

Using Cases as Triggers for Teachers' Thinking about Practice:

A Comparison of Responses to Animations and Videos

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Abstract

This study compared conversations among groups of teachers of high school geometry that had been triggered by either a video or an animation representation of instruction and managed with an open-ended agenda. All triggers represented scenarios that departed from what was hypothesized as normative. We used as the dependent variable the proportion of modal statements about instructional practice made by a group, which we argue is a good quantitative indicator that the statement appeals to the group's knowledge of the norms of practice. Animations and videos produced similar proportion of modal statements, but the types of modal statements differed—with animations being associated with more statements of probability and obligation and videos being associated with more statements of inclination.

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Introduction

This paper is concerned with a methodological question in research on teaching: How can we access teaching knowledge that can be tacit in nature? Our purpose here is to contribute to validate the technique of utilizing open-ended agendas for group discussions of cartoon-based classroom scenarios, by benchmarking those against the more common use of videotaped episodes. We utilize a linguistic measure of the discussions elicited to do such benchmarking. We start the paper, however, by situating our study in a discussion of teaching knowledge and on the reasons that have motivated us to use both videos and animations in focus group sessions with experienced practitioners.

The Nature of Teaching Knowledge

Teacher knowledge has been identified as a crucial factor in students' opportunity to learn (Shulman, 1986). Professionalization of teaching relies on the possibility to articulate and organize this knowledge (Shulman 1987). As Buchmann (1987) noted, however, the expression "teacher knowledge" may require too early a commitment to the question of how widely spread this knowledge is among individuals, while a more fundamental question to ask first is what that knowledge consists of. Consequently, Buchmann proposed the alternative expression "teaching knowledge." Among the components of teaching knowledge, Buchmann (1987) identified the *folkways of teaching*:

The folkways of teaching describe 'teaching as usual', learned and practised in the half-conscious way in which people go about their everyday life, where they carry themselves fittingly. These folkways are typical and generally work; they have their correlates in the character of school knowledge, that is, in the content and structure of what children learn in school. (Buchmann, 1987, p. 153)

Buchmann's choice to talk about "teaching knowledge" was deliberate so as to leave the question open as to whether and how this knowledge is held by individuals. Her classification of teaching knowledge (into *folkways of teaching*, *local mores*, *private views*, and *teaching expertise*) illustrated how some elements of knowledge might be more individual than others (e.g., *private views* contrasted in this sense with *local mores* that referred to maxims or missions that might be common among people working in locales such as schools or communities). Elements in that classification also contrasted in regard to the sources of their validity. *Teaching expertise*, in particular, contrasted with the *folkways of teaching* in regard to the existence of explicit sources of justification:

Teaching expertise goes beyond their mastery or skilled performance by including (1) judgments of appropriateness, testing of consequences, and consideration of ends, not just means; and (2) less typical modes of practice, such as explanation, discussion and the deliberate management of value dilemmas by the teacher. (Buchmann, 1987, p. 154).

Thus for Buchmann, teaching knowledge contains elements held collectively and individually, as well as elements held tacitly (in the form of ways of doing things that belong in the *folkways of teaching*) and elements held explicitly (tied to justificatory discourses, as in *teaching expertise*). Cook and Brown (1999) offer a compatible framework to describe organizational knowledge. For them, the knowledge of organizations can be individually held or collectively held, and it can also be explicit or tacit.

Herbst and Chazan (2003, 2011, in press) have used the expression *practical rationality* to refer to the source of justifications of actions in teaching. Like Buchmann (1986), Herbst and

Chazan are interested not on a teacher's personal explanation of their actions, but in the public justification that could be offered of their actions. The sources of those justifications cover the continuum between Buchmann's folkways of teaching and teaching expertise, inasmuch as these justifications can be ascribed to a practice rather than to individual practitioners. The expression practical rationality, adapted from Bourdieu's (1998) theory of practice, underscores the possibility that even though the actions of 'teaching as usual' may be tacit or half-conscious, they may have a reason to exist, particularly inasmuch as they are adapted to negotiate the conditions and constraints of the practice in which they participate. Furthermore, some elements of this rationality can be quite explicit and available for teachers to come up with alternative ways of acting or to justify departures from ordinary ways of acting.

In our earlier work (e.g., Herbst, 2003, 2006), we've described action in teaching as regulated by norms that may be more or less tacit. These norms could apply to mathematics instruction as a whole (e.g., the norm that if a teacher assigns a problem, the teacher is expected to know the answer to the problem), or they can apply to specific knowledge transactions (e.g., the norm that when expecting students to do a proof, the teacher is expected to provide the conclusion that students will prove). Our account of practical rationality has described it as generated on the basis of those norms as well as on relatively explicit professional obligations: Obligations to the discipline a teacher teaches, to the individual students to be taught, to the group of students with whom instruction proceeds, and to the school institution in which that instructional system is located (Herbst & Chazan, 2011). Those basic elements span or generate more or less tacit dispositions that could be described as instantiations or combinations of those obligations that sometimes enable practitioners to justify deviations from those norms.

Our empirical research has sought to ground the constructs *norm* and *disposition* in conversations about instruction among groups of teachers. To facilitate those conversations we initially used clips of video recorded instruction (e.g., Herbst & Chazan, 2003; Nachlieli and Herbst, 2009; Weiss, Herbst, & Chen, 2009). Later, we produced animated scenarios using cartoon characters (Chazan, Sela, and Herbst, 2012; Herbst & Miyakawa, 2008; Herbst, Nachlieli, and Chazan, 2011). In both cases, the viewing of the representations was managed with a rather open ended agenda, where moderators sought to devolve control to practitioners about the subject of their conversation and researchers who were present only asked provoking questions about the issues that practitioners sought to speak about (Nachlieli, 2011). In other writing we have discussed how specific conversations have shed light on various substantive elements of practical rationality, such as how teachers of geometry perceive and appreciate deviations to norms in the installation of theorems in geometry (Herbst et al., 2011), the doing of proofs in geometry (Nachlieli & Herbst, 2009; Weiss, et al., 2009), the solving of equations in algebra (Chazan & Lueke, 2009; Chazan & Herbst, 2011) and the doing of word problems in algebra (Chazan, Herbst, and Sela, 2011; Chazan, et al., 2012). In contrast with those examinations of specific norms, the present paper looks above the particulars of specific instructional situations and their norms and uses data generated in response to both animations and video representations. The aim of this paper is to compare the conversations that teachers had in response to the two kinds of representations that could equally be used to elicit group knowledge of practice (or practical rationality). We believe that such a comparison would aid us in determining whether the type of representation of teaching used (video or animation) interacts with the form of appraisal teachers made to a group of peers regarding instruction. We focus on tacit knowledge of mathematics teaching held by the group of practitioners responsible for

congruent curricular goals (canonically, teachers teaching the same course of studies): This knowledge could be described as knowledge of the norms of practice associated to teaching such course. This paper aims at validating the use of animations of cartoon characters as a technique for the elicitation of tacit group knowledge.

