Volumetric Video With Skateboarders

Creative Opportunities of Working With an Emerging Screen Technology Beyond the Studio

Dani Landau
University of Plymouth
Dani.landau@Plymouth.ac.uk

Diego Zamora
University of Plymouth
diego.zamora@Plymouth.ac.uk

| abstract

Volumetric video is an emerging moving image technology in which each pixel is recorded with a location in three dimensions. Volumetric videos are normally created in studios using rigs made up of multiple cameras with LiDAR sensors and computers that combine the moving images. We took this technology out of the studio to explore variations of this technique in public skateparks. We found that as the technology is still in developing stages it has creative constraints: it can records at a limited distance to the subject, the image is of a relatively low resolution, and there are often glitches in the image. In our creative experiments with the skateboard community, we found we could use these qualities to our advantage. For example, we could create images that emphasise movement over surface texture. In this paper we explore this emerging screen technology through the theoretical lens of *Modes of Existence of Technical Objects* by Gilbert Simondon (2017/1958). Simondon articulates the individuation of novel technologies from *abstract* phases, which are multiple and emergent, towards a metastable phase of *concretisation* when they become consistent and coherent. This paper argues for the valorisation of working with screen technologies in their abstract phases. In this phase and the situation in which the technology is employed can easily shape the techniques, the means of production becomes more readily visible to the viewer, and unintended functionality may be explored for creative outcomes.

DOI 10.36158/97912566929415

1. Introduction

In this article, we examine an emerging screen technology from the perspective of creative media arts practitioners at the intersection with skateboarding. The technology we have worked with has been variously described as volumetric video, spatial video, or motion point cloud (Schreer et al., 2019). This technology involves capturing a series of images in which each pixel is recorded as a defined location in three-dimensional space and, in some cases, an associated colour value. We argue that working with this technology in its developing stage offers unique opportunities for creative practice. Through experimenting with the technology in a situation it was not designed for, new possibilities emerged, leading to adaptations of the technical processes.

We draw upon our experimental work creating volumetric videos with skaters. Although volumetric video is predominantly used in controlled studio environments, our

Figure 1. Still Images from volumetric moving-image recording of skateboarder (2024).

research investigates its potential in a mode closer to observational documentary practice. We explore creative possibilities offered by placing this future screen technology on location, and in contingencies within the skatepark. We chose skating as a subject firstly because skaters explore alternative ways in which public spaces of the city can be inhabited beyond their prescribed usage – a bench or curb becomes a means to explore weights, movements and bodies in the city (Willing and Shearer, 2015). Secondly skater culture has a long history of filming themselves and making innovations in filmmaking (Borden, 2017). This situates our study within research that treats the skateboard as a mobile technology and skateboarding as an embodied practice that reconfigures perception and mobility through continual adaptation of body, board, and environment (Hauser et al. 2013).

In this article we propose an analysis of skateboarding as a way of navigating and appropriating technological dissemination within the urban environment. Skateboarding has been touted as a "techno sport" (Davidson, 1985) and as activity mediated by embodied technology (Hauser et al. 2013). As a community of practice, skaters engage in the appropriation of urban spaces and construct identities through their interaction with the city (Glover et al. 2021; Woolley & Johns, 2001). Urban appropriation and meaning making are not exclusive to skateboarding communities (Campo, 2002). However, skaters, in their pursuit of self-reaffirmation and differentiation, often generate forms of practice and identity that resist more vernacular modes of

urban appropriation and instead strive for individual expression (Valentine, 1996; Woolley & Johns, 2001). Borden (2001, pp. 114-118) demonstrates how skaters appropriate benches, plazas, and ledges, shifting them from conceived spaces of commerce to lived spaces of play and identity.

DOI 10.36158/97912566929415

Skateboarders use spatial practice by turning steps into an embodied site of performance, transforming ordinary spaces into physical experiences through technological capturing (videos, sensors) and a practice rooted on urban exploration. In this way, skaters approach public spaces with a mindset of creative appropriation, viewing the urban landscape as raw material for their activity. Their drive for expression, both individually and collectively, fuels their exploration of urban features finding new possibilities from mundane objects inherent in these spaces, leading to a unique and dynamic relationship with the urban environment.

We explore the developing stages of volumetric video, through the lens of Gilbert Simondon's thesis on the individuation of technical objects (2017/1958, pp. 25-52). Simondon describes how technologies move from primitive phases he terms *abstract* in which aspects of the technologies emerge together and are shaped by their situation (milieu), towards *concretisation* phases where the technologies shape the milieu they are in. We describe how we experimented with using volumetric video techniques in their emerging abstract phase in the skateparks, and how we found that by using not yet fully integrated systems such as the Kinect sensor we were able to explore creative possibilities of using volumetric video on location.

2. Brief Genealogy of Low Budget Volumetric Video Technologies

Volumetric video is an emergent technological format that captures moving three-dimensional representations of scenes, objects, and performances, enabling interactive viewing within immersive environments such as virtual and augmented reality or rendering in 2D. Earlier 3D video systems relied on the optical effects of binocular vision – using two coloured or polarising filters to simulate depth by presenting slightly offset images to each eye. Volumetric video, records and maps every pixel within a three-dimensional coordinate system, capturing spatial depth so that scenes can be navigated and rendered from any viewpoint within a digital 3D space. Unlike traditional two-dimensional video, which records images from fixed single camera perspectives, volumetric video can record spatial data simultaneously from multiple viewpoints, integrating them into coherent, interactive 3D models (Schreer et al. 2019). The system records pixels, each containing both XY position and depth (Z coordinate) information. However, when working with a single camera as we did the resulting 3D objects remain incomplete, since the hidden or rear surfaces cannot be captured.

Processing volumetric video requires advanced computational algorithms capable of merging visual and depth data into unified, dynamic 3D models. Innovations in mesh reconstruction, point-cloud processing, texture mapping, and compression have allowed higher-quality real-time rendering of volumetric data, enhancing interactivity and realism (Mateer, 2017). The technological evolution underpinning volumetric sensors and processing from early experimental techniques towards accessible, real-time capture and rendering enabling integration into diverse fields ranging from industrial uses in safety and self-driving cars to virtual collaboration and telepresence. Volumetric video technology has evolved significantly through innovative workflows integrating diverse software and platforms. Central to this practice is the use of point cloud data created with LiDAR sensors. LiDAR sensors use laser, infrared, or structured light emissions to measure the time it takes for reflected signals to return, generating the three-dimen-

DOI 10.36158/97912566929415

sional representations of objects and environments. They are in many mobile phones, cars, and industrial equipment, but their use for creative moving image work is in early stages.

