Visualization, Feminist

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Glossary

Cartographic Visualization or Geovisualization A set of techniques for representing spatial data for visual examination in a computerized environment.

Exploratory Spatial Data Analysis (ESDA) Techniques for multiple and interactive graphic display of data to facilitate its visual examination.

Feminist Geography Part of human geography and focused on representing adequately women's worlds and transforming research practice in accordance with principles of feminist scholarship.

GIS (Geographic Information Systems) Computer-based technology for storage, management, display, and analysis of spatial information.

GISci (Geographic Information Science) Body of knowledge about representing and analyzing spatial objects and processes in a computerized environment.

Visuality Use of visual information and images in production of knowledge and other social practices.

Geography is a fundamentally visual discipline. Geographers have long studied and understood landscapes, people, and their experiences through observation (using a whole range of devices from the human eye to satellites) and have represented their knowledge of them using images – maps, pictures, and photographs. As a feminist geographer Gillian Rose argued, visuality plays a crucial role in the production of geographic knowledge, although seldom recognized or reflected upon. Because of the substantive and methodological diversity of geography, its strategies of visualization today encompass such varied and even contrasting practices as geographic information systems (GISs) map display, plotting a regression line, tornado activity modeling, photographs of urban mural art, diagrams of theoretical relationships, or mapping qualitative interview data. With the rapid growth of GIS in recent decades, visualization research has become one of the key directions in geographic information science (GISci). It seeks new ways to represent and visually examine digital spatial information. In this GISci context, visualization is variously referred to as cartographic visualization, geographic visualization, or geovisualization.

The trenchant post-structuralist, postcolonial, and especially feminist critiques of the role of vision and looking in Western science have fundamentally changed practices of knowledge production in the last two decades. Moreover, feminist scholars including geographers have relied on the intensive use of images in their work that tended to look into aspects of human experience not captured by quantitative methodologies. But it is within the context of GIS-based visualization that feminist visualization gained particular prominence in recent years. Inspired by the feminist critiques of both visuality and technology, it attempted to reinvent computer-based visualization – and mapping – as a tool for feminist geography. This article focuses on feminist critiques of visuality in geography and feminist GIS-based visualization.

In the next section I turn to feminist analyses of vision and looking as a way of knowing. Then I consider visuality in geography and identify a number of feminist visualization strategies. Lastly, I focus on feminist GIS-based visualization. The article concludes by discussing examples of feminist visualization from the recent literature.

Feminist Critiques of Vision

Social theorists and human geographers explicitly acknowledged and also profoundly criticized the power of vision, sight, and looking in Western culture and scientific practice. Most critics exposed the privileged position of vision over other senses that facilitated the separation of the object from the subject and helped to produce the neutral, detached, and objective observer – a modern scientist and a controlling master. For example, postcolonial and post-structuralist theorists have analyzed vision as a central mechanism in establishing power relations. Michel de Certeau famously exposed the sense of mastery over the city one gained by observing New York City from the top of the World Trade Center. Edward Said examined the colonial gaze – Orientalism – as a set of practices to represent and rule colonial subjects, while Michel Foucault analyzed the role of vision in the rise of Western surveillance practices.

Feminist scholars, however, made a unique contribution. They, too, emphasized the significance of looking as a way of knowing in Western culture but focused on knowledge/power linkages that determine how different subjects use their vision. Not all looking is the same. People can, do, and are allowed to look as well as to be seen differently. Specifically, feminist scholars showed how the gendering of visual practices facilitated the rise of masculinist knowledge production in Western science.

In a number of works, Donna Haraway has argued that the authority of science rooted in its claims to objectivity

stems from the construction of a scientist as someone capable of creating a disembodied vision of the world, the view from nowhere. Such a neutral (or objective) way of seeing the world occurs once there is a distance between the knower and the known (or the subject and the object of research) because this distance allows for a detached examination. Various technologies of visualization, from satellites to microscopes, consolidate the illusion of infinite vision – "the god-trick" in Haraway's words – and the possibility of objective knowledge. Post-structuralist and feminist scholars, in contrast, have argued that knowledge production practices are not neutral but in Western societies are related to the quest for power and express the power of the privileged such as, for example, white middle-class men. Furthermore, disguised as scientific objectivity, Haraway shows, a masculinist vision of the world escapes critical examination and responsibility for the outcomes of the practices it legitimates.

