Pockets Full of Memories (2001-2007)

An installation integrating Data Collection and the

Kohonen Self-Organizing Artificial Neural-Network Algorithm

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Fig. 1, George Legrady, Pockets Full of Memories, Data Screen and Movement Lines, George Legrady © 2001

Abstract (146 words)

Pockets Full of Memories is an early generative art installation consisting of a data acquisition and a data visualization space. It was commissioned by the Centre Pompidou in Paris in 2000 to explore themes of public participation and archive memory. The installation travelled to seven other venues, each with a distinct audience, ending in a Chinese language version at MOCA, Taipei in 2007. The installation consisted of 4 core components: 1) a data collection/questionnaire station, 2) dynamic data processing by the Kohonen unsupervised, artificial neural-network, self-organizing map algorithm, 3) multiple animation visualization projections featuring continuously updated contributed data, and 4) online access to the contributed data. Each exhibition's and venue's contributed data can be thought of as an assemblage of cultural artifacts, ideal for an archaeological analysis by which to evaluate differences in cultural perceptions over time, venue-specific audiences, and geographic locations between the various exhibitions.

Keywords

Generative Art, data collection, data analysis, artificial neural-network processing, data visualization, public interaction, algorithms and artificial intelligence in artistic and museological projects

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Introduction

"Pockets Full of Memories" (PFOM) as an interactive installation that premiered at the Centre Pompidou on April 18 and exhibited until September 3rd, 2001. It was organized by exhibition coordinator Boris Tissot to explore the combined themes of public participation, archive interaction, and cultural narrative and memory. The installation was showcased in conjunction with artist and professor Jean-Louis Boissier's project "Mémoire de crayons" (http://jlggb.net/jlb/?page_id=149).The two installations were exhibited side-by-side contextualized by the title "Interactivités" and had as common themes the collection of objects, the art of memory through interactivity, the function of

objects to convey stories, the indexicality of data entries in a database and the description of objects stored as metadata.

Fig.2 Wall screen design at the entrance of the installation by Projekttriangle Design for the Centre Pompidou installation. Fig 3. George Legrady's Pockets Full of Memories on the left, Jean-Louis Boissier's Mémoire de crayons on the right, Summer 2001.

Exhibition Description

At each new presentation, the exhibition began with a near-empty database seeded by a few contributions to activate the neural-network for data analysis. The public was invited to scan an object in their possession at the data collection station, and to describe the object through an interactive digital questionnaire. As the collection accumulated over time through the incoming submissions, the visualization intensified in the movement of objects' positions in the projection, illustrating the incoming data's influence on the re-ordering of the two-dimensional matrix of objects. Viewers were able to witness through the activities in the large dynamically changing visualization, the process by which the self-organizing map (SOM) algorithm reformulated the relationship of the submitted image-objects, moving them around as the objects optimized their position in relation to each other. The attending audience was able to perceive their recent object's entry and performance as the algorithm was programmed to prioritize the placement of the ten most recent contributions and populate the surrounding cells by searching the database for other objects with similar metadata values.

Fig 4. Announcement card for the installation des souvenirs plein les poches/Pockets full of Memories, Projekttriangle Design, 2001

Exhibition History 2001-2007

Pockets Full of Memories was commissioned by Exhibition coordinator Boris Tissot for the public space of the Centre Pompidou, Museum of Modern Art, Paris, where it was

exhibited throughout the summer of 2001. The installation was later presented at the Dutch Electronic Arts (DEAF '03) Festival, Rotterdam (February 2003); the Ars Electronica Festival (September 2003); the "Aura" exhibition organized by c3, Budapest, (October 2003); the Museum of Contemporary Art Kiasma, Helsinki (Summer, 2004), Cornerhouse Gallery, Manchester (Winter, 2005), and a Taiwanese language version at the Museum of Contemporary Art, Taipei (Summer, 2007).

The installation circulated in eight exhibitions, each in a different country, to wide-ranging audiences from the general public to specialized media arts-specific communities. There were four museum installations (Paris, Helsinki, Frankfurt, Taipei), a fine-art gallery (Manchester), and 3 media-arts festivals (Rotterdam, Linz, Budapest). Each of the locations had their own culture-specific audiences resulting in a broad sampling of over 11,288 contributions, which can be accessed online through the previously mentioned interactive database where viewers can search the database and retrieve contributions based on the metadata used by the SOM algorithm.

