

Design Research Proposal Brief:

“I SHO U”



HDG409: New Technologies Research
Dr Keith Robertson & Dr Simon Jackson
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Callaghan Forsyth 6497950
Ha Co 6652638
Jessica Langdon 614876X
Nick Lyall 6148816
Nathan Orton 6148425
Mario Yannakakis 4084349

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ABSTRACT

Description of the project proposal

The Rio Tinto AVIE exhibition by iCinema UNSW is a fully immersive 3D exhibit currently running at the Melbourne Museum. The stakeholders behind the AVIE exhibitions are interested in using user-centered design principles to determine the 'felt responses' of users of the new technology.

The information gathered from these users gives the stakeholders and exhibition designers a powerful tool in designing successful and pertinent displays for the public. The main issue lies in successfully extracting this vital data without inconveniencing users and creating biased data provided by the test subjects. This will be achieved through the successful application of design interaction and creative experimentation within the possibilities of information collection in assisting users to express their experiences.

Emotional definitions and theories from Wundt, Picard and Lazarus have influenced the type of information that will need to be extracted as stated above to produce pertinent data. The required data lies in the split-second emotive responses of the users during the exhibition. Research into emotive evaluation techniques and new technologies such as the iCalm (Hedman, E 2009) led to the ideation for a device that could be worn by users in the AVIE exhibition to passively monitor two key aspects of their experience. The two keys aspects are, what the immediate felt emotional responses of the users were and what the users were directly responding to.

The integration of the device into the existing exhibition proved the most crucial aspect of the design in making the monitoring equipment as unobtrusive or noticeable as possible. The solution lay in the 3D experience with the users required to wear a pair of 3D stereoscopic glasses, this lead to the integration point that would prove the least invasive and eliminated the need to incorporate another piece of function based paraphernalia into the design experience.



BACKGROUND

An introduction into the context and meaning of this project

Focused on the interactive, stereoscopic immersive environment of the AVIE exhibition at the Melbourne Museum, this design proposal looks at the application of design and new technologies to assist users to describe and evaluate their exhibition experience. With a focus on user-centred design this proposal looks at the abstract and hard-to-explain aspects of user experience, portraying user emotions at real time in correlation to specific events.

Emphasising the need to obtain accurate unbiased data the proposed solution will look at capturing data in the most unobtrusive ways possible. Eliminating the need for users to actively participate in the emotive evaluation process through producing their responses cognitively, a product will be developed through which user information will be measured passively. This passive involvement is hoped to eliminate bias and incorrect responses from the users.

Through secondary research it was discovered that there were no current emotion measuring devices that were suitable for the context of the AVIE experience with the functional capabilities required as listed above. Looking back into early methods of emotive evaluation, relevance was found in theories by Wilhelm Wundt who used a method of three bipolar affective dimensions to describe and evaluate emotion. The dimensions included breaking emotion into “pleasant versus unpleasant, high arousal versus low arousal, and concentrated attention versus relaxed attention” (Blumenthal, 1975). In conjunction with the theory of Richard Lazarus that human emotions follow the pattern of cognitive appraisal, physical responses and action, the proposal will be aimed at measuring the physical responses of the users. Further illustrating the possibility for success in this context of exploration is the statement “if emotions are universal, the experience of different emotions should be associated with the same distinct facial expressions in every society, worldwide” (K Oatley, D Keltner, J M Jenkins, 2006).

Sharing similar views to that of Wundt is Rosalind Picard. From her own work, Picard suggests that there is merit in looking into “two dominant dimensions of emotion that can be described as valence (pleasant vs. unpleasant or positive vs. negative) and arousal (activated vs. deactivated or excited vs. calm),” (Picard, 2009). The challenge for the proposed solution lay in finding and combining technologies that can determine these two aspects of emotion from physical responses. Two cutting edge technologies, electromyography (EMG) and electrodermal activity (EDA) have

been found to produce the data required to passively measure user emotions. Recent studies have seen the testing of such EDA wireless monitoring devices such as the iCalm (Hedman, E 2009) being linked to measuring emotional states of children with autism. New advancements in these technologies are being explored as to the accessibility, capabilities and functionality as well as whether they will be feasible for the requirements of the solution.

Emotional reactions are the primary type of information intended to be gathered from our proposed solution, however there will also need to be a type of secondary type of information gathered to provide assessment and reasoning for these emotional reactions. Context and events occurring during the exhibition will play a big part in accessing the emotive responses gained from the users. For this reason we must also incorporate into our final a solution a method of distinguishing what the users are responding to making it “possible to cross reference what they are actually viewing at the time” (Whitfield, 2011). Like aforementioned monitoring methods of EMG and EDA the context measuring method must be equally as non-invasive and unobtrusive as possible. Technologies such as eye tracking and motion sensors are examples of methods being investigated for possible use in the solution.

Through our primary research we plan to conduct two investigations into low-tech experience evaluation techniques as well as conduct an interview with an expert in the field of psychology Swinburne Professor Allan Whitfield. The two low-tech methods of experience evaluation are to be an observational evaluation of a user in the AVIE exhibition as well as a post-experience survey. Through these more obtrusive techniques of capturing user experiences we hope to prove the subjective nature of these early methods and provide backing in the potential for design in the more hi-tech methods of experience capturing.