The iterations of the now discontinued Microsoft Kinect sensor series (2010-2023) have been pivotal in the development of volumetric video technology in the DIY space. Initially developed to track user movements in gaming, the Kinect found broader applications due to its effective depth-sensing capabilities. Early Kinect models, the Kinect model 1414 and Kinect model 1473, used structured light technology, projecting an infrared (IR) speckle pattern onto scenes and calculating depth from shifts in these patterns. Researchers demonstrated the Kinect 1414 was most accurate at close distances, while the Kinect 1473 performed better at greater distances (DiFilippo, & Jouaneh, 2015). The introduction of the Kinect for Windows brought improvements, notably the ability to track objects at shorter distances (400 mm compared to 800 mm for previous Xbox models). The Kinect for Windows v2 introduced time-of-flight (ToF) technology, significantly enhancing depth fidelity and image resolution. This model operates by emitting modulated light and measuring reflection time to determine depth, thus providing superior accuracy and spatial resolution for volumetric video applications. The Azure Kinect Development Kit released in 2020 we used had further enhancements, including advanced AI-driven body tracking, improved depth sensing accuracy, and real-time data integration into platforms such as Unity's Visual Effects Graph (VFX Graph). These emerging workflows have provided opportunities for experimental uses in volumetric capture and rendering. Software developers have creatively repurposed these LiDAR sensors to facilitate volumetric video capture. As well as exploring the Kinect and other depth sensing devices. Apple's iPhone Pro modules, integrate LiDAR technology primarily to aid autofocus and face mapping for security. Experimental software such as Record3D by Marek Šimoník enables use of this sensor for volumetric video. The Brekel software by Jasper Brekelman enables recording using various sensors. The community of volumetric video creative users continue to explore software interoperability across platforms such as Blender, Unity, Houdini, and Unreal Engine.

Recent advancements in consumer technology, most notably Apple's Vision Pro headset, released in 2024, introduces Spatial Video which uses LiDAR combined with multiple 2D video cameras within a proprietary, closed system. It employs an exclusive codec that restricts content playback solely to its platform: the MV-HEVC (Multiview High-Efficiency Video Coding), an extension of HEVC, to encode its spatial and immersive videos. This closed approach is intended to ensure a dependably high visual quality within the headset. In contrast, Microsoft's Kinect series arose from gaming-oriented motion sensing. The data it produced was made accessible, which made it possible to explore applications beyond its intended use, this contributed to the emergence of a community of experimental volumetric video. Unlike Kinect's open approach that enables integration with diverse platforms Apple's Vision Pro integrated system maintains control over content creation methods and viewing. These significant differences in accessibility, flexibility, and adaptability, impact community-driven technological evolution within spatial and volumetric media.

DOI 10.36158/97912566929415

3. Experimenting in the Field

Between 2023 and 2024 we worked in three skate parks – Dean Lane in Bristol, Kingsbridge in Devon, and Central Park in Plymouth – partnering with Skate to the Max Community Interest Company who work to promote skateboard safety. We created a portable volumetric video rig adapted from a studio-based system that used the Brekel Pointcloud software. We powered the computer, Kinect, audio, and camera together with portable batteries. The main challenge was power, and the unwieldy nature of the rig. While the rig itself was relatively conventional, using it in this portable way in the unpredictable situation of the skate park to record action is novel. Much previous non-fiction volumetric moving image work has been done in controlled environments of the studio, or at least with static camera. We moved the camera creating an unstable anchor point for the 3D. We then placed this imagery into a stable scan of the locations, produced using the Gaussian Splat method.

This is a constructed documentary mode, but one that includes observational imagery. Rather than attempting a faithful rendition of a stable, pro-filmic reality, figure 2 and figure 5 bring together two different temporalities and modes of recording. This is explicit in the imagery itself due to differing qualities of the images that have been assembled 3D but have differing image textures as a result of the sensors and processing technologies. There is wide discussion on the nature of truth in relation to the real in non-fiction film practices for example, Stella Bruzzi (2006) and Trinh T, Minh-Ha (2014). While a full exposition of this debate is beyond the scope of this article, it is worth noting that experimental work in volumetric video forms part of a wider interest in new modes of digital image creation entering into non-fiction storytelling. For example, *Constant* (2022) by Sasha Litvintseva and Beny Wagner uses point cloud scans and 360 cameras in unusual ways to within a 2D single screen film to tell a critical story about the history of measurement.

Figure 2. Image created by using multiple technologies. Here the skater is rendered from Kinect data recorded in Brekel, rendered in Houdini and combined with Gaussian Splat image of Kingsbridge Skate Park made on another day.

4. Engaging the Community

This article presents on-going research based on the collaboration with Skate to the Max (STTM) CIC. Skate to the Max aims to provide opportunities for learning about skateboarding safety, but also to support the development of its associated activities through understanding potential risks and fostering a sense of community. Here we present media explorations of skateboarding activities in three

DOI 10.36158/97912566929415

events. Participants were encouraged to experiment with the rig as well as the output of the volumetric camera through the computer screen.

STTM is associated with local groups of practice around the southwest of England. Supported by this company we have been able to engage with skaters on three occasions to explore the workflow for producing the media presented here. This work in progress aims at developing further relationships with skateboarding communities for contesting and challenging the possibilities of the mobile technology at hand. To do so we use images and technology as cultural probes to assess the perception about the technology and the media it generates, serving as speculative probes (Auger, 2012). We treated the rig as a negotiable artefact: participants proposed lines, requested closer following at rail height, and commented on what the Azure Kinect "saw", this interaction is consistent with studies of skateboarding as everyday design through experimentation and adaptation (Hauser et al., 2013).