Origins & Inspirations

The exhibition coordinator, Boris Tissot had come across my autobiographical, interactive multi-linear artwork, the "Anecdoted Archive from the Cold War" (1992), at the musée des beaux-arts in Brussels, in the two-person exhibition "Verbindingen / Jonctions" with the artist Chris Marker. Seeing the exhibition inspired him to further explore the potential of how the public might directly engage with creating a digital-based archive. The "Anecdoted Archive from the Cold War" was an interactive artwork designed as a compilation of brief stories made possible through newly available technologies such as digital scanning of documents, time-based digital capture of movies and sounds, interactive software by which to compile data, stored on the digital optical CD-ROM media. Using the metaphoric interface of the lay-out of the architectural floorplan of the Hungarian Propaganda Museum, viewers were able to browse through the stories by selecting any one of the 8 'rooms', and navigate their way, choosing any of the stories in each room to view. Each story comprised of combinations of texts, digitized photographs, scanned documents,

recorded sound bites, and short video clips by which to convey an auto-biographical narrative related to the Cold War. The interactive format of this work ensured that every viewing yielded a different narrative.

Digital encoding made it possible to transcend the constraints of linear structures, and this led to investigations to develop methods by which to organize data. In the late 1990s I held a faculty position in Stuttgart, Germany, and my institution was part of a European media arts organization that held regular gatherings to define directions of the digital media arts education field. It was at one of these meetings that I was introduced to the Kohonen (SOM), unsupervised self-organizing artificial neural-network algorithm by Dr. Timo Honkela from Helsinki. I was inspired by his presentation as I had been looking for such an autonomous, self-learning process that mathematically classified data based on multi-dimensional analysis of metadata. Timo was a computer scientist who did his dissertation on the Kohonen algorithm, and at the time we met was doing research in natural language processing focused on text-based information retrieval, specifically to organize a large collection of documents to facilitate interactive browsing by clustering articles of similar content through spatial proximity. Our discussions at these meetings led to the idea of using the SOM to spatially position images according to text (semantic) encoded in metadata rather than an images' pictorial features.

Unique Features of the PFOM Installation

The Pockets Full of Memories installation introduced a number of unique features to the museum exhibition format. The exhibition's goal was to have the public create a collection that recorded their participation and interests through the process of contributing cultural artifacts. The collection was created by visually scanning an object of their choice and describing it through a questionnaire. Once the data was entered, it was processed by the SOM algorithm, and joined the existing collection visualized on a large screen. The staging of the installation was determined by the two-step operation of how artificial neural-networks function. There is a training set which builds up over time and is continuously mapped through the projection.

Initially empty, the collection expanded over time, changing in content. The SOM algorithm processed the incoming data with the current existing data order as its input, creating a newly ordered table but this required many iterations as at each step, the calculations engaged in the learning state, initially organizing at the global scale and eventually at the local cell state, with the ordering process disrupted each time a new entry was added to the database.

Animation Sequences & Emergence

The interface to the collection was through the viewing of the three repeating animations. The main animation featured the images of objects, spatially positioned according to their multi-dimensional metadata. The public was able to observe their object, positioned in relation to the others, based on the semantic data provided through the questionnaire. The succeeding animation showed the objects' repositioned from the current to the new location with lines connecting the start and end cell locations in the matrix. The forthcoming animation, titled 'unified distance matrix" (U-matrix) visualized the relationships of values between cells with gray-scale tones. Light tones representing similar values and the darker tones indicating semantic distance and separation. The animation sequence was designed to reveal to the spectators the hidden operations taking place behind the scenes by that determined each object's position.

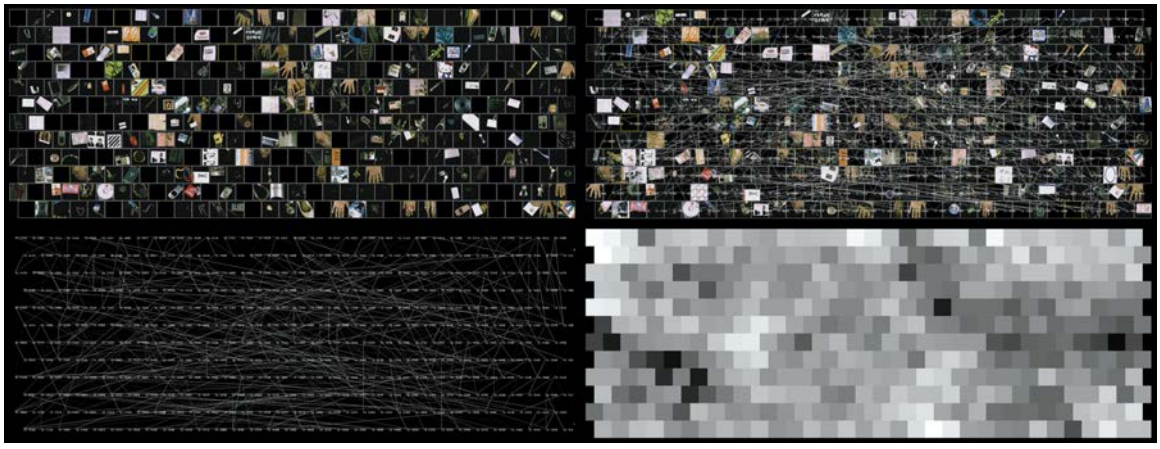

Fig 5. The 4 Animations: top left: the objects, top right, the movement of objects, bottom left, the lines showing objects, bottom right, the U-Matrix.

