

Where Did the Error Go?

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Failure: Noise, Crash, Bug, and Glitch

At first, digital computation promised a noiseless channel, but it quickly became clear that flawless transmission was a design fantasy, not a technical reality. Error control, sampling, and compression do not remove uncertainty - they re-express it as aliasing, quantisation and other artefacts. As a result, the emergence of digital technologies did not eliminate failure; it relocated it.

With computation (and its failures) becoming commonplace, the vocabulary evolved. Terms like *noise*, *crash*, *bug*, and *glitch* (all predating digital media) gradually entered the lexicon to name different anomalies. Over time, these terms gained distinct meanings. For instance, while engineers had used the term *bug* for defects since the 19th century,¹ Grace Hopper popularised it in computing culture with her 1947 *Mark II logbook* entry of an actual moth; a traceable fault inside a working system.²

By the 1990s–2000s, protected memory and pre-emptive multitasking were widespread on consumer systems, isolating each application’s memory from others. As a result, errors increasingly localised to single processes. Instead of total collapse, failures surfaced as hiccups, exceptions, or recoverable freezes: a perceptible in-between state often read as a *glitch*. Many audio-visual glitches arise in input and codec paths (sync loss, packet drops) rather than in the operating system itself. Real-time media pipelines made such partial, recoverable breakdowns common and visible.

¹ “What Happened on September 9th?,” Computer History Museum, accessed October 4, 2025, <https://www.computerhistory.org/tjih/september/9/>.

² Sadie Plant, *Zeros and Ones* (New York: Doubleday, 1997), 37.

In 2008, Olga Goriunova and Alexei Shulgin write in their chapter “Glitch,” that the term is often used as a synonym for *bug*, but not for *error*. While an error might lead to a glitch, it may not necessarily result in a noticeable system malfunction experienced as a glitch. Goriunova and Shulgin also remind us that in software, errors are often categorised into syntax errors (grammatical issues in code), logic errors (flaws in an algorithm), and exception errors (arising from unanticipated conditions). However, glitches can be mistaken for technical anomalies, even when they are not. Glitch-like artefacts do not always stem from an error: “What users might perceive as “glitchy” can arise from a normally working function of a program.”³

The glitch renders the computer’s complexity visible, as it breaks the predictable surface flow of “normal” operation. It announces a precarious kind of moment/um: both the uncanny moment of lost control and the momentum that forces interpretation.⁴

Lexicon of Failures

Error is located inside a causal chain: Fault → Error → Failure.⁵

Following Laprie/Avizienis, A fault (cause) when active produces an error (erroneous state); when that error reaches the service interface it becomes a failure (deviation of delivered service). Errors can remain internal; faults may be dormant; vulnerabilities are internal faults that let external faults induce errors.

³ Olga Goriunova and Alexei Shulgin, “Glitch,” in *Software Studies: A Lexicon*, ed. Matthew Fuller (Cambridge, MA: MIT Press, 2008), 111.

⁴ Rosa Menkman, *The Glitch Moment(um)* (Amsterdam: Institute of Network Cultures, 2011), 31.

⁵ Algirdas Avizienis et al., “Basic Concepts and Taxonomy of Dependable and Secure Computing,” *IEEE Transactions on Dependable and Secure Computing* 1, no. 1 (2004): 11–33, at 13, <https://doi.org/10.1109/TDSC.2004.2>.

Fault - a diagnosable cause.

- **Bug:** code defect (logic/syntax/algorithm).
- **Hardware fault:** component or connection failure.
- **External fault:** environmental/input cause (power, malformed packet).
- **Vulnerability:** an internal fault that enables an external fault to activate and produce an error.

Error - deviation of internal state from the specification (may remain invisible).

- **Data corruption:** altered bits/frames/packets
- **Timing error:** missed deadline, buffer underrun/overrun.

Failure - externally perceivable deviation at the interface

- **Glitch:** localized, transient hiccup; often recoverable.
- **Hang / freeze:** service continues but is non-responsive or stalled.
- **Crash:** unrecoverable termination of a process or system.

Artefacts & Noise

While acceptable or objectionable, they are not failures. They are fingerprints of the pipeline; they are symptoms of the pipeline's normal limits/choices (capture, processing, compression). They are diagnostic of how the image was produced (codec, bit-depth, demosaic).

- **Noise** - stochastic, adds grain and hides faint detail
 - *random fluctuations from the sensor (shot noise).*
 - *electronics (read noise).*

- *or heat (thermal noise).*
- **Artefacts** - deterministic distortion
 - *Aliasing / sampling: moiré.*
 - *Demosaic: zippering.*
 - *Compression (DCT/transform): 8×8 blocking, ringing.*
 - *Quantisation / tone mapping: banding in smooth gradients.*

From Failure to Preset

The video *Digital TV Dinner* by Jamie Fenton and Raul Zaritsky (music by Dick Ainsworth, 1978) challenged the lines between failure and function. Working on the *Bally Astrocade* (a game computer), Fenton hot-swapped a cartridge mid-execution, resulting in patterned memory dumps and ‘orphaned routines;’ or *executions without context*.⁶ This type of designed failure made the glitch repeatable enough to be recorded, yet still indeterminate in form. Taking on the role of both maker and breaker, Fenton and Zaritsky performed failure.

