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FROM TRACE TO ALGORITHM: DATA SHADOWS AND STRATEGIC CO-OPTATIONS IN EARLY LOCATIVE ART

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Abstract

This paper explores how early locative media art, emerging around the turn of the millennium, functioned as a testing ground at the intersection of newly accessible military technologies like GPS and forward-looking concepts such as ubiquitous computing. Through a comparative analysis of two seminal artworks from 2002, Esther Polak's *Amsterdam RealTime* and Ursula Damm's *Memory of Space*, it argues that these artistic experiments articulated a set of 'productive contradictions' that continue to shape our evolving relationship with urban technologies. Polak's project stands as a landmark in urban data visualization, revealing the inherent tension between the celebration of free, exploratory movement, conceived as a technologically mediated *dérive*, and the structuring logic of the database. Damm's installation, by contrast, marks a radical conceptual shift. Employing a self-organizing neural network, *Memory of Space* moves beyond representational mapping toward generative interpretation, ceding agency to an algorithmic co-creator while engaging presciently with questions of posthuman aesthetics and machine intelligence. This paper contends that the legacy of this artistic moment extends far beyond historical curiosity, forming instead a critical grammar for interpreting the subsequent informatization of the urban sphere, from surveillance and participatory infrastructures to the emergent agency of intelligent systems embedded in everyday life.

Introduction

The contemporary urban experience is increasingly permeated by digital information, subtly woven into the spaces, rhythms, and interactions of everyday life. This gradual informatization of the public sphere unfolds along a complex historical lineage that begins with Cold War military infrastructures and evolves through successive computational imaginaries. At the turn of the millennium, digital technologies crossed a threshold, moving beyond the confines of the desktop to become increasingly embedded within the fabric of urban life. The technological groundwork for this transformation had been laid over several decades [1; 2; 3]. Originally conceived as a classified military system, the Global Positioning System (GPS) was made fully accessible to the civilian sector in May 2000, expanding the possibilities for spatial orientation and navigation [4;

5]. This opening coincided with the major advancements in Geographic Information Systems (GIS), the proliferation of wireless networks, and the growing diffusion of sensors across urban space. These interconnected developments gave rise to what Adam Greenfield [6] would later describe as ‘everyware’: a state in which information processing is distributed across objects, surfaces, and the routines of everyday life. The conceptual foundation for this shift had already been articulated by Mark Weiser [7], whose vision of ‘ubiquitous computing’ imagined technology as an invisible ambient presence, seamlessly embedded within the environment. This vision was subsequently reinterpreted through the framework of ‘Ambient Intelligence’ (AmI), which emphasized anticipatory and adaptive systems operating within inhabited spaces [8; 9; 10].

In this evolving landscape, the notion of ‘locative media’ began to take shape around 2002–2003 within a loosely defined artistic context, particularly in Europe [11; 12; 13; 14]. Many of the artists involved, coming out of the experimental practices of 1990s Net art [15; 16; 17] or more traditionally performative approaches, began to explore the expanding presence of networks in mobile and public spaces. A comparative analysis of Esther Polak’s *Amsterdam RealTime* and Ursula Damm’s *Memory of Space* discloses two distinct yet complementary approaches to the use of locative data. Polak’s work utilizes GPS tracking to produce a cartographic visualization of individual movement, foregrounding processes of inscription and representation. In contrast, Damm adopts a more generative non-GPS methodology, translating spatial trajectories into algorithmically mediated visual experiences. Taken together, these works offer an early and remarkable meditation on issues that still define contemporary discourse: specifically, the reciprocity of agency, surveillance, and co-creation within urban space.

Digital mapping as creative grammar

A seminal work in the early history of locative media art, Esther Polak’s *Amsterdam RealTime* (2002, in collaboration with Jeroen Kee and Waag Society) was conceived at a time when GPS was still unfamiliar to the general public – having only recently been made fully available for civilian use. The project enlisted seventy Amsterdam residents, each equipped with a satellite tracking device to record their movements over a two-month period. Rather than plotting these trajectories onto a conventional map, Polak opted for a minimal, data-driven aesthetic: against a black background, glowing lines gradually accumulated to reveal the contours of the city as a dynamic pattern of lived, embodied mobility (Polak, 2002).

