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Residential Interior Design as Complex Composition

A Case Study of a High School Senior's Composing Process

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This research analyzed the composing processes of one high school student as she designed the interiors of homes for a course in interior design. Data included field notes, an interview with the teacher, artifacts from the class, and the focal student's concurrent and retrospective protocols in relation to her design of home interiors. The analysis revealed that the object of activity in this setting included aspects of the motive (including the teacher's constructed environment and attendant expectations, the teacher's governing logic and common sense with respect to interior design, and the broader field of interior design as interpreted and implemented in the class) and both fixed and emergent goals. The student's object-related problem-solving involved a hierarchy of problem-solving decisions and employed a variety of tools in solving these problems, particularly those derived from culture, reliant on knowledge from a discipline or field, and following from images such as narratives.

Keywords: *multimedia composing; home economics; multimedia design; protocol analysis; semiotics; situated cognition*

More than 100 television programs broadcast in the United States have centered on the interior design of homes (see Table 1). The prevalence of these programs on all manner of networks—including entire networks dedicated to home improvement and abundant programming in both English and Spanish, from the United States and abroad—suggests the importance of interior design to a wide range of the public. Yet in U.S. high schools, interior design is among those marginalized subjects in the curriculum housed in vocational education or home economics, areas that are outside the core of academic courses that colleges and universities require

of incoming students. As such, they are typically viewed as intellectually unstimulating, designed for students who are not destined for the rarified world of college, and fitting only for those who are oriented to "handedness" rather than "headedness" (Goodlad, 1984, p. 142).

This relatively low stature obtains in spite of the fact that home economics has been offered in U.S. universities since as far back as 1869 (Bliss, 1953). As Rossiter (1982) argues, however, home economics faculties in higher education are accorded low status relative to faculty in other disciplines. Berlage (1998) finds home economics to be a complex applied social science that, while reinforcing traditional women's roles, additionally provides a scientific basis for domestic work. Yet the belief that courses offered within home economics—with the multiple problems of being historically a woman's domain (Waring, 1999), being an applied science rather than a theoretical field (Straussman, 2003), having a vocational or domestic rather than academic emphasis (Eckert, 1989), and relying on nonverbal rather than written texts for representing ideas (Gardner, 1999)—as intellectually unchallenging persists, its public popularity and demand notwithstanding.

In this study, we investigate the composing processes of one 11th grader, Dee, as she designed the interior of various homes for a high school class in interior design. (All names of people and places are pseudonyms; see Figure 1 for Dee's major course project). We situate this study within a line of inquiry through which we have argued for a broadened notion of composition that includes not only writing but art, drama, dance, designs of houses and horse ranches, and other semiotic sign systems through which meaning and representation are available (O'Donnell-Allen & Smagorinsky, 1999; Smagorinsky, 1995a, 1997a, 2001a; Smagorinsky, Cook, & Reed, 2005; Smagorinsky & Coppock, 1994, 1995a, 1995b; Smagorinsky & O'Donnell-Allen, 1998a, 1998b, 2000; Smagorinsky, Pettis, & Reed, 2004; Smagorinsky, Zoss, & O'Donnell-Allen, 2005).

Through this work we have found that although nonverbal modes of representation and communication are viewed by many educators and policymakers as less intellectually important than verbal (particularly written)

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Table 1
Interior Design Programs on Television

Network	Programs
ABC (including ABC Family)	*Bachelor Pad, Extreme Makeover: Home Edition, Extreme Makeover: Home Edition: How'd They Do That?, Knock First*
A&E	*Find & Design, House Beautiful, Sell This House*
BBC	*Big Strong Boys, Changing Rooms, Design Inspiration, Design Rules, DIY SOS, Home Front, Homes, House Calls, House Doctor, House Invaders, Housecall in the Country, Life Laundry, Period Style, Real Rooms, Room Rivals, Trading Up*
Bravo	*Queer Eye for the Straight Guy, Queer Eye for the Straight Girl*
Club Casa	*Abriendo Puertas, Casa Ideal, De la Mano de Herminia, Las Decoradores, De Compras, Hogar y Harmonia, Detalles, En Casa de Lucy, House and Home, La Casa de Rebeca, Pitando la Casa con Debbie Travis, Our House*
Comedy Central	*Straight Plan for the Gay Man*
Discovery Channel (including Discovery Kids, TLC, Health, and Home and Leisure Channel)	*Bob Vila's Home Again, The Christopher Lowell Show, Christopher Lowell's Wall to Wall, Clean Sweep, Design Rivals, Designer Guys, Home Matters, Home Savvy, How-2 Crew, In a Fix, Interior Motives, It's Christopher Lowell!, Lynette Jennings Design, Make Room for Baby, Makeover Mamas, Monster House, neat, Picture This, Surprise by Design, Tommy Walsh's DIY Survival, Town Haul, Trading Spaces, Trading Spaces: Boys vs. Girls, Trading Spaces: Family, While You Were Out*
Do-It-Yourself Channel	*Bare Walls, Bathroom Remodeling, DIY Decorating and Design, DIY Home Repair & Remodeling, Flooring Wall to Wall, Kitchen Renovations, Weekend Decorating, Weekend Remodeling*
Fine Living	*American Home, Before and After Decorating, Breathing Room, Dwell, Room Service, Sheila Bridges: Designer Living, World by Design*
Home and Garden TV	*American Home, Awesome Interiors, Bed & Bath Design, Building Character, Country at Home, Country Style, Curb Appeal, Date with Design, Debbie Travis' Facelift, Debbie Travis' Painted House, Decorating Cents, Decorating with Style, Design Basics, Design on a Dime, Design Remix, Designed to Sell, Designer Finals, Designers' Challenge, Designing for the Sexes, Divine Design, Dream House, Generation Renovation,*

(continued)

Table 1 (continued)

Network	Programs
	Home Time, Home to Go, Interiors by Design, Kitchen Design, Kitchen Trends, Kitty Bartholomew: You're Home, Mission: Organization, New Spaces, Our Place, Room by Room, Room to Improve, Sensible Chic, Smart Design, Smart Solutions, This Small Space, Treasure Makers, Weekend Warriors
Lifetime	*Merge*
MTV	*Crib Crashers, Cribs*
Oxygen	*Facelift, Painted House*
PBS	*Ask This Old House, Find!, HandyMa'am With Beverly DeJulio, This Old House, This Old House Hour*
Style Network	*Area, Clean House, Guess Who's Coming to Decorate, Homes with Style, Shabby Chic*
TBS Superstation	*House Rules, Movie & A Makeover*
Turner South	*Southern Home By Design*
Women's Entertainment	*Mix It Up, Everyday Elegance*
USA	*House Wars*
VH1	*Rock the House*