OBJECTIVES

Concerns of the design outcome

Overview

The objectives can be defined and summarized in three categories:
Conduct primary and secondary research into a designed product, determine the products that are out there now on the market and design a proposal as a viable solution to the problem.

Firstly, the objectives are: Conduct academic research on the emotional aspects of recording information that is deemed necessary for a product design. Determine how to capture data electronically for a product design. Through investigative research determine what graphical user interface and methods are currently being used to capture data. Determine what types of emotions that need to be targeted. Determine how to measure emotional states and determine what parts of the human brain are used in defining emotion.

Secondly, Determining the competition will help discover new markets for the proposed solution. Research who will be the investors, if any. Determine what companies or services need and want the product. Determine what processes are needed within information technology to create the product. Determine what method will be necessary to capture the data.

Thirdly, Conduct research and discover how the product will work and what it will look like. Research and develop ideas for where the product will fit on the human body. Through marketing principles and research, determine whether the product is going viral or will it stay local. Conduct research and determine product sustainability, toughness or breakability. Determine the product's usability in the near future. Determine a pricing range and a name for the product.



DESIGN CONSIDERATION

Issues relating to the design outcome

“Evaluation of the cause becomes the depending factor”

Introduction

There are many factors that must be considered in relation to the proposed products. As this is quite a complex idea this will inevitably effect the considerations of the outcome. The parameters that we must deliberate are as follows:

Cause and Effect

Based on both our primary and secondary research conducted we cannot just simply evaluate user emotions whilst in any environment – here are too many factors to focus on in the 360°AVIE environment. We need to be able to identify specific stimuli – the context or cause – that the user is responding to within the environment. Without this, the evaluation of the emotion the results will prove meaningless, no matter how sophisticated or targeted they are.

The current technologies used to evaluate human emotions are conducted in a manner that the test subject is usually static and the content in which they are exposed to is either extremely targeted or simple in construction. This notion of a simple environment in which the user is only exposed to 1 or 2 tasks/topics is, in practice, unobtainable. The kinds of environments in which the product will need to effectively operate present real-world challenges such as subject mobility, rich content and multiple stimuli. What this means is that our evaluation of the cause becomes the dependent factor and key element of the system function that will need to be solved.

By gaining greater understanding into the cause our research suggests that it will enable the evaluation of the effect to be that much sharper. This is backed up by meetings that we have had with Professor Allan Whitfield, an expert in the field of Psychology at Swinburne University. The results from these interviews are located in the ‘Research Methodologies’ section of the document.

Function

The function of the device will be a complicated system where by the user will be exposed to a range of environmental stimuli and evaluated in real time. Our solution will have to recognize specifically what the user is responding to, whilst also recording the emotive data caused by this experience. Both these two data streams have to be synchronized over a unified timeline in order for triangulation of information to occur. This timeline will then have to be mapped against what the content was at the time in order to gain the true extraction.

This will mean that this system will have to have a intelligent information collection point that controls the lapse of time in order to synchronize the device with the 360° AVIE Projections. It is not clear to us yet whether the data will be sent in constant packets through out the content or as one large bundle at the completion. This thinking also has a direct correlation in regards to where processing, coding and encryption (if taken place at all) will occur within the system. These are questions that we will have to discuss with programmers and coders of our solution, as these algorithms are very complex.

Mobility of Solution

The actual physical environment that presents itself during the exhibition is another interesting problem that our team must face. Due to the nature of the 360° AVIE technology and its installation space, users within are able to move freely. This makes the evaluation of cause and effect problematic due to the range and scope of subject activity it allows. This includes changing orientation, walking and sitting within the space. A 360° environment also means that the user is constantly drawn to many aspects of the projection, which in turn causes them to direct their heads in all different directions. This means two very important things:

The technology that we choose to use in our evaluation of the cause must be extremely responsive to the situations. As users that have been observed by our studies show that not only are their eyes darting around but also neck and body movements become much more sudden and exaggerated. Mobility also spells the end for most of today’s emotive evaluation machines. MRI, fMRI, PET and EMG scanners are both cumbersome and rely on the user to be still.

We will have to find a non-invasive technology that is able to extract subconscious emotions from the user's brain. The compounding problem is how we will get around the need to connect people with wires to a computer to perform such a task, which is often accompanied by electrodes that require gels and adhesives. As stated above the real-time evaluation factor will cause the solution to perform significantly high levels of information calculation. This means that the system itself must be flexible in order to achieve cohesive clear information.

Wireless

Not only will the solution have to extract information wirelessly but it will also have to transfer the data to an external source for processing. It is assumed that this data that is being transferred will be in a number of different formats and sizes. This will force the team to explore wireless technologies that can handle large bandwidth transferring whilst also thinking about above discussed themes. It appears that the data transferring will have to occur rapidly and frequently, which dictates that the wireless system is always on and not subject to sleep, along with interference and distance problems. Wi-Fi, Bluetooth and RF are obvious starting points for exploration each having their own positives and negatives.

Varied Demographics & Ergonomics

The varied demographic observed in these environments will force us to consider many aspects about the product. From children to grandparents, male to female the product must meet all demographics. This obviously will have some large impacts on ergonomics, user interface and functionality. Again everything about the product must tie into this overall theme of adaptability and fluidity, in order for successful integration. This will also include users that don't want to participate. The product has to in some way at least consider or address this notion.

