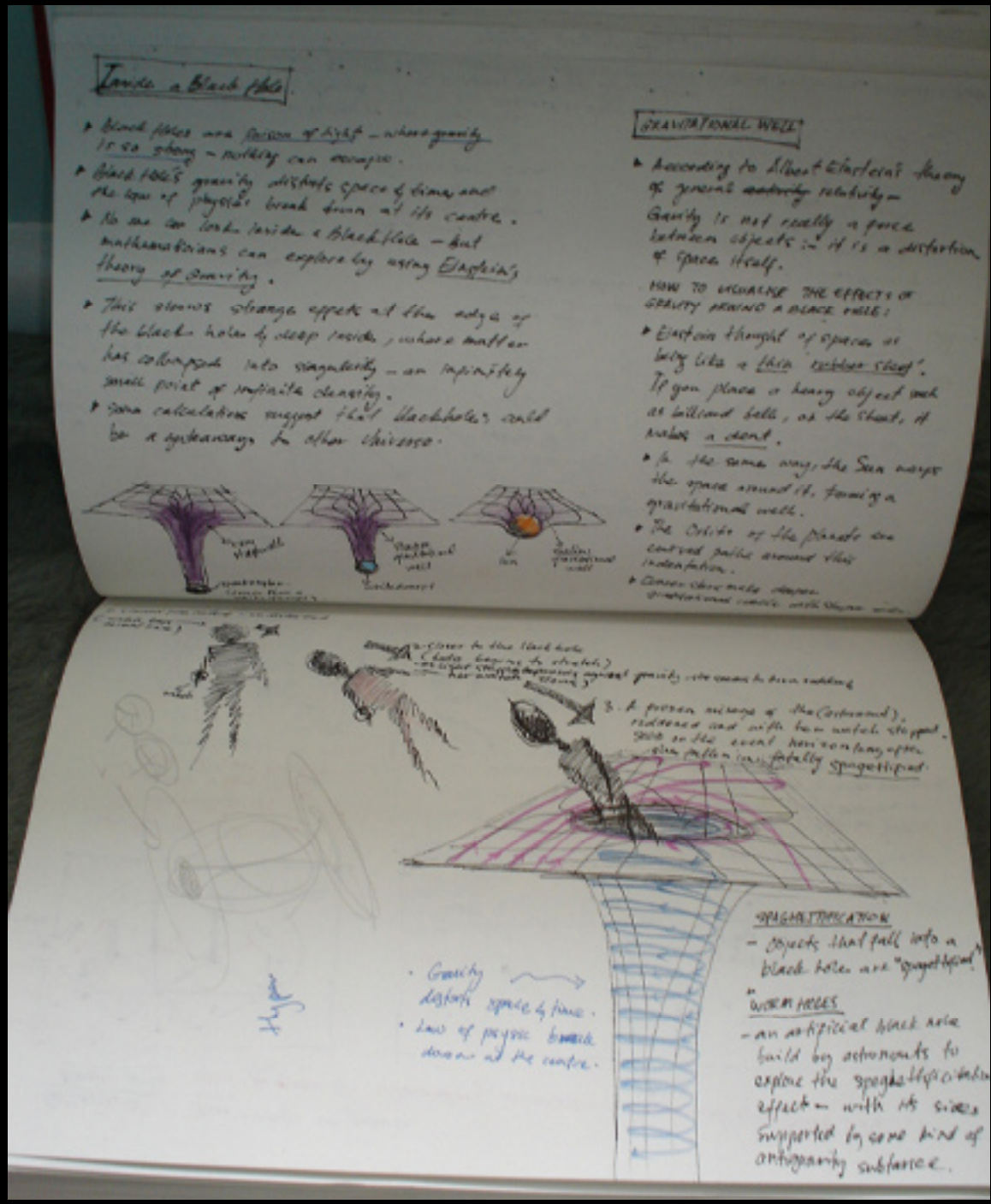
study of star formation and redgiant



study of black holes

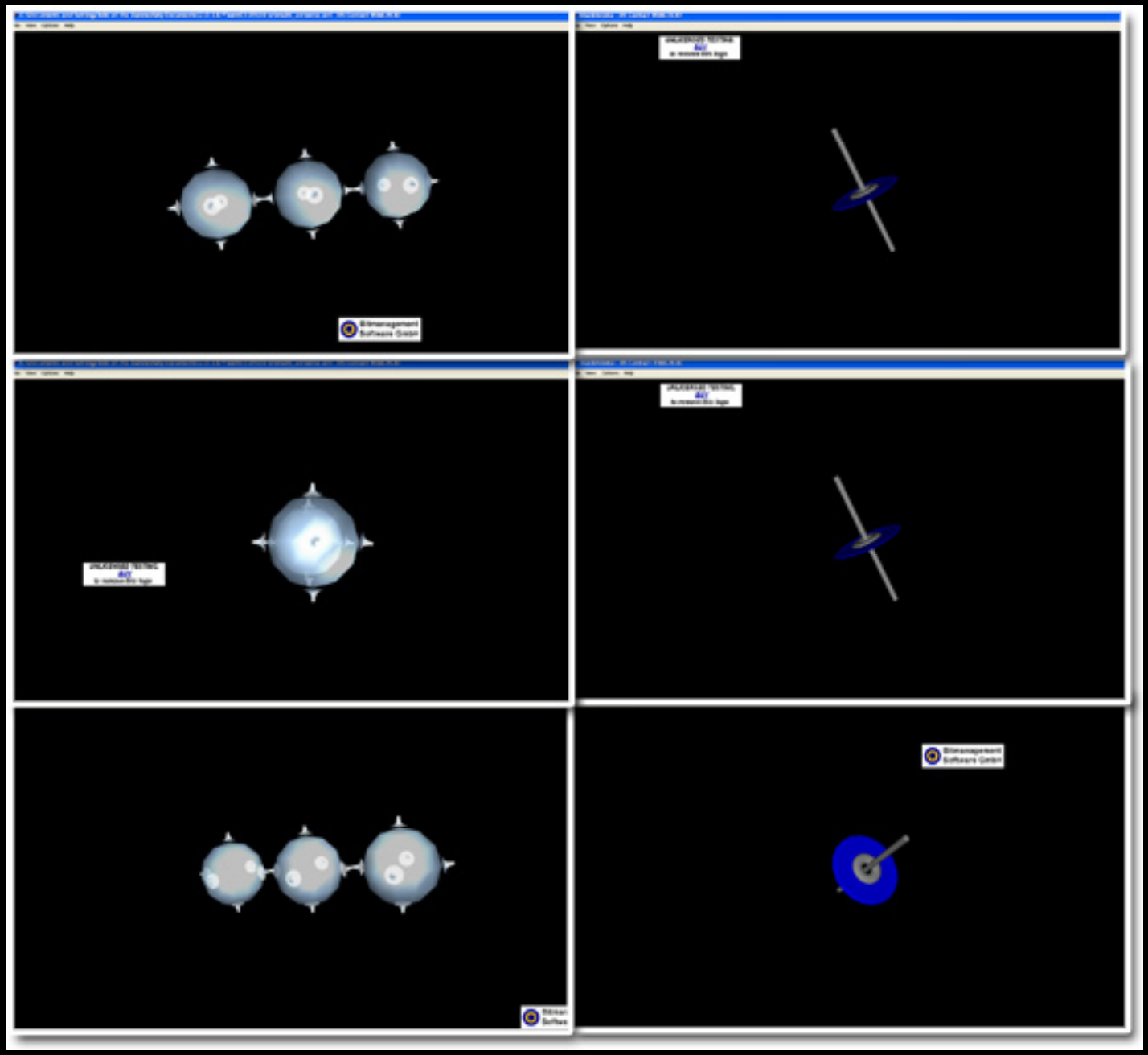


study of black hole's anatomy and the distortion of time and space



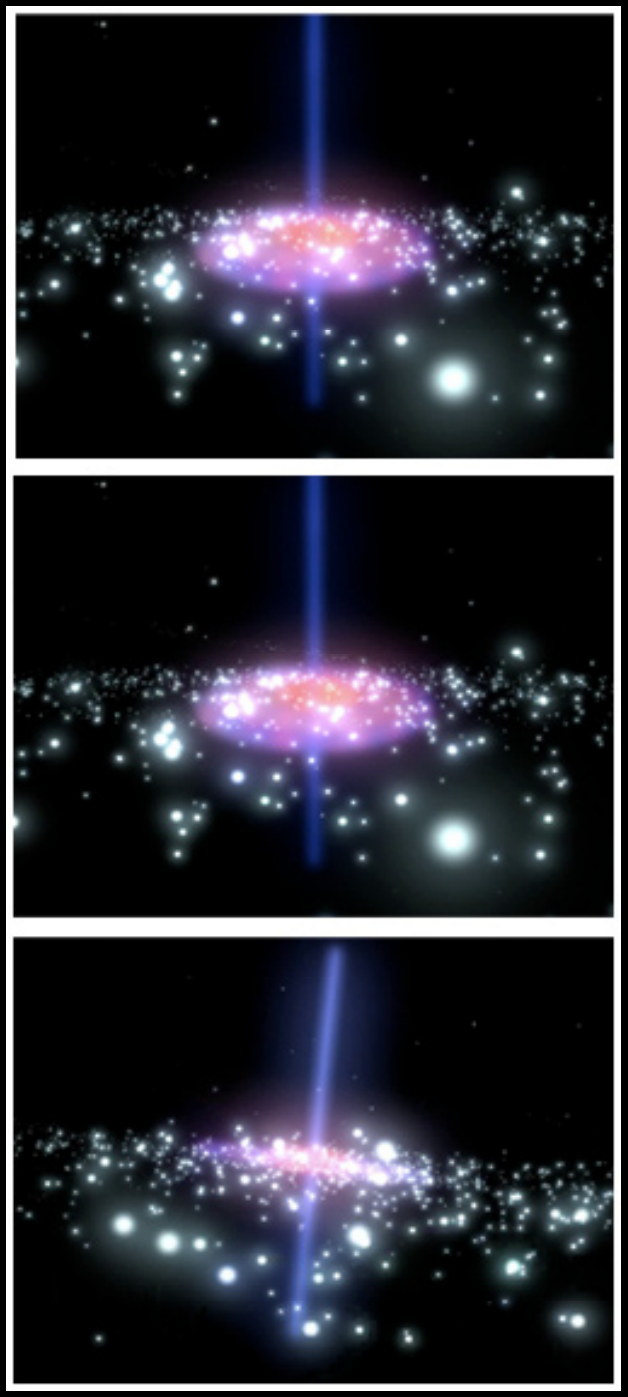
x3d
experiments

Experimenting with X3D and VRML using BitSoftware Management. Object is modelled using MAYA and exported as .x3d to the software. Unfortunately this software is for PC only. Since I worked on Mac computer, Mac just cannot view or run the file.



flash
experiments

Experimenting with Flash driven360^0 movie. The movie is triggered by rollover mouse to get the object rotate for 360^0. Objects are modelled and animated using MAYA before exporting to Flash to run the interactive scripts.