STTM aims to provide inclusive learning in both skateboard construction and skateboarding skills through hands-on workshops, a concept that resonates with Hauser's notion of technological appropriation within skateboarding (Hauser et al., 2013). Additionally, the initiative seeks to challenge policing practices by challenging the views on skating and the social preconceptions around skate culture.

Our methods involve a co-design approach. Co-design processes are participatory and involve collaboration to generate ideas, prototypes, and futures for technologies, working with creativity and ongoing design rather than fixed outcomes (Sanders et al., 2008; Binder et al., 2008). We brought the nascent media technology into a community of practice – the skate community. We wanted to discover what the community could do with it, and what we could do with the techniques within that context. Taking the technologies out of the studio shaped the techniques themselves.

Exploring volumetric video within the space of the skate park, the location and nature of the activities prompted us to seek creative approaches. For example, volumetric cameras are designed to remain static while action passes in front of them, allowing 3D software to locate objects within a consistent Euclidean geometry. However, when recording a skater or BMX rider in this way, the results were often just a flash of pixels. By instead following the rider with the camera, we produced videos in which the fixed external geometry became unstable, in this way the movement of the individual skater was traced around their position.

Co-design of novel uses of media technologies can be understood through Simondon's philosophy of individuation. Rather than treating media technologies as fixed tools, with Simondon technical objects are metastable (2017/1958, p. 177), always open to further concretisation. In co-design practices, users and designers collaboratively shape techniques beyond pre-given functions. The co-design encounter thus becomes «propagates transductively» (Simondon, 2017/1958, p. 80), wherein technical and social elements individuate together, producing emergent capacities. As Mackenzie (2002, p. 13) notes, media technologies «take shape in the relay between collective practices and technical operations», enabling ongoing modulation. In this sense, novelty in the development of the technique is not imposed externally but arises out of relational practices.

DOI 10.36158/97912566929415

5. How Nascent Volumetric Video Techniques Differ From Conventional Video. Non-normative Vision

In the following sections we explore how our experience with volumetric video creation and rendering systems offer opportunities for making images that communicate in ways with qualities familiar in some ways to reading 2D photographic video images while differing significantly from an imitation of a normative human vision. Volumetric videos are shortsighted, may render colour differently, there are often glitches in the images produced by unexpected reflections as well as software produced glitches due to inconsistencies between recording and rendering software. We found that the volumetric videos offered novel ways to encounter and record movement in space, but only if the movement was within a few meters of the camera. A recording of a movement involving volumetric video can be spun round so it can be seen from different angles. The reduction in detail due to lower resolutions of volumetric video causes a viewer to concentrate on the movement over the textured detail of surface in the image. In the following sections we discuss how these divergences from a normative video vision can offer creative opportunities.

5.1. *Noise and Glitch*

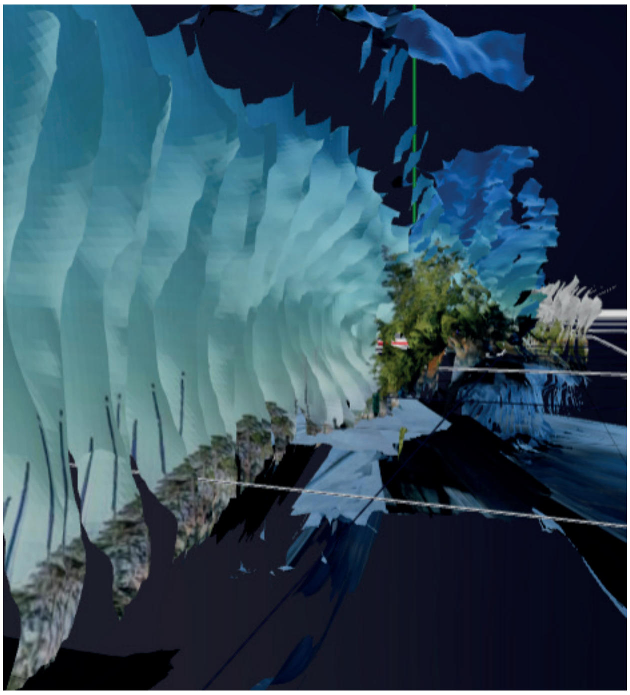

Figure 3. Glitch in volumetric video rendering.

Noise in volumetric video commonly manifests through visual artefacts such as stray pixels, anomalous textures, irregular grid-like patterns, and mirrored images appearing simultaneously on opposite sides of captured objects. Rather than treating these occurrences purely as technical failures or unwanted disturbances, they can be used as expressive images both of the subject and of traces of the recording process itself. Noise in sensing is normally considered as something to be avoided, where we try to ratio of noise to the signal. An alternative is to consider noise as productive. For Malaspina noise is not the negation of signal but the constitutive uncertainty that systems must nego-

DOI 10.36158/97912566929415

tiate enabling «ambiguity and openness» in information rather than merely corrupting it (Malaspina, 2018, p. 57). Mark Nunes argues for a «poetics of noise in exploring the creative potential of the "errant and the unintended outcomes»" (Nunes 2010, p. 16). In this sense, interference or distortion is not solely obstructive; what appears as error can «communicate as information» by showing uncertainty and choice produced by system (Nunes, 2010, p. 13).

In volumetric video, noise emerges particularly due to the complexities inherent in spatial sensing technologies such as those utilised by the Microsoft Kinect sensor we used. Early Kinect sensors relied on structured-light technology, projecting infrared patterns onto surfaces and measuring pattern distortion to ascertain depth. Later Kinect models transitioned to time-of-flight sensing, calculating depth from modulated infrared light reflecting from surfaces (DiFilippo & Jouaneh, 2015). Like Euclids emission theory of vision, the LiDAR sensors see by reaching out from the sensor rather then sensing ambient light. Ambient light can interfere with the depth reading as well as complimenting it with colour information in the visible spectrum recorded by conventional video sensors. Both Kinect sensing methods are sensitive to surface reflectivity, ambient interference, and sensor positioning, often resulting in ambiguous depth readings that manifest visually as pixelated distortions or duplicated images. The technologically unstable, informationally ambiguous image produced in this abstract phase of the development of this screen technology carries a trace of its own production. It shows limits and inconsistencies in the sensing. The deliberate making visible of the means of production was made political by pioneers in experimental moving image as discussed below in section seven.