Norms and Dispositions: Tacit Knowledge of the Teaching Profession

As an organization, teaching relies on various kinds of knowledge. Cook and Brown (1999) distinguish between kinds of knowledge along two dimensions: How the knowledge is held (explicit or tacit knowledge), and where the knowledge is held (individual or group knowledge). Explicit knowledge can be represented through sentences and formulae and can describe a large part, but arguably not all, of the subject matter that teachers teach. Explicit knowledge can also encompass the basic obligations of the teaching profession (e.g., to their discipline, to students as individuals, to the class as a social group, to the school institution), often represented through maxims such as ‘all students can learn.’ Tacit knowledge, however, either is not or cannot be conveyed through such mediums and is “tied to the senses, movement skills, physical experience, intuition, or rules of thumb” (Erden, von Krogh, & Nonaka, 2008, p. 5) in a given context. Both of these forms of knowledge can be held by individuals or shared in groups. We focus on tacit knowledge that is also group knowledge as a larger container where to situate teaching knowledge of the norms of instruction and the dispositions that justify or indict deviations from those norms. This section reviews some of this literature.

Erden et al. (2008) suggest that when individuals in a group are confronted with a problematic task, they begin to act collectively in solving the task without explicit procedures, rules, or communication. The knowledge that is shared amongst these individuals is tacit group knowledge. Yet, to possess the tacit knowledge specific to a group, individuals must be

completely socialized into that group (Leonard & Sensiper, 1998). Various authors (e.g., Collins, 2010; Erden et al., 2008; Leonard & Sensiper, 1998) characterize tacit group knowledge as being developed through interaction between members of a group, but simultaneously being tied into the actions of the group. Without a shared set of experiences, tacit group knowledge does not exist (Erden et al., 2008).

Exemplifying tacit group knowledge, Collins (2010) describes the coordination needed among bicycle riders and car drivers to negotiate sharing the road. While the bicycle rider possesses a degree of individual (somatic, embodied) tacit knowledge of how to balance their self on the bike, they partake of a collective tacit knowledge about riding a bicycle in traffic. Traffic patterns include explicit elements of knowledge such as the conventions of using hand signals yet they also include tacit and important elements represented in the coordination of movements and facial expressions between riders and automobile drivers. Collins notes that this tacit knowledge can and will vary by geographic region. In such a sense, we can characterize some tacit group knowledge as existing in the form of norms or sets of mutual expectations that members of a practice hold for themselves and other participants; these are not explicit like rules or laws, but participants can be described as acting *as if* they were applying such a rule. In Collins's (2010) traffic example, the collective includes drivers and riders using vehicles (bicycles and automobiles) on the same road. Thus, one might construe collective knowledge as embodied in physically proximal social interactions. Yet other examples exist that help broaden the conception of what kinds of collectives may possess tacit group knowledge.

Polanyi (1967) provides the example of a scientist who must use certain conventions for describing uncertainty in their conclusions to an experiment, even if they themselves "know" the results are certain. Such disposition to hedge their claims indicates that the scientist is beholden

to some criteria knowledge external to their self, such as conventions for statistical significance or how to describe correlation results. Some of that knowledge is explicit and collective, such as the notion that correlation does not imply causality; other knowledge, for example, knowledge of the ways of relating to written language in a given scientific field so as to simultaneously read or write professionalism and circumspection are better described as tacit group knowledge.

The case of tacit collective knowledge of teaching is arguably comparable to that of scientists' knowledge of writing. This tacit knowledge of teaching is collective in the sense that it is embodied in the interactions between teacher and students. It is also collective in the sense that it is shared between actions teacher and students do and the material resources and constraints provided by the artifacts they use in their trade, much in the same way that mechanical and electronic apparatuses embody knowledge in technical activity systems (Engeström & Kerosuo, 2007; Noss, Bakker, Hoyles, & Kent, 2007): Construction tools, calculators and computers, textbooks, conventions, notations, and writing formats also have a share in the holding of this collective knowledge (see for example Herbst, 2002, for an analysis of the two-column format of writing proofs). While teachers do not typically teach their classes in teams of colleagues, they do interact in formal and informal settings (e.g., departmental exchanges among teachers of the same course) and use common artifacts such as textbooks or common final exams and these interactions contribute to their socialization into this collective tacit knowledge (Horn & Little, 2010).

Our interest in tacit group knowledge is presently focused on the instructional norms common to teachers of the same course of secondary mathematics studies and the dispositions with which teachers handle those norms. As noted above, by *norm* we mean tacit expectations that teachers would have of what subject matter instruction should be like, particularly in regard

to specific knowledge transactions. Herbst et al. (2011) illustrate this notion of norm in the case of introducing a new theorem in geometry: When a proved statement is to be taken by students as a theorem that they can use in other pursuits (e.g., to prove other statements), the teacher is expected to sanction that statement—they are expected to give it a status by labeling it “theorem” or “property.” These norms are often not explicit: Teachers only act *as if* they followed them. Like other tacit social norms they become visible when they are breached. We call *dispositions* the grounds that a group of colleagues might use to justify or else rebuff breaches of norms. Our earlier work has demonstrated the existence of norms that are specific to the teaching of specific subject matter (e.g., Chazan, et al., 2012; Herbst et al., 2011; Nachlieli & Herbst, 2009). Evidence suggests that different norms exist across teaching practices in different cultures (Jacobs & Morita, 2002).

