

Integrity in the Airline Cockpit: Embodying Claims About Progress for the Conduct of an Approach Briefing

Maurice Nevile

Linguistics and Applied Linguistics, School of Language Studies
Australian National University, Canberra

Toward the end of every airline flight, the pilots must prepare and agree on a plan for how the final stages of the flight—the descent, approach to the runway, and landing—will proceed, for what it is that they will do and know, as a crew, to bring their plane safely and unremarkably (all going well) to the ground. This plan emerges from a specific cockpit task called an *approach briefing*, which the pilots complete. In this article, I used transcriptions from video recordings of pilots at work on an actual scheduled passenger flight to examine in microdetail processes of talk-in-interaction as pilots conduct an *approach briefing*. My main interest is to show how the *approach briefing* emerges as talk and nontalk activities (e.g., writing, touching displays) are precisely coordinated to constitute a series of embodied claims, by the pilot leading the briefing, about his progress in conducting the various parts of the task. I suggest that this coordination is constitutive of work in the airline cockpit and most likely other sociotechnical work settings. In these settings, it is critical to perform and complete tasks and the talk and nontalk activities required for them in strict sequence, and

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Correspondence concerning this article should be sent to Maurice Nevile, Linguistics and Applied Linguistics, School of Language Studies, Faculty of Arts, Baldessin Precinct Building, Australian National University, Canberra, ACT, 0200, Australia. E-mail: mauricenevile@optusnet.com.au

so it is critical to ensure a kind of integrity in creating understandings of conduct in the trajectory of task-related actions. I suggest that the methods and findings of this article have a particular applied significance for commercial aviation, related research in aviation human factors, and accident investigation, particularly for the description and analysis of 2 key constructs: situation awareness and human error. In the article, I also present a new way for showing in transcriptions details of nontalk activities and their timing relative to talk.

As an airliner descended for landing in very heavy rain and reduced visibility, the Captain asked the First Officer, “You happy?” The First Officer, in control of the aircraft, replied “Ah yes” (Australian Transport Safety Bureau [ATSB], 2001, p. 8). Just 49 sec later, the aircraft crashed as it overran the runway and collided with an antenna structure before running onto a golf course. As the official report into the accident showed (ATSB, 2001), this accident was typical in that it was not caused by a single factor but was the outcome of a combination of many factors (Dekker, 2001a, 2001b; Helmreich, 1994; Maurino, Reason, Johnston, & Lee, 1995). These factors included organizational, policy, regulatory, mechanical, company, economic, and finally human factors. Although in this article, I do not analyze data of that accident, I am generally concerned with the last of these factors, *human factors*, in commercial aviation, and I am specifically concerned with one aspect of how pilots routinely talk and interact as they work together to prepare a flight for descent, approach to the runway, and landing. In the article, I use naturally occurring data, transcriptions from video recordings of pilots at work on an actual scheduled passenger flight, to examine in microdetail processes of talk-in-interaction as pilots develop and demonstrate to one another their understandings as they conduct an *approach briefing*, which one pilot presents and both pilots consider and agree to for bringing the flight safely to the ground.

My main interest is to show how the *approach briefing*, a kind of plan, emerges as talk and nontalk activities (e.g., writing, touching displays) are precisely coordinated to constitute a series of embodied claims, by the pilot leading the briefing, about his progress in conducting the various parts of the briefing. For each part of the briefing, this coordination of talk and nontalk activities is evidence, available to the other pilot, of moment-to-moment shifts from preparedness, to in-progress, to completion. Through this precise coordination, the pilot always both creates and presents a match between what he claims to be doing and what he is doing, and between what he claims to have done and what he has actually done. There is therefore always a match between what he has done and what he claims,

consequently, to understand about his progress in the conduct of the briefing, and so presents as acceptable and appropriate for the other pilot to understand about his progress. That is, by producing, modifying, and coordinating his emerging talk and nontalk activities in delicate ways, the pilot establishes and makes publicly available the activities he performs, exactly when he performs them, and the understandings he claims to have, exactly when he has them, as he progresses in the task. In this way, the pilot paces the development of task-related understandings, presenting not just what should be known but exactly when it is appropriate for him and the other pilot to know certain things about his conduct of the briefing. In this article, therefore, I investigate the interactional creation of shared understandings for one cockpit task. I consider both aspects of the nature and organization of the talk and the significance of the way in which talk is coordinated with nontalk activity to examine how an *approach briefing* is accomplished in a way that is recognized by the pilots as meaningful, unremarkable, and acceptable.

In the airline cockpit and other sociotechnical work settings, it is critical to perform and complete tasks and the talk and nontalk activities required for them in strict sequence. That is, one task becomes appropriate or even possible only when some other task has been completed and is understood to be so by both pilots. Within any task, such as an *approach briefing*, specific talk or nontalk activities are appropriate or possible only when other talk and nontalk activities have been completed and are known to be so by both pilots. This article is evidence of how airline pilots, moment to moment, routinely orient to and achieve this sequential nature of their work. I suggest that a precise coordination of talk and nontalk activity reflects and realizes a professional orientation of airline pilots and others for a kind of integrity in creating understandings of the trajectory of task-related actions, and that this integrity is a constitutive part of the work of airline pilots: it is one critical aspect of talking like and being an airline pilot.

TALK-IN-INTERACTION IN SOCIOTECHNICAL WORK SETTINGS

In this article, I offer detailed description and analysis of talk-in-interaction for routine practice in a specific sociotechnical workplace and so join recent interest, using or informed by insights and methods of ethnomethodology and conversation analysis, in talk-in-interaction in a range of

sociotechnical work settings where groups or teams coordinate their activity to work together and complete goals (Button, 1993; Heath & Luff, 2000). Such studies have presented detailed descriptions and analyses of participants' talk and actions for the moment-to-moment conduct of work, showing how work actually gets done, for example, in medical settings (Hindmarsh & Pilnick, 2002), in oceanographic research (C. Goodwin, 1995), in maritime navigation (Hutchins, 1990), a control room for the London Underground (Heath & Luff, 1996), and in aviation related settings, air traffic control (Harper & Hughes, 1993), and an airline operations room (C. Goodwin, 1996; M. H. Goodwin, 1995, 1996; C. Goodwin & Goodwin, 1996; Suchman, 1993, 1996, 1997). In this article, I add to such literature by considering the work of airline pilots.

Talk-in-interaction in these settings typically involves multiple participants who may or may not be in the same physical location and is closely aligned to and mediated by participants' use of "tools" of various kinds in the performance of nontalk activities such as reading a chart, monitoring a display, writing on a form, handling a surgical instrument, or controlling, responding to, or manipulating other features of the physical setting. Furthermore, through processes of talk-in-interaction, participants develop situated understandings that are germane to the tasks they are performing. That is, talk enables participants to understand what is happening around them and where they are up to and what they are doing relative to the team's goals. Such studies have been able to draw on the insights of many researchers, including C. Goodwin (1981, 1986, 2000a, 2000b), Kendon (1990), and Schegloff (1998), with particular interest in how naturally occurring talk is closely integrated with participants' nontalk activities and how participants move and position their bodies. Talk has been shown to be just one of the many resources available to participants in their collaborative work to accomplish interaction. For example, talk occurs alongside participants' gaze direction, variations in posture, head movement (e.g., nodding), hand action, and even walking from one place to another. Nontalk features of an interaction can be described in precise detail to understand their relation to the talk that emerges and to the participants' interpretations of what is going on.