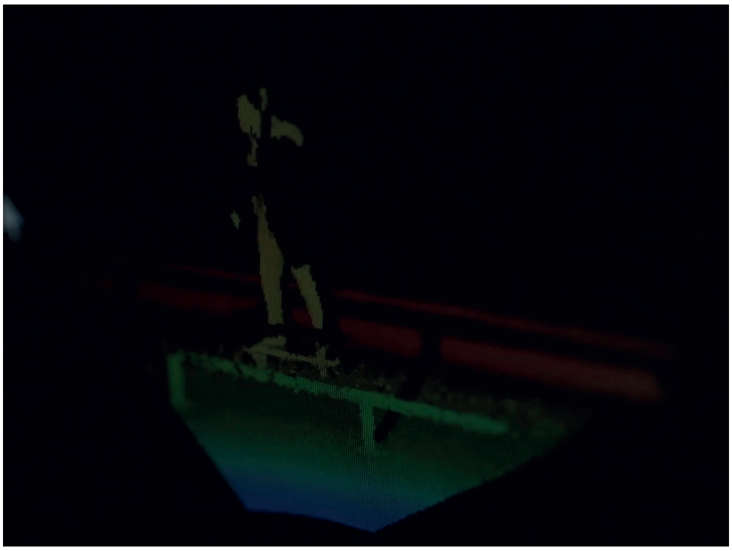

Figure 4. Image showing the short range vision of the Azure Kinect sensor. This image shows the distances as a depth map. Colours from blue nearest to red further away. The rendering is in the Azure Kinect Software Development Kit.

5.2. *Myopic Vision*

Volumetric video's restricted sensing range abruptly ends within a few metres. The range of the Kinect Azure sensor is visible in figure 4. The black areas are out of range. With a 2D video camera the side areas would not be visible as they are framed out by the edges of the rendered image. In 3D we can see the boundaries of the imaging area. In addition to the width cropping there is depth cropping that does not occur visible light video cameras. This is because LiDAR is dependent on bouncing light off the sub-

DOI 10.36158/97912566929415

ject. For the Kinect Azure the maximum distance it reaches is between 2.2 meters and 3.86 meters dependent on resolution and field of view (Bamji et al., 2018) The effective depth of the iPhone sensor we found to be a little less. We found the distance varied depending on the conditions such as the surfaces the Lidar reflects from, and ambient lighting.

Artists have explored the differences from normative vision such as myopia and astigmatism as part of their creative processes. Trevor-Roper's famous study on differences in vision and arts practice *The World Through Blunted Sight* (1997) identifies examples. He describes how a short-sighted painter «is reduced to painting what he sees, however blurred or distorted a percept it is [...] with a loss of detail and with relative clarity only in the essential lines and contours» (Trevor-Roper, 1997, p. 31). He describes how the limitation can be an advantage to creative work. This compression of vision produces a tendency to work through shape and tone rather than detail, a quality that artists such as Cézanne who dismissed spectacles and Degas, who relied increasingly on pastel for his failing sight. Trevor-Roper also observes that astigmatism introduces further perceptual anomalies: «can materially confuse and distort the retinal image», causing subtle directional biases and «depth-distortion in the rendering» (ibid., p. 38). Such impairments, rather than purely limiting, produces images depicting different types of perceptions. The stripping away of extraneous particulars to reveal structure and mass. Likewise, the spatial cut-offs and low resolution of volumetric video evoke this tradition of productive visual constraint, where limitation becomes the condition for renewed attention to the perception in the organisation of light, colour, and form.

Although working with a sensor with a different perception mode is significantly from working as an artist with myopia, we can learn from these artists on how they use different vision as part of their working processes. The myopic non-biological vision of the sensor separates the skater from their environment. They appear out of the black into the shallow field of vision, skate through it, demonstrating a trick and flowing out. This is a different type of editing from a film edit cut, or even characters coming and going out of frame. They enter frame through the reach of the LiDAR. This is different from human vision, extending to the horizon. The skaters appear almost as if out of dense fog. The technique offers new ways of editing – objects in three-dimensional space. Within the post-production software volumetric recordings can be placed into new environments and appear as if from thin air.

5.3. *Distorted Colors and Low Resolution*

Colour in volumetric video is dependent on various factors. Initially the colour image is recorded separately from the point cloud frame. Pixel depth may be recorded as a depth map false colour, for example in fig. 4 above where closer pixels are recorded in the blue end of the spectrum towards red signifying further away. Full colour images are recorded through a separate camera and may be mapped onto the depth image, colouring each pixel. Then, when the volumetric clip is placed in 3D editing software virtual lighting is added. Therefore, colours are represented in unusual ways. Rendering varies considerably between software. Resolution is limited and covered over by smudging due to forming shapes between the points in the rendering software or gridding due to the rendering of the points as they are recorded as in the image in the myopic vision section above. The sensor resolutions are of the Kinect Azure is 1024x1024 or 604x576 when it is set for greater distances, and narrower field of view

DOI 10.36158/97912566929415

Figure 5. Video still created using 3D scan of the Kingsbridge Skate Park generated through photogrammetry, into which volumetric video images of skaters were inserted. The resulting image includes multiple artifacts and inconsistencies inherent in the technologies used.

(Banmji et al., 2018) on the iPhone 15 Pro we used had a resolution of 0.01 megapixels. Images translated dependent on the type of rendering for viewing. As the technology moves towards similarity to human vision, away from the glitches of the current phase these differences will no doubt be ironed out, but for now they are available as aesthetic tools.

5.4. *Images that Emphasise Movement*

These stills from a moving image sequence are recognisable as a skater through their combination as movement, but individually they are not recognisable. Here movement has precedent over form for a viewer; the action of the jump is noticed first, which then leads to the understanding of recognisable objects – person and skateboard. The effect of emphasis on movement over surface detail runs through all the rendering variations we explored. In filmmaking this is not obfuscation for effect. Movement produces the development of event in cinema. These new techniques offer ways to draw the audience attention to shaping of perceptual experience itself, drawing attention to recognition emerging through motion rather than static representation. In this sense, the image becomes less a depiction of form than an unfolding of event. This emphasis on motion over surface detail resonates with accounts that recognition and meaning in skate media arise through body performance in relation to place, rather than through static appearance (Hauser et al. 2013).