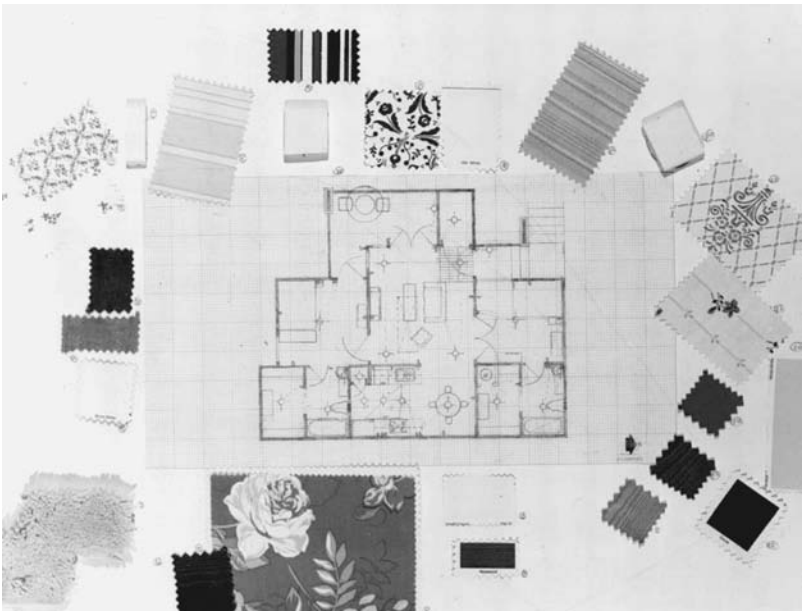
modes, they (a) often are viewed within particular disciplines as more appropriate than written expression to represent ideas, (b) typically involve general processes similar to those identified and celebrated in studies of writing (e.g., they are social and collaborative; they involve planning, drafting, revising, and other extended processes; they enable the discovery of meaning through the process of articulation; etc.), (c) can provide the potential for expressions of meaning that are not available through writing, and (d) potentially stimulate symbolic and abstract thinking at what Bloom (1956) would consider complex levels of cognition.

To understand Dee's socially situated process of composition in designing home interiors, we focus on the following questions:

1. What was the object of Dee's activity in terms of the motive of the setting and her goals within the setting?
2. What object-related problem-solving did Dee engage in as she designed the interior of a home, and how did her organization of problem-solving decisions contribute to her completion of the task?

Based on these considerations, we interrogate the low status of both home economics and nonverbal forms of composition in school. To undertake this inquiry, we adopt a Vygotskian perspective that emphasizes the

Figure 1
Dee's Interior Design



volitional, goal-directed, tool-mediated action in social context that people engage in as they produce cultural texts (Wertsch, 1991) in the form of orchestrated configurations of signs. We next outline the major tenets of our understanding of a Vygotskian perspective as it informs our work.

Theoretical Framework

A Vygotskian perspective is appropriate for our analysis because we share his fundamental concern with understanding how any individual's sense of suitable behavior—including the choice of tool for achieving an end and sign system for representing an idea—derives from experience in cultural practice in social settings (Cole, 1996). We construe a setting as that with which one stands in relation. A setting may include people, physical spaces, social groups, technologies, and whatever else comprises the mediational environment, both physical and social, for human activity. A classroom may comprise one bounded setting, albeit one with fluid borders

as its participants invoke and import mediational means from other settings with which they have experience. Any setting is thus "nested" within broader settings (Cazden, 1988, p. 198), overlaps with other settings—a classroom within a school, a school within a district and its policies, teaching and learning within various educational traditions, and so on—and overlaps concentrically with the settings that its participants have experienced.

Cultural practice refers to the shared, socially organized sets of activities that embody the direction, goals, and values of a group and provide people with scripts for participating in social action. Each cultural setting provides its participants with unique problems to solve (Tulviste, 1991). In schools, abstract problem-solving in the core classes (e.g., working on a mathematics problem through a symbol system such as a formula) is valued over the sorts of practical problem-solving activity (e.g., repairing an engine, preparing a meal) required in vocational and home economics classes, even when practical work requires mathematical application such as balancing food ingredients properly, computing the revolutions per minute of machinery parts, measuring and cutting component parts of clothing so that they are in proportion, and otherwise employing mathematics to address concrete problems.

Problem-solving action may be directed toward two types of ends, both of which contribute to what many Vygotskian theorists call the object or presumed endpoint of activity within the setting: motive and goal. The motive of a social setting refers to the broad teleological ends toward which social action is directed (Leont'ev, 1981; Wertsch, 1985), which in a school might include preparing students for college, raising test scores, educating for good character, training students for the workforce, raising literacy rates, and otherwise socializing and educating students for participation in the world beyond school. Because schools include various stakeholders and interest groups, there may be multiple motives at work simultaneously, not all of which are consistent with each other. Schools often address these seemingly divergent ends by creating separate curricula for students believed to be working toward different social futures: courses focusing on abstract knowledge for the presumed college-bound, work-oriented practical courses for those assumed to lack the intellectual or material resources needed for higher education.

The other purpose toward which problem-solving activity is directed is the more personal set of goals that individuals or groups have within this broader setting, which may or may not work in concert with the overall motive. Although one's goals may conceivably be at odds with the broader motive of a setting, more typically they are related to a cultural group's identification of and progress toward a shared destination. Indeed, the

broader motive of a culture typically suggests the goals that people develop to guide their activity within a setting. For the purposes of our research, we focus on Dee's activity in addressing her goal of completing interior designs. Presumably, her participation in this activity also is embedded in broader action toward the motive of both the school and classroom settings (i.e., to produce successful students, however defined).

To work toward goals, people employ cultural tools. The logocentric emphasis of society and schools privileges the tool of speech that Vygotsky (1987) found so important to human development. Yet, as many have argued, people both in and out of school have access to a broader set of cultural tools than language alone to mediate their thinking (Wertsch, 1991). In this expanded view, a psychological tool may include anything that mediates human action, including an artistic or graphic medium (e.g., a paintbrush, pencil, or computer program), a broader community of practice (e.g., a discipline or field of study), a set of procedures or scripts (e.g., the speech genres that govern particular kinds of talk), different types of images (e.g., a narrative of typical action), and countless other alternatives. With this potential in mind, Gardner (1983) has critiqued schools' orientation to language and logic, especially at the expense of creative cognition through the arts; Witte (1992) has argued that writing is but one of many semiotic systems through which people may fruitfully express themselves; and the contributors to Flood, Heath, and Lapp's (1997/2005) volumes collectively argue that the emerging global economy is producing communication technologies that make schools' limited reliance on writing obsolete.

A semiotic framework necessitates attention to the sign, described by Eco (1985) as a "relation or referring back, where . . . something stands to somebody for something else in some respect or capacity" (p. 176). What the sign, or configuration of signs (i.e., a text) stands for depends on how readers are enculturated to reading them; although a range of people might agree that a particular configuration of stars and bars comprises the 1860s Confederate battle flag, some might read it as an emblem of a proud heritage, whereas others might read it as a statement of bigotry and oppression. As this example illustrates, signs include "the full range of semiotic modes in use in a particular society" (Kress, 2000, p. 183), leading a host of literacy researchers to question education's exclusive emphasis on the written word as the sine qua non of suitable academic performance. Reading any sort of text requires resonance with the codes employed to produce it, such that the degree to which composer and reader are "*in or out of tune with each other*" (Nystrand, 1986, p. 74; emphasis in original) is central to any judgment about a text's quality.

Our study is designed to understand how, in the setting of this classroom, Dee developed goals and used tools to solve problems in relation to the task

of designing home interiors for given hypothetical clients. Our study inquires into the degree to which such work is evident in this student's experiences in the setting of this classroom, set in a discipline in which many assume that little of value is accomplished except perhaps the acquisition of mundane life skills.

Context of the Investigation

City and School

Data collection took place in a college town in the southwestern United States populated by about 95,000 people. The city's public school system served over 12,500 students, one fourth of whom qualified for free or reduced lunch. The school system's student population was 81.4% European American, 6.6% Native American, 6% African American, 2.6% Asian American, and 1.7% Latino/a American. Central High School was a 2-year senior high school enrolling about 1,800 students. Over 50% of graduates attended 4-year colleges, 26% attended 2-year colleges, and fewer than 5% entered technical schools or the armed services. Advanced placement courses and testing were offered in 11 areas, and students annually scored above the state and national averages on the SAT and the ACT.