Power

Design thinking must be applied not only to the integration of the power supply into the device, but also to the challenge of how in such a fluid environment we are able to create a system that allows for easy recharging. The charging is a big concern, as it must not disrupt the flow of AVIE experience whilst also allowing the largest possible amount of time for power regeneration. Alternative means of recharging such as induction, Kinetic or wireless power may have to be explored here as apposed to conventional plug and charge systems. This is a critical path in terms of the flow of the space as it may lead to grid- locking and funnel type issues.

Semantics

The semantics of this product will also play a key role in convincing the user that this is a legitimate design solution. Obviously the outcome that we are proposing is not current and quite futuristic in approach. Therefore the styling and overall feel must meet the concepts goals. We must not overlook this last point because ultimately it is not the function but the styling of the product that will present the user with the first impression.

RESEARCH METHODOLOGIES

Methods of research and triangulation strategy

“You want direct, unobtrusive measures”

Primary Research Methodology

A review of current literature revealed that there is inadequate material available to measure emotion, particularly in exhibition spaces. Existing technologies such as FMRI, EEG and ERP, are too invasive for public use, and are also considerably expensive. However simple means of measurement, for example observation, are not an accurate method of gaining insight into deep emotions. Initially, three research methods were used in triangulation in order to develop a basis for the need for a new device that measures emotion. Firstly expert interviews were conducted with Professor Allan Whitfield, Swinburne's on site psychologist. Observation of four subjects was then undertaken at the AVIE site, the Melbourne Museum. A survey was also given to observed subjects to obtain a more detailed understanding of user experience, with an observer's interpretation of their movement. The triangulation of these three research methods was to produce a verbal, visual and written account of the use and response towards the AVIE exhibition.

Expert Interview

Identify an individual who is extremely familiar with the subject and ask them to evaluate the situation. “These individuals are often able to highlight key issues of the design problem and provide insights for design improvements.” IDEO Method Cards.

Professor Allan Whitfield is a psychologist working in the area of design research at Swinburne University. Two separate interviews were conducted with Professor Whitfield over a space of two weeks. He looked into the depth of research we had done on this study into employing effective design to understand emotion, and suggested certain directions to take in order to develop a more refined knowledge. The basis for the interviews with Professor Whitfield was to gain insight from an academic on the scope of research undergone thus far. He had useful information on devices for measuring emotion being used around the world, “EMG, Facial Myography, focuses on two muscles in the face, obviously with frowning the brow is not happy, then there is a muscle in the cheek that is related to smiling...under normal circumstances you can't see it. But if you have electrodes attached to those areas on the face you can pick up reactions”. He also suggested looking into devices such as FMRI, ERP, EEG, eye-tracking systems, and in general the neuro-market.

Professor Whitfield shared his interesting perspective on arousal, and how dramatically subjective it can be to the individual, “When arousal is too high or too low it is uncomfortable, that is why we prefer it in the middle. But people will have different middles. So the introvert's notion of being moderately aroused would be kind of low, whereas the extrovert would need a high level of arousal for it to be normal. It's a bit like the introvert is already aroused. So there will be big individual differences.” This extended knowledge instilled the notion that there needs to be a combination of valence and arousal in order to measure an emotion accurately.

Through the interviews with Professor Whitfield, his agreement was attained that there needs to be some sort of “time sequence of what they are reacting to at the exhibition, so it is possible to cross reference what they are actually viewing at the time.” This coincides with the earlier belief that there needs to be an understanding of what the reaction is based on, otherwise the data produced of emotive response is meaningless.

The group had also explored considerate research into whether the iPad was to be used in correlation with a device that measures emotion, in order to obtain the most accurate data. However Professor Whitfield's thoughts were that the cognitive part was impractical, “the issue there is that actually pressing the thing/a button will present troubles in itself. It will affect eye movement and tracking, ERP movements.”

The most insightful comment from the expert interviews with Professor Whitfield was “You want direct, unobtrusive measures”. This has guided the resolution of incorporating a type of EMG, with eye tracking into the already existing 3D glasses at the AVIE exhibition. The advanced glasses will heighten the already impressive 3D experience, and produce proficient data for the stakeholders.

Observation

The act of observing in this case involves noting and recording an individual's movements and reactions in order to develop an assumption of emotion. "This is a valuable way to reveal design opportunities and show how a space might affect or complement a user's behavior." IDEO Method Cards.

The observation was undertaken at the Melbourne Museums 360 degree AVIE exhibition on Volcano's. Four subjects were observed before, during and after the show. Their emotions, actions, and reactions were observed, noted and then compared.

There was a set list of observations the viewer had to note throughout the length of the 360-degree exhibition. These included questions in relation to the facial expressions and reactions of the user. Such questions involved the user's engagement with the exhibition, were they impressed by the technology? Did they enjoy the exhibition? Answers to these brands of queries are speculations at the most, "Seemed to enjoy the technology, quiet and attentive." The interior of the exhibition is almost darkness, confirming that these kinds of observations are based on subjective actions such as body language, facial reactions and in some cases, verbal comments. Actual emotional changes are near impossible to see in the exhibition space, which alludes to the finding that observation is not an accurate means to measure the feelings of users at the AVIE exhibition.