DOI 10.36158/97912566929415

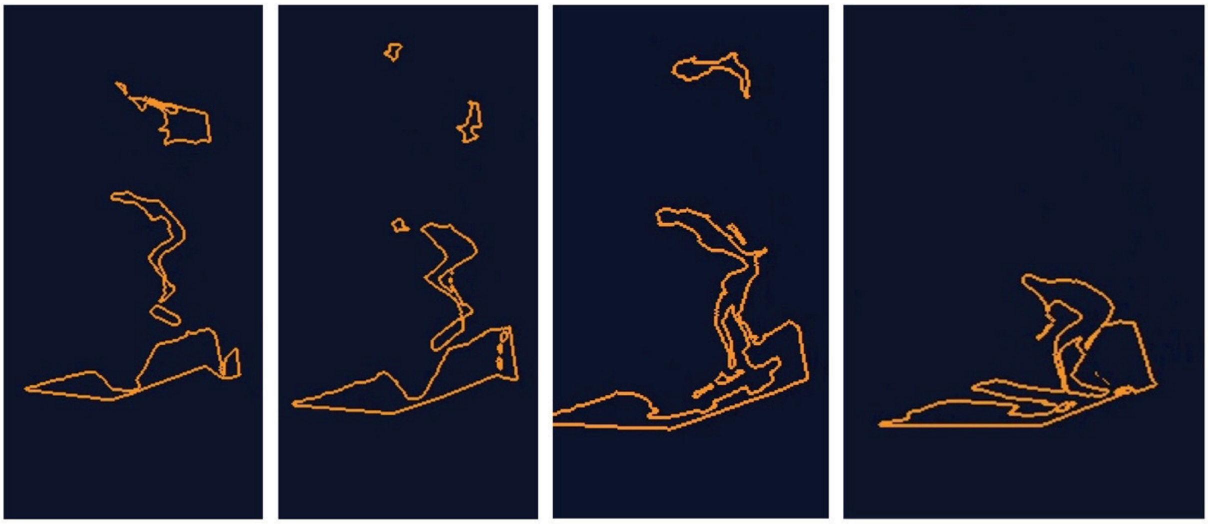

Figure 6. Simplified images emphasise movement.

6. Applying Understandings of the *Technical Object* From Simondon to Our Volumetric Video Experimentation

Each of the above qualities led to experimentation in the development of our volumetric workflows. These experiments formed part of the development of our creative approaches: each configuration of hardware and software contributed to the emergence of techniques. Our method of connecting technologies and working in the skatepark was open, adaptive, and exploratory. The setup – clunky and precarious required continual adjustment within the dynamic environment of the skatepark. We adapted its configuration and software around the skaters' movements and environmental contingencies.

This process exemplifies what Gilbert Simondon describes as technological individuation (Simondon, 2017/1958), where technical ensembles evolve through feedback between components, people, and milieu. In *On the Mode of Existence of Technical Objects* (2017/1958), Simondon challenges the hylomorphic model of technical genesis, which assumes that form is imposed upon inert matter or that tools are designed as direct extensions of human intention. Instead, he conceives the technical object as emerging as *ontogenesis* (Simondon 2017/1958, p. 255) through *individuation* – a process in which material, energetic, and human factors co-determine the evolution of form. (ibid., p. xi) Individuation unfolds as part of a situation, or *milieu,* that includes inventors, operators, and the associated milieu through which technical beings take shape (ibid., p. 242). In the companion thesis by Simondon, *Individuation in light of notions of form and information* (2020/1958), he describes a *transindividual* field in which the energetic and structural aspects contribute to *ontogenesis* (ibid., p. 93) in which the technical object develops. In this way the emergence of a technical object is considered to be the result of this collective relational development.

As Keating (2024) describes, this understanding of the technical is a shift from ontology to ontogenesis, from being to becoming. Simondon's conception of the technical object follows this orientation: relational and dynamic, defined by ongoing processes of individuation, transduction, and concretisations. Simondon's use of the term technical, or French *technique* derives from the Greek term *technê*, encompassing both art and craft. Technê concerns not the fixed ontology of tools but the process through which techniques emerge and evolve themselves. For Simondon, the technical object is not a static entity but a mode of existence defined by internal coherence and evolving relations with its environment. In the *abstract* or *primitive* phase, technical elements remain loosely connected, operating in partial independence and largely conditioned by external circumstances. It has the capacity for *concretisation* – a process by which separate parts become integrated, achieving what he terms "technical individuality" (Simondon, 2017/1958, p. 21). Simondon writes:

> A primitive technical object is an abstract system of isolated partial ways of functioning, without common ground of existence, without reciprocal causality, without internal resonance; a perfected technical object is an individualized technical object. (Simondon, 2017/1958, p. xv)

It is the *abstract*, primitive phase that is the concern of this paper, because there we found the ontogenesis in action. In volumetric video setup – comprising two tripods, a Azure Kinect sensor, a camera, a sound recording device, portable power systems, and Brekel software – the configuration exemplified a technical system in its *abstract* phase. Each component functioned independently and could serve other purposes; their coordination was provisional, improvised, and environmentally conditioned. Working in the field required continuous adaptation between apparatus, skaters, and site. This process revealed the system's dependency on its environment. Software was combined in to produce differing rendering of the recordings. The relation between the technical object and its use were emergent. The community of volumetric video users sharing aspects of their approaches via YouTube and online forums support one another in developing new configurations of hardware and software, sharing their findings and developing the methods.

Rather than treating the *abstract* phase as of less value, our research considers it as a productive state in which the relations that compose a technical object are most visible. In this phase, components remain exposed. They may be reorganised to explore possibilities for different image making techniques. Our creative experimentation in the skatepark, produced a challenging environment showing how technical composition itself can become a site of aesthetic and conceptual inquiry.

The emergance of volumetric video can be understood as the progressive concretisation of techniques from abstract to concrete forms. Simondon describes this evolution as a process wherein initially abstract technical systems become increasingly integrated, multifunctional, and adapted to their environments, acquiring greater internal coherence and operational autonomy (Simondon, 2017/1958, p. 56). Simon Mills elaborates on this trajectory, emphasising Simondon's concept that early technical objects begin as isolated, abstract constructs which, through iterative interaction with their environment, progressively evolve into more concrete and integrated entities (Mills, 2016, p. 108).