The phenomenon of proceeding from small local actions (each individual public's contribution) to an ordered state in the 2D matrix expresses the operation of 'emergence' as the order is not determined beforehand but emerges over time through the local interactions as each new object enters the database. In this sense, the system has been defined as 'self-organizing'. The 8-slider multi-dimensional attribute values and keywords entered in the questionnaire defined each object's value by the system. The data analysis of common objects like keys, cellphones, pens, hands in the collection disclosed a wide range of ratings of the objects. Through the process of filling out the questionnaire by which to describe the objects, world views and personal opinions were articulated. A post-museum visit opportunity was introduced with online access, giving the general public opportunities to further contribute commentaries and conversation to each object in the database collection.

Multi-Disciplinary Production

The planning and conceptual development of the project began in the spring of 1999 with actual production starting in the summer of 2000 and continuing for months until the opening of the exhibition in April 2001. Once funding was secured, the greatest challenge in the production process was caused by the geographic distribution of the collaborators. Project management, visual identity design, and design of the questionnaire occurred in Stuttgart where I was living at that time. The operational design and integration of the Kohonen self-organizing map (SOM) algorithm work was accomplished in Helsinki, and the fabrication of the data collection station and software integration of all components took place in Budapest. Dr. Steinheider, a psychologist who at the time was a researcher at the Fraunhofer Institute and worked on the questionnaire wrote an analysis of the project's development resulting in a publication in Leonardo, MIT Press in 2004 [Steinheider, Legrady].

The software application of the Kohonen self-organizing map (SOM) algorithm, which was at the core of the installation, was developed by Timo Koskenniemi and Petri Saarikko and Timo Honkela at the Media Lab of the University of Art & Design in Helsinki. The code was written in Perl but integrated existing C language functions from the open-source Kohonen library. The SOM sequence involved the following three steps:

1) Map Initialization: randomizing multi-dimensional values associated with each of the 24 x 12 positions in a 2D matrix, retrieving each contribution and identifying a best match to any of the matrix positions, multiplying values with decreased percentage to distanced cells. SOM compresses high-dimensional data into nodes in a 2D lattice and is used to automatically find clusters in input data, especially were data elements may be related in a non-linear, associative fashion.
2) Map Training: An iterative process where the data is ordered and fine-tuned
3) Map Visualization: Positions data within a 2D space based on clusters, with attached labels. The process essentially re-positions the images of the objects over time into an ordered state based on metadata defined by the contributors' semantic descriptions.

The questionnaire's design was conducted by psychologist Brigitte Steinheider. It consisted of multiple screens to collect the following metadata: A language choice screen (French, English, and later Chinese), an image capture screen to digitally scan the object, screens to provide descriptions, keywords, object origins. A number of screens collected demographic data recording age, gender, profession, country. The most impactdul screen comprised of the eight attributes sliders by which the objects were classified. The sliders were modeled on the Osgood / semantic differential scales normally used to measure attitudes. The sampling rate was set to 128 positions (-64 to 64) between the two polar positions with a central neutral (0) position. The attribute topics for the 8 sliders were chosen on the basis of what visitors might have with them at the Pompidou museum. We decided on the following: old/new, soft/hard, natural/synthetic, disposable/long use, personal/non-personal, fashionable/not fashionable, useful/useless, functional/symbolic. All except the last attributes were opposites except the last as an object could be both functional and symbolic.