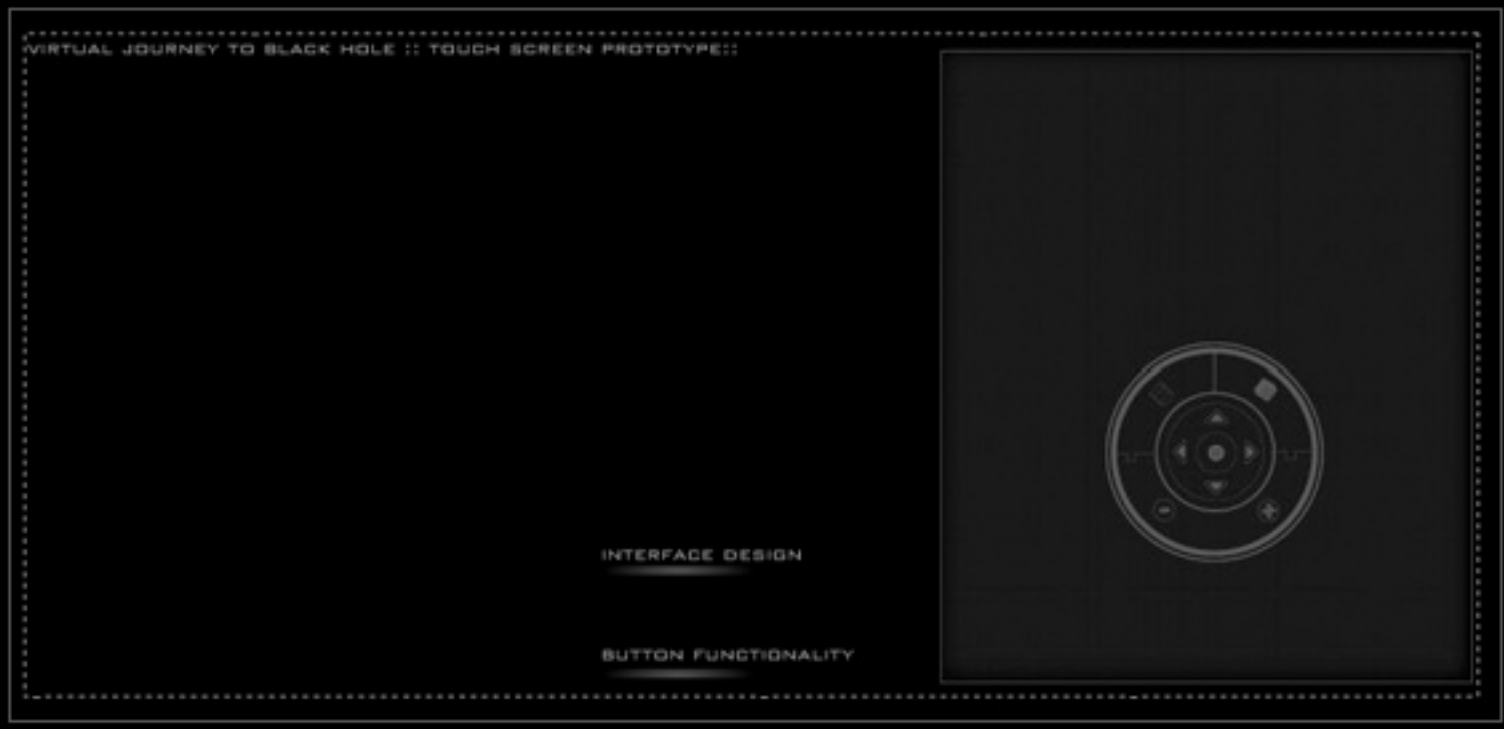
prototype
interface

The prototype consists of 2 sections. You can start browsing from the index page that have 2 subjects:

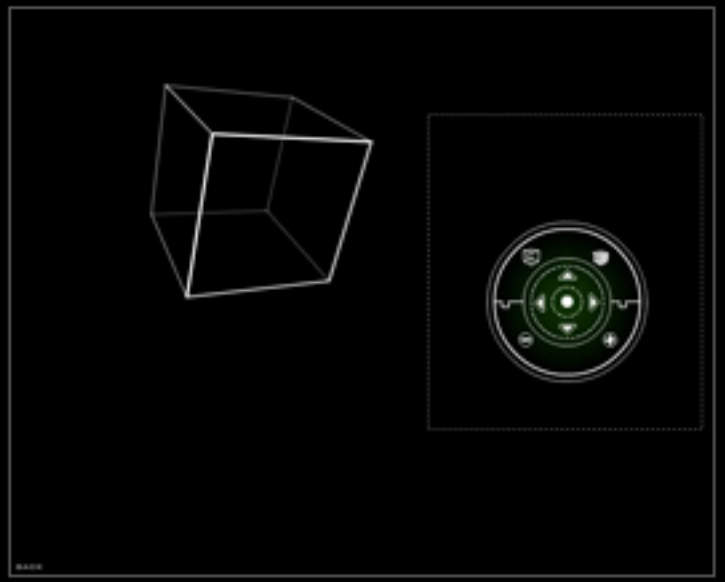
. Interface design
. Button functionality

Note: These two section is made to saperate the movie controller that has been made using Flash API scripts. Therefore, it needs to be in saperate page.

prototype index page



button functionality section



touch panel interface section

project

timeline

Week	Task
1	Project brief
2	Discussion of project concept and idea-brainstorming
3	First presentation of 3 initials ideas
4	. ACMI visits . Idea is finalised
5	Meeting with Andrew and Anita for Astrophysic project
6	Study of stars and galaxies begun - drawing and skethes . Research of materia land technology for touch screen and user interaction design
7	Consultation and idea presentation with Andrew (Visual Comm class).
8	Final concept and idea finalised. Presentation with Mark.

Week	Task
8.5	Study and experiments week: . study of 3D modelling and animations with MAYA . experimental with 3D interactive and VRML with Directormx (3D shockwave), Cult 3D Designer and BS Contact VRML/X3D . study of API Flash scripts
9	Production begun
10	Consultation with Mark . design in depth . mock up size and dimension
11	Presentation with Anita and Andrew (Visual Comm class)
12	Prototype testings and usability feedback
13	Final presentation

conclusion

WHAT I HAVE LEARNT THROUGH THE PROCESS?

. Learnt about technology that combines science and art for public education to develop user interaction and immersion

. Complex visualization using 3D is crucial and time consuming – be prepared!!

. Complex visualization like science can always be simplified through 3D visualization especially using virtual reality approach

. There are so many possibilities for VROOM particularly with user interaction

. Learnt a lot about process of making interface design for custom made touch screen and its component and materials although the process is complicated

. A multimedia designer should also know about the specs and the mechanisms of a product that they designed along with creating interactive interface prototype to get the design achievable and logical

. I really wish that I had a proper reference and guidance on making the 3D visualization so that it could achieve its aims.

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