Feminists also challenged the related construction of women and other disempowered groups as having embodied subjectivities with no claims to objectivity and, therefore, authority and power. Donna Haraway elaborated the concept of situated knowledge centered around seeing and viewing practices that always originate in a particular location and are produced by embodied subjects. With transcending views no longer possible, all knowledges must be treated as responsible accounts of the world. As a result, masculinist knowledge is no longer objective either but situated as that of a particular ('master') subject – white, middle-class, and heterosexual man. As such, it has lost its absolute authority while subjugated knowledges (e.g., those of women or colonial subjects) are enabled to create their partially objective – situated and responsible – visions that can converse with each other and work together. Thus, reflexivity and critical self-examination are important aspects of feminist scholarship.

More recently, practices of looking and visual representation have received renewed attention in the humanities and social sciences as visuality studies. They focus on the role of vision and visualization in maintaining and challenging cultural practices. Images of different sorts are considered sites for the construction of difference and hierarchy – as in diasporic visualities in art or in scientific practice.

The Visual in Geography and Its Critiques

The visual in geography is found in several locations. First, geographers have long used vision as a primary method to gain knowledge. Second, geographers have used photographs and other visual means to communicate their knowledge. Finally, geographers have specifically used maps as a key tool to represent territories and the people within them. The feminist visualization draws upon the feminist critique of vision and science (see previous section) and the related feminist critiques of vision in geography. It involves a widespread use of (noncartographic) imagery in feminist research as well as the appropriation by feminist geographers of mapping, mainly GIS-based mapping that is both quantitative and qualitative.

While the 'new' cultural geographers such as Denis Cosgrove and Stephen Daniels have problematized seemingly objective representations of landscape as expressions of hegemonic class power and culture, feminist geographers have exposed the role of the masculine gaze in geographical knowledge production. Drawing on feminist psychoanalytical theory, Gillian Rose has shown that, similar to other sciences, the central categories of knowing in geography became masculinist despite the supposedly gender-neutral conceptual tools, methodologies (e.g., fieldwork), and subject matter (e.g., landscape). That supposed absence of gender from the discipline was due to the fact that women were absent as both subjects and objects of research.

Yet, concepts of femininity and masculinity have shaped the ways in which geographers have both analyzed and represented the world around them. In particular, the visual examination of landscapes has long been an important analytical tool in geography. This method was the forte of the first modern geographers who were mainly men engaged into scientific exploration within the context of Western culture, a culture in which nature is constructed as feminine in art, literature, and science. On the one hand, nature is seen as a nurturing mother to be awed and adored, and, on the other hand, she is an unruly and seductive female. Furthermore, the unknown territory was associated with the feminine (e.g., a passive object to be discovered, chaos to be ordered, an image to be seen) while the knower clearly possessed the supposed masculine qualities (e.g., an active and rationalizing subject, a looking and ordering master).

Early geographical inquiry depended on fieldwork during which direct visual examination and observation of landscape features served as a fundamental method of discovery. The traveling geographer became a hero confronting dangers during his scientific explorations. But in addition to the quest for knowledge, Rose argues, visual observation also gave pleasure, making the geographer's relationship with the landscape profoundly ambivalent. Discovery combined fear, a desire to conquer, adoration, and attraction. Resolving this ambiguity required maintaining a distance between the scientist and the landscape. That intended distancing, in turn, reinforced the role of vision in the process of knowing. According to Rose, the distanced male gaze played a double role in the foundation of geography as a

masculine discipline – as an analytical tool to study landscapes and as a source of pleasure for the geographer.

The masculinist geographic imagination also fed the imperial ambitions of the West. Constructing colonized landscapes as feminine played a key role in sustaining imperial practices by representing both women and landscapes as sites for colonization. Here, male colonizers engaged in heroic conquests of new unknown lands that were also identified with indigenous women. This identification made both lands and their people subject to colonial desire and control. Furthermore, mastery of colonial lands was supported by the creation of maps in which the acquired territories were represented as known and ordered through the lens of colonizers' knowledge. In the case of Ireland, constructing its territory as female made it naturally subject to control by British colonial power, the state, and the Church and also helped sustain a male nationalism.