Eliciting Tacit Knowledge of Teaching: Techniques and Tools

The issue of how to assess teachers’ recognition of instructional norms and how to surface their dispositions toward breaches of norms is of critical significance to ground this perspective on teaching knowledge. Since tacit knowledge of teaching is inherently tied to action in context, examinations of teachers’ tacit knowledge requires either observation of the use of this knowledge in actual teaching or some vicarious immersion in action, for example by involving practitioners in tasks that include some representations of instruction (Grossman, Compton, Igra, Ronfeldt, Shahan, & Williamson, 2009). Representations of instruction have commonly been realized using written cases (Freire & Sanches, 1992; Harrington, 1995) and video records (Jacobs & Morita, 2002; see also Elliott et al., 2011; Grigorenko, Sternberg, & Strauss, 2006; Kagan, 1990; Powell, 2004; Toom, 2006). Therefore, representations of instruction provide a useful context for examining teaching norms. In the next section, we

discuss different forms of representations of teaching and what each may offer in examining tacit group knowledge.

Representations of Teaching Practice

Representations of practice can be realized using several media, with artifact and photography display, written cases, and video recordings being common in the literature. Herbst, Chazan, Chen, Chieu, and Weiss (2011) propose the categories of *temporality* and *individuality* to describe how various forms of representations of instruction differ. Representations of instruction may reproduce the passing of time in the events represented or else they may alter it by expanding or collapsing the time that events took. Representations of instruction may also mirror the individualities of people and places represented or else they may turn them into symbols that only maintain selected aspects of individuality but conceal others.

Written vignettes of teaching have been used to examine teachers' beliefs and knowledge concerning practice (e.g., Joram, 2007; Ohan, Visser, Strain, & Allen, 2011; Yoon, Bauman, Choi, & Hutchison, 2011). Much of this research focuses on individual interactions with the representation(s) of practice, which may be characteristic of how such representations have been traditionally used in teacher education; written vignettes have been used to study groups in other areas (Hughes & Huby, 2002) as well as in education (Cutter, Palincsar, & Magnusson, 2002; Down, Hogan, & Chadbourne, 1999). Various studies have used video representations to engage groups of teachers in discussions about practice (Cwikla, 2010; Gonzalez, 2011; Sherin & van Es, 2009). Unlike written cases and within the boundaries of the unedited video clip, video records of practice can immerse viewers in a temporality similar to that of real classroom events. In spite of their limitations (see Hall, 2000), video records can also capture much of the individuality of the people and settings involved in those events, unlike written records that

symbolize those people and settings with word choices. Jacobs and Morita (2002) showed how video records could be quite effective in eliciting elements of tacit teaching knowledge (see also Colestock & Sherin, 2009; Correa, Perry, Sims, Miller, & Fang, 2008)

An alternative media for representing teaching are animations of nondescript cartoon characters (animations hereafter), which, while lacking the face value of video records, allow designers more control on how to depict a scenario (e.g., how much to individuate characters and setting). While animations resemble video records in that both of them can approximate the temporality of real classroom events, animations do not necessarily display the individualities of participants and settings as much as video records do while providing more flexibility than written text to do so. Few scholars have used animations to represent instruction (Bailey, Tettegah, & Bradley, 2006; Herbst & Chazan, 2006; Moreno & Ortegado-Layne, 2008; Tettegah, 2005). Moreno and Ortegado-Layne (2008) studied what kind of media form (written case, animation, video) is best to support the learning of individual explicit knowledge of prospective teachers but no such comparisons have been done for tacit group knowledge of practicing teachers.

How to Elicit Tacit Group Knowledge: What Agenda to Use with the Media

Tacit group knowledge of instructional norms, such as the sense that colleagues have of what is appropriate to provide and expect when assigning a task to students, is hard to bring to the surface using direct questions or questionnaires. Accordingly, a question that follows is how to use any representation of teaching (written, video, or animation) to elicit the tacit knowledge of a group of teachers. There has been research that looks at groups of teachers examining video records or other representations of teaching (e.g., Borko et al., 2008; Rosebery & Puttick, 1998; Sherin & van Es, 2009). Agendas for such examinations have varied between explicit problem

posing, where researchers ask direct questions (Makhanya, 2002), to more open ended agendas where practitioners are free to pick what they want to talk about (Tochon, 1999). The distinction between the two types of agendas seems to be aligned with that between “focus groups” and “study groups.”

Focus groups have been used since the mid 20th century for various forms of social research (Flores & Alonso, 1995; Lederman, 1990). Focus groups allow for examination of a phenomenon from a shared perspective, where the shared perspective may be elicited through or even developed from the interaction among participants who share some common experiences or background (Flores & Alonso, 1995; Lederman, 1990). A basic assumption of the focus group approach is that participants in a group of individuals that share a common background or experiences (e.g., they teach the same course) are more likely to share information more openly in a group conversation than they would in a one-on-one context. Flores and Alonso (1995) described the use of focus groups in educational research as “a nondirective technique that results in the controlled production of a discussion of a group of people” (p. 85). Lederman (1990) provides another description of this approach in that while a researcher may use guiding questions to help scaffold focus group discussions, the questions are neither exhaustive nor overly detailed. Rather, the goal is to provide opportunities for relevant conversations to develop in a manner less constrained by an approach that has more specific questioning, and therefore less biased by the researcher’s influence. Therefore, the role of the researcher in focus group discussions is as facilitator more so than interviewer.

While focus groups have been used to examine a variety of topics such as school climate (McDougall et al., 2007; Saunders & Goldenberg, 2005), female students’ mathematical identities (Solomon, Croft, & Lawson, 2010), and teachers’ self-efficacy (Ribeiro &

DeMagistris, 2009), there are similarities in the manner of their use. In education, focus groups have often been used to examine how groups of teachers or students have been affected by some intervention or stimulus. But even when focus groups have been used to examine the effect of participation in things such as professional development, these uses all appear to concur with Flores and Alonso's (1995) recommendation that such groups have an open agenda where interactions among participants may be facilitated but is not directed with explicit research questions.

The approach connected to "study groups" seems to have a subtle but important distinction from focus groups in that study groups are purposefully driven towards transforming teachers' beliefs, perceptions, knowledge, or some other facet related to the profession (Clair, 1998; Saavedra, 1996). While focus groups have been used to assess the effects of professional development, study groups have been seen as a form of professional development in and of themselves (Arbaugh, 2003; Clair, 1998; Florio-Ruane & Raphael, 2000). On the surface, research involving study groups may appear very similar to research involving focus groups. Both approaches use open discussion questions to facilitate dialogue (see Sherin & van Es, 2009 for examples of study group questions). However, the objectives of the two approaches are different and they seem to compel facilitators to act differently. For example, Sherin and van Es (2009) used video clubs (a form of study group) to help middle school mathematics teachers develop their ability to notice and interpret student thinking. While the questions used to scaffold the discussion were fairly open at face value, the questions had a purpose in promoting participants' noticing and interpreting of student thinking.