COMMUNICATION IN THE COCKPIT

With its focus on routine talk and practices in the airline cockpit, this article also has a particular applied significance as hinted at in my opening

comments. Over many years, the evidence from “black box” cockpit voice recorders (Faith, 1998; MacPherson, 1998) had led the commercial aviation industry and accident investigators to recognize that human performance is a contributing factor in around two thirds of all accidents and at least that proportion of incidents (Cushing, 1994; Pope, 1995). Around 75% of fatal airline accidents involve planes that are technically able to be flown and landed safely (Taggart, 1994). Usually the concern is not so much one of pilots’ individual competence, their technical knowledge or ability to control their plane, but the way the pilots communicate and act as a crew in specific circumstances, for example, to share information, assess situations, and make decisions (Cushing, 1994). As a result, training and practice in commercial aviation are now increasingly influenced by studies of leadership, coordination, decision making, and communication within teams (Castellan, 1993; Foushee, 1984; Galegher, Kraut, & Egidio, 1990; Hayward & Lowe, 2000; Johnston, McDonald, & Fuller, 1994; Klein, Orasanu, Calderwood, & Zsombok, 1993; Lowe & Hayward, 2000; Wiener & Nagel, 1988). It is common now for airline pilots to receive training in “crew (or cockpit) resource management” to improve their performance and communication as members of a team (McAllister, 1997).

However, although it is accepted that pilots’ communication plays a critical role in their performance, such communication has rarely been studied in detail and in context as part of interaction evolving over time. As a result, *communication* is frequently mentioned in the relevant aviation literature, but it is not exactly clear how airline pilots talk and interact with one another and with the physical features of cockpit in naturally occurring, routine situations. Overwhelmingly, industry and human factors researchers have favored psychology-driven studies that are experimental and quantitative, laboratory or simulator based, and in which pilots’ utterances are categorized (e.g., as commands, reports, questions, prognoses, diagnoses, requests, complies, etc.), coded, and entered into large databases where they are isolated from the interactional circumstances that gave rise to them. Pilots’ utterances are then counted and compared and related to official cockpit roles (Captain, First Officer), specific cockpit tasks (e.g., setting the autopilot), stages of flight (e.g., takeoff), or aircraft types (e.g., Helmreich, 1994, 1997; Krifka, Martens, & Schwarz, 2003; Mjøs, 2001; Redding & Seamster, 1994; Sumwalt & Watson, 1995; and see Hayward & Lowe, 2000, and Lowe & Hayward, 2000).

This is also typically the case for studies that have drawn on expertise in language and linguistics, and such studies also usually have focused on the role of communication in accidents or other abnormal or crisis situa-

tions, perhaps best exemplified by Cushing's (1994) dramatically titled book *Fatal Words: Communication Clashes and Aircraft Crashes*. That is, the focus has usually been on communication when things go wrong rather than on routine communication when everything is as it should be. In contrast, my interest is on seeing what such routine talk looks and sounds like or on how it works and comes to be produced, recognized, and accepted as routine talk. For example, Linde (1988) looked at politeness in flight crew communication and its possible effect in emergency and accident situations. Linde claimed that politeness, in the form of mitigation, affects communicative success, particularly in utterances from lower to higher ranked pilots and that, for example, suggestions to a Captain are more likely to fail if they are mitigated. Morrow, Rodvold, and Lee (1994) looked at nonroutine radio exchanges between pilots (not only airline pilots) and air traffic controllers. Such exchanges occur when routine communications are disrupted by some kind of communication problem. Morrow et al. identified the causes of communication problems and explored how pilots and controllers collaborate to resolve them. Likewise, Kent Jones (2003) was concerned with "language flaws" (p. 239) such as "phraseology defects" (p. 239) in pilot-controller talk. Kent Jones claimed that language issues were a critical factor in a number of accidents and argued against the use of English for air traffic control. Shuy (1993) counted various aspects of one pilot's speech to controllers to determine the possibility of pilot error in a plane crash including the pilot's syntax, pronunciation, and speech acts but presented only isolated actual instances of communication.

Frankel (2000) offered a significant account of microanalysis of communication and interaction in the cockpit but like others also focused on talk when things go wrong and like much of the aviation literature used recordings from sessions in flight simulators rather than actual flights. Frankel (2000) identified the significance of "orders of interactional complexity" (p. 296) and suggested that participation in more than one interactional exchange can be a source of distraction and play a role in the emergence of human error. Frankel (2000) called for further such research and noted, "virtually all previous research in the aviation context has focused on individual behavior, with disappointing results" (p. 299) and that micro-interactional analysis of cockpit crew conversations "is still in its infancy" (p. 300). It is time this field grew up, especially given the significance of communication and interaction for pilots' work and ultimately for safe flight.

An Approach Briefing

In this article, I consider in detail a flight crew's performance of a routine task, an *approach briefing*, as part of a larger study (Nevile, 2004) on routine processes of talk-in-interaction in the airline cockpit. In the larger study (Nevile, 2004), I considered pilots' routine conduct of numerous flight tasks such as taking off, monitoring and changing altitude (also Nevile, 2002b), engaging the autopilot, setting a new directional heading, talking to air traffic controllers, landing (also Nevile, 2001), and conducting a checklist (Nevile, in press). Like all flight tasks, it is important to get the briefing right, and getting it wrong or otherwise preparing inadequately for the final stages of the flight can have catastrophic consequences for the outcome of the flight (Flight Safety Foundation [FSF], 1996, 1997). In the accident I referred to at the outset of this article, the pilots were unaware of the amount of water on the runway, and the potential effect of this water on braking given how they had prepared the plane for the landing (ATSB, 2001). Pilots of another airliner became confused about the identity of the navigation points to be used for the approach, became lost, and collided with mountains (MacPherson, 1998), whereas other aircraft have crashed on approach to the airport when they ran out of fuel (Helmreich, 1994) or when pilots agreed on an incorrect "minimum altitude" for the descent, and consequently, their plane descended below the height of surrounding terrain (i.e., flew into the ground; Bureau of Air Safety Investigation, 1996; FSF, 1995, 2002). By focusing on an *approach briefing*, in this article, I deepen the understanding of the range of tasks that make up the work life of a particular sociotechnical work setting, the airline cockpit, and the ways in which pilots draw on various interactional resources to conduct an important part of their routine work.

