

ReDrawing Campinas with Disc-Rabisco

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Abstract

Disc-Rabisco is an interactive installation that with sound guidance translates the movements and actions of the human body – in air-gestures of the visitor’s hand - into a work of art, or the “action report”. Disc-Rabisco has three main components, an OAK-D camera with neural inference hardware; a graphical and audible interface and the ReDrawing library, created to provide simple data exchange for artistic applications. We describe the system’s architecture, aesthetic characteristics, its sonification features and how Disc-Rabisco promotes creative and artistic empowerment.

Introduction

The dialogue between art and technology is much closer than is commonly recognized. On the one hand, art and

aesthetics enriched computational models and technological development; on the other hand, computing and technology enabled new artistic experiences [1].

With the advent of computer-based interactivity, new kinds of artistic experience emerged. In computer-based interactive artworks, the activity is not only psychological, but also constituted through exchanges that occur between a person and an artefact. In this context, Artificial Intelligence and Computer Vision support the development of interactive applications that are simple to use but allow expressive artistic results.

In interactive art, the artist is concerned with how the artwork behaves, how the audience interacts with it (and possibly with one another through it), and ultimately, with participants’ experience and their degree of engagement [2, 3].

Disc-Rabisco is an interactive installation that aims to provide, even for people without knowledge of artistic techniques, a creative and expressive experience. It captures the movement of the visitor’s hand (an in air-gesture) and with sound guidance shows its trajectory on the computer screen, in analogy with a

scribble (*Rabisco*, in Portuguese), in different colours and audiovisual effects.

Disc-Rabisco has three main components: i. an OAK-D camera with neural inference hardware; ii. a graphical and audible interface and iii. The ReDrawing library, created to provide simple data exchange for artistic applications. The intelligent camera combines elements of hardware, firmware, software, and AI training. Machine learning offers an efficient and accurate way to build systems that respond to human gestures or actions and map these actions to dynamic changes in visuals, sound, or other computer-generated responses.

Disc-Rabisco used Rabisco (that means scribble in Portuguese) as a framework [4, 5]. Disc-Rabisco was a finalist in Phase 1 of OpenCV IA Competition 2021, submitted by the ReDrawing Campinas team, (Campinas, SP, Brazil), with six students from Computer Engineering and Mathematics, two researchers and two teachers, from Computer Engineering, Mathematics, Arts and Music.

Collaborative efforts between artists and researchers are likely to continue and even accelerate with the rapid advancement of technologies; they will gradually evolve from making art through interactive technology to making art with smart technology to reach a deeper understanding of people, artifacts/interactive environments and the interactions between them.

Following, we present the architecture of Disc-Rabisco. In Section 2 we describe the aesthetical choices and in Section 3 the sonification process. In Section 4, we report how Disc-Rabisco promotes

creative and artistic empowerment. Finally, in Section 5 we present the conclusions.

1. Drawing with Gestures

In air-gestures are purposeful movements a performer makes with the body in free space in order to control a device that is designed to have an immediate response [6]. In Disc-Rabisco, the device is an OAK-D camera for intelligent spatial computing. It calculates the environment depth, runs artificial intelligence models, and performs image processing. It enables data sensing and collection from the environment, similarly to human capacity.

Using the OAK-D we were able to simultaneously run neural network models obtained from open source repositories to recognize gestures [7, 8]. The challenge was then to transform the data from gestures, from OAK-D, into audiovisual compositions, in Processing environment [9]. We created the ReDrawing library to provide simple data exchange for artistic applications. The modular ReDrawing library allows the definition of stages with the necessary functionalities for application development and the combination of different applications to run on OAK-D.

In short, in Disc-Rabisco the participant draws in the air with the hand. The OAK-D camera senses the hand movement; the gesture recognition module processes the data and send it to the presentation module, which displays the result on the screen accompanied by a soundtrack. The ReDrawing library supports all the process. Figure 1 presents the architecture of Disc-Rabisco. Figure 2 shows Cássio Dezzoti experiencing Disc-Rabisco.

Disc-Rabisco source code is available at [16, 17, 18].

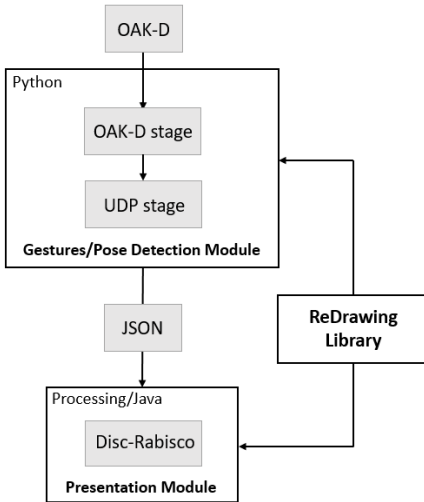


Fig. 1. On the top, the gestures recognition module. On the bottom, the presentation module.

