Applying Interaction design for building mediated experiences by Technology to Foster the Ancestral Culture of Colombia. Case: Kosmos Astronomical Museum.

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Abstract

This work develops an applied research that engages methodologies from the Interaction design field (IxD) and user-center design (UCD) methods for building an interactive installation in the astronomical observatory and museum, Kosmos, located in Villa de Leyva, Colombia. Taking as a starting point the construction of an artifact that could efficiently adapt itself to the environment of Kosmos Museum and its surroundings. We construct an artifact that motivates the user to interact with it, promotes cultural identity dialogues and usage of technology on first hand.

The result is the construction of an interacting intervention as the enhancer of dialogues and guidance about a prehispanic megalithic monument, transcendental for the creation of mental imaginaries about the Colombian ancestral cultures. The design concept manages to express itself in an artifact consistent with digital and analogous elements which act as an information processing container by which the museum guides and the visitors can generate dialogue around this chosen topic. Being a source of an attractive and active experience around the topic of the ancestral astronomical observatory built by the Muisca pre-Hispanic culture, 2200 year ago. User to interact with it, promotes cultural identity dialogues and usage of technology on first hand.

Keywords

Cultural Identity, Ancestral Culture, Technology for Peace, Man-Machine Interaction, Interdisciplinary, Museography, Astronomical Observatory, Interaction Design, User-Centered D esign

Introduction

The purpose of all the work was to develop a multimedia system, which would allow the implementation of interactive exhibition procedures for the communication, explanation and dissemination of elements related to the Museum and astronomical observatory Kosmos. We applied methodologies Known as User-Centered Design and Design Thinking, in order to create an own methodology that would be adapted to the project. Its main objective was to highlight the most typical aspects of the context, highlighting the ancestral cultural identity of the region, to explore the environmental and social factors and to work on an artisanal, analogue and mechanical-technology point of view. This methodology was divided in 8 phases for its execution, which focused on: Customer and environment recognition, user definition, requirements definition and analysis, system design and ideation, prototyping and testing system and finally the implementation process.

The context

The astronomical observatory and museum Kosmos is located in Santa Sofia town at 8 miles away from Villa de Leyva in the department of Boyacá Colombia. It has an educational program with the objective of taking astronomy to the farthest rural schools in Boyacá, where kids and teens can use a telescope and learn about spatial science, astronomy, physics and chemistry by different programs developed on the museum.

The observatory has a telescope of great coverage and other instruments that serve to observe stellar objects. The museum team offers tourists and amateurs, a program that includes: Introductory talks, astronomical observations guided by experts, management of celestial charts, recognition of constellations and visible celestial objects (the moon, planets, nebulae, galaxies, Comets, among others), Observing the Sun through specialized telescopes, Practical astronomy workshops, Hydraulic rocketry workshops and the 'Kosmos Space Museum'.

The museum also promotes to the public an Ancestral Muisca observatory which is still object of research. This Muisca Megalithic monument is located near Kosmos in the "Parque arquelógico de Zaquencipa", a property of the government located 4 miles away from Kosmos Museum.

The museum handles different topics such as spatial exploration, extraterrestrial live (history and

documentation), even the history of the project "Hermes, el Ratonauta" an own initiative with the objective of sending a rocket crewed by a mouse trained to activate its own parachute.

The Design Problem

The museum and astronomical observatory "Kosmos" has two exhibition spaces: The observatory, with telescopes and instruments for celestial navigation, mainly offering a practical and experimental knowledge; and the Kosmos museum, a place where knowledge about astronomy, archaeoastronomy of the region, rocketry and exobiology is deepened, developing through discourse the interrelation of these topics in order to broaden the understanding regarding this field.

The museum is the space that should have more relevance, due to the ideological importance it represents. This way a digital multimedia structure was implemented, as an artifact which contributes with the activities developed within the museum for the user's, implementing a flashy and innovative mechanism in place.

It was evident the problematic with respect to the little use of modern digital media, which would make easier the work of the museum as a divulger entity of scientific contents. Through the interactive tool, it is achieved to modernize some of the everyday activities developed by the museum team and also motivate the viewer with the use of didactic means.

The research problem of the project, as well as its main motive of action, focused on the development of the three following aspects as fundamental pillars.

Social and Environmental Aspects

The main ideological vision of the Kosmos Museum Project and the Elkeve Foundation, while being immersed in a rural community, remote but prosperous in the Colombian context, is to generate a positive impact on the diffusion of knowledge in themes that can expand the ideas of the students, children, youth and adults who lives in the small rural populations in the sector. Making them participants in an exploratory different space and culturally nourishing.