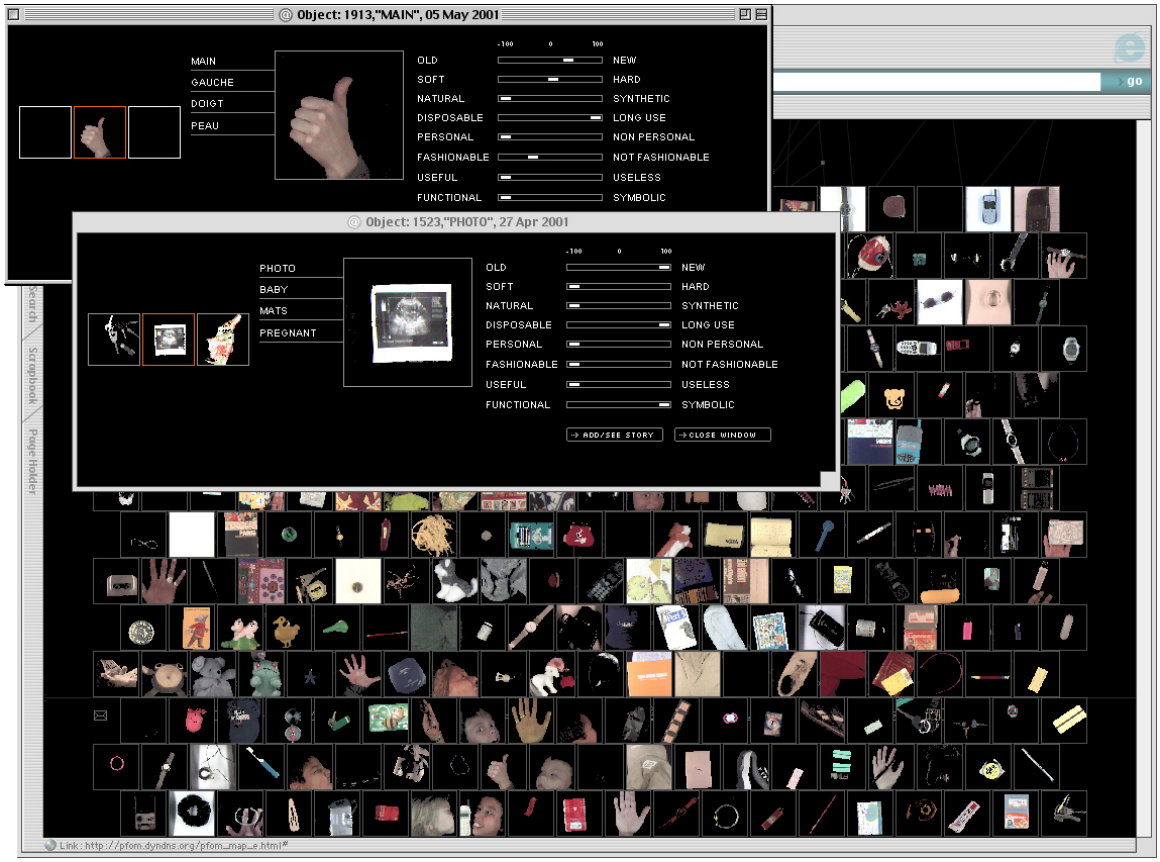

Fig 6. George Legrady, *Pockets Full of Memories*, Online data Screen with two views of contributed objects, George Legrady © 2001

Projekttriangle Design from Stuttgart created the project's visual identity. The design occurred over time as a research study in infographics with the goal to guide the public through the process of digitizing objects and filling out the questionnaire. The staging of the installation was enhanced by additional wall icons positioned to situate the narrative, likewise instructing the public through the procedural steps and to explain the broader conceptual premise of the artwork. For each of the exhibitions spread across 6 years, Projekttriangle Design re-designed the visual icons showcased on the walls and floors of the installations to fit the specifics of each of the venues.

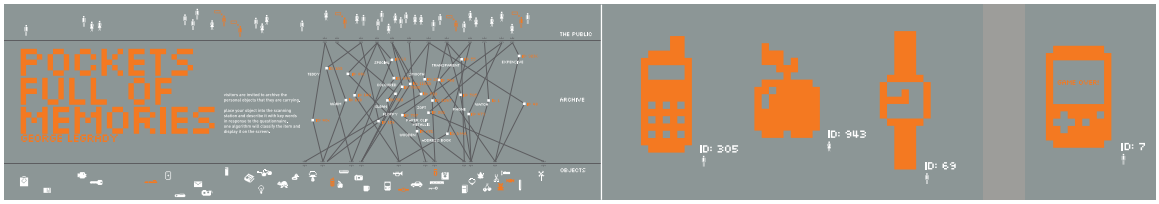

Fig 7. Dutch Electronic Arts Festival (DEAF) wall infographics, Projekttriangle, Rotterdam (2003)

The MOCA Taipei exhibition required a Chinese language translation, a design challenge in itself. Peter Conolly at Urge Studio in Los Angeles redesigned the questionnaire interface first used at Cornerhouse Gallery in Manchester (2005) and MOCA Taipei (2007).