An *approach briefing* is conducted on every flight as pilots prepare for the descent, approach to the destination airport, and landing. The briefing occurs at the end of the cruise stage of the flight as the plane approaches the *descent point*, that is, the point in the flight at which the descent is begun. The aim of *approach briefings* is for the pilots to develop a shared understanding of how the descent, approach, and landing will proceed. Briefings are led by one pilot, the *Pilot-Flying* (i.e., the pilot in control), and can include information on turns the plane will make, speeds for different points in the approach, important altitudes, settings for the wing flaps as well as details of the destination airport, runway, surrounding terrain, and possible obstacles. The precise details to be covered will vary for every flight, and so

the *approach briefing* is an opportunity for matters to be raised and discussed, clarified, and even for details to be amended when necessary according to particular circumstances (e.g., changed weather conditions). The *approach briefing* is worthy of attention because of its role, as a plan, in informing and directing future tasks. Although the briefing itself is a task that involves certain activities, its primary role is to form the basis for new shared understandings that will be a guide and warrant to the conduct of later tasks. The *approach briefing* can therefore be thought of as the first in a larger sequence of tasks required to land the plane.

The *approach briefing* is particularly interesting as a cockpit task because of its apparently monologic nature, that is, most of the talk is produced by just one pilot. A Pilot-Flying typically leads the briefing, with the other pilot's contribution, often consisting only of an acknowledgment to confirm understanding and to accept the briefing, coming only at the end. What I show, however, is that the Pilot-Flying, on the flight examined here the First Officer, can be seen to produce his talk and nontalk activities in ways that are oriented to the needs of the listening pilot, the Captain. That is, I show how the First Officer's substantial contribution to the briefing is recipient designed in the form of embodied claims about his progress in the task. I show that the First Officer orients to his accountability to the Captain for both the technical content of various parts of the plan and for the claims he makes as these parts are addressed and completed by coordinating the timing of his talk and nontalk activities in particular ways. In this article, I therefore further interest in the interactive features of monologic talk, for example, Atkinson (1984, 1985), McIlvenny (1996), and Rendle-Short (2002) who considered speakers' gaze, gestures, and use of various tools in seminar presentations. In the article, I develop such interest in that I consider a new site for such monologic talk, the airline cockpit, a site that is different because the participants are members of a team performing a task for which they are both professionally accountable. In this article, I therefore consider a new kind of "audience" for monologue.

COLLECTING AND TRANSCRIBING THE DATA

The larger study (Neville, 2004) from which the data segment here is drawn used transcriptions made from video recordings of pilots at work on actual scheduled passenger flights. I arranged with two airlines to sit in the cockpit to video flight crews. I made 18 flights of which 6 were made on a Boeing 737, a twin engine jet airliner seating approximately 130 to 140

passengers, and 12 were made on a Fokker 50, a 40- to 50-seat twin propeller regional airliner. On these flights, I sat in the cockpit observer's seat or "jumpseat" positioned in between and immediately behind the seats of the two pilots. I could easily see and video both the pilots and almost all the cockpit controls and instrument panels. I used an ordinary handheld video camera, and I had access to a cockpit headset assigned to the jumpseat, which enabled me to record everything the pilots said and could hear. I was able to record the pilots' talk to each other, their talk to others outside the cockpit (e.g., air traffic controllers, passengers), as well as the noise of the engines and the many cockpit alert sounds and automated voice warnings. The larger study (Nevile, 2004) from which the data segment here is drawn also used video and audio cockpit data of European airlines.

In this article, I use transcription notation I have developed to represent precisely the timing of nontalk activities (e.g., hand movements) relative to talk and to periods of silence (see Nevile, 2004). That is, these conventions represent precisely when a nontalk activity begins and precisely when it ends relative to the flow of emerging talk. Nontalk activities are given below the line of talk with which they are concurrent. They are represented between double brackets, that is, (()), and also in bold. When there was more than one nontalk activity for a line of talk (or silence), these are listed below one another in the order in which they began (as in Ochs, Gonzales, & Jacoby, 1996). The "owners" of nontalk activities are indicated at the far left of the transcript just as they are for turns at talk. I use upward pointing arrows (↑) to indicate the precise points in the talk when a nontalk activity begins and ends, and these arrows are joined by underlining to show the duration of the nontalk activity (↑_____↑). Lines of nontalk activity are numbered according to the line of talk with which they are concurrent and also have a letter suffix. One advantage of this approach is that it shows at a glance that particular nontalk activities occur relative to the same line of talk, and the letter suffixes make further visible their relative chronological order. This approach allows easy identification of lines of nontalk activity whereas also allowing presentation of the same segment of data with or without nontalk activities included and with the numbering of lines able to remain consistent. The transcription notation is given in Appendix A.

Introducing the Segment

The segment of data here is the beginning of the briefing. Earlier in the flight, the Pilot-Flying, on this flight, the First Officer (FO/PF), had written this information on a small pad, the *landing data pad*. The pad rests on the

low central instrument console between the two pilots and just forward of the FO/PF's left knee (see Figure 1). According to standard operating procedures for this airline, the FO/PF leads the briefing by reading out the information, the landing data, on the pad. He also checks some of this information against relevant instrument displays, an altimeter (displaying altitude), and an airspeed indicator on his side of the cockpit. As the FO/PF reads, the other pilot, Captain/Pilot-Not-Flying (C/PNF), listens and checks the corresponding displays on his side of the cockpit. The pilots check that the settings each has made on these two displays (explained following) are identical to the settings made by the other pilot. On any flight, the briefing is always led by the pilot in the role of Pilot-Flying (PF). The Pilot-Flying is the pilot in control of the flight, and in this instance is the First Officer. The Captain on this flight is therefore the Pilot-Not-Flying (PNF) assisting the Pilot-Flying, but as Captain, he retains ultimate command of the flight. To avoid possible confusion in wording and too much repetition of acronyms, throughout the following analysis, I refer to the pilots as the First Officer and Captain. Both pilots are male.

The data segment may be difficult to grasp at first because of its specialist and technical nature. In Fragment 1, I present first a simplified transcription of only the talk, which can be read with reference to explanations given in Appendix B. Then in Fragment 2, I give a detailed transcription of



FIGURE 1 The First Officer leads the *approach briefing* and sits on the right-hand side of the cockpit. His left hand rests on the landing data pad to the left of his left knee. In the center of the picture is the control yoke in front of the First Officer (with the top-left corner of the approach chart just visible). Also in center picture are the altimeter and airspeed displays on the main instrument panel directly behind the First Officer's control yoke.

the talk before later in the article including in transcriptions the details of nontalk activities. The destination “Smalltown” is fictitious.

Simplified Transcription of the Talk

(1)

FO/PF: okay we need to plan so the plan shall be, go downhill at fortyeight miles south of Smalltown on DME on the GPS, we'll expect to be visual within twentyfive miles make a visual approach, to join left downwind for left circuit landing runway one eight. The airfield elevation is eighteen circuit height a thousand feet is bugged on the altimeter. Visual procedures left circuit. We'll be landing flap twentyfive with a Vref of ninety-nine and seventeen point seven (ton), carry ten for a hundred and nine and Vfr Vcl's a hundred and nine and fourteen. And they're all set.

(0.8)

C/PNF: set (crosschecked).

