MECHANICAL DRAWING MACHINES AND THE GLITCH – VISUALIZING TECHNOLOGY THROUGH ITS FAILURES

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A glitch is an unpremeditated result of a digital protocol, making visible technology by its failures. Both practitioners and scholars have explored this phenomenon creatively and theoretically.

This paper provides an overview on glitch literature and examines definitions and motivations for glitch art, grounded in a more established discourse on the role of the error in art. The Artificial Intelligence notion of emergence will be consulted, to offer a model for phenomena arising without being prescribed.

The paper applies these concepts from literature to a practical line of inquiry, describing two mechanical drawing machines of the author, which draw their aesthetics from imperfection. Peirce's semiotics is consulted to establish a distinctive framework situating both the mechanical patterns and digital glitches.

1.CONTEXT: THE GLITCH

1.1.THE ERROR AS A PRODUCTIVE FORCE IN ART

The glitch discourse relies on more general reflections on errors and accidents. In *The Original Accident*, Paul Virilio frames the accident as inherent in any product, highlighting its "accidental potential": "To invent the sailing ship [...] is to invent the shipwreck. To invent the train is to invent [...] derailment." (Virilio 2007, 2)

While accidents have held an appeal for introducing an unpredictable quantity into art making since a long time, only recently this idea has stepped over to digital culture. The electronic musician Kim Cascone writes

> *Indeed, 'failure' has become a prominent aesthetic in many of the arts in the late 20th century, reminding us that our control of technology is an illusion, and revealing digital tools to be only as perfect, precise, and efficient as the humans who build them. (Cascone 2000, 13)*

Accidents, failure and imprecision have played a role in art since a long time. With the glitch, they have also become a topic of interest in the digital realm.

1.2.THE GLITCH

After an initial gold rush, in which many artists have playfully explored the phenomenon of the glitch, some of these have also engaged in theorizing it and discussing its cultural implications. Rosa Menkman is one of the leading figures in this discourse; she has established some canonical references for discussing the glitch. She defines the glitch as "an unexpected occurrence, unintended result, or break or disruption in a system," (Menkman 2010, 26) or as a "break from (one of) the protocolized data flows within a technological system." (Menkman 2010, 26)

Iman Moradi is another main contributor to the discourse. In his initial Bachelor's thesis on the glitch, he calls the (pure) glitch "an unpremeditated digital artefact, which may or may not have its own aesthetic merits." (Moradi 2004, 10) The aspect of aesthetic discovery that he points out here seems to be a powerful driver of glitch culture. In a later definition, this aesthetic element is less prevalent, when he specifies glitches to be "short-lived disturbances that populate our digital landscapes." (Moradi 2009, cover text)

A glitch seems to be a transient, ephemeral phenomenon arising out of digital cultures. This limitation to the digital is not shared among all writers: The scholar of screen studies Hugh S. Manon and the glitch artist Daniel Temkin hold that framing the glitch as a purely digital phenomenon is not enough: "Glitch is an intersection of analog and digital modes of (re)production." (Manon and Temkin 2011, 4)

They emphasize that hybridity and intersection between analog and digital lead to the glitch. This hybrid interplay is often described as the "materiality" of the glitch:

> Despite the seeming immateriality of digital representation, it would be difficult to deny that some glitch experimentation has a materialist bent: […] when broken, a JPEG looks very different from a BMP. (Manon and Temkin 2011, 9)

The term "material glitch" is used to describe how the glitch reveals "material" properties of a digital file format. The relation between digital and material is also the topic of a much earlier essay *Einmaliges und Beliebiges / Künstliche Kunst im Strom der Zeit* by computer art pioneer Frieder Nake:

> The artist as programmer looks for the resistance he has lost materially. […] The artist as programmer finds a resisting material. This material a priori is of a semiotic nature. ("Der Künstler als Programmierer sucht die Widerständigkeit, die ihm stofflich ja abhanden gekommen ist […] Der Künstler als Programmierer findet ein widerständiges Material. Dieses ist von vornherein semiotischer Art.") (Nake 1995, n. pag.)

Reflecting on the resistance a digital material offers to the creator, he contrasts this semiotic resistance with the physical realm, in which the resistance is manifest and embodied. Material is understood as something offering resistance that is worth exploring. A similar point of view is entertained by critic and curator Ed Halter, who uses the term "digital materialism" to say that glitch art's goal is to make visible technology by its failures and to "see the material through disruption." (Halter 2010, n. pag.) The glitch artist and researcher Theodore Davis illustrates this way of seeing, comparing a digital file format

to a window, in which the glitch introduces a crack: "the window transfers from a transparent or unnoticed medium to an opaque one." (Davis 2011, 212)

Also Menkman holds that the glitch "reflects critically on a medium." (Menkmann 2010, 2) She identifies the rejection of the "continuing search for a noiseless channel" as a motivation for glitch art. (Menkmann 2009/10, 2) Her motivations are post-structuralist: they serve the purpose of deconstructing media and revealing inherent properties, thus bringing to the discussion our use of media itself. In *Glitch Studies Manifesto*, she appeals to glitch artists for disputing the "the operating templates of creative practice; fight genres and expectations!" and thus using the glitch as an "exoskeleton of progress." (Menkmann 2009/10, 5)

To compile the literature into a workable definition for this paper, let us summarize that a glitch is an unexpected, unpremeditated result of a protocol. This result is used to reflect critically on the medium and making visible technology by its failures and disruptions.