Volumetric video is largely in an abstract phase characterised by fragmented workflows, experimental setups, and technological limitations such as short-sightedness, noise, and movement-based glitches. These forms are heterogeneous, with components often operating independently, requiring considerable manual intervention, and offering multiple directions of development. Simondon describes this early abstraction as marked by a state of "discontinuous functioning" where the parts lack full harmonisation (Simondon, 2017, p. 153). Our practical experience with volumetric video at this abstract stage has been characterised by productive engagement with uncertainty and noise.

DOI 10.36158/97912566929415

Our experiments emphasised movement-oriented improvisations with both camera and skaters, leveraging technological shortcomings as aesthetic possibilities, thereby amplifying performative and experiential dimensions. The Apple Spatial Video technologies discussed above is our example of a concretisation of volumetric video. It is self-contained. The functionality of the various sensors involved in creating the image become less apparent in the output. However, the system risks diminishing the aesthetic opportunities inherent to volumetric video approaches in their abstract, primitive, forms.

7. History of Making the Technologies of Production Visible as Critical Practice in Screen

As discussed in above, we enjoyed how one can see the traces of the volumetric video methods in the images produced. There is a significant historical precedent for artists explicitly exposing the mechanisms and processes of filmmaking within their works, rejecting cinema's drive for immersion and suspension of disbelief. Malcolm Le Grice situates such approaches within the tradition of experimental cinema, where the method of production is rendered evident rather than concealed. He identifies this as central to his experimental practice, and to filmmakers that draw attention to the materiality of film, its chemical and mechanical operations, to the medium itself rather than its illusionistic effects (Le Grice, 1977, p. 55). Peter Gidal (1976) understood the work of the structural/materialist filmmakers such as Le Grice and Liz Rhodes as a political aesthetic, in that it was against the illusionism of continuity editing and sharp images that dominate mass media. Le Grice later described how the «illusion of a space and time not physically present» can be countered by asserting the material presence of the film image itself (Le Grice, 2001, p. 202). By stressing the work as material and process rather than illusion experimental filmmakers redefined cinema's relation to perception and representation. By revealing rather than concealing filmic process, it resists the dominant ideology of cinematic realism – the pursuit of seamless continuity and verisimilitude.

Although thinking through making of these experimental filmmakers was concerned with the material of photochemical film, it can be applied to digital. The images in this paper do the opposite of the immersion promised by Apple Spatial Video. Experimental filmmakers explored of what film technologies could do, testing perception – both biological and non-biological, duration, and making apparent process of image creation as structural elements of viewing.

8. Urban Skating as a Mediator of Future Possibilities

Speculative design has laid the groundwork for envisioning alternative futures through critical and reflective design practices. Dunne and Raby's seminal work, *Speculative Everything* (2013), highlights the role of speculative design in prompting reactions and debates about possible futures. However, speculative design often leaves unanswered the question of how such futures might be realised. In this sense, skateboarding enacts "future-making" at micro-scale via iterative trials, failures, and refinements; the same experiential loop by which practitioners adapt board, body, and route to the environment (Hauser et al., 2013).

DOI 10.36158/97912566929415

Thompson and Byrne, along with others, use the term "future-making" to resolve the provocations of speculative design by creating actionable strategies and aiming at preferable futures with intent and active participation, as such, creative speculation is approached with the intention of materialising and developing steps towards said future (Auger et al., 2021; Thompson & Byrne, 2022). However, given that the perception of the future highly depends on individuals' perception and education about the future (Wenzel et al., 2020), future-making does bring certain challenges. As such, some of the challenges come from the fact that individual definition of the future is somewhat limited compared to that of a group of individuals, thus suggesting that future making is participatory among institutions (Beckert, 2016), and individuals as an experiential co-production of future-making (Wenzel et al., 2020).

Because visions are collectively negotiated, future-making involves challenges of formulation, representation, and organisation within groups of practice (Llewellyn & Spence, 2009; Wenzel et al., 2020; Beckert, 2016). The practice of future-making requires participants to identify methods for coordinating actions and intentions to organise conjectures into plausible and shared views of the future (Thompson & Byrne, 2022). As such, future-making is concerned with the realisation of imagined futures by testing, validating, and engaging stakeholders to consolidate these visions.

Skateboarding enacts future-making at micro-scale. Through repeated trials, failures, and refinements, practitioners adapt board, body, and route to the environment (Hauser et al., 2013). This situated appropriation of urban features–benches, plazas, ledges–reconfigures conceived spaces into lived spaces of play and identity (Borden, 2001; Németh, 2006). As Willing et al. (2025) describe, skateboarding's "world-making pedagogies" cultivate speculative thinking through embodied experimentation-skaters imagine possible movements and then test them materially, producing futures of space and practice through motion. Similarly, Glover et al. (2021) show how community skate events act as "gentle activism", transforming public space into a site where alternative civic futures are rehearsed.

The challenges Llewellyn and Spence identify for future-making align strongly with skaters sensibility and their exploitation of urban features, by echoing formulation, representation and organisation (Llewellyn & Spence, 2009). Borden (2001, pp. 114-118) demonstrates how skaters appropriate benches, plazas, and ledges, shifting them from conceived spaces of commerce to lived spaces of play and identity. As such, Skaters envision potential uses for existing structures (affordances), experiment with these possibilities (formulation), through repeated practice and shared knowledge within the skateboarding community (representation and organisation), they collectively shape the future of that space for their activity. The development of a new trick or a novel way to use an urban element is a small-scale enactment of an imagined future.

Simondon emphasises how technical objects mediate our relationship with the world by creating the milieus in which they function (Simondon, 2017/1958. p. 59) As we have discussed, skateboarding fundamentally changes how practitioners engage with the environment and their mobility (Hauser et al., 2013). Skateboarders perceive and interact with urban spaces in unique ways, discovering possibilities for their practice through appropriating the urban environment. This active engagement with the environment, enabled by the skateboard as a mobile technology, resonates with Simondon's broader view of how technology shapes worlds (Simondon, 2017/1958, pp. 57-61) The reinterpretation of urban elements as skateable terrain highlights this mediated relationship and hints at skateboarding core values of self-determination (Glover et al., 2021; Németh, 2004).