Although the academy and geography have been significantly transformed by feminist scholarship over the last decades, the masculinist nature of the discipline continues to manifest itself in commonly used visualization practices. Many maps published by geographers and especially those created with a GIS, for example, continue to express the supposedly objective vision of a scientist. Furthermore, Gillian Rose has recently examined contemporary visual practices that geographers use to deliver their findings publicly. Because geography's relationship to images is often taken for granted, the effects of these strategies are ironically overlooked. Rose focused on the role of what she called "disciplinary visualities" in the production of geographical knowledge or how geographers use images (as opposed to a focus on the meaning of the images themselves). She found that particular uses of images (in her example slides) in academic presentations (including image display, audiencing, and space) continue to produce specific notions of truth and position geographers relative to the world in specific ways that yield authority.

Feminist Visualization

Feminist visualization may be defined as the use of images in geographic research that is inspired by feminist sensibility and politics. While feminist geographers continue to deconstruct the hegemony of looking in order to create 'multivocal' spaces where different voices can be heard, they also made an effort to appropriate looking and transform it into a nonmasculinist practice of knowledge production. They began to actively use visual methodologies and images in their work as well as to reflect on the intersections of power that arise during this process.

First, feminist scholars complicated their own accounts of visual representation and exploration. They problematized gaze and vision as solely masculine and representations of the landscape as solely feminine. By disrupting these linkages, they created openings for reclaiming the authority of vision and its use in feminist geographic research. In addition, they created room for responsible and accountable feminisms that do not collapse differences between women but allow them to look and speak from diverse locations. For example, Catherine Nash analyzed work by feminist artists who reversed gender power hierarchies by equating the male body with the landscape and positioning women as observers taking pleasure in a nonexploitative looking.

Second, feminist geographers have employed visual images such as photographs of places and people, drawings, and maps as crucial strategies of representation in their work – in addition to textual analysis. For example, cultural and historical geographer Mona Domosh interprets historical photographs from a feminist perspective to construct linkages between gender relations and urban space in Boston and New York. Also, Gillian Rose has recently analyzed practices of viewing family photographs to explore the 'emotional geographies' of mothers.

Third, feminist geographers turned to cartography as a means to reclaim woman's distinct economic, social, and cultural experiences. In other words, women finally became the object of systematic mapping and began authoring maps themselves. A great example is the 2003 'The state of women in the world' produced by Joni Seager in collaboration with a group of scholars. Having survived multiple editions, this atlas displays country-level socioeconomic indicators that specifically describe women's achievements and struggles worldwide.

Finally, in recent years, Mei-Po Kwan defined feminist visualization as a method for feminist geographers specifically using GIS. It is in this capacity that it is becoming increasingly known. While geography has a long-standing relationship with technology, it is technologies for the production of cartographic images that have played an especially important role in shaping geographic visualization practices. Although cartographic practices have always been central to the field of geography, until recently the world of mapping and GIS has remained largely separated from the world of feminism. While feminist geographers made an outstanding contribution to the discipline in the last two and a half decades, they did not directly engage cartography or GIS until the end of the 1990s. In most feminist and post-structuralist writings, mapping and maps are used metaphorically reflecting the recent spatial turn in social sciences and the humanities. This relatively recent direct engagement with mapping and GIS, discussed below, is nonetheless potentially very fruitful given the significance of feminist analyses of vision and the centrality of visualization for geospatial technologies.

From Map Communication to Geovisualization

Visualization of spatial information has been inseparable from cartography and mapmaking. Today, it constitutes a core functionality of GIS and other spatial and nonspatial multimedia technologies. As such, digital visualization provides an entry point for feminism into a field of geospatial technologies. Before the advent of digital data processing, spatial data could only be visualized in the form of paper maps and graphs, the production of which was very labor and cost intensive and required specialized training and expertise. Its primary goal was to communicate map data to the public as Robinson and Petchenik explained in their 1976 map communication model, to convey information from the scientist and/or a cartographer (i.e., author) to the map user (i.e., reader). The meaning of visualization has changed as digital datasets and analytical tools for their analysis and display (e.g., GISs) have rapidly spread throughout the 1990s and geocomputational power has dramatically increased.