2. Aesthetical Possibilities in Disc-Rabisco

Like in Rabisco, in Disc-Rabisco the participant can choose among three types of lines, combining them to produce different compositions: straight lines, a line where each point of the trajectory creates a sphere, and a line where each point of the trajectory creates a square. Figure 3 shows a composition with the three types of lines.

Rabisco visuals refers to 20th century abstract art. Pollock's works inspire the action lines; the squares resemble the geometric works of Mondrian. While this last author used only the three primary colours in his works, in Disc-Rabisco the compositions are always in green, red, yellow and blue, on black or white background.



Fig. 2. The developer experiencing Disc-Rabisco.



Fig. 3. Composition with the three possible type of lines (by Cassio Dezzoti).

Conceptually, the visitor draws on the faces of a imaginary cube, as depicted in Figure 4. However, each face of the cube has a different colour scheme associated with it, as depicted in Figure 5. This means that when the visitor is drawing on face 3, for example, all the strokes on the left region of the face will be yellow while the strokes on the right region will be green. The visitor can change the face of the cube at any moment, with just a gesture.

Another trick of Disc-Rabisco is that on each face of the cube the coordinate system changes. Thus, the same movement produces different results on each face. For example, a movement drawing a "<" in air can result in a composition following the trajectory of a

">", surprising and inducing the participant to a new behaviour. In short, Disc-Rabisco can be described as an interactive artistic game.



Fig. 4. The participant and the conceptual cube.

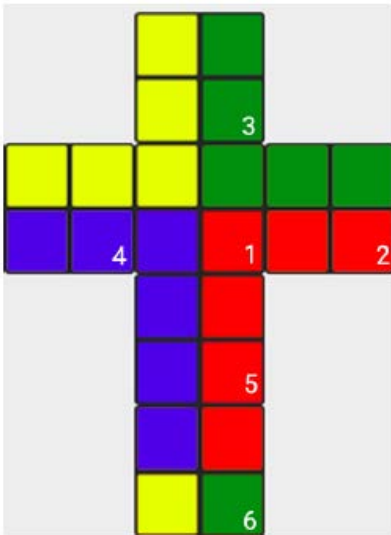


Fig. 5. The colour scheme associated with each face of the cube.

3. Sonification in Disc-Rabisco

Each face of the conceptual cube has a specific sound, which triggers whenever the visitor starts drawing with the hand's movement. There are also two other sounds associated with the actions of

rotating the cube, left and down, thus completing a set of eight digital audio samples. Since in Disc-Rabisco the goal is to stimulate artistic expression, we predefined four thematic sets of sounds, as follows: 1) sounds with piano chords, 2) sounds from body percussion, 3) sounds from game and 4) sounds from pottery.

After the implementation of the sonification control, the inclusion of a new sound thematic set is simple. Such sonification features can be understood as a kind of laboratory to experiment with new sound compositions.

4. Creative and Artistic Empowerment

Recently, the term "creative empowerment" has emerged in association with different contexts: opportunities, shared design philosophy, children's community, sustainable development by empowering artists and creative entrepreneurs, and many others [13, 14, 15, 16]. In [17] the authors define it as "the rewarding experience and the perception that occurs while gaining full control over our actions during the interaction itself".

It is interesting to observe people interacting with Disc-Rabisco. We can notice, from discomfort to curiosity, various manifestations: irritation, surprise, amusement. But the magic happens when the participant does something he/she appreciates. From there, another range of feelings presents itself: joy, excitement, triumph, which culminate in what we will nominate "artistic empowerment", in the sense of being able to create something with aesthetic value for the participant, in a first moment, instigating him/her to new

explorations.

Due to the pandemic, Disc-Rabisco developers, engineers and mathematicians, were the first visitors that experienced the installation. Some of them had never acted in the artistic context. From their experimentation, interesting compositions emerged. Figure 6 shows a composition created by Gabriel Kuae, a member of the ReDrawing Campinas team, who until his participation in the development of Disc-Rabisco had little involvement with the artistic area.

