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ABSTRACT

The place of women in the existing and emergent discourses of the visual and spatial is explored. When gender and the visual-spatial emerge together, the visual and spatial are almost always associated with the masculine perspective. The social construction of women is tied to visual-spatial representations in diverse domains. Within the discourses and analyses of education, there are several important associations between gender and the visual-spatial, such as the attribution of low spatial ability to females, the panopticon organization of classrooms, the portrayal of girls and women in educational materials, and the influence of engineering on these materials. Three categories of content that emerge are: (1) the visual representation of women, (2) the visual-spatial abilities of women, and (3) the rights of women to use space. Schools are gendered spaces, and the imprint of Western, white, heterosexual, and male-oriented perspectives is encoded in the spatial organization of schools, in assumptions about women, and in instructional materials. Such organization and assumptions must be acknowledged if real equality in education is to be achieved. (Contains 21 references.) (SLD)

Women and the Discourses of the Visual: Where are Women in this Picture?

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Visual metaphors have been used to represent knowledge and understanding, at least since the time of Plato. In contemporary times, the visual display of information is pervasive. An increasing emphasis on the visual over other sensory domains is evident as both cause and effect of the growth of electronic media and technologies: video games, microcomputers television, multimedia, and so on. Those who create these technologies, or who use them most frequently or effectively, are increasingly advantaged within society. This advantage accrues in several ways. With the exponential growth of information, the acceptance of information as capital, and the increasing utilization of visual and spatial models and modes for the representation and control of information, "mastery" of the visual becomes key to success in traditional capitalistic terms. Secondly, insofar as the visual replaces the verbal as a dominant mode in which ideas are communicated and explored, and realities are constructed and investigated, visual literacy displaces the literacy of words and symbols. Thirdly, insofar as social relations among individuals and groups of persons are affected and even determined by the representations of some persons or groups to others, the creation by one person of the visual-spatial images or realities of others becomes an increasingly powerful activity.

Thus, as we consider the growth in importance of visual and spatial representations and "realities," we are dealing with power. As feminists, we are concerned with the effects of this power on those who have been disempowered in previous regimes of knowledge and "truth". As educators, we are particularly concerned with these effects within schools and other institutions of learning. In this paper, and in the larger project of which it is a part, we focus primarily on women and interrogate the place of women in the existing and emergent discourses of the visual and spatial.

The discourses of the visual-spatial can be seen as challenging the scientific as the dominant mode of knowing and understanding. As we move toward the information society and what Donna Haraway calls the "informatics of domination," epistemological underpinnings shift from those of an "organic industrial society to a polymorphous information system." Haraway delineates specifics of this transition by listing pairs of concepts, contrasting the old and organic with the new and informational (Haraway, 1991, pp. 161-162, 209-210). Generally, these pairs indicate movement away from assumptions of a pre-existing "reality" which we seek to understand via science to construction of "realities" which we must navigate. Some of her pairs clearly implicate or suggest a transition to visual-spatial ways of knowing; depth and integrity, for example, yield to surface and boundary. Haraway's work reveals the general ways in which gender is implicated in the informatics of domination. In our work we seek to identify specific gendered aspects of the visual-spatial within these informatics.

The feminist study of science interrogates not only the findings of science *per se,* but also multiple discourses which intersect the scientific (e.g., history and sociology of science, science museums, science education, among others). Analogously, we interrogate various discourses which intersect the visual-spatial. Where gender and the visual-spatial emerge together we find that the visual and spatial are almost always associated with the masculine perspective; our purpose here is to begin an examination of those associations.

A partial catalog of associations. The social construction of woman is tied to visual-spatial requirements or representations in diverse domains of social, professional, and academic discourse. Among the fields in which feminist analysis has revealed visual-spatial rationales for negative treatment of women are medicine, the weight loss industry, advertising, entertainment, pornography, the built environment, work environments, and virtually all fields of academic study. The representation of women in scholarly discourse by visual forms, by verbal descriptions of visible female presences, and by clinical descriptions of visible attributes and problematic vision and visual ability among women have all been subject to feminist critique. Within the discourses and analyses of education, there are several important associations between gender and the

visual-spatial. The attribution of low spatial ability to females, the panoptican organization of classrooms, the portrayal of girls and women in educational materials, and the influence of engineering on these materials all mitigate against women. Moreover, Mary Belenkey and her colleagues (1986) argue that vision, a frequent metaphor for knowledge and understanding, is not an apt description for women's ways of knowing.