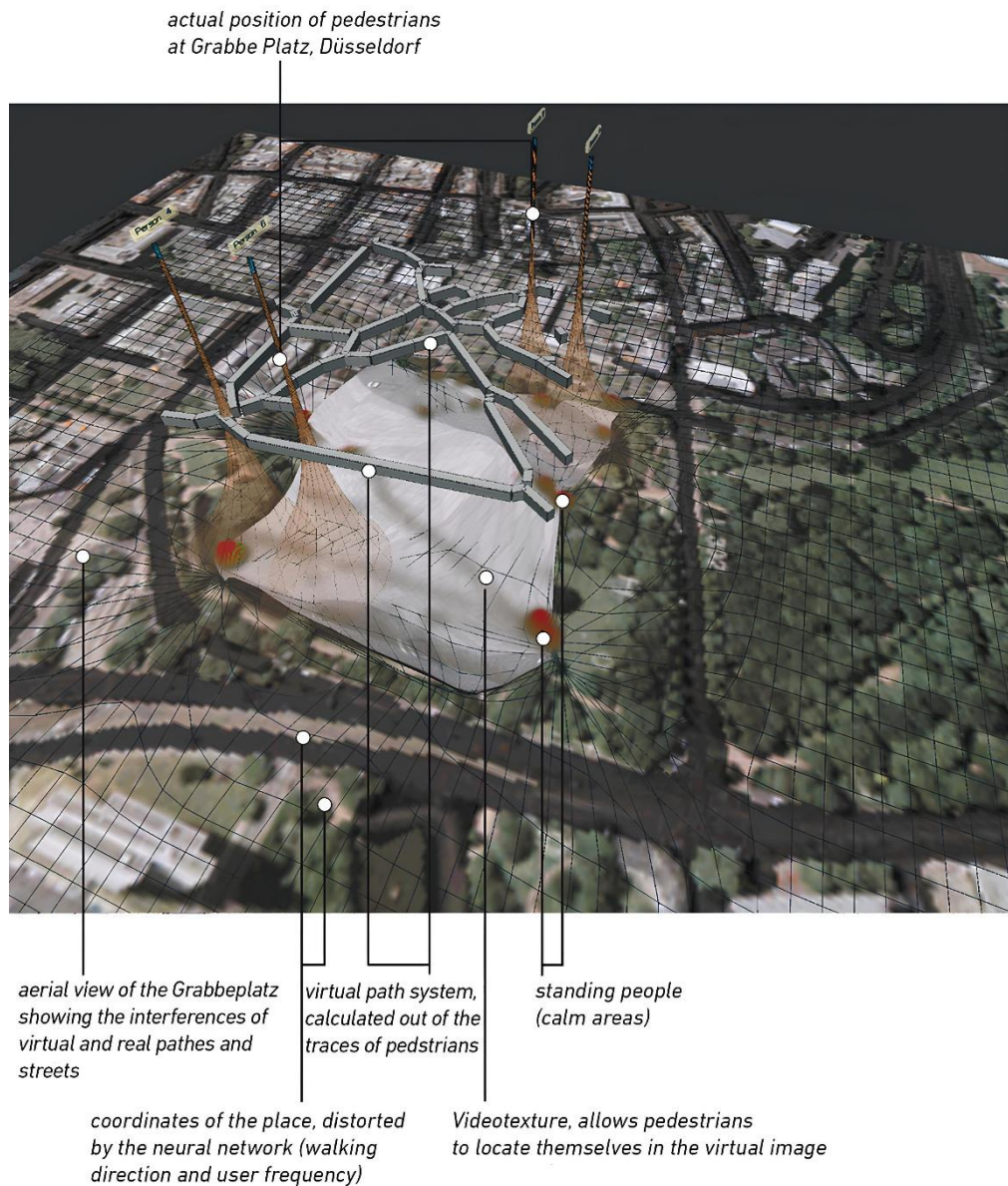


Fig. 1 - Ursula Damm, Memory of Space, 2002. Screen print of the software. Courtesy of the artist

The effectiveness of the work lies in its procedural logic and formal restraint. Each path is captured, stored, and visualized, producing an emergent portrait of urban life composed entirely of machine-readable coordinates. The map is generated through the mutual influence of human movement and computational sensing, evoking traditions of art-as-process and the artist-as-system-designer, as theorized by figures such as Jack Burnham [18; 19]. This generative dimension also conforms *Amsterdam RealTime* with the influence of post-cybernetics art practices that privilege system behaviour and process over symbolic content [20; 21]. In doing so, the work renders visible what we can describe as ‘data shadows’ – the continuous digital traces produced as individuals interact with computational systems [22]. Rather than directly contesting cartographic authority, the work draws attention to the ambient operation of data infrastructures.

