A Software Based Installation to Assist Self-Reflection

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1. Introduction

The evolution of Information technology (IT), from the invention of the computer (Eniac, 1946), to the Internet (1977), to multimedia and mobile phones (1990's), and to social media (2000) has proceeded in a way that IT has now impact on the life of half of the world population (6 billion in 2009: 1.5 billion people using the Internet, 3 billion people using mobile phones).

IT certainly helps individuals to maintain connections to other persons, hence IT can give the feeling of connectedness between human beings, even if in many cases these interactions are rather shallow relations.

In many important cultures in the world it is believed that the true "self" of every person is eternal and indistinct from the supreme spirit. Hence it is believed all things in the universe are connected. E.g. see the voice Hinduism on Wikipedia. And from connectedness it derives the need of accepting life events without refusing them as external to us.

Can technology improve the sense of connectedness of somebody to the rest of the universe? In this paper we propose to use IT technology to help people to come to a better grasp of these wholeness and acceptance concepts.

Digital technologies have long been used to enhance the expressive palette by which artists represent emotions and feelings (Ascott 2003, Popper 1997, Paul 2008) and digital artworks are increasingly being considered part of mainstream IT (Oates 2006, Trifonova et al. 2008).

In (Nardelli 2010) we have presented a classification of interactive digital artworks based on some of their more meaningful IT characteristics. An interactive digital artwork is any artwork where digital technology is an essential component and which is interactive. The definition of our classification convinced us of the importance not just to reflect on these themes as observers but also to enter ourselves in this area and to try out to deal first-hand with the subject matter.

Hence, elaborating on the issues presented in call for paper of the 11th edition of the Consciousness Reframed we have defined and built an IT-based installation aiming at improving the capability of a person to accept what happens in her life without being too emotionally disrupted by unexpected events.

In the installation the person sees an image of herself that is processed on the basis of some regular laws having as input the values read by some sensors from the person: e.g., body temperature, skin humidity, and conscious actions: e.g. finger pressure, hand movements.

Hence there is a regularity and predictability in the evolution of her image: the person may be able to obtain a desired processing effect by means of a conscious manipulation of sensors.

But from time to time some obscure processing rule is inserted in the processing and a completely unexpected result is obtained which is then very difficult to control. If the user succeeds in regaining control then regularity is recovered again, and the person returns in the normal cycle of interaction. Even if now the image of herself may be in an unexpected state the processing is back under her full control. And then again destiny, under the form of unpredictable events, perturbs the course of actions.

It may happen that one of these unexpected events is completely uncontrollable: this catastrophic process leads to the complete destruction of the image. The person is therefore induced to reflect on the need of accepting what happens in the universe as an un-escapable characteristic of life. And from this computer assisted self reflection she can regain a sense of unity with the universe.

The installation is based on the manipulation of the pixels of a self image by means of the "Processing" language (Processing 2001) and it is available for interaction on the home page of the author. The source code is also available under a Creative Common license from the author's web site.

In the rest of the paper we first shortly describe the classification framework for interactive digital artworks which prompted us to design and implement this installation and then describe in more detail our installation and its architecture. We conclude with an evaluation of what we obtained.

2. The classification framework

In this section, for the purpose of giving the overall context of our work, we provide just a short description of our classification framework, which is described in more detailed elsewhere (Nardelli 2010), together with comparison with previous work and a discussion on how it has been derived and validated.

An information system is conventionally seen as a system which **process**es a given **input** to produce a desired **output**. We consider an Interactive Digital Artwork (IDA, in the following) in the same way, as a system which receives a certain input, called *content* in this context, and producing as a result the output intended by the IDA author (i.e., the artist). It is also helpful to consider the process producing the intended output as if it were

a function in a mathematical sense, that is an abstract "device" which at each time instant transforms its inputs into its outputs according to its mathematical specification.

The dimensions of the classification are:

- **content provider**: who produces the raw material processed by the IDA,
- **processing dynamics**: which kind of variability has the processing itself,
- **processing contributors**: which are the sources affecting the dynamics of processing.

