Teaching creative thinking: how design professors externalize their creative thinking in studio classroom talk

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To cite this article: R. Keith Sawyer (2021): Teaching creative thinking: how design professors externalize their creative thinking in studio classroom talk, Mind, Culture, and Activity, DOI: 10.1080/10749039.2021.1893337

To link to this article: https://doi.org/10.1080/10749039.2021.1893337

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Teaching creative thinking: how design professors externalize their creative thinking in studio classroom talk

R. Keith Sawyer

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ABSTRACT
This paper reports on a study of professor talk in design studio classrooms. In design education, creative thinking is an important learning outcome, as demonstrated in previous observational studies of studio classrooms and interviews with design professors. I found that professors explicitly describe their concurrent and spontaneous thinking while they are analyzing student work and that this talk represents the features of creative thinking identified in prior research. But more significantly, I also found that professors externalize their creative thinking nonverbally through interactional mechanisms that implicitly represent many features of creative thinking. I used an interaction analysis methodology—transcribing nondenotational features of talk, such as elongated phonemes, restarts, and repairs—to analyze these implicit ways of speaking. Drawing on previous findings in conversation analysis and in creativity research, I demonstrate that these nondenotational aspects of talk implicitly represent the features of creative thinking documented in prior research. As professors externalize their concurrent creative thinking in speech, both explicitly and implicitly, students are scaffolded in their appropriation of creative thinking.

Introduction
The goal of this study is to contribute to our understanding of how to teach creative thinking. To further this goal, I chose to study how design professors teach in university studio classes, where creativity is an important learning outcome. Through an interaction analysis methodology, I show that while professors are discussing student work, they externalize their own creative thinking in their talk, thus making their thinking visible to the students. This provides students with the opportunity to appropriate this visible social speech to enhance their own creative thinking ability. I call this talk externalized creative thinking (ECT).

Creativity has been conceived of by researchers in at least four different ways, sometimes referred to as the four “P”s: studies of the creative process, the creative person, the created product, and the context of creativity, somewhat awkwardly called press (Rhodes, 1961). This study falls in the first of these, the creative process tradition, where creativity is considered to be an ongoing process involving thought and action (e.g., Craft et al., 2008; Sawyer, 2012). The creative process is associated with the following features of creative thinking:

1. Iteration. Creative thinking is not a linear process from a moment of insight to its execution; there’s a lot of improvisationality, with unpredictable shifts in direction, and with ideas emerging throughout the process.

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(2) **Problem finding.** Creative thinking involves a question-asking exploration that works to identify and formulate a problem. During the creative process, new issues are identified, conceptions of the problem often change, and new questions emerge.

(3) **Divergent thinking.** Creative thinking involves the generation of many ideas and potential solutions to problems.

(4) **Dead ends.** Most of these ideas will not be successful or worth pursuing further. Consequently, creative thinking often results in dead ends or failures that require rethinking and restarting.

(5) **Uncertainty.** Creative thinking is often enhanced by, and thrives within, ambiguity and uncertainty.

My research question is: How do design professors teach creative thinking in design studio classrooms? Specifically, how do they teach these five features of creative thinking? Prior studies of studio pedagogy have found that it is active, participatory, and project-based. Professors do not give lectures that explicitly instruct students in how to be creative. Students engage in hands-on project work in response to open-ended assignments. In class, the professor and the students work together in disciplinarily-appropriate social practices (see the literature review in Sawyer, 2017). This is often referred to as the studio model of teaching and learning (Hetland et al., 2007; Sawyer, 2018b).

I take a sociocultural theoretical approach to analyze how creative thinking and acting are embedded in situated social practices. I used an interaction analysis methodology to analyze how professors make their own creative thinking visible in their talk. I found that professor talk externalizes their expert creative thinking, with these five features made visible for students to observe. In the first set of findings, I analyze talk where professors explicitly externalize their spontaneous, concurrent thinking. I show that this talk aligns with these five features of creative thinking. This analysis largely consists of quoting the professors directly, as they use progressive imperfective verb constructions such as *I’m thinking that* or *I wonder whether*. These findings are consistent with prior studies of studio discourse as an apprenticeship where professors model how to think as a designer (Sawyer, 2017). Using an interaction analysis methodology, I extend these previous findings with additional interactional detail. In the second set of findings, I analyze implicit externalizations of spontaneous and concurrent creative thinking. These implicit externalizations are found in the patterns and mechanisms of talk. They are nondenotational, and unlike explicit externalizations of thinking, they cannot simply be quoted for their pedagogical content. These implicit externalizations are found in interactional mechanisms that include restarts, self-repairs, elongated phonemes, modal verbs like *could* and *should*, hedges like *maybe*, and disclaimers like *or whatever*. Drawing on prior studies of how these interactional mechanisms carry implicit meaning in talk – both in everyday encounters and in educational settings – I show that ECT enlists these interactional mechanisms to model one or more of the five features of creative thinking. A professor’s unfolding talk itself – not the content of what they say, but how they say it – externalizes their simultaneous creative thinking in speech. The uses of these interactional mechanisms in studio classes have been examined by only a few scholars (James, 1996; McDonnell, 2016; Oak, 2012), and these few studies each only identify one or two of the eleven mechanisms that we analyze here Table 2.

My interaction analysis shows that ECT takes place concurrently with the professor’s thinking – it is spontaneous and immediate, rather than considered and retrospective. It represents creative thinking as an ongoing and improvisational process, where ideas emerge from both thought and action. By combining explicit and implicit talk to model their concurrent thinking, professors provide students with opportunities to appropriate this talk as their own creative thinking. I conclude by suggesting that these pedagogical practices may contribute to our understanding of how to teach creative thinking in all disciplines.

**Theoretical approach**

This paper takes a sociocultural theory approach (e.g., Cole, 1996; Luria, 1928), which holds that thinking and learning are grounded in situated social practices. These social practices are interactional phenomena, and are external and visible to all participants. Newman et al. (1989) argued that “interactive
processes ... can provide an important link to explain cognitive change” (pp. 92–93). Interaction provides a powerful window onto thought because “things allegedly in people’s heads – such as cognition and attitudes ... are made relevant to communication through social interaction” (Jacoby & Ochs, 1995, p. 175). In this theoretical framework, learning occurs when social interaction is internalized as thought:

Internalization refers to the process by which material that is held out for the individual by social others is imported into the individual’s intra-psychological domain of thinking and affective processes ... what was originally in the interpersonal (or intermental) domain becomes intra-personal (intra-mental). (Lawrence & Valsiner, 1993, p. 151)

In Vygotsky’s (1978) formulation, “The history of the process of the internalization of social speech is also the history of the socialization of children’s practical intellect” (p. 27; italics in original).