Yet it remains shaped by a central tension, what we might call the dialectic of the *dérive* and the database-as-symbolic-form [23]. *Amsterdam RealTime* evokes the legacy of the Situationist International, particularly their practice of the *dérive*: a drift through the city intended to uncover its ‘psychogeographical’ resonances and resist the rationalism of urban planning [24]. However, at the same time, this wandering unfolded through GPS, a system associated with the coordinate-driven logic of the database and the very impossibility of getting lost [12]. The piece thus occupies a liminal space: it celebrates free movement while simultaneously demonstrating the capabilities of constant real-time tracking, anticipating both the rise of voluntary self-tracking as a hallmark of social media culture and the early corporate interest in participatory surveillance via mobile apps [25].

Polak’s work did not exist in a vacuum. The early 2000s saw a growing enthusiasm for Location-Based Services (LBS), though companies were still uncertain about their social and cultural applications. Locative media artists, through critical and playful experimentation, effectively became an informal R&D lab for the future of mobile interaction. This led to a series of collaborations that blurred the boundaries between artistic inquiry and corporate innovation. One key example is the *Urban Tapestries* project (2002–2004), developed by the UK-based art collective Proboscis in partnership with Hewlett-Packard and Orange. More than a conventional art project, *Urban Tapestries* functioned as a robust platform for public authoring, allowing users to attach digital content – texts, images, sounds – to specific locations, creating shareable, spatially embedded narratives. Operating as a kind of ‘living lab’ [26], the project served as a real-world testbed for observing how people engage with tools for mobile, location-based annotation. It generated perspectives into user motivations and interaction patterns, all of which later informed the development of commercial LBS platforms and social media applications [27]. A similar trajectory can be observed in the 2005 collaboration between Siemens and the Ars Electronica Futurelab on *Digital Graffiti*, a project that allowed users to leave SMS-based messages tied to physical locations.

We can argue that the ‘authenticity’ of artistic subcultures was often mobilized to generate value for the emerging experience-based economy. At the same time, however, the emergence of living labs introduced a countervailing tendency. As Wershler, Emerson, and Parikka [28: 231-234] have noted, moving beyond conventional laboratories, living labs operate in real-world contexts, where boundaries are shaped by the project’s goals, scope, and setting. In principle, they can emerge anywhere – on a street, in a home, or across an entire city – aiming to develop and test prototypes in actual conditions, often involving a broad array of stakeholders, including research

institutions, segments of maker culture, and corporate actors. Arrigoni and Schofield [29] conceptualize living lab practices as a form of artistic impulse, closely aligned with the ethos of media labs, the very milieu contexts in which Polak's work initially took shape [30]. They place particular emphasis on the figure of the artist as a 'lead user' and experiential designer. While remaining critical of techno-utopian narratives centered on open, bottom-up participation, a hallmark of early 1990s digital culture, they nonetheless recognize the social potential embedded in the living lab model. Its emphasis on speculative design and iterative prototyping rather than finalised products makes it especially apt for emerging technologies such as mobile, GPS-based systems, as illustrated by Polak's practice.

Already in the 1990s, much of the European Net art scene, out of which many locative artists emerged, had begun to move beyond the confines of the browser, gravitating toward physical interaction and embodied modes of engagement (Heath Bunting, for instance, exemplifies this shift). What ensued was the development of a broader participatory culture anchored in the distributed ecosystems of media labs. Institutions like Ars Electronica in Linz, active since 1979 and attuned to these dynamics from the outset, played a crucial role in fostering such practices. The *Digital Graffiti* project offers a particularly illustrative case of this alignment, though other leading European media art centers, including the ZKM in Karlsruhe, also began to explore similar trajectories.