The first major consequence of these innovations included the use of mapping not only for the presentation of a final product but also as a tool for data exploration and analysis (e.g., exploratory spatial data analysis or ESDA). Data visualization (or geovisualization or cartographic visualization) became an integral part of the research process (as in Allan MacEarchren's concept of cartography cubed or C^3) along with spatial analysis itself. The second was the unforeseen democratization of the practice of mapping that has transformed the map user into a cartographer her/himself. This shift is increasingly possible as more software tools and data have become accessible to a wide range of users both in terms of design and cost. The third is that the notion of spatial data and its analysis have also changed. In addition to numerical datasets, today's technologies not only provide us with radically new symbolizations and color schemes but also incorporate and visualize various qualitative information such as nonmap images and pictures, three-dimensional (3-D) representations, sounds, voices, and movies. These developments have been recently enriched by the ideas about representation, image, and visuality stemming from feminist, critical, post-structuralist, and postcolonial scholarship. While these ideas have gained prominence in the social sciences, including human geography, some time ago, their encounter with GIS-based geographic visualization is more recent yet is already and increasingly fruitful.

Critical Cartography and GIS

Despite the turn toward cartographic visualization as an important scientific exploration practice as well as the attempts, similar to other post-positivist scientific trends, to, for example, incorporate uncertainty, visualization researchers have not questioned the production of knowledge through mapping *per se*. The interrogation of maps as imbued with and mediating power relations originated in the work of the historian of cartography J. B. Harley. Drawing on Foucault and Derrida, Brian Harley laid out an agenda for deconstructing the map as a power-knowledge practice as opposed to a scientific fact and initiated what is today referred to as 'critical cartography'. In his work, maps emerged as social constructs employed by those in power to sustain relations of domination, especially those of empire. More recently, critical cartography has been complemented by a growing critical GIS literature that examines the societal effects of GIS technologies and the mapping practices it enables. As GIS expanded in the 1990s, human geographers began to critically examine the power relations embedded within its design, application, use, and the images it produces. In their view, GIS was exclusively a positivist technology that supported established hierarchies of social power. Its social impact was enhanced by the unprecedented rhetoric of the digital map in creation of which visual and computing power powerfully combined.

More recent critics of geospatial technologies no longer read them as incompatible with nonpositivist practices of knowledge production. Maps and GIS displays are no longer seen as only suitable for the visualization of quantitative scientific data, bearing only the message from those in power and serving solely technocratic, patriarchal, imperialistic, capitalist, and militarist goals. Instead, these authors argue, the meanings of maps and of geospatial technologies are actively constructed through contradictory social practices. Moreover, the control over technology, and therefore, representations that it enables, increasingly (also not without setbacks and contradictions) shifts to those outside the established networks of power. For example, map readers have been recognized as important as map authors in the construction of a map meaning while the democratization of GIS is collapsing this difference altogether. Not only does GIS continue to serve the holders of power, it also can empower communities as the vibrant research on public participation GIS (PPGIS) demonstrates.

Feminist Critiques of GIS

In their critique of vision, feminist scholars have emphasized the role of visual technologies in enabling particular types of knowledge production. In Donna Haraway's opinion, these technologies (e.g., satellites and microscopes) are prosthetic devices that people

increasingly use to augment their vision of the world. Her point, however, was that these technologies, contrary to masculinist scientific claims, do not make vision more objective; rather, they expand what a human eye can see. They help, therefore, to incorporate additional – although equally subjective – capacity to see, this time assisted by the machines. Therefore, Haraway argues, it is important to understand and master visual technologies because it could both enhance partial objectivity of a situated (feminist) knowledge and show the embodied character of masculine science. Furthermore, understanding technology also enables feminist scholars to practice its use reflectively and responsibly such that the very basis for domination and social hierarchies is undermined as in the new world of information that Haraway describes in her *Cyborg Manifesto*.

As the discourses of feminism and GIS have recently begun to speak to each other, feminist geographers have fruitfully addressed, among other things, the visual power of GIS. They proceeded in two ways – by deconstructing this technology's visual practices and by appropriating its visual power for the purposes of feminist research. In the first instance, and similar to social theorists in the 1990s, they provided excruciating critiques of mapping and GIS as being the tools for masculinist – and positivist – science and a male-dominated professional field. Similarly, these early critiques came from the outside of the GIS field *per se*. Cartography, GIS, and remote sensing (RS) were exposed as having the same masculinist biases as quantitative and spatial science methods (e.g., reliance upon a Cartesian grid to organize space, preference for quantitative data, reduction of lived worlds to a pixel or a point) that do not capture but marginalize women's experiences. But additionally, viewing territories 'from above' with help of maps and commercial satellite images and aerial photos provides the viewer with a sense of mastery and in the case of Third World countries contributes to their appropriation via satellite imagery. Later feminist critiques, however, originated from a group of feminist geographers who were trained in GIS themselves. While they challenged the masculinist and positivist nature of GIS technology, they refused to discard GIS altogether. Instead, they started developing alternative uses of GIS and worked to create alternative visualizations, which is more difficult than critique.