Participant

Dee was a white female who was in the 11th grade during the semester of data collection. From 5th through 9th grades, Dee had taken art classes after school and on weekends in a community art center. She had taken classes in painting and drawing, saying of these courses, "It was really fun. I would get away from everything else and just paint."

At the time of the research, she was also enrolled in English, philosophy, world history, geography, and algebra II, with a stated preference for geography and interior design. In contrast, she said, "Math is not my thing." Interior design was the first home economics class she had taken since 6th grade. The course appealed to her; she said, "I figured that I would like it because it is art and I have always liked to just—you should see my room [at home]. I mean, such as the wall and interior design things. . . . I am just interested in that kind of stuff." Following graduation, she hoped to attend a technology-oriented university and major in photography with a possible second major in interior design.

The Class

Data collection took place in the interior design class taught by Rachel Chambers, a white female veteran teacher whose itinerant career included appointments at many schools. In Dee's year of enrollment, Rachel had been at Central High School for 6 years; she left for a new school in a different state 1 year later and could not be located for a member check by the time we began the data analysis. She described her class as follows:

> This class is really designed for students who have a sense of design, [have] a sense of color, and enjoy pleasing things around them. And it's not based on just academia in a textbook, but it's based on common sense, being able to move things around in space, even if it's just in your mind, which is very difficult to teach . . . I see a wide variety of students, intellectual-wise. We've got [inaudible] students who are at the lower end of the scale, we've got kids who are at the upper end of the scale and a lot of kids in between . . . I'm just hoping that more people see these kinds of classes being very constructive, and not only just coming in, sitting through a class and getting a grade, but forming some of your own ideas in how the world is to you.

To achieve her instructional goals, Rachel used a textbook, Ruth F. Sherwood's (1990) *Homes: Today and Tomorrow*, along with film strips, videos, trips to homes in the community, and ventures out to local merchants to look at materials and price them within their allotted budgets. Each day included at least one activity designed to break down the design process into tasks and help students integrate their understandings from the textbook and materials she provided such as blueprints, design layouts in magazines, and other manipulatives. The activities were typically accompanied by handouts that helped students to take notes and organize information for their own purposes. For example, one day students were learning about door styles. Rachel had the students find eight different door styles in magazines she provided, cut them out, and paste them onto a handout. The aggregated handouts helped students create personal reference books for design ideas. She also provided study guides that helped students learn appropriate symbols and vocabulary for discussing and representing design ideas.

Although home economics was viewed by many as a low-status discipline and because the students were presumed to need the school to act in loco parentis, Rachel said, "Our administrators [comprised of both men and women] put a real high rank on home economics and other areas. They feel like it's an integral part of the whole." She said that the combination of high

divorce rates and an increasingly frenetic societal pace permitted less and less contact time between students and their parents, leading to a decline in what she called *life skills* of the sort taught in home economics classes. "We are not teaching these in our homes," she said, "so we teach them in our schools." The home economics faculty thus felt ambivalent about the overall value of their own work, which Rachel characterized as both low status and a valued part of a whole education.

We view Rachel's class, situated within the discipline of home economics, as having a gendered motive. All of the home economics faculty members were women, and the class in which Dee was enrolled included 21 girls and 4 boys. We assume that in a discipline and setting so heavily dominated by women, the motive would be gendered in terms of the purpose of the work, the processes of doing that work, and the ends toward which this work might be dedicated. This gendering of the discipline was most evident in Rachel's emphasis on the development of relationships in the field of interior design (Belenky, Clinchy, Goldberger, & Tarule, 1997).

Rachel modeled a relational stance by getting to know her students as well as possible so that she could understand their perspectives in terms of their personal goals for their designs. Her assessment of students' designs was laborious: "It takes me about an hour and a half to grade some of their projects, because it is so subjective," she said. This evaluation included an effort to take on the students' perspectives; she said,

> If I were this student, how would I be feeling about this work? And I get to know them very well . . . I have to know something about their likes and dislikes to be able to help them understand why it's maybe right or wrong for me.

Furthermore, she strongly encouraged her students to collaborate with a variety of people in their execution of their designs. Rachel herself worked collaboratively with her students, circulating while they were working and consulting with students about problems they were having with their designs. She also urged students to help each other on both their course projects and exams. Rachel said,

> [My students] learn from each other a lot more than they learn from me. And they'll sit together in groups and they'll be critical of each other's work and they'll say, "Why did you do that?" And then they're explaining why. It's a learning process. It's not a matter of "Don't talk to your neighbor." This is a class where even on tests they get to converse, because the conversing is a learning process.

Rachel's efforts to connect and collaborate with her colleagues extended to the ways in which she encouraged her students to work together. For instance, the work that students did for the interior design class could potentially be part of a larger project. Students could design an entire house for another teacher in an architectural design class (see Smagorinsky et al., 2005) and design the interior for Rachel's class; the written portions of the projects could be typed in the school's business department. Furthermore, she encouraged students to go outside the school itself to make connections with local businesses or apply the principles from the class to their own homes.

During her retrospective protocol, Dee revealed her congruence with this value when talking about the most vexing aspect of interior design for her: doing calculations properly. She said, "[I'm] an invalid in that part of my life" and "totally lost" when it came to doing mathematics for spatial configurations. When asked if this shortcoming might inhibit her aspirations to be an interior designer, she replied, "I figure that if I have a really good calculator, and I'll have a few friends, I'll say that I [have] these numbers, and would you do them for me, please? I'll decorate their room [in return]." Rather than viewing design as an isolated pursuit, Dee had learned to see it as a joint activity, conducted cooperatively with clients and colleagues with whom she could exchange services and favors.

This ability to connect with, relate to, and see the perspective of clients is a key relational skill in designing a living space for another person or set of people. The designer's efforts need to fit the needs of the client; furthermore, the designer needs to be able to work collaboratively with the clients themselves. This attention to the needs of others contributes to what we considered the gendered complexion of interior design, one that Rachel overtly promoted and that Dee understood to be central to her success in the class and hypothetically the field.

The Task

The assignments toward which Dee's activity was directed were to design the interior of apartments for specified types of hypothetical clients (e.g., two college students). These projects required students to incorporate knowledge from throughout the semester in their design of the homes. The students were provided a floor plan for an apartment set in an actual complex located in the city. Within this basic design each student selected and placed furniture, oriented the dwelling relative to the sun and local geography, chose wall and floor treatments, located the utilities and the electrical

system that powered them, and otherwise planned the apartment's interior design. Rachel included constraints that would influence other design decisions. For instance, on one assignment, she specified that Dee's hypothetical clients, two female college students, had already selected a pink floral fabric for a bedspread (an accoutrement that Dee found distasteful), around which Dee needed to make other design decisions.

Method

Data Collection

Observations were made by third author Patty Reed, who visited Rachel's class each time it met from early February to early May, encompassing most of the duration of the semester-long course. Field notes from these observations helped to provide an account of the instructional context in which Dee produced her designs; they were not subjected to a formal analysis.

Rachel provided an extended interview for the first author that probed for the content, curriculum, and goals of the interior design class. This interview included questions about what she expected students to know and do, how she helped them know and do these tasks, and other questions designed to inquire into the instructional context—the goals, practices, and tools emphasized in the course—in which Dee and her classmates produced their interior designs. Like the field notes, this interview was not coded; its primary role was to help us construct the instructional context of Dee's compositions, often corroborating or enriching the field observations.