I take this theoretical approach in exploring the research question: How do design professors teach creative thinking in design studio classrooms? The pedagogy that I observed is aligned with an apprenticeship conception of pedagogy as participatory social practice (e.g., Lave & Wenger, 1991; Rogoff, 1990), in which more experienced and less experienced members of a community of practice jointly participate in situated social practices. This joint participation scaffolds learners in gradual appropriation of the thinking embedded and enacted in social practices. Sociocultural theory suggests that learning creative thinking would be most likely in social encounters when experienced creators make visible their creative thinking in talk and action. As Smagorinsky (1998) noted, ”Vygotsky argued that thinking achieves meaning on its way to articulation” (p. 172). This then provides learners with the opportunity to internalize this talk, eventually becoming their own creative thinking. In a study of visitors to art museums, Steier (2014) applied a similar dialectic framework to his analysis of their body position and gesture, arguing that these serve to externalize the visitor’s representation of the artwork, while also functioning to internalize meaning (p. 166).

This account of teaching and learning for creativity faces a longstanding theoretical issue that presents an unavoidable and unresolved tension for sociocultural theory: What is the nature of the relationship between internal thought and visible interactional situated practices? In an analysis of seminal publications by influential sociocultural theorists (Sawyer, 2002), I identified two theoretical stances that are in tension. Some theorists argue that there can be no thought apart from social practice – that individual cognition is subservient to social action. Others acknowledge that individual cognition exists and that its psychological study may be beneficial, but they nonetheless believe that psychology is limited in its ability to explain collective social action. This tension is embedded in interpretations of Vygotsky’s conception of internalization. Sociocultural theorists today reject a conception of learning as passive internalization of what is observed or experienced. Following these theorists (e.g., Wertsch, 1998), I prefer to speak of appropriation rather than internalization, because the former word connotes that learners actively participate in knowledge construction.

In this paper I take a position between these two extremes. I hold that the creative process is manifest both in social action as well as in individual cognition. I consider these design professors to be creativity experts, who have an advanced ability to engage in creative thinking conceived of as cognition grounded in the five features of creativity: iteration, problem finding, divergent thinking, dead ends, and uncertainty. These professors are able to think in these ways while silently creating their own work alone. Their creative ability does not depend on them externalizing their creative thought in the ways I document here. And yet, in the presence of students, they are able to verbally externalize their creative process and to demonstrate creative action. My analysis of ECT shows that in studio classrooms, the professor’s creative thinking occurs concurrently with their speech. The sociocultural theoretical perspective suggests that professors teach by externalizing their ongoing creative thinking in their talk, and students learn by participating, observing, and appropriating that talk as their own creative thinking.

**Literature review**

Prior research (e.g., Hetland et al., 2007; Sawyer, 2018b; Shreve, 2007; Shreeve et al., 2010) has suggested that studio pedagogy guides students to learn the five features of creative thinking. These are the explicit
pedagogical intentions of design professors: In interviews, they say they are teaching creative thinking with these features (Sawyer, 2018b). For example, in an observational study of a sculpture studio class, James (1996) found that “The instructors translated their thoughts into words and actions so that students could hear and see how artists generate and solve artistic problems. . . . Much of the instructors’ assistance consisted of modeling a creative attitude: they verbally and physically asked ‘what if’ so students could perceive alternative solutions” (p. 152). Studio encounters were found to involve students in creative project work, with professors and peers providing informal and improvised feedback and advice throughout the process.

Empirical studies of talk in design education (including Cennamo & Brandt, 2012; Cossentino, 2002; James, 1996; Lymer, 2009; Murphy et al., 2012; McDonnell, 2016; Oak, 2012) have found that “the teacher demonstrates how designers think about designing . . . . Both teacher and student demonstrate, reflect and discuss the design-in-process throughout the process of instruction, and it is through this process of demonstration, reflection, and discussion that the student learns how to design as well as how to think about designing” (Cossentino, 2002, pp. 43–44). As Lymer (2009) concluded in his analysis of architecture formal design critiques, “socialization into disciplinary ways of seeing . . . dovetails with the development of fluency in the discipline’s discursive practices” (p. 148). Lymer found that during final critiques, professors topicalize different features of the student’s design by gesturing toward the student’s 2D sketches and 3D models, thereby drawing the student’s attention to aspects that aren’t immediately obvious and yet that are important to successful design (Lymer, 2009).

In sum, past studies of creativity and of design have documented a pedagogy with the potential to teach the five features of creative thinking and practice: iteration, problem finding, divergent thinking, dead ends, and uncertainty. However, there have been very few studies of the interactional mechanisms whereby creative thinking might be taught and learned through classroom conversation. While there have been a few studies of interaction in final critiques – where the student gives a formal presentation to a panel of experts for a final grade (e.g., Lymer, 2009; Murphy et al., 2012) – there has been much less study of the informal professor-student conversations that take place in studio classes in the weeks prior to the final presentation, when students are developing their work under the guidance of the professor and with support from their peers. Specifically, most of the interactional mechanisms of professor talk that I identify and analyze below have not previously been studied. I hope that this study has the potential to extend prior research by increasing our understanding of teaching and learning creative thinking.

**Methodology**

The seven classrooms analyzed here were observed and video recorded as part of a larger study that included ethnographies at two different U.S. colleges of art and design (Sawyer, 2018b). The seven professors were recommended to me by their department chairs as being exceptional teachers. They had an average of over ten years of teaching experience at the time of the study. The professor pseudonyms and their disciplines are:

- Dan: Illustration (college 2)
- Ellen: Interior design (college 1)
- Harriet: Communication design (college 2)
- Ian: Architecture (college 2)
- Jeff: Product design (college 1)
- Janet: Architecture (college 1)
- Robin: Graphic design (college 1)

The eleven transcripts analyzed here capture conversation that took place during a pedagogical practice called the *pinup critique*, also known as an “intermediate critique” or “in-progress critique” (Cennamo & Brandt, 2012). These encounters are very different from a *formal critique*, which is
a summative assessment of a student’s final project, at the end of the semester, where a panel of external reviewers evaluates a student’s completed design. Although both of these interactional formats are called “critiques,” their pedagogical intentions and their interaction patterns are very different, so I refer to these interactions as “pinups” throughout this paper.

In most design classes, a project takes several weeks to complete – in some classes, the entire semester – and each student undergoes a pinup as frequently as every week. Students are not expected to present finished work in a pinup; rather, they are invited to present early design concepts and to honestly and openly talk about issues and challenges they are facing. A student brings her work-in-progress to class and displays it to the professor and the rest of the class either by mounting it on the classroom wall or placing it on a table at the front of the room. The eleven transcript examples all take place partway through a project. The professor and students have seen several previous iterations of everyone’s projects, and a student only needs to describe the work that’s been done since the last pinup. For this reason, the student’s introductory comments are typically no more than one or two minutes. The professor then takes the floor and begins the form of talk that I call externalized creative thinking (ECT).

Each pinup takes approximately 15 minutes. At the two colleges studied here, each class meets twice each week for 2 1/2 hours each time. The seven classes I analyze here each have between 10 and 15 students, so that all students have the opportunity to do a pinup many times during a single project. A pinup is informal, tentative, and conversational in tone, having a “spontaneous, improvisational character” (Cossentino, 2002, p. 46). The other students often contribute their comments, and are encouraged to do so by the professor. After class ends, students are expected to use the pinup feedback to inform their next design iterations (e.g., Cennamo & Brandt, 2012, p. 852).