Other questions were more focused on the physical actions and reactions of the user. These included what they did when they walked in, what was the first thing they read? Did they converse with others? These topics are more straightforward, and easier to observe. This is exemplified through the example from the observation of subject 3, when asked how they found the orientation of the AVIE exhibition "He did not take full advantage of the 360 degree experience, he only looked forward and didn't take much notice of the environment." These are physical movements that could possibly refer to an emotion. However to presume that the user enjoyed the experience because "they found the other visitors responses amusing" is misleading and inaccurate. Hence the need for a more invasive method of measuring emotion in the exhibition space is vital to accumulate accurate data.

The aim was to observe and record behavior within its context, without interfering. The observation of the four subjects established certain issues with the use of the exhibition, and how these concerns could interfere with or impact on someone's emotional state. These include the orientation of the exhibition, the number of users intended in the space at one time and instructions received throughout.

Determining a person's emotions based on appearance was proved difficult in the AVIE exhibition. This was due to a number of reasons including, lighting, subjective human factors and the lack of strong evidence associated with observation. The AVIE Volcanic experience lasts for 10 minutes, this brief space of time does not allow extensive observation to be undertaken, one subject used the words "short and sweet". This produced the finding that gaining a large amount of usable data proved to be very difficult in a short time frame.

It is useful to understand the actions of individuals within real contexts and time frames, rather than accept what they say they did after the fact. This leads in to the final primary research method. The survey outlined below, had an established aim - to produce data with conclusions that observation is an erroneous tool for measuring emotion, by proving the inaccuracies between a user and observer survey.

User and Observer Survey

"Ask a series of targeted questions in order to ascertain particular characteristics and perceptions of users. This is a quick way to elicit answers from a large number of people." IDEO Method Cards

Four subjects who were unfamiliar with the exhibition were asked to evaluate their experience using a survey. The survey was designed with 10 simple questions in order to ascertain particular data about the use of the AVIE exhibition. These ten questions explored the experiences individuals remember having in the space, and in contrast they were observed with the same 10 questions.

The survey aimed to obtain information regarding how the subject felt in the space, their actions and reactions, and also what they did before and after the exhibition. It was designed to produce a number of both quantitative and qualitative responses with regards to the current exhibition.

The survey entailed various questions surrounding issues associated with the AVIE exhibition, including, what was the first thing you read? What did you do when you walked in? How did you find the orientation of the AVIE exhibition? It was found that the user had difficulty recalling the information after the exhibition had ended and answer the survey in an accurate manner. Each of the subjects left at least one question unanswered and referred to this as a result of not being aware of their actions throughout the exhibition.

When making comparisons between the survey completed by the subject, and by the observer, it was difficult to quantify the findings. Some answers had no correlation, a selected few had minute similarities and others held a vague relationship. Only a third of the information that was triangulated was proven correct.

It was established that a percentage of 32.5 of the questions correlated to each other. The other 67.5% of answers produced distinct differences between what was observed, and the users understanding of their own experience. The answers that interconnected in most cases were ones that could be physically observed. Such as, whether they conversed throughout the exhibition, or whether they were distracted. Subjective questions relating to emotions, for example, their favorite and least favorite aspects of the exhibition could not be established with any of the four subjects.

This process forces people to examine and express the underlying reasons for their behavior and attitudes. In contrasting the answers given by the participants, to those of the observer, it is obvious that the method of observation of emotions in such a small and dark space, such as the AVIE exhibition is unmanageable and produces inaccurate data.

The Gap – linking the research & the outcome

Through primary and secondary research it has been found that unobtrusive, accurate methods of measuring emotion are non-existent or not completely developed. Our solution therefore comes in the form of new technologies being incorporated into the already existing 3D glasses that users wear in the AVIE exhibition at the Melbourne Museum.

In linking the research findings to the design outcome, it can be seen that the solution is designed to make measuring emotions of users in any context easier. Through conducting observation at the AVIE site, it was found that this is an unrealistic method of evaluating user emotion, and retrieves inaccurate results. With the survey answers produced by the user and observer generating a little over a third of the same data, conclusions that observation is an impractical method in this instance were made. Hence there is a need for a product that has the ability to measure human emotion without interfering with the user experience.

Furthermore through expert interviews with Professor Allan Whitfield, his knowledge and capabilities in the psychology/neuro sector provided answers supportive of the above conclusion that the our solution, the implementation of new technologies into the existing 3D glasses at the AVIE exhibition, will be significantly important to the future of exhibition.

POSITIONING

Marketing, demographics and competition

“Bringing future technology to today”

Audience

The product audience of the glasses can be split into two categories, the users who benefit from wearing the 3D stereoscopic glasses during the exhibition and those who are presented with the feedback that the glasses produce (in real-time or post experience). The audience members are as follows:

Users

The users require the glasses to be able to view the exhibition. The information gathered from the glasses will then be calibrated and displayed to the users after their viewing experience in a series of info-graphical displays. These displays help provide a sense of closure to the exhibition experience and provide a unique feedback that enhances the experience and may encourage repeat visits to the exhibition.

Stakeholders

The stakeholders have the ability to view the raw data that will be collected from the users during the exhibition. This can help them to adjust certain parts of the exhibition that may be causing negative feedback or simply validate minor adjustments. The success will be able to be efficiently evaluated through viewing the large amounts of viewer data. This information will prove helpful in sourcing investors and marketing the technology to museums and gallery spaces around the world.