As we consider this partial listing of areas in which gender and the visual-spatial come together to affect women's lives, three categories of concern emerge: (1) visual representation of women, (2) visual-spatial abilities of women, and (3) rights of women to use space. In the remainder of this paper, we turn to brief discussion of issues, one selected from each of these categories.

Visual representation of women in educational materials. Feminist critique of the visual arts and of visions within the literary arts is extensive. A sampling of feminist writings on topics ranging from art history to pornography, from silent films to cyberspace, and from classical theatre to postmodern performance art reveals that visual representations are often problematic from a feminist perspective. Like literature, visual representations conform to patriarchal conventions which evolved from male projects created to be shown to other men. Various scholars have argued that women are often alienated from/by these conventions, that the adoption and adaption of conventions developed in fields of entertainment and the arts to school uses often carry bias into the classroom, and that for women (more than for men), learning to interpret visual information as intended by the materials designer can be problematic.

Discussions of this gender difference are complex. Michelle Barrett (1987) has identified three distinct locations or kinds of difference. *Experiential difference* between the sexes assumes that men and women are so situated within society that they have different expectations of the world and different experiences of it. *Positional difference* between the sexes assumes that gender is a semiotic category; that is, women and men have different locations within a discourse, and the presence of one and/or the other sex in a conversation, discourse, painting, or drama carries different meanings. *Psychoanalytic difference* is the difference (presumed) in the unconscious of persons of different genders.

Recognizing that works of art are both constructed and viewed or experienced within the larger domain of gender difference, feminist art historians such as Griselda Pollock (1992) concern themselves with these differences. Pollock and others reject the notion that a work of art is a "window on the world" with the artist "an inspired seer, a visionary, an eye." Instead, these critics adopt a semiotic view that "often involves a rejection of the prevailing ideologies of art as purely visual experience unmediated by language and social relations (p. iv)." Thus, for Pollock and for other feminist art historians, the visual arts are not "purely visual;" experiential, positional, and psychoanalytic differences between and among viewers entail differences in the visual experience of the art.

Visual representations of women and men reflect the sex/gender of the artist in that they are constructed from her/his locations on Barrett's three dimensions of difference; the experiences, position, and psyche of the graphic artist influence decisions as to what is appropriate, typical, and meaningful. Once rendered, the visual representation is "read" by various persons in ways that also vary with their locations on Barrett's three dimensions of difference. In this context, the major concern of the authors is not with the multiplicity of representations and interpretations. Rather, our concern is that, despite this multiplicity and potential for variety in the representation of women, the same stereotypical types of images emerges so frequently. The types which seem to emerge repeatedly originated in pornography where their purpose was to objectify women.

Among the visual art forms which influence the visual mediation of instruction, pornography cannot be ignored; Ann Devaney (1990) points out that pornographic codes have been adapted from hard core porn to MTV, film, and related entertainment, and from these contexts to instructional television. Multiply marked by sexual difference, these images become, not discussable forms, but "visual information." Within the school context, they are not open to the same kind of textual criticism that feminist art historians find essential for several reasons. First, they provide "the form" and not "the content" which is the subject of instruction and thus the discussable material. Secondly, the gendered differences in the viewing experience is problematic; experiential, positional, and psychoanalytic differences among students con-

tribute to differential readings of the visual material.

That these codes have been imported into educational TV programming on mathematics (Devaney, 1990) poses a potential barrier to girls' and women's math learning. We turn now to other visual-spatial factors which have been studied in relation to mathematics ability and achievement.

Mathematics, Visual-spatial Ability, and Women. Our quest for and expression of knowledge about the world we experience is conducted by means of a great deal of abstraction, supported by a system of formal education in the ways of abstract thinking and reasoning. The history of modern education can be read as a story of the exclusion of women from formal education, and the assignment of women to tasks educated men haven't wanted for themselves. Thus have women been relegated to the "private" sphere, or at least an invisible status, as keepers of the hearth, care givers, or clerical staff in the corporate world. This education/ exclusion process has involved the labeling of women as illogical, non-mathematical, and disinclined toward the scientific. Yet there have always been women actively involved in mathematics and the sciences.

In an effort to explain these phenomena scientifically, sex differences were studied extensively through the 1970s and early 1980s. Characteristics and abilities of all sorts were examined in attempts to draw generalizations about women and men and their differences (Maccoby & Jacklin, 1974). Research into sex-related differences in mathematics achievement explored and attempted to interpret the influence of several categories of variables including cognitive, affective , educational, biological, and socio-cultural factors. Among the cognitive variables, visual-spatial ability has been the topic of a great deal of speculation and investigation, particularly by Elizabeth Fennema and her colleagues.