The rural socioeconomic stratum carries a great number of limitations as to resources and means available for them. Their response has been to generate pro-activity in terms of alternative means of sustainability, from the construction of installations and artifacts in a craft way to the use of clean energy through solar panels.

The project contributes to this vision and lifestyle, not only with an interactive and multimedia experience of knowledge but also:

- Implementing a final product adapted to the social and environmental context of the place.
- Making a viable resource use for the museum.

Designing an installation that doesn't interfere with the artisan landscape, nor with the countryside experience that is lived in the museum.

Interdisciplinary Aspect

Aspect that refers to the development of a project of collaborative nature, which mainly integrated the disciplines of Graphic Communication Design and Multimedia Engineering as part of a single core of work, on par and together with other areas of knowledge backed by the Team of the Kosmos Museum such as Psychology and Social Communication.

Technological Aspect

This aspect refers to the importance of re-interpretation and exploration of existing technologies, both from the stage of ideation and conception of a development idea and in the subsequent prototype processes, experimenting with modern and alternative devices, both digital and analog.

Theoretical Framework

The Design and the Interaction as Common Territory between Two Disciplines

"Design is the conscious and intuitive effort to impose a meaningful order" (Papanek, 1984, p.4).

From a general framework, the concept of design is approached in different fields and disciplines as an activity focused on the planning, configuration or generation of project strategies aimed at solving specific problems whose nature varies depending on the field of study, application and pursued purpose. However, its basic features and methodologies are still maintained in distant disciplines such as business, marketing, engineering or graphic design. The universal design process represents the continuous and systematic iteration, in where research, prototyping and evaluation techniques are retaken in order to achieve a specific development purpose. Actions adjacent to design processes are linked with the collection and analysis of data, identification, and understanding of associated problems, decantation of alternatives and evaluation of

solutions with the purpose to make assertive decision making, taking into account factors such as the context, the user and the resources.

The design process, seen from the field of engineering, focuses on the resolution of practical problems applied to mankind benefit, in where any natural or artificial resource is seized in favor of generating potential developments for the economic use of human society.

"Mathematicians, physicists, chemists and other scientists seek unique solutions to the problems that they investigate. In other words, each of these problems has a one-of-a-kind solution. In contrast, engineers focus on problems of which there are many practical solutions; they seek the best solution from among these many alternatives…To perform this task in an effective and efficient manner, engineers often follow a procedure known as the engineering design process" (Voland, 2004, p.5)

The multimedia engineering, being a hybrid field between the principles that rule the engineering and the products of the informatics and electronic branch related to the development of new media that facilitate channels of communication and information, takes care of the progress in the use of digital and technological systems, that transmit information in a visual, auditory, tactile, textual and interactive way using design processes focused on the user experience.

From the Graphical Communication, the concept of design is assumed to be the process of conceiving, scheduling, projecting, coordinating, selecting and organizing a series of factors and elements-usually textual and visual-with a purpose of the materialization of products designed to produce visual communications. (Frascara, 2006). Ergo, the design for graphic communication focuses on the configuration of content as messages, using visual and symbolic codes that are transmitted through one or more Likewise, the design of the graphic communication has its own methodology according to the same principles and foundations that rule the process of universal design. Bruno Munari, one of the most important authors in the field, has conceptualized this process as a "project design methodology" (Munari, 2013) which summarizes the process by which a creation concept is materialized in an organized and systematic way to effectively solve the components of a design problem.

The culture around innovation in both industry and current's society is what makes it possible the dialogue between disciplines and areas of knowledge in order to achieve more products that are increasingly better adapted to the needs of human society, from a general sustainability perspective. Authors such as Francesc Aragall and Jordi Montana raise in their book Universal Design (Aragall, 2012), design strategies that modify traditional business models where, when implementing their "Design for all" method, they introduce the understanding and adaptation of products and services to the user, taking into account the human diversity and applying design strategies on transversal way in the different areas of the company.

"Design for All can be applied in each and every area within a Company, from the purchasing department to human resources or customer support to the finance department or production." (Aragall, 2012, p.20).

In the field of interaction converges a great variety of disciplines focused on the effective design of products, environments, systems and services aimed at human use and the diversity of contexts and social or individual factors.