In all seven classes analyzed here, the students are working on what Cennamo and Brandt (2012) called focused assignments: All students have been given the same project brief, with similar goals and context, and yet their design challenge is open-ended so that each student has to formulate their own approach to the problem and develop their own creative solution. Because they all face a similar design challenge, all students learn from “listening-in” to the other students’ pinups (p. 851).

My theoretical framework suggests that talk is a visibly manifest form of thinking and that talk mediates the pedagogical encounter (e.g., Jacoby & Ochs, 1995). Consequently, I chose a methodology that allows a close analysis of talk, including not only the denotational content of what is said, but also interactional mechanisms that are nondenotational but that nonetheless are essential elements of conversation. Prior studies of conversation have demonstrated that participants orient to “a complex of paralinguistic and nonlinguistic details as interactional events in the interactional stream, in addition to attending to whatever is actually said in words and linguistic structures” (Jacoby & Ochs, 1995, p. 176). This research challenges the idea that the informational, semantic, and propositional content of utterances can capture what talk is doing interactionally. To capture these interactional mechanisms, I used an interaction analysis methodology (Jacoby & Ochs, 1995; Jordan & Henderson, 1995).

I transcribed the seven videos using the Jeffersonian conventions associated with conversation analysis (Jefferson, 1984; see Appendix A). Taking an inductive approach, I did not begin this study with theory-motivated hypotheses. In fact, I was not aware that professors talked in this way; there is almost no prior research documentng or analyzing the interactional mechanisms that professors use to externalize their thinking in studio pedagogy. During the initial analysis, several conversational phenomena emerged, including many features of talk that aligned with the five features of creative thinking. Through iterative, constant comparative analysis (Charmaz, 2014), these phenomena gradually grouped into categories and became the findings identified below. As these patterns and interactional mechanisms emerged from the data, I then more closely studied the transcripts, along with the corresponding videos, to identify stretches of talk where professors seemed to be most visibly externalizing creative thinking. I chose the eleven transcript examples below as those that most effectively exemplify the explicit and implicit features of externalized creative thinking (ECT) that emerged from the inductive grounded theory analysis. These episodes are illustrative examples of patterns and mechanisms that I observed throughout the pinup critiques.
Findings

For all seven professors and in all of their pinups, when a student’s introductory comments ended, the professors immediately began to talk. The professors did not silently examine the work before speaking. As they talked about the student’s work they rarely stopped talking for more than 2 or 3 seconds. This suggests that the professors did not plan what they would say before saying it. The appearance of spontaneity was reinforced by a variety of interactional mechanisms that conversation research has found to occur when talk is an externalization of simultaneously occurring and unplanned thought. I found that these spontaneous externalizations of thinking contained a variety of explicit and implicit ways of talking that model the five features of creative thinking. To support these claims, I engage with empirical studies of informal spontaneous conversation to argue which features of creative thinking are demonstrated by each of these interactional mechanisms.

These findings are organized into two sections. Findings 1 analyzes explicit externalizations of creative thinking, like lines 37–38 of Example 1, where the professor says “I think there’s got to be some other way to think about that.” Explicit externalizations of creative thinking are found in all eleven transcript examples, as displayed in Table 1. Findings 2 analyzes eleven interactional mechanisms that implicitly externalize creative thinking. Each of the eleven subsections in Findings 2 describes one interactional mechanism, and I use prior research in conversation analysis to interpret how that mechanism models one or more of the five features of creativity. In Example 1, these include elongated vowels like um:: in lines 15 and 35, indicating that talk is unplanned and has gotten ahead of thought; qualifiers like kinda in lines 7 and 26, indicating that the speaker isn’t yet certain of what he means to say; and you know, like lines 32–33 You know do I do this thing where it’s, double, you know? Implicit externalizations of creative thinking are found in all eleven transcript examples; these occurrences are summarized in Table 2.

Table 1. Explicit externalizations of the five features of creative thinking that are found in all the eleven transcript examples.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Ex 1</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td>yes</td>
</tr>
<tr>
<td>Ex 2</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td>yes</td>
</tr>
<tr>
<td>Ex 3</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td>yes</td>
</tr>
<tr>
<td>Ex 4</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td>yes</td>
</tr>
<tr>
<td>Ex 5</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex 6</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex 7</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex 9</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex 11</td>
<td></td>
<td></td>
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</tbody>
</table>

Table 2. Interactional mechanisms and the features of creative thinking they represent that are found in the eleven transcript examples

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Signals that Talk is an Externalization of Thinking in Progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Um/uh</td>
<td>Ex 8</td>
<td>Ex 7</td>
<td></td>
<td>Ex 3, 8, 8</td>
</tr>
<tr>
<td>2 Elongated speech</td>
<td>Ex 8</td>
<td></td>
<td></td>
<td>Ex 1, 8</td>
</tr>
<tr>
<td>3 Restarts</td>
<td>Ex 4, 3, 6, 8</td>
<td>Ex 4, 5, 6, 9</td>
<td></td>
<td>Ex 1, 3, 4, 6, 8, 11</td>
</tr>
</tbody>
</table>

| Indications of Uncertainty in Thinking |
| 4 Self-repair | Ex 3 | | | Ex 3, 6, 7 |
| 5 I mean | Ex 9 | | | Ex 1, 8 |
| 6 You know | Ex 1 | Ex 10, 11 | | Ex 1, 8, 11, 11 |
| 7 Well | Ex 9 | Ex 10 | | Ex 9, 1, 8 |

| Indications that Suggestions are Tentative Possibilities Only |
| 8 Qualifiers | Ex 1, 7 | | | Ex 1, 7 |
| 9 Hedges | Ex 1, 4, 5 | Ex 10 | | Ex 1, 3, 4, 5 |
| 10 Modal verbs | Ex 10 | | | Ex 10 |
| 11 Disclaimers | Ex 3, 6, 7, 11 | Ex 3, 6, 9, 11 | | Ex 3, 6, 9 |
**Findings 1. Explicit externalizations of creative thinking**

Example 1 is taken from a class in sustainable product design. The assignment was for students to design a portable case out of recycled materials. At the beginning of the transcript, Jeff is looking at a student’s prototype, which is resting on a table of approximately 10 feet by 4 feet. The presenter, and the other students in the class, are gathered standing around the table. Jeff’s gaze remains on the prototype through the transcript; he does not look at the students.