Dee provided six protocols in which she revealed her composing process. Five were think-aloud protocols (Ericsson & Simon, 1993) provided for Patty—that is, they consisted of transcripts made from Dee's articulating her thoughts for a tape recorder while working on her design plans. Rather than relying on the controlled laboratory conditions described by information processing theorists for the collection of think-aloud protocol data (e.g., Newell & Simon, 1972), Dee provided her protocols in situ (see Smagorinsky, 1997b, 1998, 2001b)—that is, as she worked during class. During these protocols, Dee would sometimes converse with Rachel or other students about her work, and Patty would at times prompt her to continue uttering her thoughts. These five protocols were of varying length, consisting of 2,490, 2,869, 1,842, 1,823, and 2,042 words. The counts are somewhat inflated in that they include the researcher's prompts, conversations between Dee and Rachel during which Rachel provided critique and

guidance, discussions of work with other students during the process of composition, and occasional digressions during which Patty and Dee built a rapport by talking about Dee's plans for the prom, her preference for country music, her recent ear piercing, and other personal matters. Each protocol was constrained in duration by Rachel's allocation of time during class and the closure provided by the school bell.

For the retrospective protocol (Ericsson & Simon, 1993; Greene & Higgins, 1994), Dee provided an interview (2,165 words) with Peter based on the series of drafts and final design plans she produced during the semester. Questions were prompted by various aspects of her drawing and ranged to related topics such as how she learned to produce drafts or parts of the drawings, what had happened during her class, how she thought as she worked, and other queries designed to get Dee to explain her process of composition as it was situated within the context of Rachel's class.

Data Analysis

The concurrent and retrospective protocols were transcribed and then collaboratively coded by the first and second authors. Our approach therefore did not employ the classic approach to reliability (i.e., one researcher coding the whole corpus of data and a second researcher, following training, coding a sample of the corpus, often 10% to 20%, at an agreement level of at least 80%). Rather, we discussed each segment and code as we worked. We thus acknowledge that our data analysis, like any, produced a socially constructed interpretation rather than any absolute or definitive account of the protocols (see Smagorinsky, 1995b; Swanson-Owens & Newell, 1994).

For coding purposes, we determined a segment to consist of any unit of text that we agreed was concentrated on a discernable or relatively discrete design decision: working on a color scheme, orienting the overall design in relation to the path of the sun, positioning an appliance, and so on. Although the finished coding system appears neat and tidy, the process of coding was considerably messier, more recursive, and more heavily negotiated than appearances would suggest. We began with a prototypical coding scheme developed in prior related studies (Smagorinsky et al., 2005; Smagorinsky et al., 2004) that provided us with general categories based on Vygotskian principles: setting, problem, and tool. Within this general framework, we looked for specific codable thinking particular to Dee's design task. Our initial coding identified a wide array of categories that we collapsed and refined over the course of the research to make for a more

manageable system. At first, for instance, we developed separate coding categories for color schemes and conventional arrangements of design elements. Ultimately, we collapsed these along with other categories into the encompassing code of design conventions.

The ultimate coding system embodied principles from our theoretical framework, modified in relation to the content of the protocols and our research questions. Our goal with the research was to understand how, within the context of the interior design class, Dee composed her text (i.e., her drafts and completed interior designs). We identified three general types of codes to help us understand her composing process: the setting that served as the social context in which Dee learned to use the tool, the problem to be solved through and attendant to text production, and the tool employed to solve goal-oriented problems. (See Table 2 for the codes and frequencies for each major category we outline next, along with examples of each code.) We next describe each of these general categories and their various subcategories in greater detail, listing specific frequencies of each untabulated referent within each category parenthetically.

Setting

We coded Dee's protocols for the setting of her cultural practice to identify social networks, particularly as they provided her with both formal and informal knowledge about how to compose her text.

Formal. Formal knowledge described the kind of academic instruction Dee received from teachers, including both her interior design teacher (Rachel) (51 instances) and her art teachers (4).

Informal. Dee's informal knowledge (i.e., that learned incidentally through everyday activity rather than through formal instruction) included Dee's current lifestyle and the knowledge this lifestyle afforded (11) and her transactions with or observation of peers during class (1).

Problem

Coding the protocols for the kinds of problems Dee was attempting to solve was central to our analysis. We identified eight categories for problems that Dee attempted to solve in producing interior designs. To create the category names, we used either language employed in Vygotskian analyses, descriptors that we agreed were appropriate, or terms found on

Table 2
Codes, Definitions, Examples, and Frequencies

Code	Definition	Example	Frequency
Setting			
Formal	Academic setting	"There is a worksheet on the common blueprints and there are architectural symbols and plumbing symbols and electrical symbols. Like what kind walls and stuff like that."	55
Informal	Knowledge from experience rather than instruction	"At my house, we have things back there—plants—it's just more room."	12
Problem			
Affordances/ constraints	Elements that allow or limit new action	"I'm going to put [lights] in all four corners because the skylight is just right there in the middle."	37
Furniture	Movable objects in a living area	"Okay, now to start on the living room and do my furniture arrangement. I don't know where I am going to put my tables. I am going to put my TV on the south wall, and north is that way. I need something that I could pull off and say it's an entertainment center. Good, good."	22
Human aspects	Attention to how a client will experience the living area	"If somebody was backing out of that table and backing out of the peninsula, they'd run into each other and so much for their work through. That's kind of too trafficy so I'm going to try to make this one not as trafficy."	25
Infrastructure	Permanent or unmovable aspects of the living area	"I'm trying to figure how 11 feet can be separated between three supporting beams."	96

(continued)

Table 2 (continued)

Code	Definition	Example	Frequency
Living space	Rooms or designated areas within the living area	"They are going to be fixed windows except for the ones in the bedroom, those are going to be double hung with ranch window in between them."	70
Spatial relations	Distances and proportions between or among objects	" I am still working on the light in the living room in there. I am just going to get them hooked up to switches and I will hook them up to the same switch. It is going to look very crowded when I finish."	122
Task	Designated work to be completed	"We're supposed to get everything done like orientation—like which direction it's going to face."	48
Visual acuity	Issue related to the appearance of the design	"There's outlets and there's a sink. Looks like one big blob."	26
Tool			
Concrete	Material used in production of design	"[We drew] on the velum paper. [A friend] told me that in drafting they have one [page] for the layout, the spread of the house, where the rooms are. Another [page] for the electrical."	16
Representational	Symbol used in production of design	"There is a worksheet on the common blueprints and there are architectural symbols and plumbing symbols and electrical symbols. Like what kind walls and stuff like that."	58
Schematic: Culture	Knowledge of particular information or practices used within	"It is not a U kitchen, it is a corner kitchen."	60

(continued)

Table 2 (continued)

Code	Definition	Example	Frequency
	given groups of people with common goals and means		
Schematic: Field	Knowledge of particular information or practices used within a professional or academic discipline	"Now I am drawing my kitchen triangle. The max is 21 feet. Three squares equals one foot. I am measuring my kitchen triangle and I was going to count my squares but it does not work that way. So I am going to get a ruler. Now we have something to measure with. I think a fourth is equal to—oh, I'll get it in a minute. Okay, the kitchen triangle is supposed to be 21 feet, right?"	45
Schematic: Image	Mental map or narrative invoked to visualize how a living space will be used	"A large [sink], one tends to put more dishes in there. So maybe someone will do their dishes more often [with a smaller sink]."	46

the websites of Interior Design programs at universities. The categories, and codes within them, are as follows.