Exhibition/Museum Curators

For the exhibitions' curators, this technology can provide better users/visitors' experience analysis with a lot more depth. Curators will be able to measure the success of exhibitions in relation to previous exhibitions, measure trends and whether a certain exhibition has longevity and public interest and change or adjust exhibitions in relation to the real-time feedback. With slight detail adjustments, this product could be adapted to suit normal exhibitions and/or displays and not be specifically marketed solely at the AVIE exhibition. However for use in this proposal no other avenues of possibilities will be explored.

Design Restraints

From the brief there was little specific criteria defined for the outcome, however there were a number of general themes and information streams of data capture to be explored. These themes included:

- Audience orientation
- Bodily experience
- Relationship between the user and screen content
- Level of immersion
- Flow (time spent, level of involvement)
- Social experience levels

The proposed outcome would have to address these above themes in giving the general overview of the 'user experience'. As well as the aforementioned themes we as designers put a number of design restraints on ourselves in order to produce a better outcome. These self-appointed design restraints included: Integrating the new technology into the existing experience with introducing any new paraphernalia or requirements (ie. Wristband or other worn apparatus). The proposed solution must extract data from the users requiring only a passive involvement, responses without the use of cognitive thought. System integration with current AVIE system would need to be simple, as it would operate separately on its own communication protocol. There would be an insignificant modification to the current exhibit design for the installation. The proposed solution must be durable, practical and accurate in its collection of user data.

Product Competition

A key selling point of the proposed outcome is the use of cutting-edge advanced technology. Utilizing immediate physical responses from the user and interpreting them will be a clear and honest way of measuring emotions. From a contextual point of view there are no real competitors who will be able to wirelessly produce raw user emotive data with the same effectiveness as our proposed solution. This is due to the combination of the technologies in our proposed solution as it is unique in its field. There are a number of single function products that can complete some of the same tasks as our proposed solution but as previously mentioned it is the multi-functional aspect of our design that sets it apart. Some of the single function products include:

SMI Eye Tracking Glasses

Designed for eye tracking studies in the fields of; shelf-testing, out-of-home research, usability studies on mobile devices, driving research, visual perception research and analysis of training methods in professional sport. These fully mobile glasses offer live observation of eye tracking movements with pinpoint accuracy. These glasses would compete with our product in contextualising the emotions of the users and visualising what they were responding to.

iCalm Wristband

Developed by the Media Lab at MIT the iCalm allows live tracking of a person's internal arousal levels. This wristband is designed with two surface electrodes that measure a person's electrodermal activity (EDA). Knowing one's arousal levels can be useful in monitoring the intensity of a feeling that someone might be having. This product has been tested on babies as well as children with autism who have trouble communicating. The data is sent wirelessly from the wristband and is received by a computer that can map the arousal levels in real time. This would be a useful competitor to our product in informing the intensity of feeling that someone is having during the exhibition. However this product doesn't describe the valence or the type of feeling that someone is having.

ExmoCare Wristwatch

Designed by the company Exmovere the wristwatch is designed for the field of automated home care. It measures a number of bio-responses in the body such as; Heart rate, galvanic skin response, heart rate variability, skin temperature, wrist movement and blood volume pulse. This information is sent to the Exmovere website for calibration. From analyzing these groups of information Exmovere can determine the emotional state of the user. On analysis the information is sent via email, SMS or instant message to care givers, doctors or family. This product can measure emotions and would be a strong competitor in that field. However the wristwatch cannot determine the context of the emotions and decipher accurately what the emotions are in response to. This is a crucial feature that is imperative to our proposed solution.

Brand Vision & Personality

The vision of the brand would be such that it would be viewed as simple, clean, sophisticated, engaged with cutting edge technologies and interesting design concepts. The personality traits of the brand would be that it was trustworthy, reliable, non invasive, intelligent and worldly. It is important that the brand have international appeal as the AVIE technology is situated at galleries and museums around the world.

Marketing Advantages

The marketing advantages of the proposed solution are that it is the only one of its kind in the context of digital user viewer emotional evaluation. It provides information to a wide range of audiences as previously mentioned and will assist in the development of more effective and interesting exhibitions. It is a way for the general public to give valuable and real feedback in such a way that has never been explored before in the digital realm. The proposed product will be paired with every AVIE exhibition that is installed around the globe. With further product development the scope of the product would expand to be introduced to further markets in the field of user analysis.

PROPOSED OUTCOMES

The Solution

“The collaboration and conversion of human senses in to informative data”

Overview

In response to the definitive need for a means of recording raw responsive data for review in test conditions, we have decided to adopt technology from a number of existing sensory recording devices to create a non-invasive, accurate and reliable system-based product.