In our research we were not so much interested in promoting a particular kind of inquiry or reflection, but instead we were interested in precipitating the tacit knowledge of the group,

particularly their knowledge of the norms of instruction. While the literature on focus and study groups was important to consider in our developing of agendas, other methodological approaches were equally valuable. The ethnomethodological approach in sociology (Garfinkel & Sacks, 1970; Rafalovich, 2006), in particular, has contributed the technique of *breaching experiments* to precipitate that kind of tacit knowledge: The original breaching experiments consisted of actual engagements of usual participants of a social situation in an instance of that situation where one of its normative characteristics had been deliberately altered. Participants would denounce a breach by engaging in some repair strategies, such as by commenting that something in the situation had gone awry. The commentary from participants in which they noticed and elaborated on the alterations could then be examined for clues that point to their tacit knowledge of the situation. Herbst and Chazan (2003; also Nachlieli & Herbst, 2009) have shown how videotaped episodes of instructions that record out of the ordinary instances of an instructional situation can be used to engage teachers in a modified, virtual version of a breaching experiment. This research had shown how practitioners would also engage in repair strategies when they confronted a videorecorded instance of a situation that included a breach of a norm that they did not know about beforehand. Since animations can be created deliberately to represent breaches of instructional situations that might be hard to find and record in video, and animations might enable more systematic study of instructional situations (and conceivably also other social situations), it was important to know if animations could elicit similar repairs. But the practitioners' encounters with these animations had to be managed with a similarly open ended agenda as that of focus groups.

In our earlier work with videos we had had focus groups of practicing teachers view representations of teaching and discuss what they saw. We'd then inspect their discourse for

indications of how practitioners appraised the work of the teacher in the video (Nachlieli & Herbst, 2009; Weiss et al., 2009). As we looked into doing the same kind of work with groups of teachers looking at animations of classroom scenarios, we designed group meetings in such a way that their agendas were equally nondirective in terms of what kinds of learning or reflection participants were expected to develop. Rather, agendas would pose general topics of conversation, for example would submit a particular animation for consideration, but participants would choose on their own what to comment on. While other researchers interested in teachers' stances toward events in practice have found it useful to use a more structured agenda (e.g., Fenstermacher & Richardson, 1993), our agendas used more open ended tasks for participants (e.g., tap the table when they want to say something), and required the facilitator to be responsive to the participants' choice of focus and only manage interpersonal aspects of the discussion (e.g., how long someone holds the floor). Research team members sitting at the table with participants would ask follow up questions (see Nachlieli, 2011). While these meetings were 'focus groups' in their design, we called these meetings 'study groups' only because that term seemed to describe better to participants the nature of the encounters they would be engaged: participants came to meetings once a month for a year and in those meetings they discussed in detail representations of teaching.

Thus the agendas used in managing both the animation-based and the video-based discussions among teachers were open ended. This approach seemed to better support the contention that encounters with breached representations of teaching could function as virtual breaching experiments. The approach of using an open ended agenda appears more adept for examining practitioners' tacit knowledge since the openness of the watching tasks helps develop discussions about what the group deems important and how the group feels about it. The present

inquiry compared the discourse data obtained from groups of teachers in response to video and animations when both responses were obtained with an open-ended agenda.

Using the Linguistic System of Modality to Examine Tacit Group Knowledge

We sought to compare the discourse of groups of practitioners about a representation of teaching in regard to how much they elicited knowledge of instructional norms. To do this, we needed to identify statements that contained the communication of a stance toward observed classroom events and that appealed to the group for shaping or validating the stance. While all videos and animations used represented instructional events where one or more hypothesized norms had been breached, we did not limit our search to responses to the breach but looked more generally across the sessions at statements in which practitioners referred to observed or experienced classroom events. We were, however, interested in statements that indicated a negotiated attitude toward instructional events; that is, expressions where participants not only offered a stance but also indicated in some way the attempt to relate to others through those stances. This was a way for us to operationalize the notion that we were eliciting the tacit knowledge the group has of norms of practice. While this operationalization is probably coarse in comparison with finer ways of coding discourse for specific purposes (e.g., determining if a particular norm has been invoked; as done by Herbst et al., 2011), it had the advantage not only that it could provide an approximate solution to the problem of comparing aggregates (responses to videos or animations of different events) but also that it could be further operationalized in terms of a linguistic indicator that could be used reliably at scale. In Kosko and Herbst (2012) we have elaborated at length on how our interest on group knowledge of instructional norms led us to look at focus group discourse through the lens of semantic modality as conceived in systemic functional linguistics (Halliday & Matthiessen, 2004). For the analysis described later in this

paper, we looked at the proportion of modal statements about classroom events in each focus group session and compared the averages across the two kinds of sessions (video based and animation based). We describe briefly what we mean by modal statements and how those satisfied our operational needs below and refer to Kosko & Herbst (2012) for more details of this aspect of the method.

The *modality* system of language consists of lexical (e.g., auxiliary verbs such as *would*, *should*, *must*, or adverbial complements such as *always*, *rarely*, etc.) and grammatical (e.g., projective clauses such as “I think that...”, “I say ...”) resources with which speakers or writers may temper propositions or proposals (Halliday & Matthiessen, 2004; Eggins & Slade, 1997). *Modality* is (along with *mood* and *person*) one of the systems with which language performs (at the lexicogrammatic level of realization) what Halliday calls the *interpersonal* metafunction: It permits speakers and writers to relate to their audience through what they say. Thus modals are often used along with propositions and proposals so as to invite the audience to comment on, concur with, or contradict those propositions or proposals. In particular, modals do that by allowing a degree of uncertainty in what is asserted or proposed.

Halliday’s account of systemic functional linguistics classifies modality resources into four categories: inclination (desirability), obligation (appropriateness), probability, and usuality.² Of these, desirability (e.g., “I’d like the teacher to write that on the board”) and obligation (e.g., “He should have written that on the board”) offer lexicogrammatic choices to *modulate* proposals or provide means to temper statements of what ought to be the case. In contrast probability (e.g., “The students are not likely to remember what he said”) and usuality (e.g., “I always write what I want them to do”) offer lexicogrammatic choices to *modalize* propositions or

² Lemke (1998) renames these and adds comprehensibility, humorousness, and importance. Eggins & Slade (1997) add capacity. For our purposes we used Halliday’s four categories.

provide means to temper statements of what is the case (see Eggins & Slade, 1997, pp. 98-106).