The digital seems to be a legitimate and viable territory for such reflections – but it is easy to argue that glitch art could also be looking for disturbances outside of "digital landscapes." As a glitch aficionado, the author argues that glitch art may be complemented with inquiries beyond the digital, and thus a similar perspective can be applied for exploring analog and digital technology.

1.3. EMERGENCE

Unexpected or unpremeditated – glitch effects emerge indirectly from its causes. The concept of emergence is also used in the field of Artificial Intelligence, where the Australian roboticist Rodney Brooks has coined the term of subsumption architecture: the behavior of a system is understood as determined by the interaction with its physical environment – it is not prescribed explicitly through an algorithm. Brooks introduces several "subsumption layers": instructions on a lower algorithmic layer lead to patterns on an overarching superior level, which cannot be predicted algorithmically. (Brooks 1991)

Christian Faubel, a researcher at the *Academy of Media Arts Cologne*, has demonstrated impressive examples of emergent phenomena, creating fascinating kinetic sculptures out of very simple electro mechanic circuits. He states: "The interactions between subsystems rather than the subsystems themselves create a huge variety of new behaviors." (Faubel 2013, 160)

In Brooks' terms: the interactions between subsystems constitute a behavioral layer that was not explicit in the design of the system: the emergent pattern only appears when "basic units are connected into a loop." (Faubel 2013, 156) Faubel defines emergence as "the property of a system to produce new structures out of the interplay of its constituents. Importantly the constituents alone cannot produce such structures and the new quality can only result from the interplay." (Faubel 2013, 156)

The concept of emergence applies to glitches as well – they are unpremeditated high-level patterns that are not explicit in their protocolized code. But emergence particularly occurs in the physical world: here, algorithms collide with material conditions such as friction, vibration, or mechanical wear. The precise effect of such conditions is never completely predictable, which opens a poetic space for emergent phenomena. This is also why it became interesting for the author to shift his attention from purely digital systems to mechanic drawing machines. Some of these will be presented in the next chapter, together with their images.

2. EXPERIMENTAL SETUP AND RESULTS

2.1. THE PLOTTER

In an earlier paper, the author has described drawings resulting from mechanic imperfections of a Lego-built drawing machine: *The Plotter* produces a generative line drawing, with resulting images caused by the interference of "instructions" with "mechanical friction." As characteristic elements, the author identifies "near congruent forms" – the slightly shifted multiple squares visible in figure 1, and "negative space compositions" – segments of different shapes and proportions into which the white space is divided. (Wanner 2010, 7) These emergent patterns lead to an aesthetic composition as an emergent result which is unpremeditated by the underlying code, and makes visible the specifics of the mechanic process.

This drawing machine is an "analogital"[1] hybrid: digital program code is interacting with an analog mechanic system. As the digital algorithm played only a minor role anyway, the consequential next step was a similar investigation of purely analog, non-programmed machines, discussed in the following subsection.

Fig. 1 Plotter drawing, featuring near congruent forms and negative space compositions
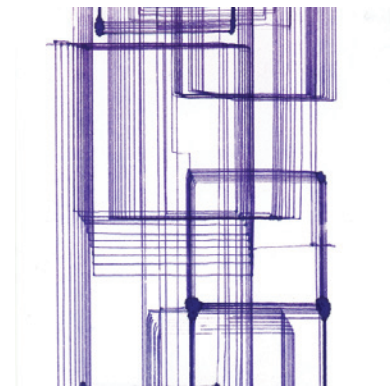
1 *Analogital!* was the title of a recent workshop at the interfiction XX festival 2013 in Kassel, Germany. In their call for participation, the organizers argue that analog and digital belong together, rather than being opposites. *Analogital* describes objects finding their way from digital culture back to material concreteness ("… Objekte, die ihren Weg aus der digitalen Kultur zurück in die materielle Gegenständlichkeit finden.") (Kuni 2013, n. pag.)

2.2 MACHINIC TRAJECTORIES

Machinic Trajectories is a series of household devices appropriated as drawing machines. Their mechanic motions are traced on paper surfaces; the machines are minimally altered and their respective drawing utensils are attached to one of the moving parts. Other than that, no electronic or mechanic changes are made to the machines, to allow direct observation of their original mechanisms.