The solution will come in the form of a pair of glasses to be worn by users of Rio Tinto's AVIE Volcanic 3D exhibition space and related iCinema exhibitions. Our product will see the integration of two key technologies:
Facial Electromyographical Sensors (fEMG) and
SensoMotoric Instruments' "Eye Tracking Glasses"

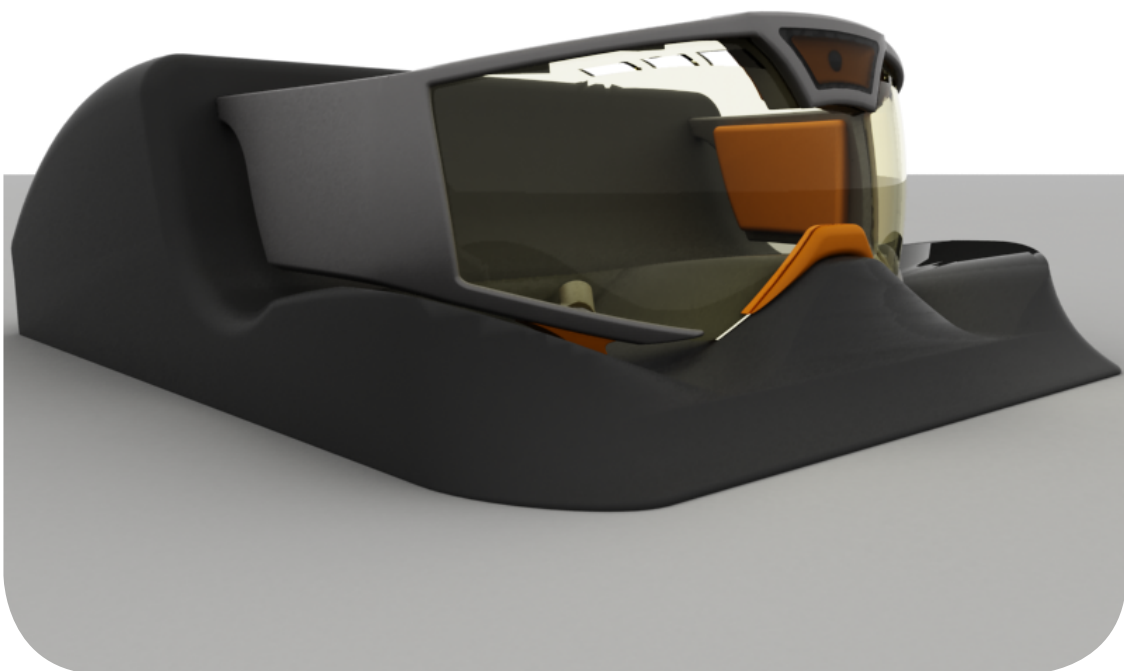
Valence

Throughout our literature review we were able to establish six descriptive physiological response mechanisms relating to human behavior. These six emotions were reduced to four that directly related to the expected responses associated with our context, the Dynamic Earth exhibition at the Melbourne Museum.

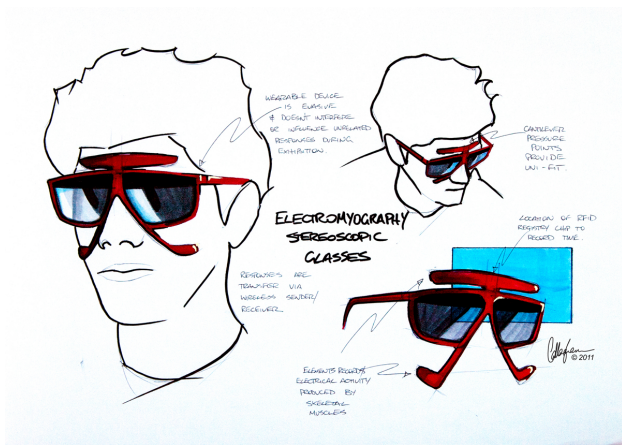
These four emotions were:

Happiness
Surprise
Disgust
Fear

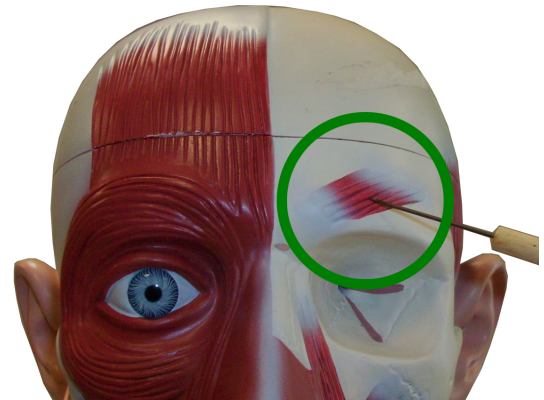
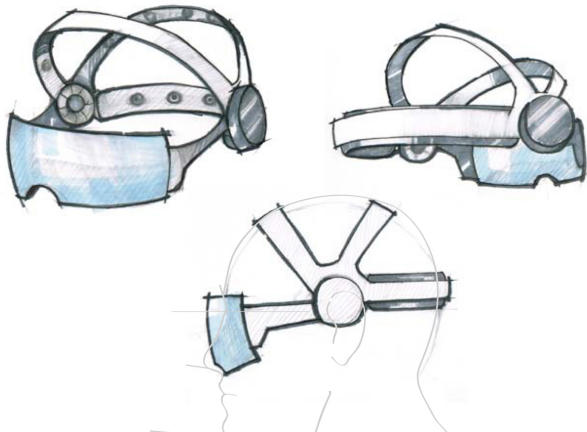
Concepts revolving around functional MRI and Electroencephalography (EEG) were initially considered due to each technologies history within this field of study. However, due to the overly invasive nature of these technologies, a more subtle, advanced form of technology needed to be investigated.