DOI 10.36158/97912566929415

According to Simondon's view, technology doesn't prescribe a linear or deterministic future. Similarly, the unpredictable and emergent nature of skateboarding within public spaces resists pre-determined uses and regulations (Borden, 2001; Németh, 2006; Donaghey & Browne, 2025; Glover et al., 2021) Skateboarders constantly adapt and reimagine the possibilities of their environment, aligning with the future-making activities, moving away from normative uses and predictable outcomes and aiming at the creation and enactment of imagined possibilities (Thompson et al., 2022). Building on this, we examine how skateboarding materialises future-making through situated, incremental coordination of body, board, device, and site. Our sessions echoed this dynamic: when one skater suggested a line optimised for the sensor's short range, others adjusted approach speed and stance to "sit" in the myopic cone; in parallel we modified follow distance. The choreography that resulted was co-designed in real time, with environment, device, and technique refining one another.

9. Opportunities for Further Research

This ongoing research aims to build stronger relationships with local skater communities of practice. We frame our approach as moving towards *participatory critical technology workshops* (DiSalvo et al., 2012, p. 185; Toupin & Van Oost, 2020, Ratto, 2011) as well as emerging digital communities of practices and theory of change (Ferreira & Pantidi, 2018). Our work has so far been exploratory and relational, using observations and experimental media practices as invitations rather than fully co-developed outputs. Key elements of our intended approach include prioritising co-design as a guiding principle, fostering bidirectional participation and shared ownership across research activities, and integrating skaters into processes of data generation. We also plan to share data with these communities of practice, to open discussions on its value, limitations, and possible transfer to other contexts.

10. Conclusion

In this article we have explored how working with a technology in early stages of development offers unique opportunities for creating screen media arts. Volumetric video techniques in their early stages produced artefacts that can reveal the means of production to an audience. The artifacts of production offer aesthetic possibilities that a concretised technology may not offer. In this way we have worked in to invert the valorisation of the complete, integrated technical object, in favour of the emergent, abstract, primitive phase of technique.

We have explored how the situation in which a new screen technology develops plays a part in its shaping. We chose the skate environment because, firstly, of the emphasis within skate film on images of movement and form in space; and secondly, because of the DIY culture of skate film production. Seen alongside research that frames skateboarding as embodied mobility and everyday design, our results show that the abstract phase of a technical object becomes generative when coupled to practices that already transform environments through iterative appropriation.

In this sense, skateboarding materialises future-making as situated, collective processes. Skaters navigate and speculate possibilities within the city, creating new relations

DOI 10.36158/97912566929415

between body, board and place through experimentation. The reconfigurations of the urban environment emerges not as a predetermined outcome but relational amongst humans, materials, and situations. Skate practice articulate futures as a situated practice working with contingency rather than against it.

Situated skate practice shows how milieu does not merely host technique but co-produces it. Early-phase configurations of hardware, software, operators, and site co-produce one another together; the skatepark becomes an associated milieu that participates in the development of our application of volumetric video. The lineage from stereoscopy to point clouds, gaussian splats, and meshes suggests that each technique carries distinct aesthetic possibilities. With our work we have aimed at showing how working deliberately within the abstract phase, embracing short range, unstable geometry, and colour/lighting remapping, can foreground movement and uses means of production as a creative opportunity.

Coupling an emergent screen technology to a community whose practice already reconfigures urban possibilities reveals a productive path for future screen media: rather than waiting for stability, we treat informational ambiguity as a creative resource and co-design technique with/within its milieu.

References

Auger, J.H. (2012). *Why Robot? Speculative Design, the Domestication of Technology and the Considered Future – ProQuest*. Retrieved September 30, 2025, from https://www.proquest.com/openview/0934a1cc7cc045e27a7c298e3db20340/1?pq-origsite=gscholar&cbl=51922.

Auger, J., Hanna, J. & Mitrović, I. (2021). Beyond speculations. In J. Auger, I. Mitrović, J. Hanna & I. Helgason (Eds). *Beyond Speculative Design: Past – Present – Future* (pp. 12-23). University of Split.

Bamji, C.S., Mehta, S., Thompson, B., Elkhatib, T., Wurster, S., Akkaya, O., Payne, A., Godbaz, J., Fenton, M., Rajasekaran, V., Prather, L. (2018). IMpixel 65nm BSI 320MHz demodulated TOF Image sensor with 3μm global shutter pixels and analog binning. In *2018 IEEE International Solid-State Circuits Conference (ISSCC)* (pp. 94-96). IEEE. Explore Link: https://ieeexplore.ieee.org/document/8310200/.

Beckert, J. (2016). *Imagined Futures: Fictional Expectations and Capitalist Dynamics*. Harvard University Press.

Binder, T., Brandt, E. & Gregory, J. (2008). Design participation(-s): A creative commons for ongoing design. *CoDesign*, 4(2), pp. 79-83.

Borden, I. (2001). *Skateboarding, space and the city: Architecture and the body*' Berg.

Borden, I. (2017). Skateboard City: London in Skateboarding Films. *London on Film* (pp. 177-192). Palgrave Macmillan.

Bruzzi, S. (2006). *New documentary*. Routledge.

Campo, D. (2002). Brooklyn's Vernacular Waterfront. *Journal of Urban Design*, 7, pp. 171-199.

Combes, M. (2013). *Gilbert Simondon and the Philosophy of the Transindividual* (translated by T. LaMarre). MIT Press.

Comi, A. & Whyte, J. (2018). Future Making and Visual Artefacts: An Ethnographic Study of a Design Project. *Organization Studies*, 39, pp. 1055-1083.

DOI 10.36158/97912566929415

Davidson, J.A. (1985). Sport and Modern Technology: The Rise of Skateboarding, 1963-1978. *Journal of Popular Culture*, 18, pp. 145-157.

DiFilippo, N.M. & Jouaneh, M.K. (2015). Characterization of Different Microsoft Kinect Sensor Models. *IEEE Sensors Journal*, 15(8), pp. 4554-4563.