While each of those modality types tempers what the clause asserts in a different way, all four of those modality types provide resources for speakers to appeal to the audience to negotiate a stance, as opposed to merely stating a stance. In particular, participants could use those resources to negotiate a stance toward a classroom event and in particular to engage the group in denouncing a breach of an instructional norm.³ All of those modality types appear to be substantively connected to different interpretations of the notion of a *norm* with appropriateness being more committal than desirability as a way to assert a norm in the sense of what participants hold each other accountable to do, and probability and usuality being different ways of tempering a statement of the norm in the sense of what frequently happens. We relied on participants' uses of modality in clauses that versed on instructional events to create a quantitative indicator of the extent to which the discussions in a focus group session featured group knowledge of instructional norms (Kosko & Herbst, 2012).

Semantic modality, as a resource for the realization of the interpersonal metafunction of language, is concerned with “enacting our personal and social relationships” (Halliday & Matthiessen, 2004, p. 29) through language. Clearly, participants in a group talking about instructional practice could make polar statements, statements that affirm or deny something without qualification (e.g., “He did not write the problem on the board”). In making a modal statement (e.g., “He could have written the problem on the board”), however, the statement not only makes an observation about the world but also invites others to respond to it. Since the

³ It is clear that other linguistic resources could also appeal to the audience: For example, the *mood* of a clause may also do that, such as when a speaker chooses to ask a question (e.g., “is that right?”) as opposed to merely state an assertion (e.g., “that’s not right”). Also, the *person* of a clause, or the speaker’s choice of how to denote who is making the claim, is an interpersonal resource: When someone says “we don’t do that” instead of “I don’t do that,” this indicates an effort to involve the audience in the claim. We expect that later efforts to size up the extent to which statements made by a member of a group appeal to the group would find ways to include resources from different linguistic systems. Here we’ve only looked at modality.

object of the talk, events in instructional practice, belong to the participants of the group conversation, such modal statements can be considered representations of group knowledge. Since the discussion had an open agenda and was facilitated without explicit questions about the norms of instruction, participants' modal statements about instructional practice could be viewed as embodying evidence of tacit knowledge.

We asked the following research questions:

- Is there a difference in the proportion of modal statements about mathematics teaching between sessions where teachers watched a video representation of mathematics teaching and sessions where teachers watched an animated representation of mathematics teaching?
- Are there differences in the type of modality in statements about mathematics teaching between sessions where teachers watched a video representation of mathematics teaching and sessions where teachers watched an animated representation of mathematics teaching?

Methods

Sample

We conducted a secondary analysis of group conversations among teachers of high school geometry. Conversations had been video-recorded and then transcribed, with the transcripts of the audio track serving as the main source of data for analysis. We examined transcripts from 10 group sessions, half were from sessions where teachers had viewed and responded to a video representation of teaching and half were from sessions where teachers had viewed and responded to animated representations. All of those sessions had been managed with

an open-ended agenda as described above. Sessions averaged 7 teachers per meeting in both video and animation sessions with the number of participants per session ranging between 4 and 15. Participants came from a range of districts including rural, urban, and suburban; all of them had, as a rule, three or more years of experience teaching high school geometry (see Table 1). On average, teachers had 15 years of experience in the classroom (*range* = 3 to 36), 11 of which were specific to the teaching of High School Geometry (*range* = 2 to 36).

Table 1.
Participants per Session and Session Type.*

Video-based Session		Animation-based Session	
Date of Session	<i>N</i>	Date of Session	<i>N</i>
May 5, 2002	4	December 6, 2005	4
November 22, 2002	4	March 7, 2006	4
May 17, 2003	6	August 22, 2006	15
August 17, 2004-1	7	January 16, 2007	9
August 17, 2004-2	7	January 24, 2007	8
Total <i>N</i>	28		40

* As a rule groups included different participants though some individuals participated in more than one session.

In both sessions where video and animations were viewed, participating teachers would watch a representation of classroom teaching, either video or animation, and engage in discussion about the teaching depicted. The teaching depicted in each of those included practices

that were not normative (e.g., in the video the teacher was seen encouraging a student to assume a statement without immediately providing a justification, in the context of doing a proof), though other practices were normative (e.g., the teacher posed the problem and let students' work on the problem). The video-based sessions were ones that had been successful in eliciting responses from participants that informed about the norms of practice (Herbst & Chazan, 2003; Nachlieli & Herbst, 2009; Weiss et al., 2009). The present study compared transcribed audio data from those video-based sessions with data generated by confronting similar groups of teachers with animations that, likewise, depicted scenarios with at least one breach of a norm of the situation "doing proofs" in high school geometry (Herbst, Chen, Weiss, and González, 2009). Table 2 describes the video and animations used in each session.

Session	Artifact Title	Synopsis and Breach
All Video-based Sessions	Angle Bisectors of a Parallelogram	A teacher is managing the students' work on proving that the angle bisectors of a parallelogram make a rectangle. The student at the board makes a statement but cannot justify it and the teacher encourages the student to assume the statement is true and move on with the proof; the teacher points out that they will come back to justify the assumed statement later.
Animation-based session 12/6/05	The Parallelogram	The class is investigating the angle bisectors of a parallelogram. Students assume the diagonals are angle bisectors and take that as givens for the proof that angle bisectors meet at a point. The teacher lets students continue on with that assumption.
Animation-based sessions 12/6/05 and 03/7/06	The Kite	The class is investigating what happens with the angle bisectors of a kite. One student assumes that the diagonals are angle bisectors and starts out a proof. The teacher lets the student continue on with the proof until she reaches an impasse. Later on the teacher asks students to consider two possible diagrams while doing the proof: in one the angle bisectors meet at one point and in the other they make three points of intersection.
Animation-based sessions 8/22/06, 1/16/07, and 1/24/07	A Proof about Rectangles	The teacher is manages the work on a proof about a rectangle. Rather than stating the givens and the "prove" statement, the teacher engages the class in proposing givens. Later on the teacher allows students to skip steps and omit reasons.

The agendas for both kinds of group sessions were open-ended and, in particular, participants were not told whether the representation (either video or animation) was proposed as a good or bad example, or that it contained a breach of a norm: Participants were told that the representation was a case of doing proofs in high school geometry instruction. They were invited to comment freely, all comments were accepted and not evaluated. Quite often participants would engage with each other's comments and the conversation would continue without the need for facilitation.