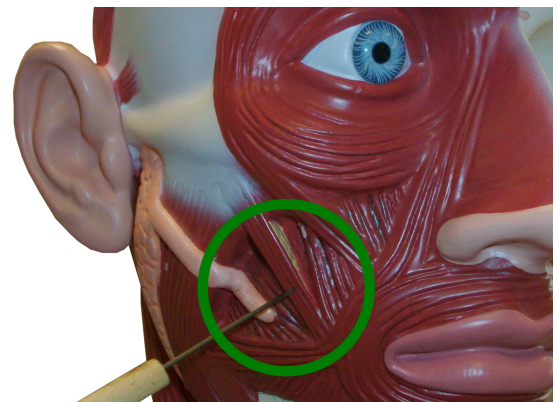
Proposed solution: The Mirage System with induction charger



Early concepts revolving around fMRI and EEG technologies



Location of the corrugator supercilii (above) and zygomaticus major (below) muscles.
Photo: Delia Rusmin



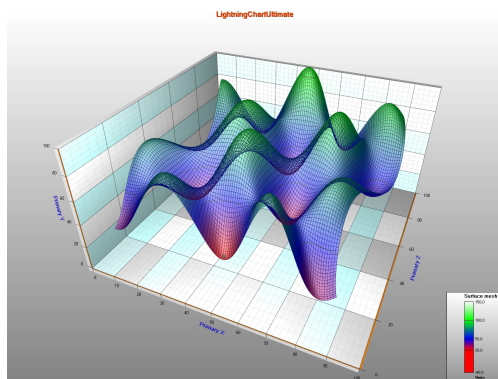
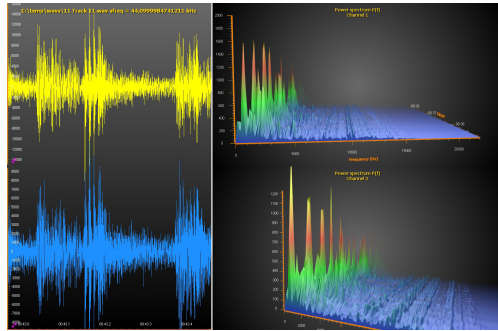
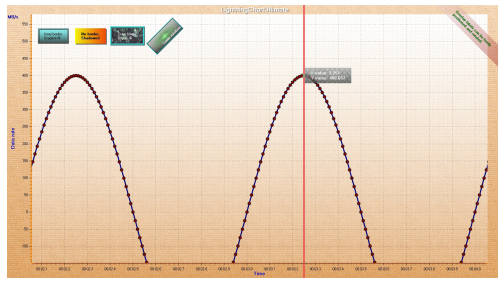
Principles of Facial Electromyography, also an electronic technique, were investigated to find its strengths and weaknesses. Facial EMG measures the contraction of a particular muscle groups during activation by amplifying the electronic signal to a readable degree. The two muscle groups that this technology measures are the corrugator supercilii muscle, situated at the medial end of the eyebrow and associated with frowning and also the zygomaticus major muscle, which extends from the cheekbone to the corner of the mouth and is directly associated with smiling.

As a group, we were able to discuss and confirm these findings as an integral element to our solution during the expert interviews that were conducted with on-site Swinburne psychologist Professor Allan Whitfield. In effect, the proposed solution will be defining happiness, surprise, disgust and fear through the fore-mentioned muscle groups.

Arousal

The arousal element of our solution will be presented according to the electrical strength of response from either the cheek or eyebrow muscle group. Current systems in place represent arousal levels through live graphs. The Wireless Bio Amplifier, produced by Mega Electronics in Finland is supported by software called LightningChart Ultimate. The application is powerful enough to present masses of data in 2D XY graph, 3D XYZ, polar and 3D pie & donut views.

Due to the limitations of this brief, researching the complex area of algorithms and the abilities of visually representing this complex data is beyond the scope of our solution. However, we imagine the data would be presented to the stakeholders of this project in a similar way.