Affordances/constraints. Affordances and constraints are the non-negotiables of the built environment. The size of a wall, for instance, would suggest how many electrical outlets were appropriate; or the placement of a built-in feature would determine what could and could not be placed around it, depending on how the space would be used. Affordances and constraints included enhancement (a beneficial circumstance—e.g., the way a skylight admits enough light so that artificial lighting is unnecessary; 1), functional pragmatism (choices based on what is needed and not more—e.g., limiting the size of walking lanes in a room so that they are distinct from open spaces; 18), materials (the substances that furniture, wall treatments,

etc. were constructed from; 5), obstacles (permanent or designed features that must be designed around; 11), and orientation (the domicile as situated with respect to the path of the sun; 2).

Furniture. Furniture described any moveable objects that played a role in activity in the home. Furniture included accessories (supplements to larger pieces—e.g., pillows; 2), bar (7), bed (1), bench (1), entertainment center (1), musical instrument (2), pool table (4), sofa (1), table (1), and television (2).

Human aspects. Human aspects described facets of design that took the client and his or her needs into account. These included care for comfort/needs (attention to the client's comfort in occupying the home; 17) and professionalism (direct attention to the hypothetical client's needs as a customer; 8).

Infrastructure. Infrastructure codes described the basic framework or permanent installations for the design. These included cabinets (8), counters (5), doors (15), ducts (1), electricity (8), ceiling fan (1), fixtures (3), floor treatments (3), large appliances (14), plumbing (7), skylight (3), stairs (1), storage (7), support beam (1), utilities (1), wall treatments (5), walls (2), and windows (11).

Living space. Living spaces described the rooms that were included in Dee's designs. These included the bathroom (12), bedroom (4), deck (1), dining room (3), entry (2), kitchen (27), living room (19), and whole space (2).

Spatial relations. Spatial relations referred to the ways in which Dee configured space to accommodate people's negotiation of the premises. Spatial relations codes included dimensions (the lengths, widths, and other measurements of spaces and objects; 25), layout (the overall positioning of furniture and infrastructure in given areas; 14), proximity/logistics (the distances between and relative positioning of furniture and infrastructure in given areas; 39), scale (the size ratio of a real object and its referent on Dee's drawing; 14), spatial efficiency (the economy of space and movement within a living space; 16), symmetry (balance between corresponding areas; 4), and traffic flow/circulation (movement of people within given spaces; 10).

Task. Task codes described Dee's decisions in relation to the task provided by Rachel. These included drawing detail (her graphic fidelity to the objects she drew; 14), problem-solving hierarchy (the order in which Dee

determined that problems must be solved to complete her design; 25), and revision (changes made to her drawing; 9).

Visual acuity. Visual acuity codes referred to the visual attributes that result in a sharp and clear image and design. These codes include color (11), lighting (5), line (3), pattern (4), and texture (3).

Tool

We identified three types of tools in Dee's design work: concrete, representational, and schematic. Of these three, schematic tools figured most prominently in our analysis.

Concrete. Concrete tools are tangible instruments used directly in production. In producing her design, Dee used a calculator (1) and drafting tools (e.g., graph paper, vellum paper, ruler; 15).

Representational. Representational tools, like concrete tools, are material (assuming that spoken words are in a sense material). However, a representational tool is symbolic—that is, it refers to something other than itself. For Dee, representational tools included the assignment (39), a blueprint (1), drafting symbols (14), neologisms (i.e., words she invented such as *tile-ish* for a floor treatment; 2), and specialized vocabulary (i.e., words specific to interior design such as *U-kitchen;* 2).

Schematic. Schematic tools are more abstract than concrete or representational tools. They serve as broad mental codifications of experience or knowledge. Not only are schematic tools intangible; it is possible that one is not even aware of their mediating role in activity. A genre of activity, for instance, is not tangible and possibly can influence cognitive development in ways not recognized by participants. We found three subcategories of schematic tools: cultural mediators, fields, and images.

1. Cultural mediators: We identified three categories as broad cultural mediators: *aesthetics* (Dee's beliefs about what is beautiful or pleasing in the design; 23), *design conventions* such as color schemes or structural arrangements such as the kitchen triangle (relative locations of the refrigerator, sink, and stove; 33), and *logic* (a specific term used by Dee to justify her decisions; 4).
2. Fields: Dee drew on a variety of disciplines or fields to produce her drawing, including climate/geography (2), earth science (1), electrical

engineering (1), geometry (16), graphic design/drawing (2), and mathematics (23).

3. Image: Schematic tools included two types of images based on Dee's personal experiences. One was a mental image or mental pattern of a design decision that we categorized as *mental maps* (22). We coded a second type of image as *narrative* (24); these were the stories (however brief) that Dee produced to imagine how she would live in the designed space or how someone would move about the premises and thus how the interior should be designed.

Example of Coded Text

We next provide a sample from Dee's retrospective protocol to illustrate how we coded her transcripts:

> In my house, the refrigerator—you walk into the kitchen and someone opens up the fridge, you get your head knocked off—someone opens up the fridge or someone opens up the [freezer door] and I hate crawling under that thing every day so I put it up against the wall so I didn't have to. I really didn't put it [there]. Like, the handle—it's going to go out that way and not that way because if you put it out that way, it goes into the window and will cut off someone.

We treated this segment as a unit of codable text because all decisions concerned with a single overriding concern: how to locate the refrigerator within the design plan and orient the handle so that the door would not impede one's passage through a traffic lane. Within this overall concern, we identified seven problems. One was the affordance or constraint of the obstacle that the door would create if hung improperly. Dee was also aware of the human aspects: care for comfort or needs problem that she needed to resolve in terms of keeping the open door from blocking traffic. She had to design the layout with attention to two aspects of the infrastructure: the large appliance of the refrigerator and the window. All of these decisions came in the context of designing the living space of the kitchen. Finally, Dee needed to solve problems related to spatial relations: the proximity and logistics of the refrigerator relative to the traffic lane that passed in front of it and the traffic flow and circulation of people walking around in the kitchen. The setting in which she learned about these problems and how to resolve them came in the informal arena of her lifestyle in her parents' home. To address these various problems, she drew on the

schematic tool of her narrative about having to duck under the door in her parents' kitchen.

Results

Our results fall into three major categories: the role of the field of interior design as a mediating tool in Dee's designs, the analytic dimension of designing the interiors of homes, and the design processes that Dee employed to compose her representational texts.

Field of Interior Design

Rachel's class was situated within the broader field of interior design. Like any design field, interior design includes a variety of approaches (postmodern, Victorian, Cape Cod, southwestern, minimalist, country living, etc.). The southwestern location of the city appeared to suggest particular types of designs for its residents' homes; we found no postmodern architecture in the city's neighborhoods, for instance, and the one new development featuring Tudor-style homes appeared to our sensibilities to be decidedly out of place amidst the brick stylings popular for their durability in this region that is prone to severe storms and tornados. We next outline what we saw as the broader mediating role of the field of interior design in Dee's work, particularly in her employment of design conventions and her use of what she and Rachel called logic or common sense.

Design Conventions

Rachel emphasized the importance of particular concepts that any designer needed to take into account, what she called basics and what we considered to be design conventions: "line design, color, proportion, a sense of rhythm and balance in a room," which the class then applied to various design problems. These basics included such standard design features as the kitchen triangle, which positions the refrigerator, sink, and stove as the critical three points in the kitchen to which everything should be arranged in relation. Carter (1998) describes this construct as follows:

> The sink, refrigerator and the cooktop represent the most used centers of activity in the average kitchen. The efficiency of a worker in the kitchen is

> drastically reduced if these activity centers are spread far apart. . . . All kitchens contain invisible throughways. These are the connecting routes between other rooms and doorways. A collision on these high-speed highways involving a kitchen worker walking with a hot pot of water and an express child or teenager can be disastrous. For this reason, no single leg of the work triangle should cross these invisible pathways. (Carter, 1998)

The kitchen triangle, then, embodies a number of design problems that we variously coded as functional pragmatism and several categories within spatial relations: dimensions, layout, proximity/logistics, spatial efficiency, symmetry, and traffic flow/circulation. This attention, along with the mathematical computations required to position the large appliances involved in the triangle, are evident in the following excerpt from a concurrent protocol. Dee had begun working on her kitchen triangle when Rachel stopped by to check on her progress. Rachel's and Dee's references to "the max" describe the maximum cumulative length of the three sides of the triangle.

