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Tracing the Multiplane: Toward a Genealogy of Animation Apparatuses

A multiplane stand is an armature devised for a camera that adapts it for animation cinematography. The structure allows an animator to arrange different parts of a single image on disparate planes (usually glass plates) with variable spatial intervals between them. The planes or items upon them can be moved independently of one another underneath or in front of a camera along two or three axes of motion. Strategic repositioning of the planes or materials they hold achieves many possible effects. These effects include the ability to alter the form or movement of isolated components of a single shot; to produce complex spatial representations using finite two-dimensional layers; and to simulate virtual cinematography movements, including ones impossible to achieve with a physical camera. To describe it in simplest terms, a multiplane stand is a physical frame (built structure) for composing animated frames (built images) using intervals between layers. I will define the entire material arrangement (often called a rig) and the effects it makes possible as the "multiplane apparatus."

My use of the term *apparatus* risks unintended associations with apparatus theory, which focuses on the structure of film spectatorship. In contrast, I am interested in turning theories of the apparatus from spectatorship to production by asking how relationships between filmmakers and specific media devices shape a film's sensibility. My choice of terminology is indebted to philosopher Vilém Flusser, who defines an apparatus as a technical arrangement

of specific materials ("hardware") that open up a particular array of possibilities for thinking or acting in the world ("software"), which are discovered in the process of exploring and using them ("playing").[1] Speculating about a distinct philosophy of photography, Flusser notes that *apparatus* relates to the Latin *apparare*: to make ready, or prepare. He goes on to characterize photography in deliberately sentient terms: "The photographic apparatus lies in wait for photography; it sharpens its teeth in readiness."[2] This language of intentionality helps Flusser tease out why theories of photography cannot think about media devices as artisanal tools or industrial machines but must understand them as participatory agents shaped by their cultural environment and affecting it in unexpected ways.

Flusser's work has received criticism for ascribing too much opaque power to media devices and offering a deterministic model of technology. Yet in her recent book *Wild Blue Media*, Melody Jue revisits Flusser's creature metaphors to reassert their urgency for contemporary media studies. Jue proposes an expansion of Flusser's medium-specific analysis toward "milieu-specific" analysis, which takes seriously different forms of media in the context of different environments, such as the ocean.[3] Reading Flusser's portrait of the vampire squid as a metaphor for what he imagined to be an anti-photographic organism, Jue suggests that a "terrestrial bias" in Flusser's philosophy limited him from imagining a more expansive ecology of photography. Pursuing photography into an aquatic milieu leads Jue to the fluidity of cameraless photography that Flusser did not take into account. More ambitiously, the aquatic milieu opens up possibilities of photography as a non-inscriptive medium.[4]

My brief sketch of the multiplane stays in the terrestrial realm, but I am similarly interested in approaching animation technology through milieu-specific analysis, tracing a single device across a variety of environments. Thinking about the multiplane as an apparatus, whose imaging capacities are activated by different makers in different milieus, reimagines its history as one in which various possibilities are realized, neglected, or developed during the process of production. This history brings together specific hardware (variations in physical iteration), software (various cultural and political forces shaping the hardware's use), and the aesthetic approaches generated via encounters with specific makers.

When we observe the multiplane solely in its industrial studio habitat, which is how it has been almost exclusively considered, its development seems to emphasize two features: division of a single image into separate planes and variability of the interval between those planes in relationship to one another and the camera. Animation studios produced a diverse range of moving images with just those features. In the opening scene of Walt Disney Productions' *Pinocchio* (Ben Sharpsteen and Hamilton Luske,

1   Vilém Flusser, *Towards a Philosophy of Photography*, trans. Anthony Mathews (London: Reaktion, 2000), 30.
2   Flusser, 21.
3   Melody Jue, *Wild Blue Media: Thinking through Seawater* (Durham, NC: Duke University Press, 2020), 21–26.
4   Jue, 88–111.

1940), for example, a single multiplane shot uses just three layers to produce the effect of a complex establishing shot that descends from an aerial stargazing position, swoops down past towers and chimneys of a small town, lands on a sunken cobblestone street, and pushes toward the single lit window of Geppetto's house. In just twenty seconds and one multiplanar movement, the film traverses an astonishing spatial and narrative range—from a bird's-eye view to a cricket's-eye view; from the expansive world of the film to an intimate home. Achieving this sequence required rethinking the studio's approach to painted backgrounds for the multiplane's distinct way of rendering space. Background painters had to reject single-point linear perspective in order to accommodate a multi-perspectival rendering of the scene on a single plane. The surreal seams between different perspectives blended on a flat canvas, such as the aerial and street positions, were carefully hidden by buildings arranged on a foreground plane during the rotation of layers under the camera.[5]