Preparation of Data for Analysis

To compare teacher group responses in video and animated sessions, we used Systemic Functional Linguistics (SFL; Halliday & Matthiessen, 2004) to examine the transcribed data from each session. Specifically, we examined teachers' use of modality, which, as described above, is a language resource that enables speakers to fulfill what Halliday has called the interpersonal metafunction of language: to relate to others. Modality allows a speaker to invite others into the conversation by hedging the utterances they make, such that the speaker's uttered claims are not limited to what is or what isn't, but what *may* be, *can* be, *must* be, etc. By hedging one's claim with modality, the speaker expands the meaning-making potential that can follow from the uttered claim (Halliday & Matthiessen, 2004). For example, in a video session from our data, one participating teacher noted that, "there are a bunch of skills that go into the proof which we don't *really* make visible to the students." By applying the modal *really* to the second half of her utterance, the participant invited other participants in the session to shape the claim made (arguably their choice of *person*—we—also supports that invitation). However, if the participant had simply stated that, "I don't make [those skills] visible to the students," the statement would

have invited fewer potential responses. Modality supports speakers' establishment of relationships with others because by qualifying the process it reports, a modal clause opens the floor for other voices, inviting to concur or lessening the cost of disagreeing (Martin & White, 2007). So "we don't *really* make [the skills] visible" effectively invites more responses from others than "I don't make [the skills] visible" because the latter statement is stated as if it were fact, and thus conveys a sterner stance in which another speaker is less likely to counter.

Table 3
Modality classifications.

Probability	High	(+)	<i>Alpha has <u>definitely</u> changed the problem.</i>
		(-)	<i>Alpha has <u>certainly</u> not worked on the problem posed.</i>
	Median	(+)	<i>Alpha <u>probably</u> knows what he is talking about.</i>
		(-)	<i>Alpha <u>may not</u> know what angle bisectors are.</i>
	Low	(+)	<i>Alpha <u>might</u> need a reminder of what the problem was.</i>
		(-)	<i>Alpha <u>might not</u> be so far off a solution.</i>
Usuality	High		<i>Alpha <u>always</u> makes confusing claims.</i>
	Median		<i>Alpha <u>usually</u> wants to share his work.</i>
	Low		<i>Alpha <u>rarely</u> has anything worth spending time on.</i>
	Zero		<i>Alpha <u>never</u> justifies his claims.</i>
Appropriateness	High	(+)	<i>It was <u>required</u> that Alpha marked the diagram.</i>
		(-)	<i>Alpha <u>must not</u> answer before being called.</i>
	Median	(+)	<i>Alpha <u>should</u> have marked the diagram.</i>
		(-)	<i>Alpha was <u>not supposed to</u> answer before being called.</i>
	Low	(+)	<i>Alpha <u>may</u> mark the diagram.</i>
		(-)	<i>It's <u>unnecessary</u> for Alpha mark the diagram.</i>
Inclination	High	(+)	<i>I like the teacher to <u>encourage</u> Alpha.</i>
		(-)	<i>I don't like it when students go back to their seats discouraged.</i>
	Median	(+)	<i>I'd be inclined to draw the diagram myself.</i>
		(-)	<i>I'd not like to derail Alpha's train of thought.</i>
	Low	(+)	<i>I'd be okay doing that.</i>
		(-)	<i>I'm not sure that is the best thing to do.</i>

As noted above Halliday and Matthiessen (2004) identify four categories of modality: probability, usuality, obligation (which we refer to as appropriateness), and inclination. Probability conveys the degree to which the speaker reports the likelihood of a process, while usuality conveys how typical a process is reported to be. Appropriateness refers to the degree to which a process is regarded as appropriate, while inclination expresses the speaker's consideration of a process as desirable. Each modality type can be conveyed as positive or negative and each category can be expressed with varying degrees of intensity. Examples for each category are provided in Table 3.

While use of modality in discourse invites responses from other participants, the specific categories of modality allow for a level of interpretability in regards to the grounds on which a hedge has been made. So, using a token of *appropriateness* offers a proposal as appropriate, or not. By doing so, such a proposal also prompts other participants to contribute their own appraisal. For example, during one animation session, a participant commented that the teacher "...*should* have just said, 'let's try to prove it all,' and he didn't" which another participant responded "Or *maybe* depending on how much experience they have with proofs, break them up into groups at that point..." The first participant used modality to describe the appropriateness of the animated teacher's actions, suggesting something that *should* have happened, which the second participant responded with another possibility. Note that the second participant's statement responded not only to the use of modality, but to the type of modality that was used; in noting what should have happened, a response to another possible action that could happen. Of particular interest for us is the fact that both hedged statements tell us something about the participants' knowledge of instructional practice. This feature of modality is what we view as being useful in examining teachers' tacit knowledge.

To examine the transcribed data, we used WordSmith 5.0 (Oxford University Press, 2004), a text analysis application, which could create concordances for a number of words that are often used as modals (e.g., would, likely, see Table 3 for examples and the Appendix for the complete list). The concordances were used to identify clauses that had those target words. Then, the clauses were examined to determine whether the target word had been used as a modal (or instead was a false positive). Further, clauses that contained modals were also examined in regard to whether the process reported in the clause concerned the practice of teaching (as opposed to logistics of the session; e.g., food would be good now; these modals were excluded from analysis). Additionally, once a word was identified as a modal, it was then categorized, assigned a negative or positive degree, and assigned a rank of intensity (see Table 3 and the Appendix).

Two raters examined the concordances and the transcribed data for these features. Cohen's Kappa was used as a measure of the interrater reliability. The Kappa scores can be interpreted such that ≤ 0 is poor; .01 - .20 is slight, .21 - .40 is fair; .41 - .60 is moderate; .61 - .80 is substantial; and .81 - 1 is almost perfect (Sim & Wright, 2005). A Kappa of .88 was obtained for rater agreement in whether or not a word in the concordance was used as a modal or not. Kappa statistics for assignment to the modality classification and degree of that classification were as follows: .79 for probability; .94 for usuality; .88 for appropriateness; and .84 for inclination. Therefore, the coding process was deemed to have sufficient reliability. Raters then reconciled the data before it was used in analysis.