**Example 1. Jeff, Professor of Product Design**

```plaintext
1  S but the other end could be (inaudible),
2  for sure,(2)
3  Jeff And I think it, you know, like um, (2)
4  ((Jeff steps closer toward the table during the 2-second pause and picks up the prototype.))
5  I’m just trying to think of
6  some paper, product though. You know,
7  The only thing that kinda bothers me in this
8  is this use of this plastic thing right now.
9  I mean, I think it- you know,
10  right now it seems to work.
11  It works fine. You know.
12  It seals it in the way that it needs to.
13  Right, It's tight, um:::
14  it's going to keep moisture out, which is great,
15  So, (3) um::: (1)
16  ((Jeff puts the prototype down))
17  I don't know.
18  I think there's got to be some way to use, uh
19  a rigid paper product, um. (2)
20  But see right now
21  we're talkin about using both,
22  both sides of it.
23  ((Jeff lifts hand up to his chin and holds it there in a “thinking” gesture))
24  You know? (3)
25  And there's no way
26  to kinda recap it,
27  ((Jeff removes hand from chin and gestures “recap it”))
28  if we don't eat the whole (1)
29  you know, the whole side,
30  or, as Heather says,
31  ((Jeff briefly glances up at Heather))
32  you know do I do this thing where it's, (1)
33  double, you know?
34  ((Jeff raises his hand to his chin))
35  Um::: (4) yeah. (1)
36  ((Jeff drops his hand down from his chin to gesture at the prototype))
37  I think there's got to be some other way
38  to think about that.
```
In Example 1, Jeff often says explicitly that he is thinking and denotationally references what and how he is thinking. (Nonverbal gestures are beyond the scope of this paper, but gestures like that in line 23 – grasping one’s chin to signal thinking – are common in the dataset.) Examples include:

- Lines 5–6: *I’m just trying to think of some paper, product though*
- Line 18: *I think there’s got to be some way to use, uh*
- Lines 37–38: *I think there’s got to be some other way to think about that*

These statements model feature 2 of the creative process: identify issues, reconsider problems, formulate new questions, and consider alternative framings and paths forward. All seven professors in the dataset made statements that explicitly say they are thinking, and all of those statements modeled one or more of the features of creative thinking.

The talk in Examples 2, 3, and 4 also explicitly denotes moments of creative thinking, in three additional classes in three different design disciplines.

**Example 2.** Harriet, Professor of Communication Design. As with Jeff in Example 1, Harriet’s gaze is at the work throughout, not at the student.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>Harriet</td>
<td>So the two things that I'm thinking about</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>right off the top of my head</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>would be the scale of this</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>that we just talked about,</td>
</tr>
</tbody>
</table>

Harriet denotationally references her thought as continuing in the moment, not as something completed in the past: *I’m thinking about* (rather than describing the endpoint of her thinking, for example, *Here are two ideas for you*). Second, she denotationally references her talk as spontaneous: *right off the top of my head* – letting students know that her talk is taking place in parallel with her thinking. The message is that the creative process shouldn’t begin with idea generation and then be following by action that executes that idea; rather, ideas emerge from action (feature 1 of creative thinking: iteration). Third, she signals how she’s thinking – she is generating multiple possibilities (feature 3: divergent thinking).

**Example 3.** Ellen, Professor of Interior Design. This transcript immediately follows a 13-second discussion of their work by a 3-student team, in the middle of the pinup and in response to an issue previously raised by Ellen. There are 2 seconds between the end of student talk and Ellen’s first utterance in line 1.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Ellen</td>
<td>The other idea that just popped in my, mind</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td><em>{(Ellen’s eye gaze shifts from the prototype to the presenting students)</em>}</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>was for your bottle part,</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>the, the back part, that, um (1)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>What if it was, if it were,</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>a cutout, of uh, I don’t know,</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>uh, bottles, (1)</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>And uh, (2) colored gel paper, (1) for instance</td>
</tr>
</tbody>
</table>
Like Harriet in Example 2, Ellen initiates her talk in line 1 with an explicit statement that an idea has spontaneously occurred to her – *just popped in my mind* – indicating that her talk is iterative (feature 1), rather than planned in advance. The idea that she then describes is presented as uncertain (feature 5) – not as a transformative insight, and not as an assessment of or command to the students. The idea is accompanied by qualifiers like *what if and I don’t know* (both discussed in Findings section 2 below). Ellen’s talk references a thought process that is simultaneous with speech, and that explores possibilities, generates suggestions, and frames new questions.

**Example 4. Ian, Professor of Architecture. Ian’s gaze is at the work throughout.**

<table>
<thead>
<tr>
<th></th>
<th>Ian</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>And maybe it’s double-layered,</td>
</tr>
<tr>
<td>2</td>
<td>and then so one layer is able to go inside,</td>
</tr>
<tr>
<td>3</td>
<td>and one layer responds to the, the outer context,</td>
</tr>
<tr>
<td>4</td>
<td>A little bit, (I um,</td>
</tr>
<tr>
<td>5</td>
<td>More completely?</td>
</tr>
<tr>
<td>6</td>
<td>Because I’m still trying to put together in my head</td>
</tr>
<tr>
<td>7</td>
<td>the, the image of this in the landscape?</td>
</tr>
</tbody>
</table>

Like examples 1, 2, and 3, Ian explicitly references his thinking as ongoing, improvisational, and uncertain, as in line 6 *Because I’m still trying to put together in my head*, which is preceded by a variety of suggestions for questions and solutions, none of which is framed as definitive. Ian is externalizing problem finding (feature 2) and generating multiple tentative possibilities (feature 3: divergent thinking).

In these first four examples – from four different professors, classes, and disciplines, and at two colleges – professors don’t give students definitive answers or directions. Rather, they identify problems and issues with the work (feature 2). In some cases, they tentatively suggest potential solutions to a problem they identify; in other cases, they describe a problem without giving solutions, thus scaffolding students in divergent thinking (feature 3). In Example 1, Jeff at line 7 identifies an unresolved issue in the work: *The only thing that kinda bothers me in this*. In lines 8 to 38, he does not provide a resolution; he continues to externalize the features of creative thinking, including welcoming ambiguity (feature 5) and identifying new questions and issues (feature 2).

In these examples, the professors do not seem embarrassed or concerned that they don’t have a definitively correct answer. And yet, this visible uncertainty is in tension with the authority role of the professor as a knowledgeable expert (also see Sawyer, 2019). In traditional pedagogical settings the instructor is expected to have the answers. As such, their talk in these examples normalizes a thought process that is exploratory and uncertain, and normalizes creative expertise as being compatible with not-knowing (feature 5: uncertainty).

**Asking questions without answers**

In all studio classes, professors ask questions that are not requests for information from the student, as demonstrated in Example 5.

The student does not orient toward the professor’s questions as requests for information. The student instead backchannels understanding and affirmation. The professor doesn’t enact her questions as requests for information, either; she doesn’t wait to allow the student to answer, and she doesn’t seem concerned that the student is not answering. Both professor and student orient toward these questions as models of how students should identify and ask similar questions of themselves (demonstrating feature 2, problem finding). McDonnell (2016), in an analysis of studio discourse, found that professors ask questions “to open up the proposals for further development”
(p. 19). In asking these questions, the instructor is modeling how the student should be asking herself questions.

Example 5. Janet, Professor of Architecture. Janet’s gaze is primarily at the student with occasional glances and gestures at the work.