(0.8)

Detailed Transcription of the Talk

(2)

1 (13.4)
 2 FO/PF: okay we need to plan hh- so the plan shall be:::, (3.4) go downhill
 3 at (0.2) f::orty: (0.3) eight (0.4) mi::les:: er::: (0.4) south of
 4 Smalltown (0.3) on DME on the GPS, (1.6) we'll expect to be
 5 visual within twentyfive miles make a visual approach:, (1.7) to
 6 join left downwind for left circuit landing runway one ei::ght::.
 7 (0.3) the airfield elevation is eighteen (.) circuit height a thousand
 8 feet is bugged on the altimeter. (0.9) visual procedures left circuit:
 9 (1.9) we'll be landing flap twentyfi::ve with a:: ah
 10 (2.2) Vref of ninety:ni:ne and (0.2) seventeen point seven (ton),
 11 (1.2) carry ten for a hundred and ni::ne (0.9) and Vfr Vcl's a
 12 hundred and nine and fourtee:n. (1.3) <and they're all se:t:>
 13 (0.8)
 14 C/PNF: °set° (°crosschecked°).
 15 (0.8)

INITIATING A NEW TASK

The *approach briefing* will be a new task for the crew, and so the First Officer must make clear that this talk and task is to be distinguished from

prior talk and tasks and make the *approach briefing* into “what we’re doing now” as a new task involving both pilots separate from prior and unrelated tasks. The First Officer initially establishes how his talk and this task fit into the pilots’ ongoing interaction to conduct this flight. He talks after a lapse in talk of 13.4 sec (Fragment 2, line 1). In starting to talk, therefore, the First Officer is not only initiating a new task but is reinitiating talk between the two pilots. He does this by beginning his talk with “okay” (line 2). This “okay” is a discourse marker (Schiffrin, 1987) and does interactional work in that it marks his talk as separate from prior talk and as initiating something new (Beach, 1993). As Beach (1993) described it, “okay” can be used “*pivotaly*, in the midst of yet at precise moments of *transition* ... where what is ‘at stake’ involves movements from prior to next-positioned matter(s)” (p. 326). In turn-initial position, “okay” can be used as both responsive to prior talk and as preparatory to ensuing talk (Beach, 1993, p. 338). Here, the First Officer uses “okay” to mark and initiate new talk for a new task; it marks this talk and task as the next in the sequence of tasks to conduct the flight. He could then continue by explicitly labeling or identifying his talk with something like “approach briefing” or “Now it’s time to conduct the approach briefing.” What is seen, however, is that the First Officer makes no direct mention of an official *approach briefing* at all but refers instead to the pilots’ “need to plan” (line 2). He draws on the pilots’ shared understanding that a plan *needed* at this late point in the flight will be for the descent, approach, and landing. The talk he is initiating is therefore the *approach briefing*. By continuing with “so the plan shall be:::,” (line 2) he begins to actually present “the plan” and so can be heard to be claiming an extended turn at talk to which he is entitled in his role as the Pilot-Flying, the pilot who is responsible for leading the *approach briefing*.

The First Officer delays the presentation of “the plan” for 3.4 sec (line 2) after saying “the plan shall be:::,”. In terms of content, his talk is noticeably incomplete, but the other pilot, the Captain, makes no attempt to repair the situation, for example, by prompting, seeking clarification, or starting to talk himself. This is evidence of the Captain’s acceptance of the First Officer’s claim to an extended turn and the Captain’s understanding of the purpose of that turn: the First Officer is the Pilot-Flying, and so it is his role to present “the plan” and continue to lead the approach briefing. Although 3.4 sec would be a long and noticeable period of silence in ordinary conversation (Jefferson, 1989; Wilson & Zimmerman, 1986), for the Captain at this point in their interaction the silence is unremarkable and unproblematic.

matic. In task-oriented interaction silences can be substantially longer than in ordinary conversation without signaling any problem for participants or their actions, and elsewhere (Nevile, 2004) I have shown that silences of up to many minutes are common and unproblematic in interaction in the airline cockpit. Note too that the First Officer seems to herald this silence by prolonging his saying of “be” and using rising intonation (“be:::”). By so doing, he highlights both the incompleteness of his talk and his intention of completing it. In fact, there are many periods of silence within the First Officer’s turn, some less than a second and some considerably longer. Each time, the Captain does not treat the silence as an opportunity to talk himself, and it is for this reason that one can interpret these silences as *within* one extended turn by the First Officer. The Captain’s own silence is his ongoing acknowledgment and acceptance of the incompleteness of the First Officer’s turn. In this way, the Captain contributes by allowing the First Officer’s talk to develop as an extended turn. The Captain is not just a passive listener but is a participant jointly constructing the First Officer’s turn. One can assume that the Captain is very familiar with the content of approach briefings and how they are conducted. The Captain’s treatment of these silences as unproblematic demonstrates this familiarity and his competence as a participant in this setting. His role as the Pilot-Not-Flying is to listen as the Pilot-Flying leads the briefing. In short, one of the things that participants do in talk-in-interaction is to enact and maintain for themselves and assign to others relevant roles (or identities). The First Officer and Captain enact the roles of Pilot-Flying and Pilot-Not-Flying in their respective contributions to the development of the First Officer’s turn at talk. The roles are not just official labels but are made real and relevant by the talk for this task at this point in the flight.

Another way participants may enact relevant roles in an interaction is through their choices of personal pronouns (i.e., *I, you, we, he, she, they*, etc.). Traditionally, personal pronouns have been described in purely grammatical terms (*I* refers to the first-person singular, etc.), but recently there has been a growing interest in the interactional work that personal pronouns do, that is, in how participants’ ongoing choices of this or that personal pronoun play a part in developing an interaction (Malone, 1997; Mühlhäusler & Harré, 1990). In a range of settings from business meetings (Nickerson & Bargiela-Chiappini, 1996) to the classroom (Wortham, 1994), pronominal choices have been found to enable participants to establish who they are talking and listening “as” (Watson, 1987, p. 271) with respect to one another. In the airline cockpit, one can identify five roles, and on any

flight, each pilot will occupy simultaneously three of these roles. Each pilot is either the Captain or the First Officer *and* the Pilot-Flying or the Pilot-Not-Flying *and* has a shared role as “flight crew member.” These roles determine the pilots’ expectations about who does what to conduct the flight (Neville, 2001, 2004).

In this segment of data, the First Officer uses the first person plural pronoun “we” to invoke the shared role of crew member. He says “we need to plan” (line 2), then “we’ll expect to be visual” (line 4), and finally “we’ll be landing flap twentyfi::ve” (line 9). The First Officer does not use the singular “I” to invoke his individual role as the Pilot-Flying on this flight. Instead, he presents various activities as involving or relevant to both pilots as “crew” members. That is, the plan is something both pilots “need,” and “expecting” and “turning” are what both pilots will later do. The First Officer is the Pilot-Flying, but his pronominal choices do not make this role salient at this point in their ongoing interaction. Instead, his choice of “we” makes salient that the outcome of the briefing is a shared understanding: the plan is something “we” will both know as a crew. One should also remember that although the Captain may be the Pilot-Not-Flying on this flight, he retains ultimate command of the flight. The approach briefing is an opportunity for him to confirm details in the briefing and possibly make changes. The briefing makes the First Officer accountable to the Captain for his planning. By choosing “we,” the First Officer’s talk is inclusive. His talk presents the plan and the conduct of the flight as activities that are not realized by him alone, even though he is the pilot primarily responsible for control of the plane.