In addition to using the concordance to detect words that might have been used to make a modal statement, we also examined the discourse for teachers' use of mental and verbal transitive processes (Halliday & Matthiessen, 2004). Mental processes are typically denoted with verbs such as *think, feel, like, see, hear, believe, etc.*, while verbal processes are typically

denoted with verbs such as *say*, *tell*, etc. Halliday and Matthiessen (2004) indicate that mental and verbal processes can be used as grammatical metaphors for modality. For example, the participant statement “I *think* a lot of kids struggle in geometry because they have trouble bringing that language to a drawing” is a modal version of “A lot of kids struggle in geometry because they have trouble bringing that language to a drawing.” The former statement conveys a sense of openness similar to the examples of modality presented thus far, while the latter is a polar statement. Given this relationship, we included mental and verbal processes in our analysis as a separate classification. Thus mental and verbal processes were counted as being present as grammatical metaphors of modality and then coded as indicating negative or positive stances. Similar to the coding process for modality, two raters coded for mental and verbal processes. A Kappa of .94 was obtained for rater agreement in whether or not a word in the concordance was a mental or verbal transitive process with specific Kappa scores of .84 for mental processes and .81 for verbal processes. Therefore, the coding process was deemed to have sufficient interrater reliability; codes were reconciled where differences between the two coders occurred (see Kosko and Herbst, 2012).

Analysis and Results

Our first research question sought to examine whether the frequencies of hedged statements, either with modals or mental/verbal processes, about mathematics teaching differed between video and animation sessions. To examine this research question, we calculated the percentage of spoken words by teachers in each session that had been deemed indicators of modality, either because they were modal words or because they were mental/verbal processes used in the service of modality. This was done since some sessions lasted longer than others, and thus could have contained more modals or mental/verbal processes just by virtue of the length of

conversation. Once percentages were calculated, the Wilcoxon-Mann-Whitney test was used for three analyses between each condition: to see if there was a difference in the use of modality (including both modal words and mental/verbal processes), to see if there was a difference in modal words alone, and to see if there was a difference in the use of mental/verbal processes. The Wilcoxon-Mann-Whitney was a particularly appropriate test given the low sample size in the comparison ($n = 10$ sessions). Further, Siegel and Castellan (1988) have characterized it as “one of the most powerful of the nonparametric tests” and “a very useful alternative to the parametric t test” (pp. 128-129).

Given the varying lengths of the different sessions, we weighted the frequency counts of modals and grammatical metaphors for modality (mental and verbal processes) by dividing the counts by the number of words in a particular session. This allowed for a weighted comparison when applying the Wilcoxon-Mann-Whitney test. Results of the Wilcoxon-Mann-Whitney test found no statistically significant differences between video and animation sessions in regards to frequency of modality usage overall ($U = 17.0, p = .421$) or modals ($U = 17.5, p = .310$). These results indicate that both video and animation sessions had relatively similar proportions of modal usage. However, a significant difference was found in the proportion of mental/verbal processes used ($U = 22.5, p < .05$), indicating that sessions where animations were viewed had higher proportions of mental/verbal processes used in the discussions surrounding them than in sessions where videos were viewed.

Our second research question focuses on differences between video sessions and animation sessions for particular classifications of modality and processes. Given the categorical nature of such data, chi-square statistics were calculated for each comparison. The first comparison sought to examine whether a relationship existed between the type of grammatical

metaphor elicited (whether a mental process or a verbal process was used as grammatical metaphor of modality) and the type of media used in sessions (video or animation). A Chi-square statistic of 13.26 ($p < .001$) was found, indicating that the relationship between type of grammatical metaphor used (mental or verbal process) was not independent from the type of session (video or animation). Table 4 illustrates that 71.1% of grammatical metaphors were mental processes in video sessions compared to only 65.9% in animation sessions. However, verbal processes made up a higher percentage of the grammatical metaphors used in animation sessions (34.1%) as compared to video sessions (29.9%). Such differences do not, on the surface, seem meaningfully large, since both forms of representation elicited mental processes in higher frequencies than verbal processes. However, the statistical significance suggests a more nuanced relationship. When the results of the Chi-square analyses are paired with the results from the Wilcoxon-Mann-Whitney test, they indicate that while animation sessions had higher proportions of grammatical metaphors (both mental and verbal processes) than video sessions, when we separate these counts into mental or verbal processes, video sessions had comparatively higher frequencies in mental processes than animation sessions, and animated sessions had comparatively higher frequencies in verbal processes. In other words, teachers made more statements involving both mental and verbal processes during animation sessions than in video sessions, but the proportion of type of process elicited was different depending on the type of representation used.

Table 4. *Presence of Mental or Verbal Process.*

	Video Session	Animation Session	Total
Verbal Process	477	1056	1533
Mental Process	1172	2039	3211
Total	1649	3095	4744

Comparisons within the modality classifications for differences between video and animation sessions are displayed in Table 5. Several statistically significant relationships were found for: probability ($\chi^2 = 4.15, p < .05$), appropriateness ($\chi^2 = 7.17, p < .01$), and inclination ($\chi^2 = 5.99, p < .05$). These results indicate that the relationships between these particular types of modality (probability, appropriateness, inclination) are not independent from the representation used in the discussion sessions (video versus animation). Examination of Table 3 shows that animation sessions had proportionally higher frequencies for appropriateness and probability than video sessions, while video sessions had proportionally higher frequencies for inclination than animation sessions. No statistically significant difference was found for the usage of the usuality type of modality ($\chi^2 = 1.47, p = .226$).

Table 5.

Presence of Modality Classifications.

		Video Session	Animation Session	Total
Probability	No	518	747	1265
	Yes	464	792	1256
Total		982	1539	2521
Usuality	No	879	1400	2279
	Yes	103	139	242
Total		982	1539	2521
Appropriateness	No	624	895	1519
	Yes	358	644	1002
Total		982	1539	2521
Inclination	No	703	1169	1872
	Yes	279	370	649
Total		982	1539	2521

While one session type was more likely to elicit one form of modality over another session type (e.g., animation sessions had higher proportions of appropriateness modals than video sessions), it is worth noting that both animated and video sessions elicited more probability

modals than appropriateness, more appropriateness modals than inclination, and more inclination modals than usability. This similarity in the rank of modal-usage type, combined with the results of the Wilcoxon-Mann-Whitney test, suggests that while video and animation sessions elicit similar kinds of modal-usage in teachers' discussions about mathematics teaching, there are subtle differences in such modal-usage. Implications of these findings are provided in the discussion section of this article.