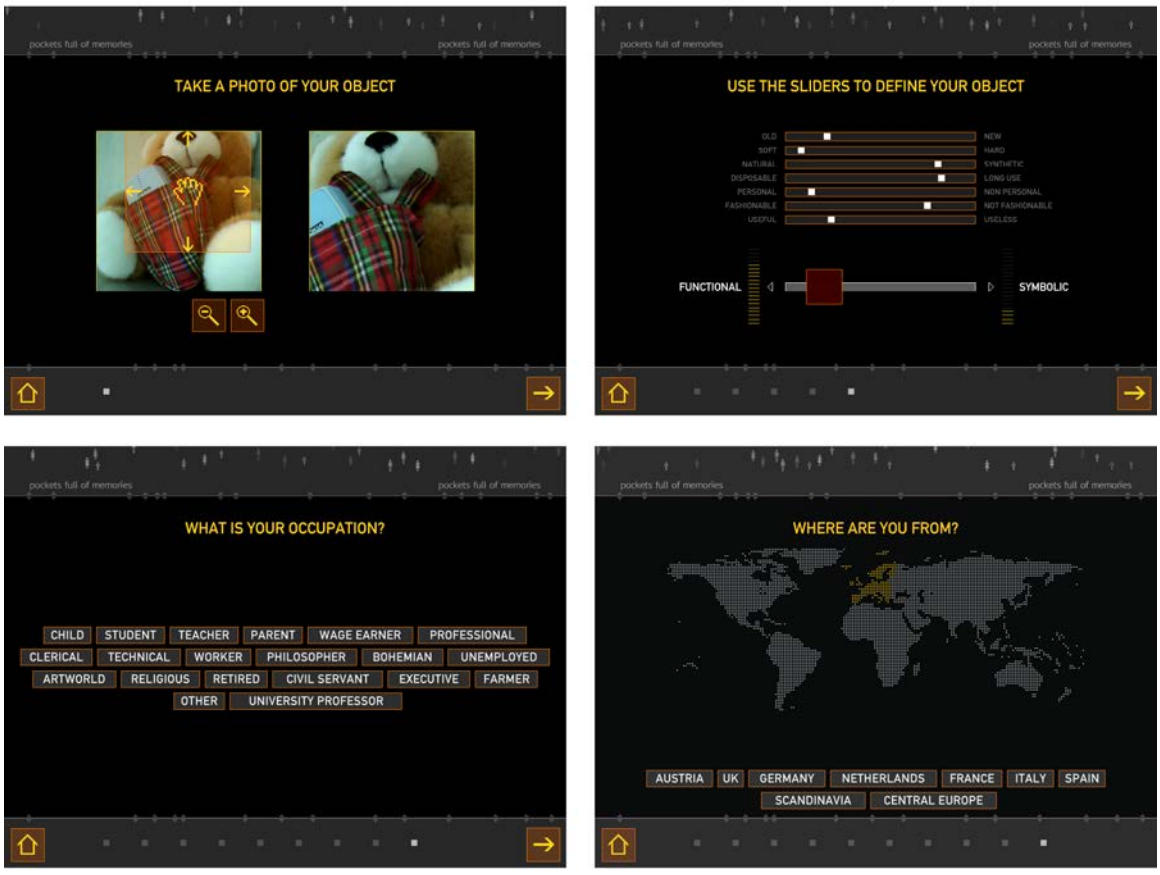

Fig 8. Four of the fifteen questionnaire screens, Design by Urge Studio, Los Angeles (2004)

Software development, fabrication of the touchscreen data collection station with camera image capture system, database setup and operations, LAN networks, and visualizations were all realized at the c3 Center for Culture and Communication in Budapest, a vanguard, digital media arts research and production center dedicated to the intersections of art, science and technology directed by art theorist and historian Miklos Peternak. Marton Fernezelyi was the lead engineer for the fabrication and software development devising multiple innovation solutions such as creating a touch screen interactive interface from scratch. C3 was selected to fabricate the complex components of the installation as I had a longstanding working relationship with the c3 team who had proven over time their expertise in design and solving unusual technical problems.

Hardware/Software Evolution

The exhibition had a seven-year lifespan from 2000 and 2007, and over this period, the technology assigned to process the data evolved at such a rapid phase that each exhibition required hardware updates for both the camera capture and the data processing to the extent that the seven computers initially used at the Centre Pompidou were reduced to 3 computers by the time of the MOCA Taipei presentation.