Lindsay Tartre (1990) gives an impressive treatment of the topic in her 1990 contribution to Fennema & Leder's *Mathematics and Gender*. She begins with a discussion of the various "spatial skills" that have been enumerated, described, operationally defined, and even "measured". She names the people involved in the early development of instruments to test for each of these skills, shows specific examples of items used in assessing them, and briefly presents the results of early tests. She organizes all of this into a taxonomy of

spatial skills, the two primary divisions of which are "spatial visualization" and "spatial orientation". Spatial visualization is the set of spatial skills most familiar to us from casual references, and it is more commonly addressed in the literature on spatial skills than is spatial orientation. Spatial visualization involves the ability to mentally manipulate objects through rotations, reflections, and translations; and to mentally transform a 2- or 3-dimensional figure into other renditions of the figure. Spatial orientation involves mentally imagining oneself in a different perspective with respect to an object under consideration. The most familiar sort of task for assessing a spatial orientation skill is the "Hidden Figures Test", which is not unlike the "Where's Waldo?" activities on the Sunday comics pages. Success with this activity has been considered to be associated with an "analytic" cognitive style, or "field independence".

In separate studies of each of these variables, Tartre used four groups of subjects: girls with high spatial skills, girls with low spatial skills, boys with high spatial skills, and boys with low spatial skills. In the spatial visualization study, she found no overall difference between the two spatial skill level groups for the number of problems solved correctly, but detected some differences in patterns of behavior. In the spatial orientation study, no overall gender difference was found in the number of correct answers but two significant differences were found in how females and males solved the problems. Tartre goes on to observe that in general, spatial skill "does seem to be more related to mathematics performance for females than for males. In both of these studies, females who scored high on a test of spatial skill achieved as well as, and in some cases much better than, the male groups on mathematics achievement and measures of many other strategic variables. However, females who scored low on a test of spatial skill experienced difficulty in accomplishing many tasks involved in solving mathematics problems" (p. 57). Tartre concludes that these studies do not support the conjecture that males' greater mathematics achievement is due to possession of higher levels of skill in spatial visualization or spatial orientation; rather, these studies suggest a need for a reassessment of the the inter-relationships among sex, spatial skills, and mathematics achievement.

Other studies, as well, have failed to establish strong correlations among the variables of sex, spatial ability, and

mathematics achievement. Ann Schonberger (1990), for example, has investigated the possibility that academic areas such as physics--along with its "mechanical skills"-- may serve to filter girls from advanced study. Like Tartre, she found that existing sex differences in skills are not correlated with persistence in technical subjects; she suggests that sociocultural factors play the most important role in women's success in technical studies.

These findings do not reflect new developments, but continue a long history. Patricia Cline Cohen (1982), in her history of numeracy in the United States, points out that the abilities associated with mathematical skill have varied over time. Although today, weak performance in geometry is often thought to be associated with weak spatial abilities, she argues that "those nineteenth-century educators who claimed that geometry was impossible for women to understand would never have assumed females to be deficient in spatial relations, for that would have been inconsistent with women's demonstrated talents in constructing garments out of flat goods without benefit of patterns" (p. 8). Today, the "rote memory work" that was crucial in the eighteenth-century conception of arithmetic might be thought of as central to the "computational superiority" girls are often said to have over boys. Computational excellence, however, is today thought unimpressive by comparison with the "analytic superiority" boys are said to have over girls.

The study of arithmetic was once seen to serve the double function of commercial skill development and exercise in logical reasoning. In our own time we are experiencing a transition in which the study of mathematics serves the double function of exercise in logical reasoning, and support for scientific and technological endeavor; hence, the ability to study mathematics successfully is conceptually linked to reasoning and visual-spatial ability. Our challenge is to define visual spatial abilities and the technical endeavor with which they are associated in ways that include women and that accept women's involvement in and contributions to visual literacy and the technologies that define and utilize it. Only then will education support the full participation of women in society, a participation made problematic by cultural conceptions of women and space.

Re/mapping Women and Space in the "Information" Age. Throughout history and around the world, visual metaphors

have not only facilitated the ideological distancing of the mind from the body, but they have also facilitated the distancing of East from West, nature from culture, private from public, and female from male in our lived spatial arrangements. "The logic of the visual is a male logic," that considers "vision as a 'higher' and touch as a 'lower' sense" (Keller & Grontkowski, 1983). The spatial character of visual metaphors is embedded in much of our everyday language. For instance, we use terms such as "private and public spheres", "political circles," "low life," "high society," "close-minded," and "far-reaching." Such language characterizes the common notion that we communicate principally with our minds; however, Shirley Ardener (1981) contends that spatial positioning is another form of communicating that imposes restraints on mobility, thus shaping our perceptions of space. She refers to this as "social mapping"-- placing people in space using culturally determined rules for defining boundaries. She further contends that such mappings "exert real influence on use of space and on mental maps of women and men" (p. 28).