EMBODYING CLAIMS ABOUT PROGRESS: COORDINATING TALK AND NONTALK ACTIVITIES

In the briefing, the First Officer’s talk and nontalk activities are precisely coordinated such that they emerge and are accomplished together and in this way constitute a series of embodied claims about his progress in conducting the many parts of the task. The First Officer coordinates his talk first with his reading and writing activity involving the landing data pad and then with touching particular displays with his hands. I look first in Fragment 3 at the beginning of his turn at talk and his nontalk activity with the landing data pad. Earlier in the flight, the First Officer wrote on this pad important information for this particular landing, and the pad rests on the

low central instrument console between the two pilots just to the left of the First Officer's left knee:

- (3)
- 2 FO/PF: okay we need to plan hh- so the plan shall be:::, (3.4) go downhill
 ↑_____↑
- 2a FO/PF: ((reaches for landing data pad))
 ↑_↑
- 2b FO/PF: ((places pad on left leg))
 ↑__↑
- 2c FO/PF: ((writes on pad))
 ↑____>
- 2d FO/PF: ((returns pad to central console))
- 3 FO/PF: at (0.2) f::orty: (0.3) eight (0.4) mi::les:: er::: (0.4) south of
 >____↑
- 3a FO/PF: ((returns pad to central console))
 ↑_____↑
- 3b FO/PF: ((hand moves back to leg))

The First Officer begins his turn at talk announcing the crew's "need to plan," but before he says anything specific of "the plan" itself, the actual plan he will present, he reaches for the landing data pad. The pad is located on the central console, the low instrument panel between the two pilots (see again Figure 1). He writes something on the pad and then returns it to the central console. He begins to reach for the pad as he says "the plan" in "the plan shall be:::", (see line 2a). He places the pad on his leg at the beginning of "be:::", (line 2b) and begins to write something on the pad during his prolonged saying of "be:::", (line 2c) and in the following 3.4 sec of silence (line 2c; see Figure 2). The First Officer resumes talking with "go downhill" (line 2) immediately after he stops writing and as he reaches forward to return the pad to its resting place on the central console (line 2d). This timing of talk and activity with the pad suggests that the First Officer needs to accomplish something else before beginning to say "the plan." As discussed previously, to lead the approach briefing, the First Officer reads aloud details for the landing that he had previously written on the landing data pad. The First Officer's action to stop his progress in the briefing to write something on the pad suggests that there was some mismatch between the two, between the plan as it exists on paper and the plan as he was about to say it, that is, the details on the pad were incomplete and/or needed



FIGURE 2 The First Officer writes on the landing data pad.

changing. One can at least be sure that he chooses to write something on the pad and that he stops talking as he does so. His coordination of talk and activity with the pad is evidence of his orientation to the link between the information recorded on the pad and his talk that presents or realizes this information *as* the approach briefing and as claims about what can be understood about the progress of the briefing.

If one looks more closely at the timing of the First Officer's talk and activity, one sees that his use of the pad corresponds closely to the emerging structure of his talk, and that it is by coordinating his talk and nontalk activities he paces, and can be understood to make claims about, his progress in the briefing and the understandings the pilots are entitled to have about that progress. It was seen that he begins to reach for the pad at exactly the point in his talk when he begins to introduce "the plan" ("the plan shall be::;"). He begins to write on the pad, which is on his leg at the beginning of "be::;" during his lengthening of "be::;" and throughout the 3.4 sec of silence after he stops talking. So, he begins to write at the precise point in his turn when the next talk would have been an item of the plan. He resumes talk with the first item of the plan ("go downhill...," line 2) at the very moment he finishes writing and reaches forward to return the pad to its resting place on the central console. What one sees is that his talk about actual detail of "the plan" begins precisely as he completes the writing activity that would make that talk possible and a legitimate action in the approach briefing task.

The timing of the First Officer's movement to replace the landing data pad is of further interest. It would be possible for him to keep the pad on his leg or maybe replace it later in the briefing, but instead, he replaces the pad on the central console and reads it from there. By beginning to return it just when he does, as he begins to say the first item in the briefing, he is organizing the tools of his setting. The pad is returned to its "home position" (Schegloff, 1998, p. 548). Replacing the pad after changing its details by writing something marks a tangible and visible (for the Captain) separation of the preparatory writing activity of the briefing from the reading and nontalk activity of the briefing. Replacing the pad signifies that the First Officer is ready to continue with the detail of the briefing and is also a visible cue to the Captain to be ready to hear it. Indeed, before continuing with the specific detail of the first item, which is the descent point ("fortyeight miles ..."), he stops talking for 0.2 sec as he places the pad on the console (line 3a). Only as he releases his grip on the pad does he resume talking (see lines 3, 3a, 3b). That is, the First Officer pauses his talk in the middle of the first item, before saying any information particular to this flight, to complete his nontalk activity. The First Officer's coordination of his nontalk activity with the pad and the timing and delivery of his talk suggests that his readiness to lead the briefing, and to be seen and heard to make claims about his progress in it, develops over the course of his turn. If one keeps in mind that this briefing occurs as part of an ongoing interaction with the Captain, the First Officer's developing readiness is apparent to the Captain and contributes to the Captain's understanding of what is going on. As Psathas (1990) pointed out when he used video data from medical interviews, the silence that accompanies one participant's practical activity of writing "does not necessarily mean that no actions of *interactional* significance are being produced or monitored auditorally, visually, or even tactually by the parties" (p. 224). The Captain's lack of talk is evidence of his understanding of the interactional significance of the First Officer's nontalk activities, that they form the basis for further talk.

It is also worth noting that the First Officer began his turn by announcing his impending approach briefing with nonstandard wording. The First Officer says "okay we need to plan hh- so the plan shall be:::, (3.4)" rather than calling out simply "approach briefing." The First Officer's talk, although nonstandard, nevertheless accompanies nontalk activity associated with performing the task. It was seen that the First Officer's "okay we need" is coordinated with his manipulation of the landing data pad and his writing activity, these being preparatory activities for the briefing itself.

The First Officer begins the actual details of the briefing with “go down-hill” (Fragment 3, line 2; an informal way of saying “begin descent”) only after the preparatory nontalk activities are completed. Therefore, even spontaneous and nonstandard talk becomes part of the pilots’ precise coordination of talk and nontalk activity as the First Officer progresses in the task. In this way, spontaneous and nonstandard talk, like prescribed wordings, is made accountable for the way it contributes to the pilots’ emerging sense of what they are doing and of what is going on.

As the First Officer continues with the briefing, he specifies various altitudes and speeds that are important for the descent, approach, and landing. He also manually “sets” these altitudes and speeds on the appropriate instrument panel displays by moving markers or *bugs* around the rim of the displays until the markers point to the required numbers. For example, one altitude bug indicates the elevation of the airport, and one of the speed bugs marks the target speed for the landing. These bugs have no direct impact on the plane’s performance. They are visual reminders to the pilots of altitudes and speeds that are relevant for this flight. These displays are monitored by the pilots as a source of visual numeric information and so form a part of the memory system of the cockpit (Hutchins, 1995).