For each dimension we now provide different values, that are the labels of our classification. We use the term *artist* to denote the person or team who has invented and realized the IDA, *audience* to denote the human beings actively and consciously providing any kind of input to the IDA, and *environment* to denote any passive or not-conscious entity present in the environment surrounding the IDA.

Regarding the **content provider** dimension, the source providing the content to the IDA can be either the *artist* or the *audience* or the *environment*. This dimension has therefore 3 possible values, or points, and an artwork can be labeled, with respect to this dimension, with one, two or all the values.

Regarding the **processing dynamics** dimension, the processing function of an artwork can be *static* with the passing of time, or it can be dynamic, that is changing as time passes. Note that the change considered here is the intrinsic change of the processing function, not a change in its input parameters. But the input parameters may determine, partly or wholly, such a change. In the case of a dynamic processing function, we consider three values, in mutual exclusion, to be used for a better characterization of the artwork:

- *predefined change*, where changes to the function follows the plan defined by the artist;
- *casual change*, where changes to the function derive by random choices, even in the case the set or the domain of the possible choices have been completely pre-defined by the artists;
- *evolutionary change*, where changes follow an unpredictable path defined by the evolution (in a biological sense) of the processing function itself.

The single value for the static case plus the three above values for the dynamic one give a total of 4 values (points) for this dimension. An artwork can be labeled with exactly one of these values.

Regarding the **processing contributors** dimension, the elements driving the content processing can be self-contained in the IDA (hence, what the *artist* has put directly inside the artwork affects the processing), or these elements can arrive at the IDA through the interaction with the context the IDA is placed within (that is, the processing function has additional input parameters causing modifications to how the content is processed). In the latter case, the providers of values changing the behavior of the processing function can be the *audience* or the *environment*. The dimension has therefore 3 values (points) and an artwork can receive one, two or all the labels.

Note that, in strictly mathematical terms, inputs to a functions are all equals, hence the distinction between "content provider" and "processing contributors" dimensions has no

compelling mathematical reason. But from the artist viewpoint this differentiation is an important one, since it distinguishes between what she has directly inserted in the artwork and what arrives from the outside of the IDA, both in terms of the raw material and its processing function.

Also, an artwork labeled both under "content provider" exclusively with *artist* and under "processing contributors" exclusively with *artist* is **not** an IDA, since it has no elements of interaction at all. But as long as, in at least one of these two dimensions, the artwork is labeled with at least one more label, then it is an IDA.

Our classification overcomes the limitations of previously presented ones and explicitly targets IDAs by means of an approach that it is rooted on the standard input-process-output view used for discussing Information Systems.

3. Interacting with the installation

Set-up phase: The interaction with the installation starts with a set-up phase where the initial image of the user is captured via a webcam.

Easily-reversible effects: The set-up phase is followed by a for-ever cycle where some *easily reversible effects* are applied to the captured image and displayed to the user. These manipulate the image according to the various input sensor values in a way that can be easily reversed from the user by simply inverting her input. For example, the brightness of the image can be driven by the amount of light read by the light sensor. The closer a light source is to the sensor, the brightest is the image. When the light source is turned away, the effect is reversed, that is the image returns darker.

The easily-reversible effects intend to represent facts of life over which one is able to have a full control. The interaction cycle time is quick enough not to be boring, but slow enough to make the user aware that she is in control of what happens. See in figure 1 an example of a self image during the application of easily reversible effects.

Figure 1: The self-image during the application of easily reversible effects

Irreversible effect: Representing the fact that some events in life are impossible to control and have catastrophic consequences for our future, after some initial grace time the system will decide, with a low probability, to start applying to the image an *irreversible* effect, randomly selected by the system among the available ones. This irreversible effect, having a low probability of happening, once started will lead the image to a complete degeneracy, without any possibility for the user of controlling or stopping or reversing it. To start-over the whole process from the beginning is the only possible action now. As a departure from the viewpoint of the installation as a metaphor of life events, the user can at any time during the interaction activate a given key on the keyboard to force the whole process to start-over from the beginning.