How we take up our worlds depends on our notions of space in the physical world and in our social reality within that world. Examining the spatial contours and borders of women's lives, and asking questions about women's access to resources and about the spaces in which women work, expose "the very clear differences between men and women, and among women" (Seager, 1992, p. 217). These queries tell us clearly that space is gendered. According to Daphne Spain (1992), the gendering of spaces also serves to "separate women from knowledge used by men to produce and reproduce power and privilege" (p. 3). This is particularly relevant for women during the current bent for mass accumulation of information; once collected, information is organized using spatial metaphors and representations. Considering women's historical spatial positioning in relation to production and reproduction of knowledge, how can women challenge, resist, and/or shape the borders of this newest form of space?

Griselda Pollack (1988) argues that with modernity there was transformation of the public world and its associated consciousness. Visible activities were relocated to invisible spaces through social stratification and urban planning. The division of the public and private spheres not only constructed a specifically bourgeois way of life, but also a

structural metaphorical map of femininity and masculinity--domestic and reproductive spaces for women, city and productive spaces for men. Pollack refers to men's position within this bourgeois space as "the flâneur," a spectator of his world, who gave an illusion of objectification and disengagement from other senses. There was no female equivalent of the flâneur; feminine, bourgeois women did go out in public space, "to promenade, go shopping, or visiting or simply to be on display" (p. 68). However, women of low socio-economic status who entered the public space to work "ceased to be women" (p. 68), and single women who ventured out alone at night were considered whores.

Now, as then, for women to enter the public space they need to "reclassify themselves as men" (Ardener, 1981), or become "one of the boys" (Wajcman, 1991). Entering male space on male terms "contributes to the devaluation of women and the concomitant reduction of their symbolic space....They must learn to manipulate male symbols....and as exceptional women... to excel at this manipulation inside the male domain" (Ardener, 1981, p. 65). Uma Narayan (1989) writes that because women exist in two spheres, they need to have "double vision," and they must not only understand the knowledge of the dominant group, but they must also understand the knowledge of their own lived experience. This multiple situatedness of women's lives becomes even more complex when intersected with class, race/culture, and sexuality. Forcing women to adapt to a world envisioned and shaped by powerful men, a group disadvantaged by needing only the knowledge of a single vision, positions women in contradiction and tension with their own lived realities.

Concluding remarks. Schools are gendered spaces. They play a significant role in producing and reproducing gendered ideological and social mappings through their production and reproduction of gendered knowledge. The underlying values, assumptions, and beliefs of the knowledge offered in schools, bear the imprint of western, white, middle-class, heterosexual, male perspectives. As discussed above, this imprint is also encoded in the spatial organization of schools, in the assumptions about the ability of women to engage in spatial thinking, and in the materials of instruction. In this age of "information," equitable production and distribution of knowledge within the gendered spaces of school is particularly problematic.

If we are to have equitable schooling, it becomes essential that the implementation of visual literacy curricula reflect the ways in which visual-spatial discourses and norms operate in the lives of all students. Designers of visual literacy curricula have long been leaders in exposing to students the ways in which television and other visual media shape understandings of the events and individuals portrayed. The introduction and proliferation of new, more interactive visual media and technologies, as well as the increasing use and importance of these in contexts of decision making and in all fields of knowledge construction, pose new challenges for visual literacy designers and educators. An important source of challenges is the gender non-neutrality of visual-spatial domains and discourses as they have been constructed to date, and as they contribute to the construction of the social environment.

Recognizing the pervasiveness and interrelatedness of gendered discourses of the visual and spatial is a first step toward meeting the challenge. The three discourses discussed above were chosen to represent very different aspects of the gendering of the visual-spatial. Yet, our brief examination uncovers their interlocking features. Each of Wallace's dimensions of sex/gender difference involved in the "reading and writing" of visual materials mirrors ways in which the spatial arrangements of society encode and create gender difference. One of the means of maintaining these arrangements over the years has been differential access to mathematics. This "critical filter" separating women from higher education, and thus from power in the public sphere, has been rationalized in terms of mythical differences in visual-spatial ability. A continuing separation of women from mathematics is supported by the use of gendered images in instructional materials. At least some of these images borrow from pornography and encode the view of the flaneur. Thus, these three examples form an interlocking network of discourses of the visual.

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