Decades after *Digital TV Dinner*, artists still hunt these tipping points, asking: when and how a glitch can be found and transition into something new? The “perfect glitch” exists only momentarily, at the shock point between potential failure and a reconfiguration of understanding.

Over the last two decades, the term *glitch* was gradually adopted by the arts and academia; first in music, where noise/electonica genres used it as a deconstructionist approach. In 2000, American

⁶ jonCates, Jonathan Kinkley, and Jamie Fenton, “Stability Isn’t Everything It’s Glitched Up to Be: An Interview with Jamie Fenton,” in *Perspectives on In/stability*, ed. Delinda Collier and Robyn Farrell (Chicago: Art Institute of Chicago, 2022), online edition, <https://www.artic.edu/digital-publications/36/perspectives-on-instability/16/stability-isnt-everything-its-glitched-up-to-be-an-interview-with-jamie-fenton>.

composer Kim Cascone coined *post-digital* music to name a wider movement that showed how glitches, bugs and clipping became compositional material, arguing that the tool (rather than the medium) became the message.⁷

In 2001, Achim Szepanski published his *A Mille Plateaux Manifesto*, making early theoretical observations on how seemingly insignificant elements (clicks, glitches, so-called mistakes) are intentionally transformed into *sound events*: audible manifestations of movement between binary states of zero and one. In-between states of transfer or transduction, as yet un-representable. "Clicks do not express meanings or essences but only intensity and connections."⁸ Notably, one of the first registered uses of the term "glitch art" appears on Beflix/Ant Scott's website in the same year.⁹

Designed Glitches and the Glitch Art Genre

As sound and image processing pipelines stabilised (as a result of for instance stricter input validation) many pathways for glitch closed and disappeared. The live, system-breakdown became rare, and practice shifted towards to simulation and presets: retaining the *look* of failure while stripping most of the risk. In tandem, the glitch turned from liminal event to meaningful effect.

This slippage from provocation to simulation is what Moradi describes as the *glitch-alike*. "Glitch artists either synthesise glitches in non-digital mediums, or produce and create the environment that

⁷ Kim Cascone, "The Aesthetics of Failure: 'Post-Digital' Tendencies in Contemporary Computer Music," *Computer Music Journal* 24, no. 4 (2000): 12–18, https://www.academia.edu/1764776/The_aesthetics_of_failure_Post_digital_tendencies_in_contemporary_computer_music.

⁸ Achim Szepanski, "A Mille Plateaux Manifesto," *Organised Sound* 6, no. 3 (2001): 225–28.

⁹ Ant Scott, "GLITCH ART," July 2001, archived at Internet Archive, accessed October 4, 2025, <https://web.archive.org/web/20010722223556/http://www.beflix.com:80/>.

is required to invoke a glitch and anticipate one to happen.”¹⁰ Moradi also proposes a true/false binary for “designed” vs “real” glitch; a tool that is useful didactically, but drew critique analytically, as the glitch art genre still tried to break binaries and cultivate a grey zone, exploiting medium-reflexivity to question *the convention of perfect function*.

These developments set up a persistent problem: where does intentional error sit, at the level of ontology (what it is) or epistemology (how it is known)? If a glitch is an “unexpected, abnormal mode of operation,” what happens when the artist’s process aims precisely at abnormality?

Following the fault → error → failure taxonomy, intent doesn’t alter the error state, but it can shift the specification under which its appearance is judged. Can an intended error really be called erroneous?

The glitch genre stages reflections on materiality not only at the technological level, but across the physical medium and its non-physical, interpretative or conceptual dimensions. Moreover, describing glitch art as a *genre* signals a shared mode of reading and writing.¹¹ Thus, paradoxically, out of error and breakage, glitch art has obtained its own set of expectations: the use of medium-reflexivity to question function and convention and a move toward aestheticisation of material specificity (sometimes to the tune of nostalgia). At this point the glitch is in the world: not only as digital event but as an effect with its own syntax.

Image Resolution: A Changing Paradigm

¹⁰ Iman Moradi, “Glitch Aesthetics” (unpublished BA thesis, University of Huddersfield, 2004), 10, https://web.archive.org/web/20061014181813/https://www.ocularism.org/glitch/download/Glitch_dissertation_print_with_pics.pdf.

¹¹ Menkman, *The Glitch Moment(um)*, 56.

With the rise of the platformed image, resolution changes. The platformed image no longer treats the file as a static, rendered surface but as a governed, mutable asset subject to ongoing processing (recompression, cropping, adaptive bitrate, recommendation systems, moderation).

While “image resolution” is often conflated with pixel count, in practice it is a relational, procedural condition. Resolution emerges from the consolidation of material systems (sensor design, demosaic/denoise/sharpen, compression, display constraints) and perceptual regimes (platform interfaces, habits of viewing), negotiating fidelity, optimisation, and feasibility.