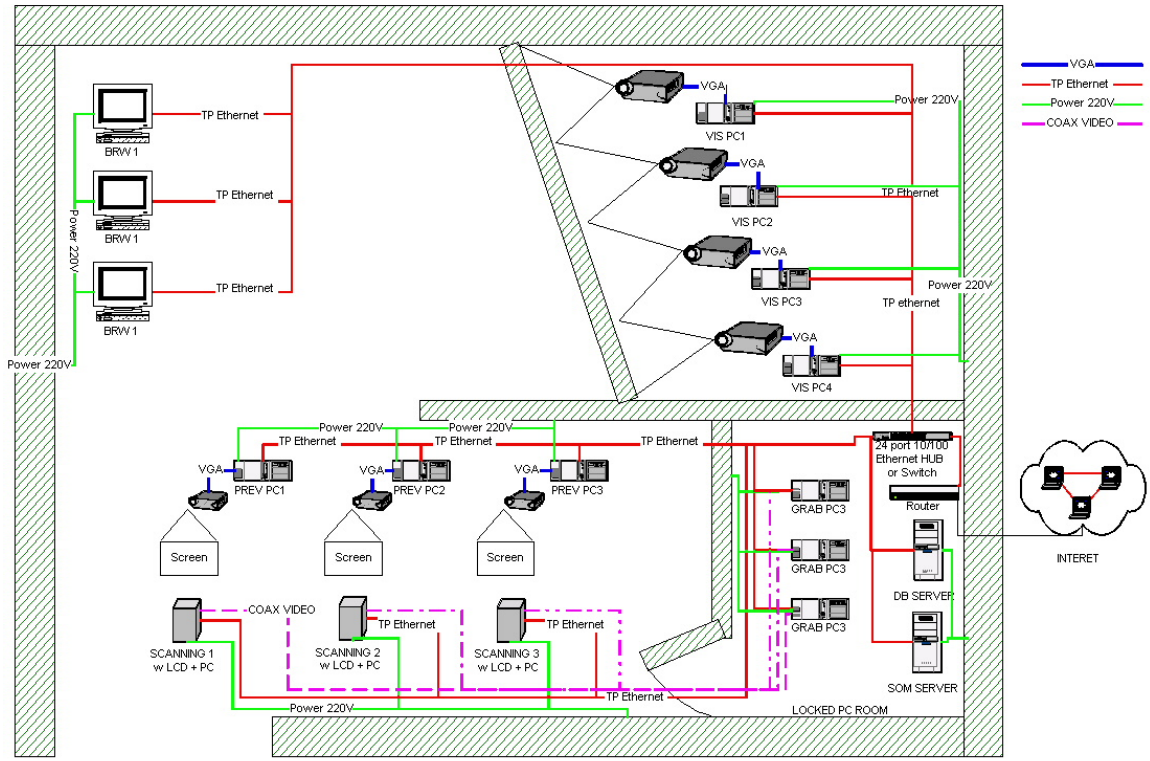

Fig 9. Original lay-out schema of hardware and LAN network connections concept sketch for a three scan Station installation for Pockets Full of Memories. Schemata drawing by Marton Fernezelyi, C3, Budapest (2001)

The Collected Data, Metadata & Analysis

Pockets Full of Memories was designed as an artwork to collect data with the intent to have the data function as a trace, record, and reflection on the community that participated in the artwork. Approximately 20,000 visitors came to view the installation at the Centre Pompidou over a four-month period and contributed 3327 data submissions of objects and their descriptions. The eight exhibitions produced a total collection of 11288 objects with the following distribution:

- **3327** contributions at the Centre Pompidou by a general audience (April 18-September 3, 2001);
- **724** by a digital media arts audience at the Dutch Electronic Arts Festival, Rotterdam (February 25-March 9, 2003)
- **627** by a digital media arts audience at Ars Electronica, Linz (September 5-21,

2003)

- **688** by general art audience, “aura” exhibition curated by c3, Budapest (October 29-November 30, 2003)
- **2449** by general art audience, Kiasma Museum of Contemporary Art, Helsinki (May 6-August 1, 2004)
- **897** by general art audience, Cornerhouse Gallery, Manchester (January 21-March 6, 2005)
- **146** by general audience, Frankfurt Museum of Communication (June 27-September 8, 2006)
- **2439** by general art audience, Museum of Contemporary Art, Taipei (August 10-October 5, 2007)

The contributions consisted of items the visitors had with them such as keys, cellphones, toys, shoes, and over time, the more creative submissions included body parts, blank screens, and messages to loved ones.

Legal Considerations

The 10-page contract stipulated in great detail the particulars of the fabrication and exhibition such as sub-contractor contracts, equipment loans, software and hardware ownership, rights of use and reproduction, conceptual development and intellectual property rights, scheduling, guarantee of functionality, maintenance through the exhibition, and promotional support. There were also legal considerations by the Pompidou lawyers how to filter the incoming data in case of problematic content, who would have ownership of the data and how the data was to be used once collected. The conversation over data use and ownership resulted in a request for a fifteen-year research use by the museum.