> Rachel: Don't forget when you do your kitchen and bath tables, you need to put the kitchen triangle in and measure it.
> Dee: Okay.
> Rachel: Just make a note of the dimension down here because you are going to do a description later.
> Dee: Okay. 21.
> Rachel: 21 was max.

After making some decisions about lighting, Dee returned to this problem:

> Dee: Now I am drawing my kitchen triangle. The max is 21 feet. Three squares equals one foot. I am measuring my kitchen triangle and I was going to count my squares but it does not work that way. So I am going to get a ruler. Now we have something to measure with. I think a fourth is equal to—oh, I'll get it in a minute. Okay, the kitchen triangle is supposed to be 21 feet, right. . . .
> Rachel: Just go back and measure the line and measure all three sides together.
> Dee: Okay, thanks. Okay, that's 16 feet and that's not bad.

With the kitchen triangle located—the primary decision in what we coded as a problem-solving hierarchy—Dee could move to the next level of design around this fundamental location of critical, related appliances. Although concerned at many levels with appearance, interior design also emphasizes the functionality of a living space. In following design conven-

tions such as the kitchen triangle, Dee employed a set of procedures for insuring that key areas of a dwelling allowed for predictable usages that could serve typical inhabitants well: those whose kitchen usage followed the cultural practices of most members of Western societies.

Governing Logic or Common Sense

Dee's design proceeded within the framework of what Rachel considered to be commonsensical, axiomatic, and logical. Rachel said, "I use the word *common sense* a lot in this class. Now, I don't know how you can develop that either. But I always say, come on, use some common sense." In previous related work at this same school site (Smagorinsky et al., 2005), we have argued that common sense is a cultural construction rather than an absolute, universal value of what makes sense in the world. Dee's thinking about interior design was thus mediated by a cultural construction about what makes for sensible design.

Both Rachel and Dee referred to this value throughout the research. During one of her concurrent protocols, Dee said,

> I am going to put three [electrical outlets] over by the sink, not the sink, but three over in the bathroom. Just logical places to put them. Like in the bedroom, I might have like one on every wall because I know in my bedroom, you have to stretch a cord really far in order to get to the nearest one. I don't want these people to go through that sort of inconvenience . . . I'm putting the ones in the bathroom. I'll put two in there. I think that's about it. You don't really need more than just two. Then in the bedroom, I'll only put like one on every wall, like in the center of every wall. If I knew where my bed was going to be I would arrange it to where they would be at the bed tables, but I can't do that because I don't know what that's going to be. I just put in the logical place.

We infer that the logical place Dee sought was one that served the pragmatic purposes she determined for the room without creating unnecessary features such as too many outlets for the activity she envisioned. She helped to arrive at this logical arrangement by generating a narrative of how a discommodious installation would interfere with telephone usage.

Dee's notion of common sense or logic included the design principle of what we coded as functional pragmatism (i.e., a choice based on what is needed and not more). Rachel's sense of governing logic encouraged students to use space, appliances, and other features prudently within their goals for their room's functions. This code appeared consistently in Dee's protocols,

suggesting that she had internalized and understood the importance of sizing her dimensions according to the needs of people in relation to their built environments. Often, these codes appeared when determining the traffic lanes within rooms, as in the following excerpt from a concurrent protocol:

> Dee: I'm trying to figure out like walking spaces and stuff like that. That's perfect.
> Patty: Walking space in the living room?
> Dee: Yeah, three feet is enough, you know, to be comfortable. You would not want any less than that.

Decisions such as this one illustrate the attention Dee needed to pay to providing for needs within available space, a spatial consideration in configuring virtually any structure for habitation. As these excerpts illustrate, Dee continually employed the field of mathematics to determine the placements of elements in relation to one another. Not only did she have to calculate dimensions and distances; she also needed to envision through the image of the narrative how people would use the premises for important aspects of domestic life: cooking, cleaning, storing, communicating, and moving comfortably through traffic lanes without committing unnecessary space to them. This sort of applied use of mathematics, as we have noted, was not valued enough within the institution for interior design to count as a core mathematics course. Rather, her extended nonverbal text, which involved the synthesis of a range of types of knowledge from both academic and experiential sources and the representation of information through cultural symbols, was regarded as appropriate to a discipline that largely enrolled the school's lowest status students, those not bound for college.

Analytic Dimension

During her interview, Rachel said, "Home ec has always been like my cohorts say, basket weaving," a term of denigration suggesting that her discipline, like others that rely on nonverbal text design and production, requires little of the intellect. She made this observation, we inferred, with some sense of ambivalence: She was aware that many people in schools and society feel that Home Economics is a fluffy field, yet at the same time described in detail the difficult analytic work required for effective designs. She noted that "I've taught kindergarten, first and second grade, and other areas other than home economics, so I know how other people perceive home ec, but I hope that the intellectual, so to speak, is not necessarily thrown out the window." She said of her course,

> I try to hit all the facets. Whether it be manipulating materials, the written word, watching videos, or field trips, moving our own physical furniture around in a classroom, using three-dimensional furniture that we have, you know, making models, all kinds of things. We do go over some real basics about how styles, and it's not just about interiors, but if you don't know anything about exteriors, you probably don't know about interiors. So, we start off with an exterior view of the house, and really pick it apart and tell why these features are important, and why it's pleasing to their eye.

She described what this cognitive work might entail, including the incorporation of disciplines from across the curriculum in the effective design of a living space:

> We even go through a cost analysis at the end. What would this house cost you if you were to build it in [this city]? How much would a lot cost you if you wanted to build it in [one subdivision] versus [another]? And they have to go investigate those things. It's not up to me to do that. They may estimate their house to be costing out at $50 a square foot, but that's without furnishings, and then they have to think about, you know, what we're going to put in this house, how am I going to furnish this house, when to landscape it, and how do I make this a physical dwelling that I'm going to be pleased with, not just a room.

Dee's protocols illustrated this cognitive complexity in her interior designs in a variety of areas. For instance, one of the apartments that she designed came with the fixed element of a skylight in the center of the living room. "Normally," said Dee during a concurrent protocol, "I like to have a fan in here, you know, but I guess I won't. I mean, there's enough doorways and stuff. There's doorways outside, there's windows to the outside and that will create some circulation." Her attention to air circulation required that she understand not only the comfort provided by moving air but how to achieve this effect in the absence of a ceiling fan.

The skylight in this example illustrates the ways in which Dee and other students needed to design around given elements, not only "distasteful" choices of the client such as the pink bedspread but fixed elements in the design. At times, these given elements did not allow for an easy alternative design. While configuring a kitchen, for instance, Dee found that the location of the freezer would inevitably prove troublesome for people walking into the kitchen:

> The door swing is not wide enough. I could make it that tall . . . That's wide enough. What really annoys me though is that they put the fridge right there. I mean it's just going to open up and I know somebody will come out of the door and immediately turn left to get into the fridge and then they're going

> to run right into the freezer. That's why I always keep our fridges in the corners and stuff so nobody will run into them.