"We view interaction design as fundamental to all disciplines, fields, and approaches that are concerned with researching and designing computer-based systems for people" (Interaction Design: Beyond Human-Computer Interaction, 2007, p.11).

The Interaction Design

"Interaction design as a discipline is tricky to define. In part, this is the result of its interdisciplinary roots: in industrial and communication design, human factors and human-computer interaction. It's also because a lot of interaction design is invisible, functioning behind the scenes" (Interaction Design: Beyond human-computer interaction, 2007, p.11)

When it comes to defining the design of interaction there is a wide variety of schools and trends both research and development that bring different points of view. At the same time a great number of methods and methodologies arise to deal with the problems of the field. Among the different schools, there are 3 main aspects from which the interaction design is assumed according to author Dan Saffer. The Technology-Centered View, The Behaviorist View, and The Social Interaction Design View (Saffer, 2010, p.5). The Technology-Centered View is based on making technology, particularly digital, useful, usable and enjoyable to use. The Behaviorist View is based on defining the behavior of artifacts,

environments and systems according to functionality and feedback and The Social Interaction Design View, the third and broadest perspective of interaction design, is based on the concept of facilitating and enhancing human communication through the products that it uses, in this aspect any object or artifact can be used to make a connection between people.

This last perspective, also known as Social Interaction Design is the philosophy that was considered most pertinent to the development of the project, being the branch that allows a process of experimentation through different tools and technologies to design a product with a social benefit that strengthens human communication, and in this particular case, enhance learning experiences.

One of the most famous methods of user-centered innovation is the design thinking process that is based on combining design sensitivity with problem-solving methods and applying it to any context, regardless of the nature of the problem (Lockwood, 2009, p.6). Actions such as understand, observe, conceptualize, validate and implement are the methodological approach of Design thinking for the development of products.

From these two work perspectives a perfect integration between project thought, focus on the user and problem solving is achieved. Fundamental factors for developing a project in interaction design.

"Designing isn't about choosing among multiple options – It's about creating options, finding a 'third option' instead of choosing between two undesirable ones" (Saffer, 2010, p.6).

Interaction Design for Museography

Information design is defined as the art and science of preparing information to be used by humans efficiently and effectively. Its main objectives are: First, the development of comprehensive, fast and aptly memorable documents that can be easily translated into effective actions; second, design interactions with instruments that are easy, natural, and as enjoyable as possible. This involves solving many problems in the design of human-machine interfaces; and third, enable people to find their way into three-dimensional spaces with ease and comfort (Jacobson, 2000, p.15).

The psychology of learning, attention and human behavior provide important implications for the design of signage, thematic exhibitions and self-learning support in public spaces. In this way, one of the most important challenges in the application of information design is the purpose of communicating knowledge, ideas, and concepts in public spaces such as museums, zoos, science centers, botanical gardens or shopping centers. (Jacobson, 2000, p.15).

Messages transmitted in such spaces require the willing cooperation of potential recipients of information while surrounded by options and distractions. Visitors are not required to pay attention, ignore or distort the messages being communicated. In such cases, it is immensely important to design information systems that not only reflect the needs and characteristics of the audience but also attract and maintain their attention (Jacobson, 2000, p.15).

In this project, the use of technology is focused on the objective of attracting and maintaining the attention of visiting users to the museography space, also collaborating on the development of a thematic concept that collaborates in processes of instruction, motivation, memory, perception, and other social factors.

If the objective of implementing a thematic concept is to provide a learning experience or recognition of a specific knowledge, it is important to maintain a visual language with the high use of images at high levels of abstraction, in order to enhance memorization and understandings through Schemes in moving images. This, since the figurative expression, can complicate the message which is tried to be transmitted clearly and evidently.

Methodological Process

The realization of this project took into account the applicative purpose of the final product. The methodology implemented was based on 2 research methods that facilitated the workflow for the Design and Development processes. The first one: User-Centered Design (UCD) which raises the understanding of the context and its relationship with the user, contains within its methodology the application of good practices in product development and also allows to generate a clear and evident information structure of the evolutionary process of the project.

The second is the methodology of Design Thinking, which allows visualizing, in an efficient and agile way, the best solution alternatives, focusing on the interaction with the end user. These methods revolve around feedback, planning, and data collection techniques.

In the first phase, a client brief was carried out, in which the testimonies of the people in charge of the museum were collected to define a document of first-hand requirements: A durable installation was required, information about their target market, the visitors to the museum; As well as answers to open-ended questions related to the recognition of the roles they played, their tastes, their experiences, etc.