Online Database

An online interactive database was launched after the last exhibition at MOCA Taipei in 2007, with all of the 11288 contributions collected through the 8 exhibitions and made

accessible through an interactive template at http://tango.mat.ucsb.edu/pfom/databrowser.php The database can be searched all of the metadata that contributors provided such as the images of the objects, their descriptions, origins, keywords, eight attribute values, and demographic data. The question which has yet to be explored is to what degree can there be evidence found in the data that could reveal unexpected differences between the various exhibitions.

Fig 10. Data entry on opening night and the next day, Pockets Full of Memories, Centre Pompidou, Paris (2001)

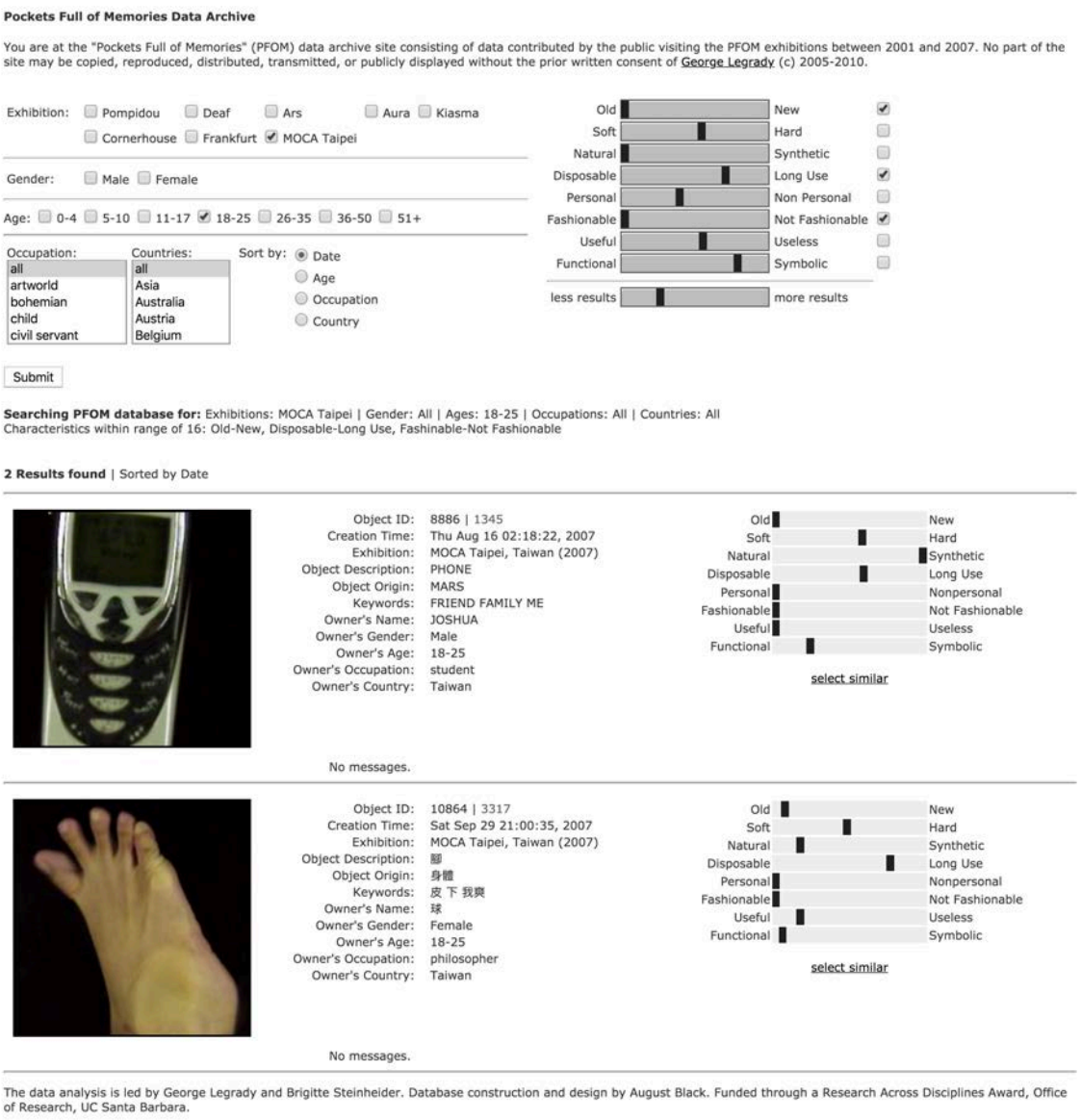

Fig 11. Example of a search query in the online database, in this case from the Taipei exhibition, 2 contributions are returned that match the query for submission by age of 18-25 of objects that had attributes of old, somewhat long use, and fashionable.