DiSalvo, C., Clement, A. & Pipek, V. (2012). Participatory design for, with, and by communities. In J. Simonsen & T. Robertson (Eds). *Routledge international handbook of participatory design* (pp. 182-209). Routledge.

Donaghey, J. & Browne, S. (2025). Skateboarding and contested public space in Portrush, Northern Ireland: exploring tensions between resortification and DIY space-claiming through co-creative methodology. *Sport in Society*, 28, pp. 293-315.

Doumanoglou, A., Alexiadis, D.S., Zarpalas, D. & Daras, P. (2018). Toward Real-Time and Efficient Compression of Human Time-Varying Meshes. *IEEE Transactions on Circuits and Systems for Video Technology*, 28(12), pp. 3384-3397.

Ferreira, J. & Pantidi, N. (2018). Going digital: Integrating digital technologies in local community initiatives. In Dezuanni, M., Foth, M., Mallan, K. & Hughes, H. (Eds). *Digital Participation through Social Living Labs* (pp. 55-76). Elsevier,

Fox, T.S. (2015). Prehensive transduction: Techno-aesthetics in new media art. *Platform: Journal of Media and Communication*, 6, pp. 96-107.

Gidal, P. (1976). Theory and definition of structural/materialist film. *Structural film anthology*, pp. 1-21.

Glover, T.D., Munro, S., Men, I., Loates, W. & Altman, I. (2021). Skateboarding, gentle activism, and the animation of public space: CITE – A Celebration of Skateboard Arts and Culture at The Bentway. *Leisure Studies*, 40, pp. 42-56.

Hauser, S., Desjardins, A., Wakkary, R. (2013). Skateboards as a mobile technology. In *CHI'13 Extended Abstracts on Human Factors in Computing Systems,* pp. 1419-1424.

Keating, T.P. (2024). Techno-genesis: Reconceptualising geography's technology from ontology to ontogenesis. *Progress in Human Geography*, 48(1), pp. 49-65.

Le Grice, M. (1977). *Abstract Film and Beyond*. MIT Press.

Le Grice, M. (2001). *Experimental Cinema in the Digital Age*. British Film Institute.

Llewellyn, N. & Spence, L. (2009). Practice as a Members' Phenomenon. *Organization Studies*, 30, pp. 1419-1439.

Mackenzie, A. (2002). *Transductions: Bodies and machines at speed'* A&C Black.

Malaspina, C. (2018). *An Epistemology of Noise*. Bloomsbury.

Mateer, J. (2017). Directing for Cinematic Virtual Reality: How the Traditional Film Director's Craft Applies to Immersive Environments and Notions of Presence. *Journal of Media Practice*, 18(1), pp. 14-25.

Mills, S. (2016). *Gilbert Simondon: Information, Technology, and Media*. Rowman & Littlefield.

Minh-Ha, T.T. (2014). *When the moon waxes red: Representation, gender and cultural politics*. Routledge.

Németh, J. (2004). Redefining security in public space: the case of LOVE park. *IEEE Technology and Society Magazine*, 23, pp. 19-20.

Németh, J. (2006). Conflict, Exclusion, Relocation: Skateboarding and Public Space. *Journal of Urban Design*, 11, pp. 297-318.

Nunes, M. (2010). Introduction: Error, noise, and potential: The outside of purpose. In M. Nunes (Ed.). *Error: Glitch, Noise, and Jam in New Media Cultures* (pp. 3-20). Continuum.

DOI 10.36158/97912566929415

Petrick, E.R. (2020). Building the Black Box: Cyberneticians and Complex Systems. *Science, Technology, & Human Values*, 45(4), pp. 575-595.

Rhodes, L. (1979). *Whose history? Feminist Review*, 3(1), pp. 53-63.

Sanders, E.B.-N. & Stappers, P.J. (2008). Co-creation and the new landscapes of design. *CoDesign*, 4(1), pp. 5-18.

Schreer, O., Feldmann, I., Renault, S., Eisert, P., Kauff, P. & Weissig, C. (2019). Capture and 3D Video Processing of Volumetric Video. In Magnor, M., Sorkine-Hornung, O., Theobalt, C. & Xu, C. (Eds). *Digital Representations of the Real World: How to Capture, Model, and Render Visual Reality*. CRC Press.

Simondon, G. (2017/1958). *On the Mode of Existence of Technical Objects* (translated by C. Malaspina & J. Rogove). Univoca l Publishing.

Simondon, G. (2020/1958). *Individuation in light of notions of form and information*. University of Minnesota Press.

Thompson, N.A., & Byrne, O. (2022). Imagining Futures: Theorizing the Practical Knowledge of Future-making. *Organization Studies*, 43, pp. 247-268.

Toupin, S. & van Oost, E. (2020). Feminist and critical approaches to participatory design. *CoDesign*, 16(1), pp. 1-13. https://doi.org/10.1080/15710882.2020.1722175.

Trevor-Roper, P. (2012). *The world through blunted sight: an inquiry into the influence of defective vision on art and character*. Souvenir Press.

Valentine, G. (1996). Children Should Be Seen and Not Heard: The Production and Transgression of Adults' Public Space. *Urban Geography*, 17, pp. 205-220.

Wenzel, M., Krämer, H., Koch, J. & Reckwitz, A. (2020). Future and Organization Studies: On the rediscovery of a problematic temporal category in organizations. *Organization Studies*, 41, pp. 1441-1455.

Willing, I., Mestrom, S., Loke, L. & Odlum, N. (2025). Skate/worlds: New pedagogies for skateboarding. In Sander Hölsgens & A. Ong (Eds). *Skate/worlds: new pedagogies for skateboarding*. University of Groningen Press. https://doi.org/10.21827/656f071868dee.

Willing, I. & Shearer, S. (2015). Skateboarding activism: Exploring diverse voices and community support. In K.-J. Lombard (Ed.). *Skateboarding: Subcultures, sites and shifts* (pp. 44-56). Routledge. https://doi.org/10.4324/9781315737577.

Woolley, H. & Johns, R. (2001). Skateboarding: The City as a Playground. *Journal of Urban Design*, 6, pp. 211-230.

DOI 10.36158/97912566929415