In the second phase, an ethnography of the place was carried out through survey and interview with a representative sample of 24 people. In order to perform a better understanding of the environmental variables such as the origin of visitors, their identity data, the perceptions of the museum, the learning experiences at the museum etc. It also included a deep data collection of the museum and its surroundings in a social and cultural level to understand relevant influences taking place at the context.

From this analysis, two types of user actors were defined: user type A (visitors) which comes from different areas of the country and worldwide defined mostly by tourist adults and companions. Type B users who are specifically the guides of the museum, they are both client and system administrator's users in which they enter a direct interaction and decision making for the product.

Once the user types and their characteristics were defined, it continued with the criteria definition that were classified as functional requirements (requirements that are essential and directly affect the interaction of the system) and non-functional (requirements that emphasize the form of how the system should be, that do not affect the interaction or experience of the system). These requirements were essential for the idea approach and the definition of the implemented product design.

Prioritization of Requirement	**Description**	**Category Research Origin**	**Type**
1. Context adaptation.	*The system should not cause interference with the visual environment in which it is located.*	*Actors Category*	*NFR*
2. Use of metaphors for analogic practices.	*The system must provide a practical and tangible experience to the user.*	*Actors Category*	*FR*
3. Development of the Muisca Observatory as the main thematic.	*The system must fulfill the function of explaining the thematic of the Muisca observatory from the three moments of the discourse from the museography script.*	*Actors Category*	*NFR*
4. Provide an experience of knowledge and learning.	*The system should not be a distraction of the thematic guidance. Appeal for clarity and understanding.*	*Actors Category*	*NFR*
5. Provide a Living Experience.	*The system should use multimedia content that stimulates the 3 senses (touch, sight and sound) but privileging the visual language and scene performance.*	*Actors Category*	*FR*
6. Product usefulness, long life.	*The system must be durable for up to 2 to 5 years.*	*The Client*	*FR*
7. The system must be intuitive and have a manual mode.	*The system should improve the capacity of attention for a greater density of visitors by route.*	*The Client*	*NFR*
8. Use of a referential public as the end user of the system.	*The user tests will be directed to the most frequently visitors.*	*Actors Category*	*NFR*
9. Use of alternative resources offline	*Appeal to the use of alternative and environmentally friendly resources that satisfactorily adapt to the rural environment and the rustic style.*	*Ethnography*	*NFR*

10. The contents must have a formal tone and develop the importance of the ancestral Muisca legacy	To contribute to the mission of the museum on improving the public's perception of the Muisca Civilization.	Ethnography	FR
11. Resistant structure.	Due to the environmental conditions and the frequent presence of children, the device must be firm and resistant.	Ethnography	FR

Table 1: Functional and non-functional requirements

In the ideation phase were made the possible solutions or ideas for development. A brainstorming process was carried out in which 16 alternatives were proposed with their respective experiences, as well as a process to select the best alternative solution for implementation. For this purpose, the AHP (Analytic Hierarchy Process) proposed by professor Saaty in 1980. The method was used to quantify the value of each solution with each requirement and the general objective of the project.

Of the 16 evaluated ideas by the AHP method, each one received a weighting that equals the weight of the idea respect to the more accurate compliance with each requirement.

The selected idea was The Interactive Wood Fire, a museography exhibition whose design concept is to re-create the environment in which stories are told around a campfire, as also in the ancient indigenous oral tradition. The rural atmosphere and darkness present in the Kosmos Museum represent the perfect environment to carry out this type of interactive experience.

It is a tool where through a holographic module and a control command a staging is performed through an artificial bonfire, the system is ignited through a sensor of fire that gives rise to the holographic contents starting with the holographic projection of a bonfire following animated infographics around the contents that the guide is explaining and controlling trough the control command. That's how the dialogue on the megalithic indigenous monument The Muisca Astronomical Observatory start.