Feminist Visualization in GIS

Among the feminist geographers who worked with GIS and began rethinking the field in feminist terms, Mei-Po Kwan was the first to claim GIS as specifically suitable for feminist visualization and, therefore, as a method for feminist geographic research. In a key article published in the *Annals of the Association of the American Geographers*, she drew on work of Donna Haraway, Gillian Rose, and other feminist scholars as well as science studies literature, to argue that GIS is not antifeminist by its nature; rather, prevailing GIS practices define it as a masculinist and positivist technology. Her's and other feminist geographers' work demonstrated that GIS visualization, despite its current limitations, can address several concerns in feminist research. First, it makes visible women's worlds and the everyday practices of people, something that conventional GIS does not address. Second, it uses nonstandard datasets that are often generated through in-depth fieldwork and, therefore, can answer questions that commercial datasets cannot. Third, it pioneered the incorporation of qualitative and nonquantitative data into GIS. In this way, GIS becomes a key method in mixed methods projects and can be used in critical geographic research. Fourth, feminist visualizations also can incorporate sound and movement in order to capture complex human experiences and challenge the primacy of vision itself.

The author ends this article with examples from feminist GIS-based visualization that illustrate the above points. In a number of studies, Mei-Po Kwan produced spatial representations of women's daily lives using space–time geography. Kwan combined Hagerstrand's ideas on mapping the daily paths of individuals in space and time with a feminist focus on gendered experiences. Information about women's daily travels was collected from dairies written by the research participants. Kwan combined this data with information from commercial datasets representing urban space such as road networks and urban opportunities. She then analyzed the data in a GIS enhanced by dedicated algorithms. The result is a series of 'body maps' that represent the life paths of women within the urban environment (**Figure 1**).

Kwan showed that while women's life paths are very different from those of men, women's space–time experiences also differ from that of other women depending upon, for example, class and race. The daily paths of African-American women in **Figure 1** are clearly the most restricted thereby limiting their access to urban opportunities. By creating this visualization in addition to geocomputational analysis, Kwan made ready for visual examination the striking differences in space–time activities. This type of work would not be possible without either GIS or feminist scholarship.

In another example, Kwan combined image, sound, voice, and movement in order to visualize in a multimedia environment the emotional experiences of Muslim women after 11 September. In particular, Kwan models the daily movement of these women through urban space in a 3-D GIS. The route taken by one woman is presented as though through her eyes and accompanied by this woman's voice as she talks about her experiences of fear in the public spaces she visits on a daily basis.

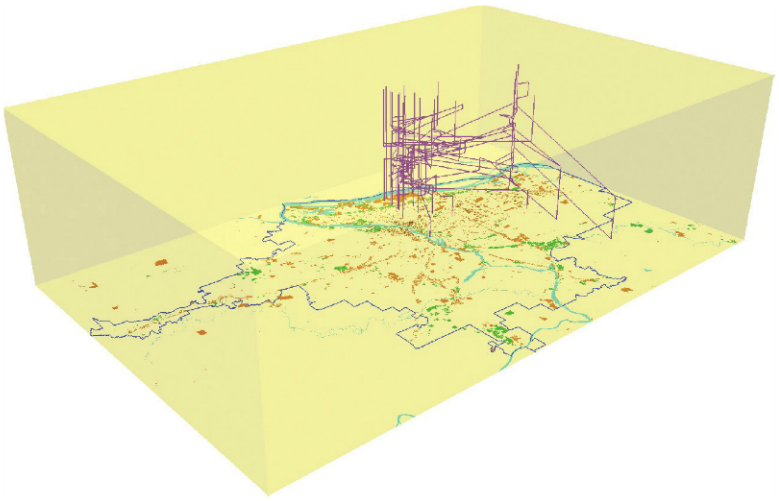

Figure 1 The time–space paths of a sample of African-American women in Portland, Oregon. Reproduced from Kwan, M.-P. (2002). Feminist visualization: Re-envisioning GIS as a method in feminist geographic research. *Annals of the Association of American Geographers* 92(4), 645–661, with permission from Blackwell.