	Video Sessions	Animation Sessions
Probability	"I would <i>probably</i> stop at this point, and if the students were having problems, then I would do an example..."	"It <i>might</i> have been easier to understand if it was a proof by contradiction..."
Usuality	"My students, they <i>always</i> used to do this..."	"I've <i>always</i> done paragraph proofs when doing proof by contradiction."
Appropriateness	"They <i>should</i> have used numbers in all those angles, because there's too many angles there..."	"I mean you <i>could</i> put the given at the beginning of the proof..."
Inclination	I think it might be <i>good to</i> see how far they can get without that..."	"I don't <i>want</i> every [one of] my kids to, just to take it as a given and go on even if you have no idea..."
Mental Process	"I <i>mean</i> , I <i>think</i> that I would assign the same problem as homework ..."	"I <i>mean</i> , visually you can slide the two diagrams together and they appear congruent."
Verbal Process	"That wouldn't work in my classroom, I guess is what I'm <i>saying</i> ."	"Using givens, let's <i>say</i> that you already know that the rectangle formula exists."

The results of the present study should be taken as evidence of differences in the relative frequencies of modality usage. The types of statements in video and animation sessions were generally similar in nature. Table 6 provides a useful sample of statements from each modality type and grammatical metaphor examined. Notably, sample statements from the video and animation sessions describe the work associated with mathematics teaching in similar ways. So, while the types of statements that incorporate probability modals are similar in nature, regardless

of the type of representation used, animation sessions elicited proportionally more of such types of statements than video sessions.

Discussion

A consequence of this study is that animations appear to be just as useful as videos to elicit modal statements about instructional practice. As long as that is the purpose of the research, producing animations to elicit that data seems not to threaten the work of researchers with loss of information, at least as far as its quantity. The study also suggests that there are subtle differences in the kinds of modal-usage elicited.

- It suggests that animations may tap into appropriateness more so than videos, while video does so for inclination. This is an interesting distinction since both appropriateness and inclination are described as resources for the modulation of proposals by Halliday & Matthiessen (2004; see also Eggins & Slade, 1997, p. 102). Proposals are statements that suggest what ought to happen: Modals temper proposals in different ways, indicating that something can, should, or must be done, and also that one is willing to, keen to, or determined to do it. The appropriateness type of modality seems to assume more of a collective stance than the inclination type. Given that animations elicited higher usage of appropriateness modals than videos, it appears that an animation-based conversation might more clearly relay norms of instruction.
- Suggests that animations may tap into probability more so than videos. While not statistically significant, video sessions had higher proportion of usuality propositions than animations. This may suggest a similar distinction in propositions (assertions of what is and what is not) as was found for proposals.

- The apparent preference to respond to videos with desirability proposals as opposed to appropriateness proposals could be related to teachers' reticence to be critical of colleagues when watching video. Seago (2004, p. 275) notes that when teachers discuss video records "politeness and agreement is the norm" and that teachers tend to handle differences with comments such as 'everybody needs to teach according to his style.' (see also Levine, 1984)

The study helps validate a novel kind of instrumentation for research on teacher thinking, by demonstrating that when animations are used along with open-ended agendas, they produce similar responses from groups of teachers as comparable video episodes do. Since animations can be produced so as to systematically represent breaches of instructional situations and they can be just as useful in the study of the tacit knowledge of groups of teachers as videos can, it seems that education researchers interested in tapping this phenomenon could do so by producing animations and using them to prompt conversations among practitioners.

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Appendix

Desirability / Inclination					
3	2	1	-1	-2	-3
High: Conviction Belief?	Median: Attitude	Low: Undertaking	(-) Low: ~Undertaking	(-) Median: ~Attitude	(-) High: ~Conviction
Determined Conviction *Definitely *Certainly	Keen to Pleasure to Wonderful to Great to Excellent to Good to *Miraculously Fortunate to *Amazingly	Willing to (it's a) commitment "I" Would I'd Considering	"I" Would not Lack conviction to Not determined to Not convinced that/...	Horrible Distasteful Alarming* Bad	Determined not to Convinced that itsn't Unwilling

*denotes cross-classification with other modal type.

Obligation / Appropriateness					
3	2	1	-1	-2	-3
High: Directive	Median: Advice	Low: Permission	(-) Low: ~Permission	(-) Median: ~Advice	(-) High: ~Directive
Necessary to Needed (need to) Responsibly Must Required to Have to Has to	Appropriate to Appropriately Valid to Should Ought to Supposed to	Acceptable to Acceptably *May (permissive) Allowed to Permitted to *can (permissive)	*May not (permissive) Not Allowed to Unnecessary to	Inappropriate to Invalid to Shouldn't Will not Ought not Not supposed to	Not Acceptable to not needed to Irresponsible Mustn't Not Required to Not have to *Cannot (permissive)

*denotes possible cross-classification with other modal type.

Warrantability / Probability (Comprehensibility / Obviousness)					
3	2	1	-1	-2	-3
High: Certain	Median: Probable	Low: Possible	(-) Low: Uncertain	(-) Median: Improbable	(-) High: Impossible
Will/Shall *Certain(ly) *Definitely Sure(ly) Absolute(ly) Really Literally Simply Inevitab(ly) Of course No doubt Indeed Undeniably Unquestionably Obviously\\ Of course\\ Clearly\\ Plainly\\	(I) think *May Likely Probab(ly) “to some extent” Mostly Evidently\\ Apparently\\ Presumably\\ Seemingly\\ Admitably Arguably	Might *Can (I) suspect Possibl(ly) Roughly So to speak Plausible Capable** Able to/ability to** Mysterious\\ Vaguely\\ Kind of** Sort of** Kinda** Sorta**	Not really Evitable Doubtful Questionably Might not Not certain	Illogical\\ *May not Unlikely Improbable unapparent Hardly\\	*Can not Incomprehensible\\ Impossib(ly) Implausible Incapable** Unable/not able** Certainly not

\\ denotes “Comprehensibility/Obviousness”; **denotes “Capability-Ability; *denotes cross-classification with other modal type.

Usuality / Expectability			
4	3	2	1
High Always /Almost Always	Median: Usual	Low: Rare	(-) Zero Never
Always Typical Mainly	Usually Usual Expectable In most cases Mostly Largely Often Almost Always	Sometimes Rare/Rarely Atypical Unusual Surprising(ly) *Alarming *Miraculous *Amazingly Seldom Almost Almost Never Not Often	Never
*denotes cross-classification with other modal type.			