As Kristin Thompson argues in her formative essay on multiplane animation, the apparatus is capable of producing stylistic heterogeneity between different layers of a single scene as well as approaches to rendering space and time that are distinctly different from live-action cinematography. However, the ideology of naturalism that shaped Hollywood animation largely repressed this potential, with the exception of rare moments of "formal disruption" that Thompson identifies.[6] Such formal disruption, or rather alternative potential, is discussed by Thomas Lamarre in his more recent investigation of the multiplane. Lamarre turns to Japanese animation to pursue a different lineage, in which the intervals between various planes are made perceptible and simulation of virtual camera movement is replaced by movement "on and between surfaces."[7] Lamarre avoids cultural explanations for why this approach to the multiplane thrives in the context of Japanese anime. However, Miho Nakagawa argues that this layered compositional approach treats the planes as sliding screens with palpable gaps, embodying the space-time principle of *ma* (dynamic spatial and temporal intervals) that also shapes architecture, printmaking, and performance traditions in Japan.[8]

Even considering these different global contexts, industrial studio production nurtured a relatively finite range of multiplanar possibilities. The apparatus was limited by bulky armatures built for efficient control, proprietary patent enforcements, and pressures of commercial conventions. In the studio milieu, moreover, the stand was intimately harnessed to cel animation, largely serving as a mobile container for paper and celluloid sheets. The multiplane's potential expanded in artisanal and independent production

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5   The multiplane special effects in this and other Disney features in the 1930s to 1940s are documented by John Canemaker in *The Lost Notebook: Herman Schultheis & the Secrets of Walt Disney's Movie Magic* (San Francisco: Walt Disney Family Foundation Press, 2014).

6   Kristin Thompson, "Implications of the Cel Animation Technique," in *The Cinematic Apparatus*, ed. Teresa de Lauretis and Stephen Heath (London: Macmillan, 1980), 106–123.

7   Thomas Lamarre, *The Anime Machine: A Media Theory of Animation* (Minneapolis: University of Minnesota Press, 2009), 7.

8   Miho Nakagawa, "Mamoru Oshii's Production of Multi-layered Space in 2D Anime," *Animation: An Interdisciplinary Journal* 8, no. 1 (2013): 65–83.

environments, where it was less restricted by standardization and available for divergent incarnations.

For instance, animator Clive Walley engineered his multiplane rig to bridge painting and cinematography.[9] The glass panes of Walley's stand are not used as shelves for holding images but as surfaces for directly applying pigment and layering painted strokes. In different films making up Walley's *Divertimenti* series (1993–1995), painted gestures gradually appear and disappear on different glass layers, revealing and occluding one another. The outer edges of the panes are sometimes visible in the frame. As they recede away from the camera, they form a long rectangular tunnel. Walley developed his rig to explore under-the-camera animation as an improvisational painting method, allowing the animator to try different interventions on different layers of a composition. However, as his films revealed effects of depth and movement added by the camera, he began to cultivate a very simple feature of the multiplane that was barely interesting to studio animation: the capacity to continually restack and reorder the same planes. The limited number of planes in the *Divertimenti* films steadily shift their shelf positions in between frames, with the bottom pane eventually coming back to the top for reuse. The effect produces a continually moving shot without any stable depth coordinates. The multiplane transforms into a temporal three-dimensional easel extended into infinity, allowing smeared and glistening brushstrokes to dance across its edges indefinitely.

Joanna Priestley developed a multiplane for *Surface Dive* (2000) that fully embraces the spatial volume between the planes, playing with the physical dimensionality of the intervals. *Surface Dive* combines drawn animation (pastel and watercolor) with object replacement animation (glass and polymer sculptures) arranged on separate layers of the stand and captured through sequential photography. Importantly, *Surface Dive* treats the actual glass material of the multiplane as a vital participant in its optical arrangement. Pieces of glass with different edges, textured surfaces, and refractive properties are used to modify the composition, breaking up the surface of each layer and transforming drawings and sculptural pieces into multifaceted figures. A white background on the bottom layer registers bouncing light and shadow from objects moving on the panes above, adding further dimension. The multiplane thus becomes a glass tank in which glossy biomorphic forms swim into and out of depth, intermingling with oceanic flora in a pool of shimmering light.

Yuri Norstein's multiplane for *Yózhik v tumáne* (*Hedgehog in the Fog*, 1975), which he designed and built with cinematographer Alexsandr Zhukovskiy, also plays with the materiality of glass. Dusted or frosted glass is used to diffuse light and obscure images behind successive layers, creating a dense, foggy environment that is essential to the film's atmosphere. According to Norstein, the diffusion was achieved by letting dust or condensation settle

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9 According to Walley, the stand was influenced by the animation of Oskar Fischinger and Berthold Bartosch. See Clive Walley, untitled article in *Film Waves*, no. 6 (1998), republished on artist's personal website, accessed August 2020, https://clivewalley.uk/other-texts/.

on the glass or camera lens during production and remain undisturbed.[10] Whether this story is factually true or deliberately coy, it is noteworthy that the apparatus in Norstein's account inhabits a space of intimacy and slow work. The film's lauded atmosphere was made possible, the animator also implies, in a milieu that did not care about controlled sterility.