<table>
<thead>
<tr>
<th></th>
<th>Janet and then what about the issue of</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>the site context information?</td>
</tr>
<tr>
<td>3</td>
<td>to (5) bilateral, symmetry of the, cylinder?</td>
</tr>
<tr>
<td>4</td>
<td>S Mm hm.</td>
</tr>
<tr>
<td>5</td>
<td>Janet Right?</td>
</tr>
<tr>
<td></td>
<td>(lines omitted)</td>
</tr>
<tr>
<td>6</td>
<td>Janet how are you defining those relevancies?</td>
</tr>
<tr>
<td>7</td>
<td>S Mm hm.</td>
</tr>
<tr>
<td></td>
<td>(lines omitted)</td>
</tr>
<tr>
<td>8</td>
<td>Janet Uh, what are the (2) the issues for the,</td>
</tr>
<tr>
<td>9</td>
<td>community’s culture,</td>
</tr>
<tr>
<td>10</td>
<td>or for the generation,</td>
</tr>
<tr>
<td>11</td>
<td>S Uh huh.</td>
</tr>
<tr>
<td>12</td>
<td>Janet What is, again, the symbolic powers</td>
</tr>
<tr>
<td>13</td>
<td>of the flak tower</td>
</tr>
</tbody>
</table>

Another implicit message is that the student is not expected to have an answer at the ready. In fact, the professor seems to expect that the student will not have an answer; the student’s state of uncertainty is to be expected. The thought process being modeled is a problem-finding mind-set of formulating new questions in the face of uncertainty (feature 5).

The use of right now
In Example 1 Jeff uses the phrase right now three times – lines 8, 10, and 20 – in a way that communicates that the current state of the student’s work is unstable. Right now, in this context, acknowledges that the student is failing to see something important in her own work and then guides the student to see what she isn’t (note Goodwin, 1994 on professional vision; Roth & Jornet, 2015 on situational awareness; also see Lymer, 2009). In all three cases right now is followed by a description of an issue to be resolved. For example, line 20 but see right now is followed, in lines 21 to 36, by a description of what the presumably unseen problem is. This description concludes in lines 37–38 with guidance for how the student should be thinking next: I think there’s got to be some other way to think about that. The professor signals that the student’s process has reached a dead end (feature 4) requiring iteration and restart (feature 1).

Using right now is done in a way that meets the student at their current level of understanding, acknowledging that it’s okay – even expected – that the student doesn’t see the issue yet. In interviews, design professors say that they often encounter situations where students don’t yet see their own work clearly, and that it’s the professor’s responsibility to guide them to notice this mismatch (Sawyer, 2018b). The use of right now is aligned with this explicitly stated belief: it signals that the student doesn’t see the issue in their own work while also letting the student know that this isn’t a failing on the student’s part. In fact, this interactional pattern signals that such dead ends (feature 4) are to be expected as a normal part of the creative process (Sawyer, 2018a). In a sense, the student hasn’t made a mistake, but rather has discovered a mistake, has made a design decision that is only visible as a dead
end in retrospect. This is aligned with an overarching feature of creative thinking: it takes place not only in the head but also in the visible act of making.

Many other professors use the words right now in ways that communicate these features of creative thinking, as in Examples 6, line 7, and Example 7, line 7.

Example 6. Janet, Professor of Architecture.

<table>
<thead>
<tr>
<th></th>
<th>Janet</th>
<th>Do they come together in, in the language of perfect unity?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td>Or balance and so forth?</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>And how do you work,</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>What are those degrees of moving</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>from the one (1) to the other- (1)</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Right now, in terms of the stitch,</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>the thread is, is the same.</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>The thread doesn’t transform at all.</td>
</tr>
</tbody>
</table>

Example 7. Dan, Professor of Sequential Art.

<table>
<thead>
<tr>
<th></th>
<th>Dan</th>
<th>((Dan and student gaze at the work))</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Dan</td>
<td>And then, (4)</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>um,</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>One thing that (1)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>is a little bit of a (4) uh:: (3)</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>((Dan’s eye gaze shifts to student))</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Right now the environment?</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>is not really a player?</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>The environment is (1)</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>like the non character area? (2)</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Like when the character stops,</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>kinda the picture stops?</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>More or less?</td>
</tr>
<tr>
<td>14</td>
<td>S</td>
<td>Yeah.</td>
</tr>
<tr>
<td>15</td>
<td>Dan</td>
<td>So at least think about like</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>what the value of that is.</td>
</tr>
</tbody>
</table>

The message of right now constructions is that we are at a temporary moment in an ongoing process. Creativity is iterative (feature 1); the best path forward can’t be known until the prior action has been taken; and often the prior action leads to a dead end (feature 4). The creative work is not finished and there is an internal tension remaining. This problem hasn’t yet revealed itself, but it will at a later point in the process. These statements communicate that the mismatch between the reality of the work and the student’s perception of the work is a normal and expected part of the creative process.

Table 1 shows which of the five features of creative thinking are referred to with explicit externalizations in all eleven transcript examples.
Findings 2. Implicit externalizations of creative thinking

Transcripts 1 through 7 contain relatively explicit externalizations of the professor’s spontaneous creative thinking. These occur frequently in these pinups. But much more common were non-denotational interactional mechanisms that implicitly externalize how professors are thinking. My grounded theory analysis identified eleven such interactional mechanisms (some of these are also called discourse markers – Schiffrin, 1987), each of which appears in its own section below grouped into three broad categories. Most of the eleven examples, including the seven above as well as the four below, contain more than one of these interactional mechanisms; Table 2 helps to capture this complexity. Drawing on studies of everyday conversation, I demonstrate that each of these eleven interactional mechanisms references one or more of the five features of creative thinking.

2.1. Signals that talk is an externalization of thinking in progress

In ECT professors use many interactional mechanisms that conversation analysis research has found demonstrate that speaking and thinking are occurring simultaneously. The use of these mechanisms communicates to the students what the professor is saying is an externalization of her own creative thinking, in real time and as it visibly unfolds.

The three mechanisms I discuss in this section are (1) um and uh, (2) elongated speech, and (3) restarts. Conversation researchers have found that these mechanisms are associated with informal, spontaneous talk that is unplanned and improvised. In pinup critiques, these mechanisms reference a thought process involving the features of creative thinking.