Different parts of the 3-D model of the city are color coded to reflect the level of anxiety experienced by the respondent.

The author's own work on the multiple economies of Moscow households employs GIS to visualize and analyze their changing the daily economic practices of households in the context of rapid urban privatization. These practices are gendered and many of them are informal and not accounted for in official statistics (e.g., domestic work or help received through social networks). The author has collected information about these practices through qualitative interviews and using this data visualized the diverse economic spaces of Moscow households both before and after the transition from state socialism. On maps comparing these two periods, each household location was represented by a circle whose size and color corresponded to the total number and composition of economies in which the household participated. The map in **Figure 2** is similar but focuses just on the informal economies (both monetized and nonmonetized resources) of households.

Clearly, informal economic practices were prominent in the economic landscape of Moscow both under the Soviet system and after but their role remains ignored by conventional economic approaches and transition theories as well as state-sponsored data collections. Revealing and mapping the multiple economies of households is a feminist issue because the lion's share of informal and unpaid work is domestic production and is carried out by women. Visualizing these subordinated economies through mapping has ontological power; mapping makes them present in the landscape, it positions them in space, and shows what they are like. Once visible, they exist and can no longer be ignored.

Another example illustrates how GIS visualization can empower communities in partnership with feminist geographers. Sara McLafferty describes how women on Long Island, New York organized to draw attention to the high incidence of breast cancer in their communities which they believed was related to environmental factors. They independently collected information about incidences of illness and showed their location on a 'pin map'. Then researchers from Hunter College transferred this information into a GIS that allowed querying the spatial distribution of breast cancer cases relative to a number of environmental factors. As a result, previous conclusions about the individual characteristics of respondents as risk factors were revised. A powerful visual and technology-based statement about the problem pressed the authorities to undertake further research.

Finally, feminist artists have also turned to the powerful visuality of GIS and RS images. For example, Ursula Biemann has created multi-media (video/audio) narratives about women transported and trafficked from Eastern Europe and South-east Asia to countries where demand exists for their sex work (e.g., Europe and the US). In these flows produced by globalized capitalism, these women are especially objectified as commodities and often deprived the basic human rights and abused. In order to re-contexualize their experiences, Biemann combined highly personal stories of these women with the remotely sensed images showing countries and places they came from and went to. The global flows of women fueled by a transnational capitalist economy demanding their bodies involve unprecedented numbers of voluntary and forced migrants. The artist thinks of her work as a counter geography that maps 'female geobodies' and emphasizes that women's personal lives are intimately

Figure 2 Informal resources and households, 1989–95. Reproduced from Pavlovskaya, M. E. (2004). Other transitions: Multiple economies of Moscow households in the 1990s. *Annals of the Association of American Geographers* 94(2), 329–351, with permission from Blackwell.

connected to seemingly impersonal global circuits of capital. These connections, however, are made invisible by scientific representations of the Earth, such as those originating from satellite imagery. These images ignore and mask the gendered experiences that are fundamental to the functionings of the transnational economy. The description and images from Biemann's work can be found on the Internet.

Conclusion

In conclusion, feminist visualization has thrived in a number of spaces, including prominently the field of geography and geospatial technologies. It has roots in feminist critiques of science and the role of vision in scientific research and particularly in geography, a very visual discipline. The rise of visual geospatial technologies such as GIS has crucially contributed to its development in geography. Critical cartographers, critical GIS scholars, and feminist geographers have all critically examined these technologies and representations that they enable to create. Feminist geographers, however, made a particularly fruitful effort to change GIS and use it to create visualizations inspired by feminist scholarship.

See also: Critical Cartography; Critical GIS; Feminism, Maps and GIS; Geovisualization; Postcolonialism/ Postcolonial Geographies; Poststructuralism/ Poststructuralist Geographies; Visuality.

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Ursula Biemann's gender and geography site: artwork by Ursula Biemann.
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Website with geovisualization images by geographer Mei-Po Kwan.