The Mixer is one of the appropriated household devices of this series. A black technical pen – connotated with precise recording – attached to one of the whisks leaves lines on a paper attached to the underlying support disk. Simultaneously, the pen causes the plate to rotate and moves the paper: the drawing results in a kind of spiral.

Fig. 2 The Mixer, 2011. Drawing machine

Fig. 3 Mixer drawing Nr. 2, parallel circles

Searching for aesthetic visual figures, the author came across emergent patterns reminiscent of the near-congruent forms observed in the Plotter drawings mentioned in the previous subsection.

Figure 3 shows the emergent pattern of a spiral consisting of dense parallel circles. This spiral shift is not a designed feature of the machine, but results from inaccuracies of the whisk movement propagating the support plate. The pattern is caused by mechanic irregularities and mechanic frictions, but also of a subtle unevenness in the flat surface. Higher density patterns result from temporary stagnations of the disk, and pressure fluctuations of the pen cause light intermissions between the circles.

Figure 4 illustrates another unpremeditated result – a defective pen splattering around ink-blobs when rotated at the given high rotational speed of the machine.

Fig. 4 Mixer drawing Nr. 9

Figure 5 illustrates the variety of expression achieved with different places and angles of attaching the pen, and different paper surfaces leading to frictional variations. The drawing features variations resulting in a rhythmic play between denser and more openly articulated circles. The intrigue of the image lies in this pattern of varying densities, the variation from the regular repetition.

Fig. 5 Mixer drawing Nr. 11

Altogether these irregularities render the drawings their aesthetic appeal –unpremeditated breaks from the repetitive geometric regularity of a functional process. Similar to investigations of corrupted digital file formats, technology is made visible through its imperfections, turning these documents of repetition into multifaceted compositions. A more extensive description of this project is provided in the author's Master's thesis. (Wanner 2013)

2.3. DIGITAL GLITCHES, MECHANIC PATTERNS AND A SEMIOTIC DIFFERENCE

The glitch reflects critically on a medium by making visible digital protocols – often the encoding conventions of a digital file format. As pointed out earlier, Nake spoke of program code as a semiotic material, resisting the form-giving intention of the artist-programmer. With Peirce's distinction between semiotic signs icon, index and symbol,[2] digital code can be framed as a symbolic sign – its reference to the world is determined by convention. The digital glitch acts on a symbolic level, revealing the arbitrary nature of digital coding conventions: minimal alterations in the code do not continuously translate into subtle visual differences, but may result in gross distortions. This lies at the heart of the surprising aesthetic discoveries the glitch offers: aesthetic artifacts seemingly appear out of the blue, small changes can lead to drastic effects. Manon and Temkin observe a "glitch paradox": "the individual glitchwork does not respond well to gradual refinement." Seemingly closely related sequences of code may result in very different aesthetic and visual output: as easy it is to make a surprising find, as hard it is to tweak this discovery just a little bit: "to attempt to refine a glitch even slightly would be to render it unreadable." (Manon and Temkin 2011, 3)

In contrast, the traces of mechanic imperfections discussed above are indexical signs (indices): the drawings document the machinic mechanisms in a way that "physically connects" the two. The deviations in *The Plotter* and *The Mixer* are a continuous result from a shift caused by mechanical frictions. The emergent patterns evidence a mechanical principle. This physical connection is continuous and more predictable than the codified symbolic relation between a digital file format and the world. In other words: small distortions lead to

2 Charles S. Peirce introduced the distinction between "icons" representing things "by imitating them", "indices" which are "physically connected" with the things they represent (e.g. resulting from a cause and effect relation), and thirdly "symbols" "associated with their meanings by usage" – symbolic meanings are arbitrary and rely on convention. (Peirce 1998, 5)

small visual effects. This lends itself better for gradual refinement, but still responds to the agenda of glitch art: reflecting critically by making visible technology, deconstructing our use of it, emphasizing noise over signal, and – through all of this – potentially acting as a vehicle for progress.

3. OUTLOOK

Based on an overview of glitch literature, the paper has outlined a widely entertained notion of the glitch and listed motivations for glitch art. Aesthetic explorations of mechanic imperfections were framed according to glitch criteria. Reoccurring formal properties were demonstrated in images exploiting inaccuracies of mechanical drawing machines. These emergent patterns were then paralleled to digital glitches by the way they make visible the technological mechanisms at their origin.

Digital and analog technology may share more connections than we usually assume. Investigating errors and inaccuracies beyond digital data compression may allow a wider view on technology and technological "failure" more specifically.

3D printing and smart materials are current technological developments that may dissolve the clean boundary between analog and digital – we may see a revival of mechanic technologies. Generalizing digital phenomena to analog or analogital environments will allow a wider perspective, and may be useful for entertaining an ongoing critical contention with technology surrounding us. To conclude with words of Paul Virilio: "In my view, the accident is positive [...] because it reveals something important that we would not otherwise be able to perceive. In this respect, it is a profane miracle." (Lotringer and Virilio 2005, 63)

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