Mechanism 1. um and uh

ECT often contains um and uh, which are both associated with spontaneous speech, and with thought that is exploratory and uncertain (feature 5). We see this in Example 1, lines 3, 13, 15, and 35, as well as throughout Example 8:

Example 8. Dan (Sequential Art) Dan’s eye gaze is at the work throughout

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dan</td>
<td>Um (3) and::: certainly tha, the addition</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>of the color, (2) is gonna help, uh::</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>a lot here. because</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>you need the middle.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>((brief gaze to S then back))</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>you need the middle tone (2) ta, ah, (2)</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>to make him look like</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>he's in the dark. you know. (1)</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Uh, and then that, that'll be great. (1)</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Boom-boom (3)</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>((tracks through individual frames))</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>uh:: (2) that's good, that's better (5) uh (5)</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>when:: there's a continuity thing. (1)</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>Okay. The, the, the::</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>this guy got kicked.</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>Now we're back to him. (1) Alright?</td>
</tr>
</tbody>
</table>
In Example 8, Dan uses *uh* or *um* at lines 1, 2, 6, 9, and 12. This is consistent with Oak’s (2012) study of design studio talk. She observed many cases of professor *um/uh* and interpreted them as indicating “uncertainty with regard to the next utterance” (p. 636). In a related study of discourse in an academic seminar, Rendle-Short (2004) identified *um/uh* as indicators of *production trouble* – meaning that speakers are having trouble producing the next talk (also sometimes called *performance problems*: Clark & Fox Tree, 2002, p. 75). These interactional mechanisms signal a wandering, exploratory, iterative thinking process (feature 1).

**Mechanism 2. Elongated speech**

In Example 8, Dan elongates several vowels and consonants. Examples include line 1 *and:::*, line 13 *when:::, and line 14 *the::*. *Um* and *uh* are also often elongated, as in Example 8, lines 2 and 12. Past research has demonstrated that elongated phonemes signal ongoing thinking and signal that the speaker hasn’t yet formulated the thought that will lead to the next utterance (Clark & Fox Tree, 2002). Like *uh/um*, elongations indicate uncertainty (Rendle-Short, 2004, p. 485). Oak (2012) noted that in studio classes, an elongation “signifies that she is searching for words, delaying the production of subsequent talk” (p. 637).

**Mechanism 3. Restarts**

A *restart* is when a speaker repeats the same word or phrase before continuing, usually with a micro-second pause before the repeat. A restart “indicates that planning is going on in the course of the speech act itself” (Ochs, 1979, p. 71). Studies of everyday speech have found that restarts are more common in spontaneous, unplanned speech, and are rare in formal or planned speech. We see several examples of restarts in the above transcripts, including:

- Example 3. Ellen, line 4: *the, the back part;* line 5 *what if it was, if it were*
- Example 4. Ian, lines 3 and 7: *the, the*
- Example 6. Janet, line 8: *is, is*
- Example 8. Dan, line 1: *tha, the;* lines 4–6: *you need the middle, you need the middle tone;* line 9: *that, that’ll be*

A restart indicates that talking has preceded thinking. It implicitly communicates to the student that the professor’s talk is unplanned and is a concurrent externalization of unfolding thought – an iterative process (feature 1) that contains frequent dead ends (feature 4).

**2.2. Indications of uncertainty in thinking**

The improvisationality of spontaneous speech often leads to moments where talking gets ahead of thinking, resulting in uncertainty about what to say next. This spontaneity is accompanied by a set of interactional mechanisms identified in prior studies of everyday conversation (e.g., Brennan & Williams, 1995; Smith & Clark, 1993). In ECT these mechanisms occur more often than in everyday speech, and when used they indicate that professors are engaged in iterative thinking (feature 1), question finding (feature 2), and generation of possibilities (feature 3). The four mechanisms analyzed in this section include (4) self repair, (5) *I mean* and *I think*, (6) *you know*, and (7) *well*. Leaper and Robnett (2011) associate many of these mechanisms with what they call *tentative language*. These indicate that the professor is externalizing a process of idea generation and possibility. The presence of these mechanisms implicitly represents creative thinking that is not linear, but rather that continually generates possibilities, and that remains open to a change in direction.
Mechanism 4. Self repair

A self repair is a redirection of thought – the generation of a new thought that was inspired by the previous thought. Self repair is associated with spontaneous talk, because when speech is concurrent with thought, it becomes more likely that the words generated do not reflect what the speaker meant to say. Many self repairs are found in the above examples, including (# marks the onset of the self repair):

- Example 3. Ellen, lines 4–5: the, the back part, that, um (1) # What if it was
- Example 6. Janet, lines 4–5: And how do you work, # What are those degrees of moving
- Example 7. Dan. lines 4–7: One thing that (1) is a little bit of a (4) uh:: (3) # Right now the environment?

Self repairs signal to students that the professor’s talk is exploratory, and that her suggestions are tentative. They model a creative process which often leads to a dead end (feature 4), but where the thinking process then restarts in successive iterations (feature 1).

Mechanism 5. I mean and I think

These are examples of editing expressions (feature 4) along with you know and that is (Clark & Fox Tree, 2002, p. 78; Levelt, 1983). Like uh/um, they often occur as repair prefaces (Kitzinger, 2013; Rendle-Short, 2004; Schegloff, 1979) signaling that “the ensuing talk contains adjustments to what has just been said” (Oak, 2012, p. 638; also see Fox Tree & Schrock, 2002). Example 1 contains many utterances that implicitly signal that a dead end has been reached, including:

- Line 3: And I think it, you know, like um
- Line 9: I mean, I think it- you know

I mean communicates that “speakers are talking more spontaneously” (Fox Tree & Schrock, 2002, p. 741). After all, “If talk is planned in advance, or considered carefully before articulating . . . there is less need for on-the-spot adjustments” (p. 741). I mean signals that what was just said isn’t quite right (Clark & Fox Tree, 2002, p. 78). Oak’s (2012) study of studio discourse found that I think plays the same role – it is followed by additional detail that has just occurred to the speaker after making the previous statement. Note that these instances of I think differ from the explicit statements of thinking in findings section 1, because they are repair prefaces and they are not followed by descriptions of what the professor is thinking: contrast the repair prefaces in Example 1, lines 3 and 9, with the explicit statement of thinking in Example 1, lines 18–19.

Editing expressions often introduce statements that provide additional clarity or specificity to the previous statement. This is often the interactional import of like, as well, which is found frequently in our dataset – as in Example 7, Dan, lines 10, 11, and 15. Like introduces and marks a new focus – signaling that important new information will follow, and implying that the prior statement was more unclear than the speaker would like (Underhill, 1998). In many cases of everyday talk, like indicates internal thought (Romaine & Lange, 1991, p. 227), and it often functions this way in ECT: statements following like are marked more clearly as externalizations of the speaker’s spontaneous thinking.

Mechanism 6. You know

You know often serves as a repair preface – similar to I mean and I think – but it carries additional meaning: it is used before or after statements that do not reference shared knowledge, but rather that provide information that the addressee could not have known (Macauly, 2002, p. 755). Some scholars have suggested that you know carries the additional distinctive meaning that the addressee is being
invited to make additional inferences. When a professor says you know in this way, it acts as a scaffold that encourages the student to generate ideas (feature 3), by indicating that idea generation is necessary and appropriate, while at the same time communicating that the professor isn’t planning to provide that idea. Other scholars argue that you know and I mean indicate uncertainty and imprecision (Fox Tree & Schrock, 2002, pp. 729–730), an imprecision that is often intentional.

- Example 1, Jeff: lines 9–10, I mean, I think it- you know, right now it seems to work.
- Example 8. Dan, lines 7–8: to make him look like he’s in the dark. You know.