I first discuss the First Officer’s talk and nontalk activity concerned with altitudes:

- (4)
- 6 FO/PF: join left downwind for left circuit landing runway one ei::ght::
↑_>
- 6a FO/PF: **((looks down to control yoke))**
- 7 FO/PF: (0.3) the airfield elevation is eighteen (.) circuit height a thousand
>__↑
- 7a FO/PF: **((continues looking down to control yoke))**
↑_____↑
- 7b FO/PF: **((reads from chart on control yoke))**
↑_____↑
- 7c FO/PF: **((reaches for bug on altimeter))**
- 8 FO/PF: feet is bugged on the altimeter. (0.9) visual procedures left circuit::
↑_____>
- 8a FO/PF: **((moves hand away from altimeter, leans back in seat))**
- 9 FO/PF: (1.9) we’ll be landing flap twentyfi::ve with a:: ah

The First Officer has an approach chart clipped to his control yoke (see again Figure 1). This is a published chart displaying standard information for an approach to the destination airport (e.g., orientation of the runways, descent path, navigation points, or local obstacles). He looks down to this chart just prior to saying “the airfield elevation is eighteen“ (see Fragment 4, lines 6 and 6a). The airfield elevation is shown on the chart, so it is probable that he looks at the chart to read aloud the elevation. Certainly this talk occurs while he is looking at the chart. If one examines the timing of his looking, one sees that he looks down to the chart just as he finishes saying the runway number (“runway one ei::ght::”; lines 6 and 6a), which was the previous item of the briefing. He lengthens his saying of “eight” (“ei::ght::”; line 6), which is also said with falling intonation signaling completeness. The First Officer then stops talking for 0.3 sec (line 7). It is at the end of “eight” and the onset of the pause that he looks down to the chart. The pause gives him an opportunity to incorporate his looking within his turn at talk. The looking activity is therefore interpretable as preparation for the talk to follow, the next item in the briefing. So the First Officer’s use of the chart is precisely coordinated so that it emerges with and affects the organization and flow of his talk as he progresses in the task.

The First Officer leans forward and reaches with his right hand for the altimeter where he will set the bugs after a micropause at the end of “eighteen” and just as he begins to say “circuit height” (Fragment 4, lines 7 and 7c). This means that the timing of his movement to set the altitude bug for the circuit height begins simultaneously with his talk for this activity. He removes his hand from the altimeter, ending his activity to set the bug immediately after saying “is bugged on the altimeter” (lines 8 and 8a). As he removes his hand, he also leans back into his seat. The completion of his nontalk activity is therefore exactly timed with the ending of the talk that claims that activity to be complete. His talk and activity are synchronized and work together to make visible and embodied claims about his progress in the task and allow the pilots to form shared understandings about what he has done and where he is up to.

To the Captain, the First Officer’s movements, and in particular his manual activity to set the bugs, are visible evidence of the First Officer’s progress in the briefing. When the First Officer removes his hand from the altitude display and leans back into his seat, the Captain can see that the First Officer’s current activity at the panel is completed. The First Officer’s next talk is “(0.9) visual procedures left circuit:. (1.9) we’ll be landing flap

twentyfi::ve with a:: ah (2.2)” (Fragment 4, lines 8–9). The content of this talk does not involve any immediate activity at a display on the instrument panel. This talk gives information about how the approach and landing will proceed (“visual procedures left circuit:.”; line 8) and activity to be conducted later (“landing flap twentyfi::ve”; line 9). So the First Officer breaks physical contact with the instrument panel and leans away from the panel at just the point in his briefing when his talk ceases to concern any activity there. Again, his nontalk activity is closely linked to the emerging structure and content of his talk as he leads the briefing. Together, talk and nontalk activity constitute a claim and make legitimate an understanding that he is completing this part of the briefing.

The First Officer concludes by saying the speeds to be used and by setting these speeds with the bugs on the airspeed display:

- (5)
- 10 (2.2) Vref of ninety:ni:ne and (0.2) seventeen point seven (ton),
 ↑_____↑
 10a FO/PF: ((leans forward, reaches for bugs on
 airspeed display))
 ↑
 10b FO/PF: ((left hand arrives at bug))
- 11 (1.2) carry ten for a hundred and ni::ne (0.9) and Vfr Vcl's a
 ↑_____↑
- 11a FO/PF: ((moves left hand to the left and away from airspeed
 display))
- 11b FO/PF: ↑_____↑
 ((returns hand to
 airspeed display, index finger on bug for '109'))
- 12 hundred and nine and fourtee:n. (1.3) <and they're all se:t:.>
 ↑__↑
- 12a FO/PF: ((moves finger to bug for
 '114'))
- 12b FO/PF: ↑_>
 ((removes hand from
 airspeed display and returns hand to leg))
- 13 (0.8)
- 14 C/PNF: °set° (°crosschecked°).
- 15 (0.8)

I first consider the First Officer's leaning and reaching movements, which act as a kind of visual punctuation for his talk and progress in the task. Having leaned back into his seat after completing the activity of setting the alti-

tude bugs, the First Officer leans forward again to the main instrument panel and reaches for the airspeed display. He begins to lean forward as he says a speed that he is to set on the display (“ninety:ni:ne”; line 10). His leaning movement is linked to the emerging structure of his talk. His earlier leaning forward to the altimeter occurred at exactly the point in his talk when he began to say the altitude to be set (“circuit height ...”; Fragment 4, lines 7 and 7c). He leaned back into his seat as he finished his activity at the altimeter and his talk concerned matters that did not involve any activity at the panel. He leans forward now, as his talk again concerns activity at the instrument panel, this time the speeds to be used for the approach and landing that must be set with bugs on the airspeed display. The First Officer could easily have leant forward at the beginning of his briefing and then leaned back into his seat only when he had completed the briefing. After all, the briefing involves substantial activity at the panel. However, this is not what the First Officer does. His talk does not refer only to activity at the panel, and so his leaning forward and backward and making and breaking physical contact with the panel are bodily (to himself) and visibly available (to the Captain) markers for those parts of his talk that do refer to activity at the panel. By leaning forward and backward as he performs tasks, the First Officer moves from and back to his body’s home position (Schegloff, 1998). Leaning back in the seat is the bodily posture that the First Officer assumes when he is not doing task-related hand activity at the panel. By moving forward and backward from this bodily home position, the First Officer physically and visibly separates himself from the panel and so can make maximally apparent that his nontalk activity there is ended. Leaning back in his seat serves as a boundary marker to his nontalk activity and that task, that is, as marking the activity and task as completed. His body posture can be presented and understood as visible physical evidence for his claims concerning the completion of activity.