Such decisions, informed here by her brief narrative of a person rounding a corner into an obstacle, typically involved the configuration of space to account for traffic flow and related problems, drawing on what Gardner (1983) calls spatial intelligence. Dee often employed what she believed was her limited ability in geometry, as illustrated by her design of kitchen triangles and the measurements it required. Dee also appeared to use a more intuitive sense of geometry to locate elements in relation to one another. For instance, while designing a kitchen, she needed to locate a cabinet in relation to the refrigerator, but realized while working out a mental map of the design that her original idea would not work:

> I am going to put like a cabinet in the corner right here and put like one of those lazy Susans in there. If I can without taking away . . . space. I don't think I can. It has to be real short. If I make the cabinet where I want to put it, then it is right in the fridge so I guess I will turn the fridge around.

This decision came not through a computation but by envisioning, with the aid of graph paper, a mental map of what the elements would look like and how they would function in practice.

Dee drew on both mental maps and narratives to inform her design. As we have illustrated, she frequently used narratives to help her configure space for a good traffic flow. During one of her a concurrent protocols, she was designing an L-shaped area in the kitchen with a peninsula and said,

> You can get tangled up. If somebody was backing out of that table and backing out of the peninsula, they'd run into each other and so much for their walk through. That's kind of too traffic-y so I'm going to try to make this one not as traffic-y.

Such brief narratives occurred frequently throughout her design process, helping her to simulate how the home would be used and thus produce what she understood to be a logical design.

Dee also used her knowledge of different materials to make other decisions about how to configure space. She attended to the path of an opening door on many occasions, not just appliance doors but those opening between rooms. Hanging doors so that they do not block pathways makes negotiating the premises much easier and more convenient. By employing

different designs, she used doors for a variety of purposes in conserving valuable space. During one concurrent protocol she said,

> Dee: I'm putting a case door right there because you really don't need one. I'm going to put one of those pocket doors right there because those are pretty nice.
> Patty: Why are you using that door?
> Dee: The pocket door?
> Patty: Uh huh.
> Dee: Well, I mean it's real easy. It doesn't get in the way. I mean you could like have a cabinet. . . close right there. I mean it doesn't get in the way. I mean any door, if I had one door open that way and one door open that way, that person's just going to sway right through there. That's going to harm him.

By choosing a pocket door—one that slides into the wall rather than opening into the space of the room—she resolved a problem common to homeowners: how to provide separation between rooms without occupying room space and blocking traffic lanes when the doors are open. Furthermore, she produced a text that used appropriate symbols to represent in cryptic fashion the host of ideas that she expressed verbally for the concurrent protocol. Her design thus embodied a great deal of thought and decision-making—the use of design symbols for appropriate elements, narratives about functionality, measurements and calculations to create proper dimensions, knowledge of materials and different sorts of accoutrements, and much else—through the elegant text of the interior design drawing. We infer that the relatively hidden nature of her cognitive work in producing this drawing contributes to the belief in school institutions that such texts lack the complexity of written texts. Yet a written text would undoubtedly have proven too verbose and would unnecessarily complicate the efforts of a knowledgeable reader—one in tune with the conventions employed—to be of value in the commerce among designer, client, and builder for whom the nonverbal text sufficiently represented the ideas appropriately.

Design Processes

Goal Formation

Dee worked toward both predetermined and emergent goals during her designs. Predetermined goals were often set by the assignment: to design a domicile for a given client with particular nonnegotiable elements in place. At the beginning of one day's concurrent protocol, for instance, when asked what she hoped to accomplish for the day, she said,

> We're supposed to get everything done like orientation—like which directions it's going to face. Kitchen. I've got to finish up my kitchen. I've got to figure out what kind of doors. I'm going to put like faucets, and tomorrow we're going to do furniture arrangement unless I can put it in today, and I doubt I can.

In trying to meet these goals, Dee often generated new goals during the course of her design process. For instance, while designing the living room of one apartment, Dee wanted to include both a pool table and a bar. The bar needed to be designed so that it did not interfere with the pool players' bodily positioning and cue stick manipulation while using the table. Dee needed to arrange the elements so that her hypothetical clients would be able to access the bar and play pool at the same time without colliding with each other; in essence, she needed to resolve a problem of spatial relations similar to that involved in arranging a kitchen triangle. During a concurrent protocol, Dee said,

> I am going to put, like, a little miniature fridge back [behind the bar] and stuff like that. So I am going to move the pool table . . . I might put it right there. Yeah, I am going to do it that way. That gives them a walking space and shooting space. . . . Oh, I just realized something. Somebody walks through it, they will walk right through a game—not good. . . . If someone walks through there, someone is going to stick a pool stick right in their face, and that would not be nice. Maybe I can just make my bar shorter. A place to put the pool sticks and stuff. Right there.

This development of a goal while working illustrates the way in which, within the broad guideline of Rachel's commonsensical emphasis on functional pragmatism, Dee made a number of emergent decisions that helped her to identify and clarify her goals for the project. Rather, then, than having all of her goals clearly in place prior to designing, Dee worked within a broad set of principles that became clarified for her as she made each new decision, adjusting and sharpening her prior goals in terms of new configurations and new understandings of the consequences of those configurations.

These new goals were often shaped by her use of imagaic tools, particularly narratives. In working out a new spatial arrangement, she would often invoke a narrative—a refrigerator door blocking a key traffic area, a pool player hitting a passerby with a cue stick—that would help her to envision the room's functional uses such as traffic flows. Her kitchen design in one apartment, for instance, included the following decision during a concurrent protocol:

> If I put anything in there, it goes into the walk-in space, and I hate that because I don't want to walk into the kitchen at 2 in the morning. I'm tired and I'm hungry and I just go in a straight line.

Her own nocturnal foraging experiences led her to design her hypothetical client's kitchen to allow for unfettered somnambulism, a value that she inscribed in her design.

This decision came about during the process of design in response to a problem that followed from prior decisions, and thus required her to identify and solve this problem to move ahead with her design. Dee thus combined formal principles learned from Rachel (e.g., the logic of spatial efficiency) with images generated from her experiences in the world, the sort of interplay between scientific (formal and academic) and spontaneous (originating in everyday experience) conceptual fields so important to Vygotsky's (1987) notion of concept development.

Problem-Solving Hierarchy

Rachel taught her students to employ a problem-solving hierarchy in doing their designs—that is, deciding what they should design first was prerequisite to other decisions, then identifying a second priority, and so on. Rachel provided the students with handouts that helped them identify their most important, least negotiable decisions so that they could proceed with minimal wholesale revising in producing their designs. Rachel's approach was evident during a concurrent protocol when Dee was designing a bedroom and realized that her walk-in closet was too large, intruding into the room's traffic lanes. She asked Rachel to look at her design, and Rachel began by looking at Dee's overall plans:

> Rachel: You are ahead of yourself. Where is your check sheet? So you are done with your walls, exterior and interior. That's right, and you are doing your door swings next. You have a couple of your doorways here, but this is not wide enough, 1, 2, 3, 4. That is a little overfit for that door. Look on the backside of your check sheet. There's some standards written in here. Front door is about 3 feet wide, all your other doors will be about 2 and 1/2 feet wide. Most of your windows will be about 9 squares.
>
> Dee: There is one window there and one there.
>
> Rachel: And there is one over here in this bedroom. But there is none across this back. So that tells you that these areas where there is lots of moisture will need exhaust fans. Especially when they are that close to a closet because a lot of these only have cased openings into the closet or that is not a division, maybe a louver door but sometimes no more than that. So you have lots of steam buildup here. What does it do to closets?