These constructions represent feature 5 of creative thinking: students should learn to engage in creative thinking that is comfortable with ambiguity (Tolbert et al., 2016).

Mechanism 7. Well

Well often serves the same function as you know in that both signal insufficiency – that the talk so far has provided insufficient information for the addressee to predict what will be said next (Lakoff, 1973). This alerts the addressee that she will need to reinterpret past talk to be able to process what’s coming next (Jucker, 1993). The addressee has to infer missing information in the face of ambiguity (Jucker, 1993; Lakoff, 1973; Svartik, 1980). As with you know, discourse constructions using well scaffold students in learning to be comfortable with uncertainty in creative thinking (feature 5).

Example 9. Robin, Professor of Graphic Design.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Robin</td>
</tr>
<tr>
<td>2</td>
<td>S</td>
</tr>
<tr>
<td>3</td>
<td>Robin</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>But, but, you know, think about</td>
</tr>
<tr>
<td>6</td>
<td>the relationship between, (2)</td>
</tr>
<tr>
<td>7</td>
<td>this, notion of decoration.</td>
</tr>
</tbody>
</table>

In Example 9, lines 3–4 reframe the suggestion in line 1, leading to a revised suggestion in lines 5–7. Line 3 of Example 9, Well not really, disclaims Robin’s immediately preceding suggestion. The insertion of well prefices a partial rejection of the following suggestion: not really. This indicates that the preceding suggestion was a dead end (feature 4), that the professor’s creative thinking is now shifting down a different path, but also that the dead end has productively led to a new and better idea (feature 5, iteration). The sequence in Example 9 models a process in which even a discarded idea can productively lead to a reconsideration and a change of direction. This interactional practice scaffolds the student’s creative thinking, in that well aids the student in thinking both what led to this point and what might come next.

Also note the explicit instruction to the student in how to think, in lines 5–7. Such examples are fascinating, and reinforce the findings here, but they are rare and did not emerge as a distinct category from my grounded theory analysis.

2.3. Indications that suggestions are tentative possibilities only

ECT contains many interactional mechanisms that externalize divergent thinking – generating multiple possibilities (feature 3) – and that indicate that each of these possibilities is tentative and uncertain (feature 5). The four mechanisms analyzed below include (8) qualifiers; (9) hedges; (10) modal verbs; and (11) disclaimers. The professor externalizes the generation of ideas that have not been planned;
the students see that the ideas emerge spontaneously during talk. The ideas are not spoken as if they are brilliant insights or final solutions; I never saw a professor suggest an idea with excitement or certainty.

**Mechanism 8. Qualifiers**

Qualifiers include *sort of*, *kind of*, and *somewhat*. When inserted into a statement, a qualifier signals the speaker’s uncertainty of the statement. By signaling that what the professor says is not definitive, it models a creative thinking process where one generates many ideas (feature 3), and yet is uncertain which of them will turn out to be useful (feature 5). Examples include:

- Example 1. Jeff, line 7: *The only thing that kinda bothers me in this* and line 26 to *kinda recap it*
- Example 7. Dan, line 12: *kinda the picture stops?*

**Mechanism 9. Hedges**

Hedges include *what if*, *maybe*, *perhaps*, *let’s say*, and *I don’t know*. Hedges convey that the speaker is uncertain or can’t vouch for the accuracy of the accompanying statement (Lakoff, 1975). Hedges make visible a thinking process where ideas and possibilities occur frequently and spontaneously. They serve a similar function to qualifiers in that they also signal uncertainty and ambiguity. Hedges differ somewhat in that they seem to engage the addressee as a joint participant in an ongoing creative exploration.

Hedging is common throughout the above examples:

- Example 4. Ian, line 1: *And maybe it’s double-layered*
- Example 5. Janet, line 1: *and then what about the issue of*

Prior studies of design studio talk have observed that professors often say *what if* (James, 1996) and *maybe* (McDonnell, 2016) to model a creative attitude in which students are encouraged to consider multiple possible formulations of the problem (feature 2). The *Possibility Thinking* approach to creative thinking is centrally grounded around posing the question “What if?” (Craft et al., 2008, p. 66).

Classroom discourse researchers Griffin and Mehan (1980, p. 211) have equated *I don’t know* with *maybe*. I frequently saw professors hedge statements with *I don’t know*:

- In Example 3, Ellen embeds *I don’t know* in the middle of a suggestion, in lines 5–7: *What if it was, if it were, a cutout, of uh, I don’t know, uh, bottles*
- In Example 1, Jeff, line 17 *I don’t know* precedes the identification of a potential issue, in lines 18–19: *I think there’s got to be some way to use, uh a rigid paper product, um.*

*I don’t know* often precedes, follows, or is embedded in a suggestion of an issue or a possibility. The student is being invited to continue the professor’s creative thinking process, thereby being scaffolded in a way of thinking that proposes new questions and suggests new ideas (features 2 and 3).

**Mechanism 10. Modal verbs**

Modal verbs refer to a state that is possible in the future, but not certain; or they refer to a potential action that has an unknown outcome, and one can’t know yet whether that action is or is not going to be desirable (feature 5). In these pinups I often saw professors using *could* and *might* to express possibility and uncertainty, as in Example 10, lines 1 and 2.
Example 10. Jeff, Professor of Product Design.

1. Jeff Well it could dispense out,
2. It could dispense from here. (2)
3. Jeff You know like they’re all stacked,
4. let’s say they were all stacked in here (2)
5. You know?
6. S Yeah

It could refers to a potential future design feature of the object, and by being presented as tentative, as one of many possibilities, it models feature 3, divergent thinking.

Mechanism 11. Disclaimers

Disclaimers are words and phrases that reduce the certainty and authority of the preceding statement, like more or less in Example 7, line 13; not really, in Example 9, line 3; and whatever, in Example 11, line 6.

Example 11. Jeff, Professor of Product Design.

1. Jeff But, you know, it- it seems like,
2. right now,
3. this is kind of limiting.
4. You know like, it it runs its course,
5. It would be a week, it’d be two weeks,
6. whatever the case may be.

In the seven pinups, disclaimers were often partial. They followed statements of one or more potential tentative possibilities, but they weren’t used to dismiss them altogether. Rather, they invited the student to continue her own thinking in the same way, as with Example 3, Ellen, line 8: for instance, and Example 6, Janet, line 3: and so forth. This interactional sequence – suggestion(s) followed by a disclaimer – invites the students to continue the professor’s thinking by generating ideas in a similar fashion. The student is scaffolded in engaging in an iterative process where many ideas should be generated, and where each of the ideas is tentative. Each idea should be examined for the possibility that it might result in new ways of thinking about the problem (features 1, 2, 3, and 4).