Fig 12. A comprehensive map of all contributions according to their categories subdivided by exhibition clusters. Centre Pompidou in the upper left and Taipei at the far right had the most contributions.

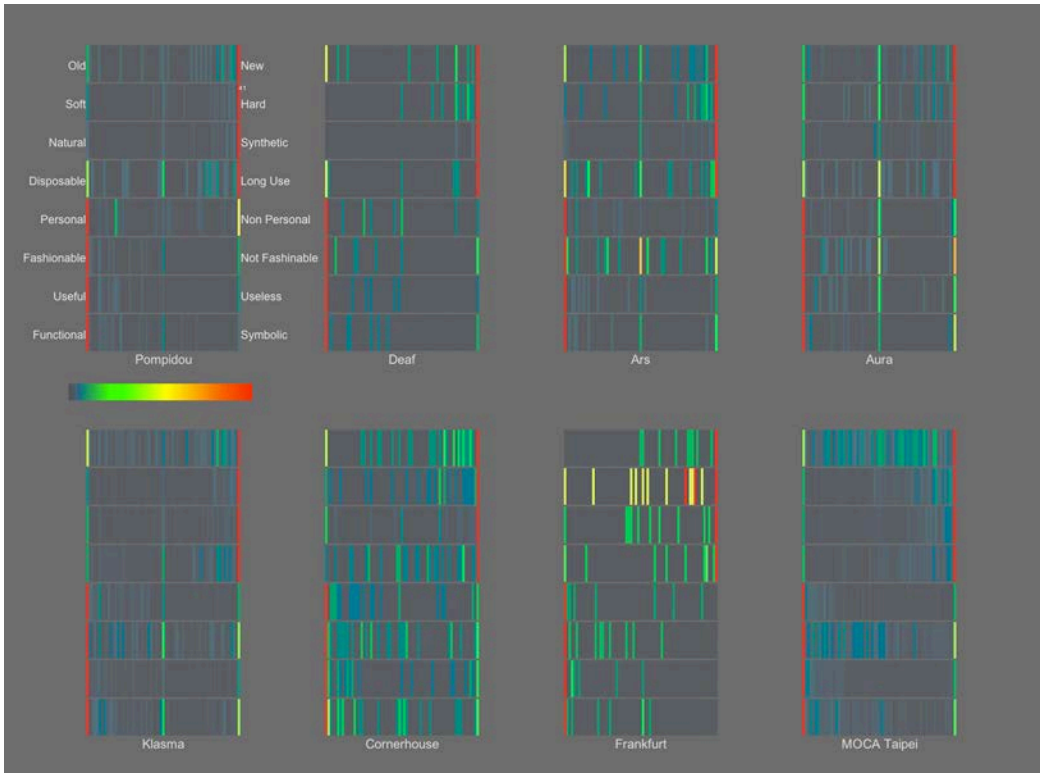

Fig 13. Summary of collected data of cellphones and their attribute ratings throughout the 8 exhibitions from 2001 to 2007. The results reveal that even though each exhibition's rating differed in the distribution, all exhibitions rated cellphones in the same way. Their attributes were considered to be new, hard, synthetic, long use, personal, fashionable, useful and functional.

Summary

"Pockets Full of Memories" was first exhibited in April 2001, twenty years ago. The installation can be categorized as digital media arts work that introduced a few unique features within the framework of applied research in the role of public interactions with data, metadata, and unsupervised, self-organized processing.

Key features of the installation are:

1) Position the audience as active partner participants in the creation of the work by contributing data to construct a collective archive, and to explore to what degree their semantic descriptions of the data impacts on how the data becomes classified within an emerging digital environment.

2) An artificial neural-network algorithm normally utilized for data mining of large

datasets was implemented in a dynamic way to visually reveal to the audience the nature of emergent behavior of an unsupervised self-organizing application.

3) Redefine the exhibition as a site of creation, of collective memory construction to reflect the diversity and make-up of the audience: who they are, what they are interested in, how they describe themselves represented through the objects contributed to the archive, and to make accessible and understandable how advanced data-structures function.

During the past 5 years, Artificial Intelligence has re-emerged with Machine-Learning, Deep Learning, artificial neural-networks, all moving to the forefront of research and practice in both engineering and the artistic communities. This installation was realized at a time when the conversation had yet to arrive, and it is in appreciation of my colleague Timo Honkela, who passed away during the COVID lockdown, that I want to offer my appreciation for our partnership in this project.

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Timo Honkela: (1962-2020) Computer scientist at the University of Helsinki, Aalto University School of Science, Aalto University School of Art, Design and Architecture. A student of Teuvo Kohonen, Honkela was a researcher in natural language processing, artificial neural-networks and machine-learning, and an expert in the kohonen self-organizing map (SOM)