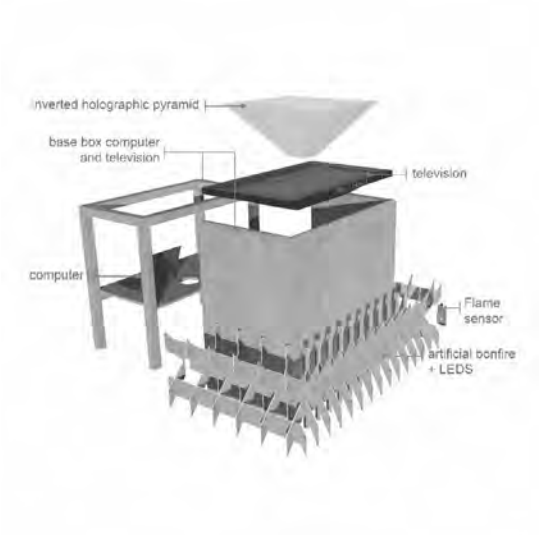

Figure 1. Explosion diagram, artificial bonfire

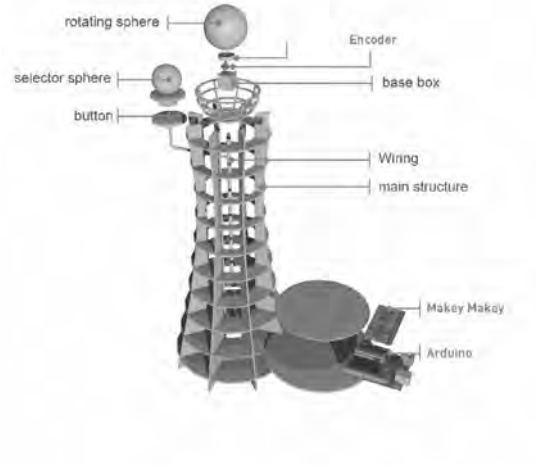

Figure 2. Explosion diagram, control command.

The flame sensor, upon detecting fire, lights the Arduino and the LED's of the campfire, unfolding the interface. To select a content between the options, the rotation is triggered on the control knob, and to select the content, press the selector button beside controlled by the Makey Makey.

On phase 7, Prototyping and Testing, prototypes were used to represent specific functions to evaluate the experience, as well as sample contents to receive feedback from users (specifically type B users). Each prototype was intended to test each experience designed in the previous phase and see what errors, changes or improving could be made. A total of 2 functional prototypes were made for the system (Test visualization and operation of sensors) and a pre-visualization of contents.

And in phase 8 was done the implementation process of the final product, taking into account the feedbacks of the functional prototypes made in the previous phase, and making respective modifications. The final construction entails the structure, the final software, and the contents.

Figure 3. Final Product

Conclusions

Successful Diagnosis of the Context

The successful diagnosis of the expository processes and the available technologies existing in the museum generated all the necessary information about resources for the system construction. Crucial information was collected through the research techniques ethnography and interview, which helped to create design criteria to achieve the implementation of a new environment in the museography scenario without affecting the essential conditions of the context. The factors took into account thanks to the diagnosis were:

-Propound a development strategy with low-cost materials and technology so that the museum could afford the investment.

-Successfully adapt modern digital technologies to the rural area without generating dissonance in the analogous and country style widely valued by the visitors of the museum.

-Find the strengths and weaknesses pivots of the explanations generated by the museum to enhance the strategies to be implemented in an interactive learning experience at the place.

-Develop a valuable and important thematic for the project that at the same time constitutes a real interest for the museum and its visitors at the same time.

Thanks to the process of analysis of collected information, it was possible to identify aspects that gave value to the museum, rescuing its value as a place that being separated from the urban area could locate the visitors in a different environment from their daily life, the museum appropriates and takes advantage of the artisan landscape to envelop the visitor with the concepts they want to transmit.

An Interactive Installation of morphological and semantic characteristics designed for Interaction with the user was designed including a visual treatment according to the context of implementation and the functional requirements found during the diagnosis.

One of the main conclusions of the implementation of the project was the use of this rural, analog, quiet, secluded, rustic and artisanal environment to envelop the user in a learning experience that attracts and manages to maintain their attention. The installation takes advantage, for example, of the deep darkness present in the place to develop a lights show that at a first sight impacts and works as a curiosity incentive to the visitors, this in order to propitiate the learning experience according to the strategy from the interaction design.

Marks in the Social and Environmental Aspect

It was made the first development of an interactive multimedia system in a museum for the region of Santa Sofia, Villa de Leyva, being the Kosmos Museum a leading entity for the local community and the public educational entities of the region, this project contains a large scale an intrinsic value related to create a positive impact on a rural community such as the sector of Santo-Ecce homo, specific location the project development.