I now look at how the First Officer sets the speed bugs (Figure 3). He stops talking for 2.2 sec (Fragment 5, line 10) before he begins to say the speeds (i.e., “Vref of ninety:ni:ne”; line 10), and he leans forward to the panel and reaches with his left hand for the airspeed display as he says the first speed (the Vref). So in this instance, the nontalk activity, his leaning forward to set the bugs, begins during and not before his relevant talk. That is, he begins to move forward after saying “Vref of” and only as he says the actual speed to be set (i.e., during “ninety:ni:ne”). He moves his hand left and away from the display briefly. His talk concerning the other two speeds to be set, the Vfr and the Vcl, begins only when his hand is back at the air-



FIGURE 3 The First Officer sets a “speed bug.”

speed display and his index finger is on the bug placed at “109” knots (“and Vfr Vcl’s a hundred and nine”; lines 11 and 11b). So the timing of his talk and hand movement is such that the two work together and confirm one another as claims about the speeds being set and the timing of this setting in the overall progress of his conduct of the task.

The First Officer moves his index finger from the bug at “109” knots to the bug for “114” knots after saying “and Vfr Vcl’s a hundred and nine and fourtee:n” (Fragment 5, lines 11–12). The movement of his finger from one bug to the next is in the order in which he says the speeds. His finger is in position at the “109” bug as his talk begins but does not move to the “114” bug until his talk concludes, that is, during the (1.3) pause at the end of “fourtee:n.” (lines 12 and 12a). In this instance, his hand movement forms a kind of boundary around his talk. His talk amounts to a claim about the bug settings, and the speeds display is where visible evidence of these settings can be found. By placing and leaving his finger on the display, he focuses his own attention on this evidence and can also direct the Captain’s attention to it. By doing this, the First Officer maximizes his accountability for appropriately setting the bugs.

Finally, when the First Officer ends with “<and they’re all se:t.:>” (Fragment 5, line 12) he makes a claim that some particular nontalk activity is completed and that now both crew members can understand this activity and part of the task to be completed. Immediately after saying “se:t:..,” the First Officer moves his hand off the airspeed display and away from the

main panel. This precise timing involves a noticeably slower delivery of this talk and his lengthening of “set” as “se:t:..” The effect of this timing is that his activity, touching the bugs on the airspeed display, is visibly completed simultaneously with the talk that claims its completion. If the First Officer had left his hand at the display after saying “set,” there would be an apparent mismatch of his talk and activity. That is, his talk would claim an activity to be finished, but the presence of his hand at the display would be visible evidence suggesting that the activity may be still in progress. His talk, claiming the bugs to be “set,” makes the First Officer accountable to the Captain for completing the activity; so when the First Officer says “set,” he is indeed ready and able to remove his hand from the bugs. By moving his hand from the display, the First Officer offers the Captain visible evidence that the bugs are indeed “set” as he has claimed.

CONCLUSION

Only 20 years ago, Heritage (1984) commented that

the gap in the social science literature on occupations consists of all the missing descriptions of what occupational activities consist of and all the missing analyses of how the practitioners manage the tasks which, for them, are matters of serious and pressing significance. (p. 299)

This gap has begun to be filled but until recently, mainly with studies focusing on interactions of professionals and their clients. This article joins recent research, typically using video recordings, considering interaction among members of workplace teams in sociotechnical settings. To echo Heritage’s words, an approach briefing is a matter of “serious and pressing significance” for an airline flight crew. I have examined some aspects of both talk and nontalk activity to see how understandings related to the conduct and progress of the task are developed and demonstrated, and accepted, moment to moment. I have explored how an *approach briefing*, a formal task that airline pilots are required to carry out, is actually accomplished by the pilots together as naturally occurring talk-in-interaction. The trajectory of the First Officer’s talk and nontalk activity and so also the trajectory of claims he makes about his conduct of the task emerge as a precisely coordinated outcome of delicate modifications of the nature and timing of both talk and nontalk activities, and in particular his use of textual

materials and visual displays as the necessary *tools* for the task. The talk and nontalk activities occur together as sources for claims and legitimate understandings about what is happening, what can and should be known to the pilots moment to moment as they interpret where they are up to, and what it is they have done or are yet to do.

This precise coordination of talk and nontalk activity is a critical part of accountability for task performance in the airline cockpit and is a constitutive part of the work life of airline pilots, of what it is to act like and be an airline pilot. Such coordination suggests an orientation of airline pilots to the importance of matching talk about activities to the actual moment-to-moment conduct of those activities and especially to the claimed completion of those activities. For example, if the activity is still in progress, then the talk is modified through pauses, lengthening of sounds, and so forth to ensure there is a match. That is, when an activity is said to be done, it must really be so *at the time of saying*. This orientation may be particularly important in sociotechnical settings such as the airline cockpit where tasks and the talk and activities associated with them are performed in strict sequence, and failure to perform an activity or to perform it at the appropriate time or in the appropriate manner can threaten the progress and safety of the flight.

I have not argued that the pilots are consciously and deliberately seeking and achieving a precise coordination of talk and activity, of talk and text. I have no way of arguing this, and in fact, it might be the pilots' lack of consciousness that is most interesting because this would show how much of the complexity of participants' contributions to an interaction is taken for granted, that is, accepted as natural and beyond notice. One aspect of being a competent airline pilot and being accepted by other pilots is an ability to talk and act as airline pilots do. What the analysis here shows is that accomplishing this involves more than a familiarity with acronyms and specialist terms or knowledge of operating procedures. Knowing how to fly an airliner involves knowing how to talk and act and interact like an airline pilot, knowing what to do and understand and when, moment to moment, there and then, every time.

Implications

To the extent that policies, procedures, training, workplace design, accident and event analysis, and so on can be influenced and improved by

knowledge of what practitioners actually do to perform their work, this article can help develop practice in commercial aviation. This article is therefore part of my wider research interest in the nature of routine talk-in-interaction in the airline cockpit and in demonstrating the value of microanalysis of interaction to the aviation industry, aviation human factors researchers, and also to accident investigators. More specifically, the methodology and findings of this article can inform two areas of practical interest: situation awareness and human error.

First, the commercial aviation industry and accident investigators have become aware that a critical factor in many accidents is that the pilots lost some sense of situation awareness (SA), some sense of what was going on around them, of the state or performance of their aircraft, of what they were doing or had done, of who knew what, and so on. For example, cockpit black boxes have recorded pilots saying things such as “Why is it doing that?,” “What is it doing now?,” and “I can’t stop it” (Faith, 1998). The value of working as a team and developing appropriate SA has increased in the information-rich environment of the highly computerized and automated airliner, when *flying* means managing the technology of various aircraft systems (Degani & Heymann, 2002). The industry and research approach has been to treat SA as an individual, mental, and perceptual phenomenon (Adams, Tenney, & Pew, 1995, p. 88; Beaumont, 2000, p. 361; Sarter & Woods, 1995, p. 16; Smith & Hancock, 1995, pp. 142, 146; Wellens, 1993, p. 268), as a matter of the information available to pilots (e.g., via displays), and to give less attention to social aspects of SA. It is now recognized by the industry and researchers that improving pilots’ SA will mean more than providing better displays and brighter and louder alerts but requires a better understanding of SA as a social and team phenomenon (Adams et al., 1995; Castellan, 1993; Cooke, Salas, Cannon-Bowers, & Stout, 2000; Salas, Prince, Baker, & Shrestha, 1995; Sarter & Woods, 1995). Necessarily, team SA in the airline cockpit is interactionally accomplished, and in this article, I studied these interactional processes in microdetail for one specific task: an *approach briefing*. In this article, I have shown how airline pilots develop and demonstrate their SA, in context and moment to moment, through specific aspects of routine processes of talk-in-interaction.