Discussion

My research question is: How do design professors teach creative thinking in design studio classrooms? I have defined creative thinking as a continuing process through time involving five features: (1) Iteration; (2) Problem finding; (3) Divergent thinking; (4) Dead ends; and (5) Uncertainty. Drawing on prior studies of everyday conversation, I argue that professor talk is constructed in ways that indicate it is spontaneous and co-occurring with the professor’s thinking. Drawing on creativity research, I argue that both the explicit and implicit aspects of professor talk represent a creative thinking process characterized by these five features. Although I have separated the findings into two sections – explicit externalizations and implicit externalizations – ECT often combines these
to model creative thinking, as in Examples 1, 3, 4, and 9. Together, these findings support the claim that professor talk externalizes creative thinking. I have analyzed each of the eleven interactional mechanisms in a separate section, but from studying the eleven transcript examples, it is apparent that ECT often combines many of the interactional mechanisms in the same stretch of talk. Example 10 – used above to demonstrate modal verb use – also includes four instances of interactional mechanisms that were analyzed in earlier sections (restarts; you know; well; and hedges). These layered combinations of multiple interactional mechanisms reinforce the pedagogical impact of ECT. I have attempted to capture this complexity in Tables 1 and Tables 2.

The eleven examples are taken from seven different professors, in six disciplines, and at two universities. This demonstrates that ECT is not specific to any one design discipline or any one student's pinup. It demonstrates that the characteristics of ECT are general across these six disciplines. This is an intriguing demonstration of domain generality in both creative thinking and in creative teaching.

Note that all of the students in the class are present and observing this talk. The ostensible purpose of the pinup is to provide feedback to the presenting student, and yet, because ECT is visible to all students, it provides opportunities for all of them to appropriate the professor's externalized thought. The students have been given the same focused assignment (Cennamo & Brandt, 2012, p. 851), and because they face the same design challenges, they learn from other student's pinups as legitimate peripheral participants (Lave & Wenger, 1991). None of the externalizations of creative thinking analyzed here were unique to the student work being discussed. Note that in these analyses, I did not describe any student's work or any of the project assignments; this was intentional. With ECT, each student's work functions as a pivot that enables the professor to represent creative thinking to all students.

Professors, as more knowledgeable experts in creative thinking, externalize their thinking as speech. The professor does not first think, then speak; rather, the professor's thinking and speaking occur together, with each contributing to the emergence of the other. Whether as the presenting student or as a silent observer, all students observe professor talk as a visible manifestation of creative thinking. Students see that creative thinking is a process, a visibly manifest way of acting in the world; they learn that creativity does not require subconscious or mysterious moments of insight. As such, ECT demystifies creativity and communicates that creative thinking can be taught and learned.

This paper contributes to creativity research in several ways. First, these findings confirm that in design disciplines, the five features of creative thinking are articulated explicitly and implicitly in professor talk. Second, I document that in this pedagogical setting, creative thinking is externalized in speech as an ongoing thinking process, not as a sudden and single moment of insight. Third, my interactional analysis methodology reveals pedagogical techniques used by design professors that have not previously been analyzed in connection with creative education.

**Conclusion**

I have argued that when professors talk about student work in studio classes, their talk is an externally visible manifestation of their own creative thinking. I call this type of speech externalized creative thinking (ECT). In ECT, professors say explicitly how they are thinking (Findings section 1), and also combine a repertoire of eleven interactional mechanisms that implicitly externalize their concurrent thinking (Findings section 2). I argue that ECT models the five features of the creative process that prior research has found to be associated with successful creativity and design.

An additional benefit of this study is that it provides the researcher with a window on the professors’ creative thinking, just as it does for the students. While reading these transcripts, we see the same manifestations of the professor’s thought that the students do. In creativity research, analyses of a creator’s ongoing spontaneous creative thinking are rare, and methodologies to study that thinking are limited. This study, by providing a window on the creative thinking of these expert designers, contributes to the broader effort to understand how creativity is based in cognition and
action. It is equally difficult to analyze how instructors are thinking while they are engaged in the act of teaching. I cannot claim that all designers would be able to externalize their own creative thinking in this way; after all, these seven professors have many years of experience as college design instructors. These transcripts demonstrate the artful and complex performances found in high-quality studio pedagogy. ECT is likely to be a specialized ability that takes years to master.

Because these findings and analyses are not specific to any one student’s work or to any one design discipline, and because the sociocultural theoretical framework has been successfully applied to pedagogy in all subjects, I hypothesize that similar pedagogical methods might help students learn how to think creatively in non-arts subjects. For example, it may be effective for science teachers to put themselves in situations, in front of students, where they think aloud through a scientific problem—such as analyzing and interpreting data, or constructing a model to represent observed findings (for an example, see Ochs et al., 1996). Or science teachers could externalize their thinking while they examine a student’s theoretical framework, experimental design, recently gathered data, or a student’s early, tentative interpretation of that data. To the extent that scientific thinking involves features of creative thought—negotiating ambiguity, identifying issues and questions, iterating through dead ends, and generating many ideas and suggestions—students may benefit from teacher talk that incorporates the interactional mechanisms documented here.

Acknowledgments

I am grateful for the close attention to this manuscript by the action editor, Dr. Alfredo Jornet, and for the sophisticated and constructive suggestions of the anonymous reviewers. An early version of this analysis was presented at the LECI Seminar (Learning, Culture, and Interventions) at the University of Helsinki, Finland, on June 8th, 2018, at the invitation of Professor Kristiina Kumpulainen.

Disclosure statement

No potential conflict of interest was reported by the author.

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References


Appendix A– Jefferson’s transcript notation

. (period) a stopping fall in tone, not necessarily the end of a sentence
, (comma) continuing intonation, not necessarily between clauses of sentences
? (question mark) rising inflection, not necessarily a question
¡ rising intonation weaker than that indicated by a question mark
– (en-dash) cut-off: flat pitch, sudden stop in breath/vocal chord. Can be followed by the same speaker, or by a different speaker

no mark no mark at the end of an utterance indicates a level intonation
t! dental click
= connecting talk. There will be two: one at the end of one speaker’s utterance, the second at the beginning of the next speaker.
[] overlapping utterances or actions. There will always be two, from two different speakers whose speech or action occurs at the same time
> < talk is faster than surrounding talk
< > talk is slower than surrounding talk
» talk that becomes gradually softer and faster, usually at the end of a turn
° ° (small circles) a passage of talk that is quieter than surrounding talk, usually short—one phrase within a turn
crazy (underline) emphasis: usually under only one syllable, and indicating slightly louder volume and/or slight rise in pitch. Not as loud as boldface or capitalization
okay (boldface type) to emphasize important words. More emphasis than underlining, less volume than capitalization
SO (Capitalization) a passage of talk that is louder than surrounding talk; louder than underlining or boldface
::: (colons) an extension of a sound or syllable. More colons means a longer extension
() Indicates that the speech is hard to hear, and uncertainty that this text is exactly correct
(1) A silent pause, in number of seconds
(.) (period in parens) a short untimed pause, less than one second
hh audible aspirations. Use more “h” for longer aspirations
.hh audible inhalations
→ a marker to indicate something that the analyst thinks is important; usually referenced in the analysis of the transcript

The transcription conventions used here are based on Gail Jefferson’s notation as presented in (Atkinson and Heritage, 1999; Jefferson, 1984).