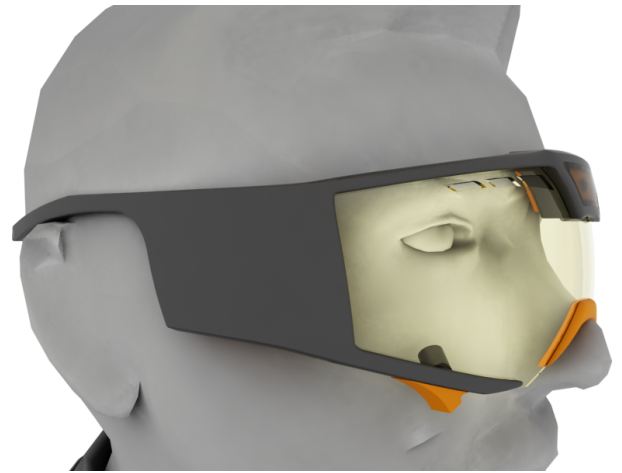


Graphs produced by Mega Electronic's
LightningChart Ultimate.
Photos: Arction

Context

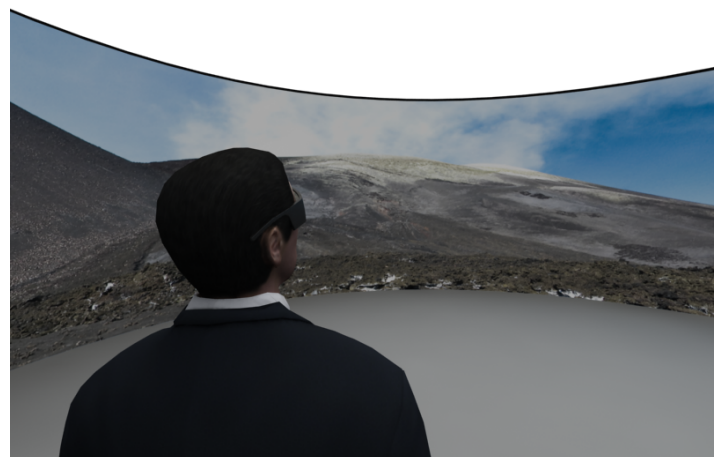
User-centered design is integral to enable successful development of our fEMG SMI integrated 3D stereoscopic glasses. A form follows function approach has been adopted to maximize the usability of our solution. A main concern highlighted by Dr Whitfield during our interviews was the distracting nature of peripheral devices during a neuron-based testing scenario. The use of an iPad during a test for example, would radically alter the outcome. If a user was particularly interested in an iPad or liked the tactile elements of the device, the human brain would signal a liking to the overall experience, even if the user found disgust or fear throughout a scene in the exhibition.

The wireless capabilities will provide users with freedom to move and focus on the exhibition without being distracted. Due to the necessity of 3D stereoscopic glasses, regardless of test conditions, integrating physiological response recorders became the obvious direction.



The Mirage System Glasses within context

The use of space where this solution will be used has also been discussed to provide users with more incentive to get involved in the testing process. On arrival, users will see other people interacting with a display that features their results upon concluding the test.



A subject's view of the Dynamic Earth exhibition



Front perspective view of the Mirage System Glasses

System

The system will comprise of three main components:

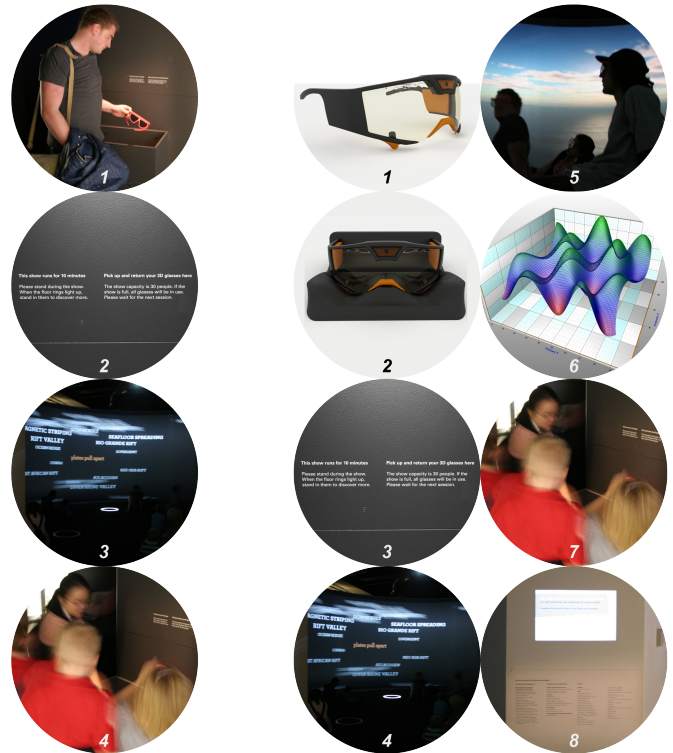
- fEMG SMI Integrated Stereoscopic Glasses
- Bluetooth Receiver (PC peripheral)
- PC with supporting software

Data flow will begin with the interaction of the user whilst wearing the glasses. Happiness, surprise, fear and disgust signals will be recorded, transferred at real-time whilst being synchronized with eye-tracking visual output for an evaluation team to review.

When approaching the exhibition space the users will be informed of the need to wear 3D stereoscopic glasses to gain a full understanding of the Dynamic Earth show. Users will then be told of the information that is gathered by wearing the Mirage System and given the opportunity to participate in data gathering or wear the traditional 3D stereoscopic glasses.

If the user chooses to participate with our new system they will receive a pair of glasses from an induction charging stand near the entrance of the exhibition shown in the diagram on the next page [2]. There will be a visual aid to explain how to operate the glasses and where they should be manipulated to suit a subject's face [3]. Once users are wearing the glasses they will enter the AVIE space and the experience will begin [4]. As soon as the exhibition begins the wireless data transfer will commence [5]. The data will continue to stream throughout the entirety of the exhibition. The data that is sent will be received by the main collection point and analyzed [6]. Once the exhibition experience is complete the users will exit the space and place their glasses back in the induction charging stand [7].

The users will take notice of the unique number of their glasses and then enter the post experience space. Within this space they will be able to view a graphical representation of their experience [8]. The emotive data received by the main collection point will be archived and stored for viewing by curators, exhibition designers and stakeholders.



Process Flow Chart
Traditional flow (left) and the
Mirage System flow (right)

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