Second, although the pilots make no error in the segment of data considered here, by showing how understandings in the cockpit emerge moment to moment through processes of interaction, I have shown the possibility of microanalysis of interaction as an analytic tool for transcribing

recorded voice data and investigating human error in aviation. In recent years, there has been a change in the way error is viewed in commercial aviation. Errors are no longer seen as avoidable at all costs but rather as inevitable occurrences in a system that is highly dependent on human performance. In a major study observing flight crews on scheduled flights, Helmreich and Merritt (2000) found that errors occurred on nearly half the flights, and the range of errors observed in a single crew was between zero and six. These are usually minor errors, such as forgetting to check as display or mishearing an air traffic control clearance, but if not recovered can become serious. The industry is concerned that pilots develop skills to work together and with others to identify and manage error (Helmreich & Merritt, 2000; Maurino et al., 1995; Sarter & Woods, 1995).

In this article, I demonstrated the potential of an alternative to the dominant approach to human error in commercial aviation practice and related research in which the concern is usually to classify errors into various types, for example, according to the nature of the error (e.g., “information error”) or some aspect of the circumstances of the error (e.g., pilot or aircraft type) to develop complex models and taxonomies (Grace, Pfister, & Wiggins, 2000; Helmreich & Merritt, 2000; Wiegmann & Shappell, 1997; Zotov, 2000). This article goes some way toward meeting the call of some human factors researchers for alternative approaches to human error in aviation. For example, Dekker (2001b) argued that analysts assume they “can meaningfully count errors and assign them to categories, that classification is the same as analysis,” (p. 247) and that there has been a “disembodiment of data in the analysis of human factors accidents” (Dekker, 2001a, p. 39). Dekker (2001a) noted that investigators “are left to draw inferences and produce ad-hoc assertions that bear some relationship with an ill-defined psychological or sociological phenomenon” (p. 48) and that there is a need for investigators to “reconstruct the unfolding mindset of the people they are investigating, in parallel and tight connection with how the world was evolving around these people at the time” (Dekker, 2001a, p. 39). In short, Dekker (2001b) called for human factors data to be returned to their context and to understand human error in the context in which it occurs. The research reported joins Frankel (2000) in showing the possibility for microanalysis of interaction to do exactly this, to show the value of detailed transcription of interaction to present talk and nontalk activities as they occur together and as the participants themselves create and experience them. Elsewhere (Neville, 2002a; Neville & Liddicoat, 2001), I have already used the approach to analyze recorded voice data for actual air accidents, exam-

ining how pilots and others develop their situation awareness and the circumstances in which human error emerges as the outcome of processes of interaction.

Finally, this article contributes to understandings of human cognition and cognition for work as situated, embodied, and socially shared understandings evolving over time (Coulter, 1991; Engeström & Middleton, 1996; Lave, 1988; Resnick, Levine, & Teasley, 1991; Resnick, Säljö, Pontecorvo, & Burge, 1997; Suchman, 1987). That is, cognition is viewed not just as something residing only in the head of an individual and a strictly “mental” phenomenon but as something that is also made real and visible in the moment-to-moment connections between such things as the nature and timing of people’s utterances, their physical actions and gestures, the positioning and movement of their bodies, and aspects and arrangements of the material setting including the use of significant objects and available technology. Cognition at work can be seen to emerge from and be spread across numerous elements of a complex system that is created and maintained through talk and processes of social interaction. One has seen here that in the cockpit, these elements can include textual materials, visual displays, and activities such as writing, touching, and possibilities for body positing such as leaning backward and forward. This kind of cognition is not “information” that is to be “stored” and will add to a person’s “knowledge” base but cognition or “knowing” as it arises and is used there and then, locally, dynamically, in temporally unfolding naturally occurring interaction. This is what C. Goodwin (1996) referred to as “the interactive organization of knowledge” (p. 399). This article therefore furthers cognitive studies of the cockpit (e.g., Hutchins, 1995; Hutchins & Klausen, 1996; Hutchins & Palen, 1997) by analyzing in microdetail processes of talk-in-interaction as pilots on actual scheduled flights construct and interpret action to perform a real cockpit task and so fulfil their need to plan and to accomplish what all pilots must: land their plane.

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APPENDIX A SPECIAL TRANSCRIPTION NOTATION

The special transcription notation is introduced and explained in greater detail in Nevile (2004).

- | | |
|-------------------------|--|
| FO/PF | First Officer/Pilot-Flying. |
| C/PNF | Captain/Pilot-Not-Flying. |
| ((click sound)) | Description of contextual features, for example, sounds other than talk. |
| ((moves hand)) | (in bold) Description of nontalk activity. |
| ↑__↑ | Arrows point upward to exact point in talk or silence where nontalk activity begins or ends. Underlining indicates duration. |
| >__↑ | Nontalk activity is continued from prior line. |
| ↑__> | Nontalk activity continues to next line. |
| 2a | A nontalk activity is identified according to the line of talk with which it is concurrent. Letter suffixes indicate the relative chronological order of nontalk activities. |

APPENDIX B EXPLANATIONS

Lines 2 through 4: “go downhill at fortyeight miles south of Smalltown.”—Means to begin the descent when the plane is 48 miles south of the destination Smalltown.

Line 4: “on DME on the GPS”—Refers to the navigation aids to be used. DME stands for “Distance Measuring Equipment,” and “GPS” stands for “Global Positioning System,” a form of navigation using satellites.

Lines 4 through 5: “be visual within twentyfive miles make a visual approach”—Means to fly and approach the airport under “visual flight rules,” a procedure for navigating visually rather than by reference to cockpit instruments alone, within 25 miles of the destination.

Lines 5 through 8: “to join left downwind for left circuit landing runway one eight”—The plane will approach the airport and runway by making turns to the left. The runway for the landing is runway “one eight.”

Lines 7 through 8: “the airfield elevation is eighteen circuit height a thousand feet is bugged on the altimeter”—The altitude of the airfield is 18 ft, the “circuit height” is the altitude at which the plane will approach the airfield, and this altitude is indicated by a “bug” (a small marker) placed on the rim of the altimeter.

Line 9: “we’ll be landing flap twentyfive”—For the landing, the wing flaps will be set at the 25° position. Wing flaps are moveable surfaces on the wing and are extended to increase the size of the wing to allow the plane to fly at slower speeds.

Lines 10 through 12: “Vref of ninety-nine and seventeen point seven (ton) carry ten for a hundred and nine and Vfr Vcl’s a hundred and nine and fourteen”—Here the First Officer says the critical speeds to be used and referred to at different points of the approach and landing. “Vref,” “Vfr,” and “Vcl” all refer to speeds.