Rather than relying on glass or celluloid, whose primary feature is facilitating transparency, some multiplane animators welcomed the opacity of different materials instead. Lotte Reiniger's multiplane stand, which is the earliest documented iteration, embraced paper as textured screen material. Inspired by Chinese shadow puppetry and landscape painting (particularly its layered perspective), Reiniger combined backlit silhouette animation with layered paper to establish atmospheric depth. In films that occasionally adopted orientalist themes, such as her famous feature-length *Die Abenteuer des Prinzen Achmed* (*The Adventures of Prince Achmed*, 1926), paper strips are overlapped to filter more or less light, their contours suggesting receding mountain ranges or undulating waves. Noburō Ōfuji's silhouette animation layered paper in similar ways but more fully embraced the material's fiber. In *Kokka Kimigayo* (National anthem, Kimigayo, 1931), Ōfuji's animated adaptation of Japan's national anthem, *washi* papers of different textures are lit from various angles to portray light as an element with density and force. Early in the film, a layer of backlit grainy paper moving in the foreground produces a striking effect of fog rolling across a landscape. Later, a brightly lit grouping of triangular strips creates the effect of sunlight bursting into a dark cave.

While the examples mentioned so far focus on the armature of the multiplane stand, the camera has also played an important role in the apparatus's history. For example, Nickolai Troshinsky's self-engineered rig for *Astigmatismo* (2013) takes advantage of a DSLR camera's capacity to precisely shift focus in a shallow depth of field. *Astigmatismo* plays with the spatial fields between the multiplane's layers, bringing different surfaces into or out of focus. The film deliberately divorces optical depth from visual clarity, oscillating between sharpness and blurriness to bounce perception forward and backward across the scene. In one scene of underwater diving, the blurred effect evokes underwater cinematography and reframes the titular theme of flawed vision as vision transposed into an aquatic milieu.

By examining all of these films according to different possibilities of the multiplane, I am avoiding a chronological timeline of a device's birth and death and pursuing a genealogical coral instead. The *coral*—a phylogenetic metaphor used in biology as an alternative to the vertical and hierarchical *tree*—allows me to speculate about multiplanar possibilities not yet encountered or realized. For example, in all of the variations, the multiplane stand has lived in darkened interior milieus with carefully controlled lighting. Animator Martin Rose describes making his film *Trawna Tuh Belvul* (1994) on a multiplane stand at the National Film Board of Canada as an environmental and psychological inferno: "I shudder to think how much electricity was required to make the film, to power the lights and air conditioning to cool

10   Yuri Norstein and Francheska Yarbusova, *Skaska Skazok* (Moscow: Krasnaya Ploshjad, 2005), 26, 202–203.

the studio." The heat, combined with hours of meticulous work in cramped conditions, resulted in Rose "burning out" from the process.[11] With that in mind, what might it mean to bring the multiplane into natural light? How might it function without careful control over each individual layer?

Appreciating the diversity of the multiplane highlights the political stakes of confusing any specific iteration of an apparatus (a single genetic variant) for an entire species. Such confusion profoundly affected the multiplane, which became synonymous with the Walt Disney Studios and cel animation throughout the twentieth century. This was the result of deliberate efforts by the studio to promote its towering multiplane rig (engineered by William Garity after an earlier design by Ub Iwerks) as a symbol of sophisticated cinematographic naturalism and a mascot for the studio's technological prowess. The studio deliberately used the patent application for Garity's structure and heavy promotional material connecting it to the studio's animation style to disingenuously lay claim to the entire concept of layered animation and its potential effects.[12] This campaign was so successful that the studio's international competitors considered the multiplane to be Disney's device, ignoring existing and low-budget precedents even among their own artists.[13] The rhetorical move of connecting specific technical arrangements of an apparatus with entire animation approaches still operates in contemporary commercial animation and needs to be treated with skepticism.

In Flusser's model of media apparatuses, innovation of a medium does not denote technical improvements but rather shifts in its application. "The question of ownership of the apparatus is irrelevant," he writes, "the real issue here is who develops its program."[14] As my overview of the multiplane demonstrates, the apparatus led many lives in different milieus, before and after its adoption and abandonment by commercial studios. As a distinct species of cinematography, it bridged physical and virtual movement to produce numerous spatial and atmospheric effects. And while some of its features made their way into digital software, its analog incarnations endure, and its possibilities are still open. As a particularly well-known apparatus, the multiplane offers a model for similarly considering light tables, optical printers, index card decks, rendering platforms, and other animation apparatuses as distinct and enduring species of animation.

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11 Martin Rose, personal website, accessed June 2020, http://martinrose.ca/slip /production-notes/camera-stand/.

12 Garity's patent makes no mention of antecedents and lays claim to the entire concept of multilayered animation. See William Garity, control device for animation, US Patent 2,198,006, filed November 16, 1938, and issued April 23, 1940.

13 See, for example, Rolf Giesen and J. P. Storm's discussion of Deutsche Zeichentrickfilme's development of the multiplane camera in *Animation under the Swastika: A History of Trickfilm in Nazi Germany, 1933–1945* (Jefferson, NC: McFarland, 2012), 92.

14 Flusser, *Towards a Philosophy*, 30.