What unfolded in those years was a dialectical movement between opposing poles. On the one hand, there was an unmistakable corporate interest in translating artistic observations into marketable innovations. As Conor McGarrigle [31] puts it, an entire generation of locative artists effectively 'set the agenda' for mobile annotation and narrative apps. Cornell and Varnelis [32] likewise contend that locative media found strategic and economic footing within private and institutional sectors (see also Morilla [33]). On the other hand, this same period witnessed a brief yet significant resurgence of participatory ideals and cultural experimentation – a moment marked by a genuine sense of networked utopianism and a heroic engagement with the possibilities of distributed media.

From operational representation to machine interpretation

In the same year that Esther Polak was tracing human movement through *Amsterdam RealTime*, German artist Ursula Damm took a radically different conceptual turn with her installation *Memory of Space*, steering locative media into new territory by exploring how living data fields might be interpreted by artificial intelligence. This work marks a subtle but

significant early encounter between locative art and machine learning. A video camera captured the movements of passersby, feeding them into a self-organizing map (SOM, or Kohonen map). SOMs are unsupervised neural networks designed to reduce high-dimensional data into two-dimensional topologies, preserving the spatial relationships within the dataset [34]. In creative contexts, their value lies in the capacity to trace patterns and give rise to visual forms that emerge from raw input. Comparable strategies had already appeared in experimental art, for example in *The Three Sirens*, a generative robotic rock band developed by Nicolas Baginsky in 1992, in which machine performers produced music through learning-based processes [35].

Damm's process unfolds in three distinct stages. First, the neutral gaze of the camera captures the movement of anonymous passersby as they cross the plaza, implicated in the tacit performance of a computational choreography. Next, these trajectories are mapped onto a Cartesian grid, an archetypal symbol of rationalized space. Finally, the data is processed by the self-organizing map, which distorts and reshapes the spatial matrix in real time as it responds to the density and rhythm of human activity. This means it considers where people are more likely to stop, where they tend to accelerate, or where architectural barriers divert their paths. The system does not merely trace movement; it learns the kinetic and affective logic of space, mapping a dynamic, three-dimensional landscape of intensities. Grey, fluid forms register fleeting trajectories, while pulsating red nodes indicate gathering points, producing a moment of 'unexpected Cubism' within the plaza.

What makes *Memory of Space* significant is the way it reconfigures the question of agency in locative media. In Esther Polak's project, the authorial voice still holds a central role: people generate the GPS traces, and the artist curates and visualizes them, shaping the final representation. Although mediated by technology, the process remains grounded in human intention and interpretation. Ursula Damm's work, by contrast, proposes a different configuration. Here, agency no longer resides solely in the human subject or the figure of the artist, rather, it unfolds across a network of human and non-human actors, generating a productive unpredictability, a receptiveness to contingency and chance that recalls earlier experimental traditions, from Surrealist automatism to the aleatory strategies of the postwar avant-garde. As N. Katherine Hayles [36] insightfully observes, such systems do more than process data; they extract information from their embodied human origins and reconfigure it

within a machinic regime. What emerges is less a transparent map or representational image than a speculative neural topography – a layered, evolving landscape of intensity.

Conclusion

The artistic engagements with geospatial and networked technologies at the turn of the millennium suggest that early locative media practices functioned as a critical laboratory, diagnosing and anticipating the tensions that would later define digital urbanism. A comparison between *Amsterdam RealTime* and *Memory of Space* reveals two complementary trajectories: one that renders the dialectic between freedom and surveillance through refined cartographic abstraction, and another that embraces generative co-creation to investigate how algorithmic systems can interpret and transform our experience of space. Polak's work reveals the core contradiction of its time: a celebratory *dérive* conducted through infrastructures of total traceability, a quantified gesture nested within the architecture of the database. Damm's project, in turn, pushes this dialectic further. By ceding interpretive authority to a self-organizing neural network, she inaugurates a shift from representation to inference. These works emerged in tandem with broader experiments such as *Urban Tapestries* and *Digital Graffiti*, which engaged artistic practice as a form of speculative research more closely linked to the industrial output of geospatial applications revolving around a similar digitization of public space. Crucially, all of them anticipate a paradigm shift wherein urban space becomes less a container for action than a networked-actor itself, dynamically shaped by participatory sensing. This ontological reconfiguration echoes broader transformations in the politics of visibility under regimes of code/space governance [37], where the acts of seeing, being seen, and interpreting are increasingly delegated to machinic interlocutors.

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