Each stage in the pipeline is shaped by interlocking technical, economic, and perceptual constraints. Compression algorithms influence sensor design; display constraints determine what is worth capturing. This dynamic exposes the limits of the linear pipeline metaphor. Contemporary imaging systems operate as iterative, recursive infrastructures: later stages constrain earlier ones. The linear pipeline is better modelled as a render stack, a layered architecture in which layers (sensor, codec, interface, user) are autonomous yet interdependent.¹² Resolution is not a metric of clarity or truth, but an iterative, hierarchical outcome that trades performance against fidelity, visibility against efficiency.

Read alongside Legacy Russell’s account of the glitch as “a form of refusal”¹³ - “This failure to function within the confines of a society that fails us is a pointed and necessary refusal.”¹⁴ this signals a shift in theorising the image: political force derives less from depicting differently than from governing what and who can appear.

¹² Alexander R. Galloway, *Protocol: How Control Exists after Decentralization* (Cambridge, MA: MIT Press, 2004), 39–40.

¹³ Legacy Russell, *Glitch Feminism: A Manifesto* (London and New York: Verso, 2020), 8.

¹⁴ Legacy Russell, *Glitch Feminism*, 11.

The contemporary image doesn't just represent; it administers flows of attention and affect. In this regime, crucial failure occurs outside the render: through ranking, cropping (thumbnails consistently crop to centred faces, cutting protest signs), deletion, "graphic-content" flags, shadow-bans, link rot (404/410), and access refusals (403). These operations standardise mood, keep feeling within bounds, and teach norms by repetition and routine, not persuasion. Consequently, visibility becomes conditional: appearance is permitted only on terms the interface can stabilise. Under platforms, to be seen is to be formatted. What's visible is not what's true; it's what the system can accommodate. Legibility is a contract while compliance is the fee.¹⁵

As a result, the error relocates to meta-layers, while glitches exist outside the render, in ranking, cropping, deletion, and access control. What vanishes is not just "noise," *but excess, contradiction, grief, testimony*.¹⁶ The image stops guaranteeing witness; it becomes a sorting device.

Administrative artefacts do not take the shape of signal failure, but governance effects that format what counts as the image. Methodologically, this relocates glitch from spectacle to diagnostic; a tool to look for where resolution is decided.

As Nóra Ó Murchú writes: the image becomes infrastructural: "it makes visible a new logic of the visual—one defined not by representation or recognition, but by affective saturation and the infrastructural choreography of attention."¹⁷ This shifts glitch from spectacle, effect, affect and

¹⁵ Nóra Ó Murchú, "This Is Not an Image," lecture, International Center for the Image, July 19, 2025, slide 7.

¹⁶ Nóra Ó Murchú. *This is not an image*. Slide 8.

¹⁷ Nóra Ó Murchú, "The Image as System: On Images as Infrastructure in Contemporary Visual Culture," *Over Journal*, no. 4 (forthcoming, 2025), 68, <https://www.overjournal.org/shop/issue-4>.

refusal, to diagnostic: a way to locate where resolution is being decided (policy, crop, adaptive bitrate, recommender, safety filter, model prior).

Seen this way, the glitch is not just an aesthetic outcome; it is an administrative power that allocates visibility—or its denial.

Conclusion

Technology cannot exist without noise; a change in architecture only causes a repositioning of noise and error. Today the error is no longer just a broken pixel. The glitch has moved from surface rupture to preset and, in parallel, into infrastructure. Error didn't disappear; it changed its location.

The error has become a mode to probe how capture, code, codec, and policy decide what may appear and what must not. Seen from this angle, "glitch" (or at least, error) persists, but its phenomenology has changed once again. The decisive moment is no longer shock or an index of affect, but the trace of selection or thresholding. If we only ask "What does this image signify?" we miss the pipeline that produced its legibility. Images are systems: the error can help ask procedural questions: Which thresholds produced this appearance? Which alternatives were excluded?

Today, the consequential operations of the image are administrative: down-ranking, deletion, auto-crop, and synthetic (model-based) interpolation that smooths failure into plausibility. In short: administrative operations can disrupt governance by making its thresholds visible. The question is not where did the error go, but where will the error be next?

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Biography

Rosa Menkman is a Dutch artist and researcher of resolutions. Her work focuses on noise artifacts resulting from accidents in both analog and digital media. Complementing her practice, she published *Glitch Moment/um* (INC, 2011), a book on the exploitation and popularization of glitch artifacts. She further explored the politics of image processing in *Beyond Resolution* (i.R.D., 2020). In this book, Menkman describes how the standardization of resolutions promotes efficiency, order, and functionality, but also involves compromises, resulting in the obfuscation of alternative ways of rendering. In 2019, Menkman won the Collide Arts at CERN Barcelona award, which inspired her recent research into im/possible images, consolidated in the *im/possible images reader* (2022).