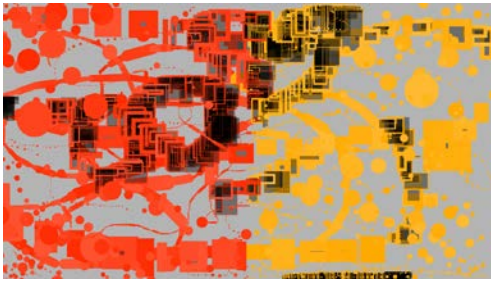


Fig. 6. *Composition with red and yellow*, by Gabriel Kuae with *Disc-Rabisco*.

STEM (Science, Technology, Engineering and Mathematics), combined with art and Design, turns STEM into STEAM [18]. STEAM allows researchers to explore STEM concepts through proactive activities so that they can understand complex constructs and their relationships in a more intuitive way, by providing design research platforms for artists as well as devising creativity-support tools, like Disc-Rabisco.

A video presenting Disc-Rabisco interactive installation is available at [19].

5. Conclusion

Machine intelligence supports new styles

of work and new modes of human creative engagement.

Collaborative efforts between artists and researchers are likely to continue and even accelerate with the rapid advancement of technologies, investigating important research questions together. They will gradually evolve from making art through interactive technology, like in Rabisco, the previous framework, into making art with intelligent technology, like in Disc-Rabisco. Such developments support amateurs and experts in creating higher quality content, facilitate embodied interaction in design and enable creative and artistic empowerment.

References

1. Jeon, M., Fiebrink, R., Edmonds, E. A., & Herath, D. (2019). From rituals to magic: Interactive art and HCI of the past, present, and future. *International Journal of Human-Computer Studies*, 131, 108–119. <https://doi.org/10.1016/j.ijhcs.2019.06.005>
2. Edmonds, E. (2011). *Interactive Art*. In L. Candy & E. Edmonds (Eds.), *Interacting: art, research and the creative practitioner*. (pp. 18–32). Faringdon: Libri Publishing Ltd. (2011).
3. Edmonds, E. *The Art of Interaction: What HCI Can Learn from Interactive Art*. Morgan & Claypool publishers (2018).
4. Moroni, A., Dezotti, C. G.; Manzolli, J. *RABISCO: An artistic creative environment using movement as a form of self-expression*. Proceedings of XXIII Generative Art Conference, 2020.

5. Dezotti, C. G.; Moroni, A., Manzolli, J. Rabisco: Um ambiente de criação usando o movimento como forma de produção. VII Simpósio Internacional de Inovação em Mídias Interativas, 2020, São Paulo. In: Anais do VII Simpósio Internacional de Inovação em Mídias Interativas. Goiânia: Media Lab/UFG, 2020.
6. Dahl, L. (2014). Triggering Sounds from Discrete Air Gestures: What Movement Feature Has the Best Timing? NIME - Proceedings of the International Conference on New Interfaces for Musical Expression, 201-206.
7. Blazepose repository. https://github.com/geaxqx/depthai_blazepose [Accessed 05 October 2021].
8. Depthai hand_tracker repository. https://github.com/geaxqx/depthai_hand_tracker [Accessed 05 October 2021].
9. Processing. <https://processing.org/> [Accessed 30 September 2021].
10. ReDrawing/Rabisco. <https://github.com/ReDrawing/Rabisco> [Accessed 05 November 2021].
11. Redrawing [Github repository. https://github.com/ReDrawing/redrawing](https://github.com/ReDrawing/redrawing) [Accessed 05 November 2021].
12. Disc-Rabisco Release. <https://github.com/ReDrawing/Rabisco/releases/tag/v1.0.0>. [Accessed 05 November 2021].
13. Opportunities. <https://creativeempowerment.org/> [Accessed 30 October 2021].
14. A shared design philosophy. <https://medium.com/google-design> [Accessed 30 October 2021].
15. Children's community. www.watopot.org/projects/creative-empowerment/ [Accessed 30 October 2021].
16. Empowering Artists and Creative Entrepreneurs. <https://en.unesco.org/creativity/files/empowering-artists-creative-entrepreneurs> [Accessed 30 October 2021].
17. Partesotti, E., Peñalba, A., and Manzolli, J. (2018). Digital instruments and their uses in music therapy. Nordic Journal of Music Therapy, 27(5):399–418.
18. Bequette, J.W., Bequette, M.B., 2012. A place for art and design education in the STEM conversation. Art Educ. 65 (2), 40–47.
19. ReDrawing Campinas with Disc-Rabisco. <https://www.youtube.com/watch?v=GlyrcEdgDU>. [Accessed 05 November 2021].