See in figure 2 an example of the previous self image during its corruption by an irreversible effect.

Figure 2: The self-image during its corruption by an irreversible effects

Hard-to-reverse effect: But life is not just either easy to control events or unrecoverable events. At a random time instant during the for-ever cycle, the installation will stop applying the easily-reversible effects and will start applying a *hard-to-reverse* effect, randomly selected by the system among the available ones. The user will then have to try to control this hard-to-reverse effect. This is not easy since the relation between user inputs and the actions happening in the system is not apparent. The system provides an audio signal as a partial feedback to the user attempts.

Hard-to-reverse effects intend to represent the fact that for some events of life we have not completely clear if it is possible to control them and how this control can be obtained.

If the user succeeds in controlling the hard-to-reverse effect (that means to prevent it from further altering the image) then the system will acknowledge her ability by switching back to the phase of application of easily-reversible effects, which are then applied to the image in the state reached when the user was able to control the hard-to-reverse effect.

If the user is not able to control this hard-to-reverse effect then the image is progressively altered until a completely unrecognizable state. The user can then start over the whole process (as previously described) or – as a further departure from the viewpoint of the installation as a metaphor of life events – can “force” the system to go “backward in time”

and artificially reversing the action of the hard-to-reverse effect. She thus regains a possibility of learning how to control it. But this possibility is paid with an increase of the probability of incurring into the irreversible effects. Hence one reflects on the fact that nothing comes for free in life.

See in figure 3 an example of the self image of figure 1 altered by a hard-to-reverse effect.

Figure 3: The self-image altered by a hard-to-reverse effect

4. Implementation, evaluation and conclusion

The installation has been implemented by Francesca Capri, Davide Patrizi, and Giovanni Ricci, students in the Master Degree in Informatics at University of Roma “Tor Vergata”, as part of their exam project for the course “Person-Computer Interaction” taught by the author.

Students, having a technical background, were initially confused by the artistic/social requirements of the installation. They had to work hard both to learn the Processing language, explicitly for this project, and to grasp and assimilate the meaning and the purpose of the installation. At the end of a 4-weeks full time effort with daily interaction with the author, their evaluation is fully positive. They have appreciated the new technical

knowledge obtained, the highly interactive work setting, the cooperative climate established where differences of viewpoint were eventually reconciled to a common vision, and the enlargement of perspectives they have obtained by working in this artistic domain so far away from the standard uses of IT. The author also has a positive evaluation of the experience, since the continuous interaction with the students/implementers greatly helped him in focusing his thinking on the installation.

With respect to our work on classification of IDAs (cfr Section 2), the value for the **content provider** dimension of our installation is *audience*, since the raw material for processing is provided by the spectator; the value for the **processing dynamics** dimension is *casual change*, since both the filter to be applied in each phase is randomly chosen and some filters execute random choices; the value for the **processing contributors** is *audience*, since the spectator provides inputs to modify the behavior of the processing function. Hence our classification is able to correctly classify our installation.

We plan in the future to add to our installation effects such that the value for the **processing dynamics** dimension is *evolutionary change*, since this is an item of our classification for which we are not aware of the existence of digital artworks and since we feel it can offer interesting artistic and technical challenges.

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Biographical Notes:

Enrico Nardelli is full professor of Computer Science in the University of Roma "Tor Vergata", in the Department of Mathematics.

He is author of more than 130 papers published in International scientific journals and conference proceedings, covering both theoretical and system implementation work done in International research projects.

He is coordinator of a National research projects on bio-informatics.

During 2003-2008 he acted as president of GRIN, the Italian Association of University Professors of Computer Science.

He is Executive Board member of Informatics Europe, the association of computer science departments and research laboratories in Europe.

Recently he started working at the intersection between informatics and other disciplines, as he believes that it is of the utmost importance for the future of informatics to investigate how informatics can benefit to and receive benefit from other cultural areas.