The Kosmos Museum project is an example to follow being the type of initiatives that the country needs to achieve positive cultural transformations

and social evolution, facilitating the explanation of topics like astronomy and regional archeology to the rural zones, introducing science topics missing in the public educational framework of the country. The implementation of this interactive installation has collaborated widely as its main tool available for the explanation and dissemination of information about the ancestral legacy of the Muisca culture, a historical item for the region.

Currently, the implementation phase has been carried out effectively and in a sustainable way for Kosmos museum. It is worth to highlight the usage of recycled materials for the construction of the installation in coherence with the eco-sustainable perspective of the Museum proactive on this subject.

The installation is constituted as an entity that facilitates processes of dialogue and connection between people around a topic that directly intervenes with the social imaginary about the ancestral culture of the country and that experience is capable of strengthening processes of social and cultural identity.

Reinterpretation of technology.

The experimental process and investigation of new accessible and novel technological resources whose main functions have been reinterpreted and reused for the configuration of a new system that also mixes analogic artifacts and any type of object that could be used to enhance the design and development of a product in the field of interaction design and user experience.

This was how a conceptual and personalized multimedia system was created to meet the needs of a local context in a rural community in Colombia, using various types of technological resources from different sources to give life to a design concept, they were used different media available in the market such as MIT inventions like “Makey Makey”, or materialized 3d designs with lace techniques for structural purposes and an acrylic pyramid used to create holographic optical illusions.

More about this project on: www.interactivewoodfire.co

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Urban Mesh: Exploring Data, Biological Processes and Immersion in the Salmon People

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Figure 1. *Salmon People*, 2015. Surrey Art Gallery's UrbanScreen. Andreyev and Overstall Press shots used with permission of the artist.

Abstract

Information systems are continually recontextualizing data, migration patterns, biological components and processes, between life and code. As Geographer Eugene Thacker states, these systems can be scientific, or many things, with lasting effects that are cultural, social, and political. As these systems evolve and grow, so to do the artworks created in the afterglow, becoming vital reflections of our contemporary algorithmically soaked culture. This paper examines these ideas alongside the *Salmon People*, a video and sound installation thematically concerned with the shared dark ecologies of nonhuman and human animals. Like information flowing through high tech super highways, sockeye salmon deftly negotiate seen and unseen geographies, technologies, politics, and cultures. In order to understand the artworks content, sequences and layout, as well as the logic of the shot selections, we conducted a close reading analysis of the installation. We suggest that the work is generative and claim that the projections are made up of 9 videos playing concurrently in 3 large vertical panels. This paper examines these ideas, asking the questions: What role does the screen play in the design of this artwork? What are the types of audience immersion and interaction? Finally, we address the work on three levels: the structural, the narrative, and the immersive. The structural level identifies the key frames, and any overlapping frames. The narrative level investigates the 3 vertical panels in relation to story parameters such as plot and story world. The immersive level considers how the audience oscillates between a heightened state of immediacy and hypermediation.

Keywords

Biomedia, Immersion, Experience, Generative, Projection, Dark Ecology, Narrative, Research Creation, Data Technology, Algorithm, Hypermediation.

Introduction

Consciously or not, we participate every minute of everyday in the transfer of data along the global information highway. This highway is comprised of a plethora of network cables hidden often beneath our feet, laying in sinkholes, and sprawled along the ocean floors (Starosielski, 2015). These cables send data into the skies and back down to the earth again. This infrastructure carries and connects us all virtually into the transoceanic internet traffic filled superhighway. As writer Susan Buck-Morss describes, we are all implicated in this exchange of power, integrating technology into our daily life practices as tools and as weapons that extend the human relationship, whilst "at the same time intensifying the vulnerability of what [Walter] Benjamin called the tiny, fragile human body" (Buck- Morss, 1992, p. 33). Thus, data systems are everywhere, part of the air we breathe, part of our bodies, part of our urban and wild cultural ecologies.

Drawing inspiration from these ideas, we introduce the *Salmon People* (2014), a video and sound installation by Canadian artists Julie Andreyev and Simon Lysander Overstall. The piece presents audiences with glimpses of spawning sockeye salmon migrating across urban landscapes. This artwork alludes to information systems, making the invisible a visible part of our everyday. The sockeye are projected onto surfaces to showcase salmon swimming around our information highways, deftly defying consciousness, time and space, as we understand it. Likewise, as Eugene Thacker suggests art and life are inseparable, a form of Biomedia. Biomedia can present us with a "unique instance in which biological life itself is at once the tool and the object, the product and the production process" (Hansen, 2010, 127). The fruit of