Rachel's approach to Dee's dilemma was to make sure that she was following the recommended problem-solving hierarchy. Once she was certain

that Dee had made the primary decisions first, she began to consider other prerequisite decisions that Dee needed to make with respect to her door sizes and swings, such as determining the necessity of exhaust fans because of the high moisture levels in this part of the house. The duct work required for these fans would set the terms for the next decisions that Dee would need to make to situate her doors properly. All of these decisions needed to come prior to Dee's efforts to resize the walk-in closet. Later during this conference, Rachel said,

> Rachel: So we are going to have to take out this wall and move it back in. So you didn't mess up very bad. Just a little bit. Make that a question mark there. So you are going to fix that wall, go back and put doorways and windows in and then we will talk about your other things. Now what is your next thing?
> Dee: Uh, doors, windows, orientation.

Here Rachel scaffolded Dee's sequence of problem-solving, asking her to identify the next series of steps she should take in designing this interior.

We found Dee employing a problem-solving hierarchy on subsequent occasions 24 times during her design process, suggesting that she had learned it at the conceptual level. During a concurrent protocol, she said, for instance, "I always start with the kitchen first. Easiest one probably." Her approach following this global decision was not always systematic or rational; at one point during a concurrent protocol, she said, "I bounce all over the place. I went from doing doors, now I'm doing my hearth. Oh dear."

Yet she also gave evidence of adopting Rachel's approach of solving problems in order of most essential and permanent to most flexible. During a concurrent protocol, she and Patty had the following exchange:

> Dee: Right now I am just doing the walls and stuff.
> Patty: Do you have to draw double lines to show that that is a solid wall or something?
> Dee: Yeah, there is an inch, there is like a square that is 3 inches or so to give way for insulation and plaster and stuff like that. There are not many windows in here. I don't like that.
> Patty: You like windows too, don't you?
> Dee: I love windows. I might have to change that. Now, I will have to figure out where doors and stuff go. I wonder what the measurements are on it.
> Patty: So the doors and everything have to be the exact size of the floor plan that's been given to you?
> Dee: At least I am trying to do it that way. It is kind of hard but, at least this will give me an idea of how much space there is.

This excerpt illustrates Dee's incorporation of a problem-solving hierarchy into her design. For this room, windows—ordinarily a higher-order decision—were less of a concern because the room she was given included few windows, an arrangement that Dee disliked and hoped to change. Given this design, however, she next moved to situating the doors, whose placement would determine how she could arrange other design elements.

Discussion

Student: It's time for the bell.
Dee: Really?

We found this sort of exchange at the end of several of Dee's protocol sessions: Dee was so engrossed in her work that she was surprised to learn that it was time to quit for the day. We considered these data to be suggestive of what Csikszentmihalyi (e.g., Csikszentmihalyi & Larson, 1984) calls a flow experience, one in which ability and challenge are well-balanced and the learner becomes so engrossed as to become unconscious of the passage of time.

Other data collected across this school's curriculum suggest that the object of activity in Rachel's classroom was different from that found in many of the school's academic core classes, possibly accounting for the presence of such flow experiences in the otherwise "flat" (Goodlad, 1984, p. 108) environment of school. The English Department, for instance, was for the most part committed to a cultural heritage model that emphasized the teacher-directed study of canonical works of American and British literature. History classes observed were taught through lectures and tests on textbook material. In contrast, Rachel said,

> I have students that do not excel in [their other] classes, but do excel in this class. And I'm very aware that the reason that they may excel in this class versus another class may be their level of interest. Or their level of self-motivation.

The common presumption is that a home economics class allows for success because it is easy and undemanding. Our study of Dee's process of composition suggests that such a judgment is facile and uninformed. Rather, we see Dee's tasks in this interior design class as complex and challenging. She had to learn formal knowledge from Rachel and her various instructional texts about not only terms but the constructs that they implied. She needed to resist her predisposition to bounce around the design process and follow a systematic

problem-solving hierarchy appropriate to designing home interiors. She had to synthesize knowledge and procedures from across the school curriculum, particularly understandings from mathematics and geometry, to achieve an appropriate sense of proportion and to design for an unencumbered flow of traffic. She benefited from incorporating knowledge from personal experience with formal knowledge from the classroom in making design decisions.

Within a general set of guidelines and constraints, she had to design a home interior that functioned with a great degree of economy: passageways needed to be wide enough but not too wide, outlets needed to provide enough electricity to power all devices without cluttering walls unnecessarily, doors and windows needed to open without blocking traffic areas, kitchens needed layouts that allowed for traffic while preserving functional routes among the three primary appliances, and so on. This activity needed to be responsible to general goals and, more broadly, to conventions governing most approaches to interior design; it also needed to account for givens in both the structure and in a hypothetical client's tastes. At the same time, the task was open-ended at the outset, allowing for infinite interpretation and execution; and it required Dee to be able to recognize when something was wrong with a design and subsequently to revise her goals and strategies during the process of composition.

In many ways, the design work evidenced by Dee in Rachel's class is out of the mainstream of education in U.S. classrooms. Unlike much teaching and academic performance in core academic classes, or the sorts of performances required on high-stakes measurements of achievement, her design work incorporated an array of types of knowledge through a collaborative, well-scaffolded process. The work was flexible and open-ended within the parameters of the general design task. Her design took place in an area of the curriculum often dismissed as involving *women's work*—a derogatory term as we understand it—and involved continual applied mathematics and a highly analytic approach in the context of a relational approach. Her whole range of activities was both domestic and yet out there in the world because the students had to make excursions to examine fabrics and other materials in local stores. Dee's designs required an extended process of composition informed by feedback from peers and her teacher and were shared with audiences (particularly peers) beyond her teacher. Such qualities are often among those lauded by composition researchers and theorists as central to a strong writing program.

The graphic symbol system enabled additional communication that would be relatively cumbersome if entirely written. The design symbols, for instance, conveyed considerable information to a well-schooled reader of the graphic text, relating not only the placement but also the style of windows, furniture,

and other elements. The spatial configuration of the elements in relation to one another was both informed by movement (e.g., the narratives that Dee drew on to inscribe particular types of activity within the dwellings) and in turn suggested optimal paths of movement about the premises. The drawing also suggested the physics of the homes, even if they could not be depicted—the issue of air circulation, for example, which was not represented in Dee's drawing but inferable from the locations of doors and windows in relation to the layout's orientation. An interior design text, then, through a relatively spare medium, can present a tremendous amount of complex, dynamic information to a reader conversant with the codes of the symbol system.

In previous work (e.g., Smagorinsky, 1995a), we have argued that the notion of writing across the curriculum ought to be reconceived as composing across the curriculum to account for the limits of writing and the appropriateness and potential of other symbol systems in some disciplines. What counts, we believe, is not so much that all texts should be written but that teachers should enable students to engage in a process of composition: one that allows learners to engage in extended activity that requires the synthesis of knowledge that they embody in culturally-valued and useful texts through appropriate sign systems. We see Dee's design work substantiating this argument by documenting her experiences during her semester in Rachel's class. We find it ironic that such performances tend to be undervalued in the educational realm, in spite of what we have demonstrated to be their complex demands. Meanwhile, national news stories, administrators' and teachers' reputations and salaries, local real estate values, and other precipitous consequences follow from students' performances on the multiple-choice items that make up standardized tests and the five-paragraph essays that comprise the writing assessments in many states (Hillocks, 2002). Like the sorts of complex authentic assessments described by Darling-Hammond, Ancess, and Falk (1995), interior designs appear to be too involved, sophisticated, and laborious for the national palate when it comes to evaluating the performances of students in school. Based on Dee's experiences, we would argue that the nation is the poorer for this preference.

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