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Jon Patrick  
*University of Sydney*

Michele Zappavigna-Lee  
*University of Sydney*

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## Explicating Tacit Knowledge Embedded in Nominalisation

Michele Zappavigna-Lee & Jon Patrick

School of Information Technologies  
University of Sydney  
Sydney, Australia

Email: {michele; jonpat}@it.usyd.edu.au

### Abstract

*This research is a field study on how tacit knowledge is construed by IT professionals through nominalisation in their language and how this knowledge may be explicated in grammar-based interviews. The study was conducted over four months of interviews with a team working on a Content Management System (CMS) redevelopment project in an Australian media organisation. The broad aim of the interviews was to elicit tacit knowledge from these technologists about their work on this project. This paper focuses on a specific aspect of this endeavour: unpacking knowledge about process that was embedded in the talk of the participants through the grammatical feature, nominalisation. We employ linguistic analysis techniques drawn from Systemic Functional Linguistics to achieve this end. While we adopt Polanyi's theory of tacit knowing, we depart from this theory by arguing that tacit knowledge is carried in language and that linguistic analysis techniques offer rich methods for understanding such knowledge.*

### Keywords

Tacit knowledge, nominalisation, Systemic Functional Linguistics

## INTRODUCTION AND LITERATURE REVIEW: DO WE CONSTRUE TACIT KNOWLEDGE IN LANGUAGE?

Understanding and attempting to capture tacit knowledge is an ongoing research agenda in Information Systems (IS) and the sub-discipline, Knowledge Management (KM) (Spender 1993; Boisot 1995; Nonaka and Takeuchi 1995; Ambrosini 2001; Castillo 2002; Tsoukas and Mylonopoulos 2004). Our position that tacit knowledge is construed in language is novel within IS. Instead Polanyi's (1966:4) idea that "we know more than we can tell" and its corresponding assumption that tacit knowledge is ineffable has currency in the field. In this paper we adopt the major tenets of Polanyi's theory of tacit knowing. We argue, however, that research following Polanyi's ineffability principle applies inadequate models of language such as the mathematical theory of communication. In contrast, when a functional approach to theorising language is adopted, the way people construct tacit knowledge in the grammar that they use is apparent (Zappavigna & Patrick, 2004). Typically a person is not aware of the processes of such grammatical construction.

Due to the general acceptance of Polanyi's position on ineffability, linguistic analysis has not been viewed as a candidate tool for studying tacit knowledge. In fact, the position that tacit knowledge, by virtue of its defining attributes such as ineffability and embeddedness, evades any analytical study appears to dominate. Thus, there has been little empirical research in the area with the exception of Sternberg's program of psychometric testing of practical intelligence (Sternberg 1985; Sternberg 2000; Sternberg and Grigorenko 2001). Within linguistics itself tacit knowledge in organisations is not an explicit research area, however, there are studies that deal with the implicit construction of knowledge within a sub-discipline referred to as 'organisational discourse analysis'. For example, Iedema (2003:95) suggests the role of the nominal group in the "struggle over what can be realized or expressed as if already taken-for-granted, what needs to be specified and particularized, and what is to remain silenced and invisible" in work activity that crosses cultural and technological boundaries.

This paper focuses on the role a particular grammatical feature, *nominalisation*, plays in tacit knowledge constructed by workers in a media organisation. We begin by explaining nominalisation and how it embeds tacit knowledge, and proceed to introduce a field site where nominalisation is investigated through a grammar-based interview method developed by the researchers. This grammar-based interview method and a content-based interview method, applied for comparative purposes, are then explained. We then detail the linguistic analysis performed on the interview transcripts to assess the performance of the grammar-based interview method.

## WHAT IS NOMINALISATION?

The theory of language used in this paper is that of Systemic Functional Linguistics (SFL). Systemic Functional Linguistics is a functional, semantically-oriented approach to analysing language as it is used. SFL posits language as a meaning-making resource rather than a rule-base. Language users exercise choice in the way they deploy this resource within the real contexts in which they operate. Appendix A contains a glossary of the SFL terms, appearing in *bold italics*, used in this paper.

SFL describes Nominalisation as a type of *grammatical metaphor* in language. It is a structural feature "whereby any element or group of elements is made to function as a nominal group in the clause" (Halliday 1994:41). For example, a *nominalised process* renders what could have been encoded *congruently* as a verb in the less congruent form of a noun. *Congruency* refers to the literal rather than metaphorical realization of meaning in language.

Table 1 gives examples of four different types of *nominalisation* that are possible in English. The first type, the nominalisation of a *process*, occurs when an action is rendered a thing. Table 1 gives an example where the noun 'communication' is selected rather than the verb 'to communicate'. The second type of nominalisation in the table is *making a quality into a thing*. In the example clause the adjective 'efficient' is instantiated as the noun 'efficiency'. Circumstances can also be nominalised as in the third example where the preposition 'to' is instantiated as the noun 'destination'. Similarly, a conjunction may be nominalised, as the fourth example shows. In this final example the conjunction 'so' is rendered as the noun 'cause'.

Type of nominalisation	Example	Less congruent form	Congruent form
Making an action into a thing	<i>Communication is important.</i>	communication	to communicate
Making a quality into a thing	<i>Efficiency is the most important factor.</i>	efficiency	efficient
Making a circumstance into a thing	<i>Organisational change is our destination.</i>	destination	to
Making a conjunction into a thing	<i>The poor uptake of the system is the cause of the project's failure.</i>	cause	so

Table 1: Types of nominalisation

This paper focuses on the first kind of nominalisation, *making an action into a thing*, because it is the easiest form for an interviewer to detect in the real-time of an interview, the others requiring the absorption time that analysis of written text affords.

## HOW IS TACIT KNOWLEDGE EMBEDDED IN NOMINALISATION?

When we speak we are unlikely to be aware of what we leave out or 'pack-up' by the way we speak. Absences and shorthand references in our talk under-represent our meaning potential, the potential for a more elaborated construal of our experience. For example, when knowledge is automatized by an expert, the expert does not attend to the parts of their experience that they have effaced or condensed in their talk. The abstraction and compaction inherent in *nominalisation* allows complex meanings to be embedded in a *nominal group*. The complex meaning may involve elaborate configurations of actions with many component steps. Thus, when a procedure or course of action is nominalised it becomes less available for analysis as any component steps are obscured. As Halliday & Martin (1993: 39) put it, "you can argue with a clause but you can't argue with a nominal group". For example, if a person says, "*we practice knowledge management*", the assumptions that they *can manage* and that *people know things* cannot be directly questioned. The nominalisation *knowledge management* will enter into relationship with other concepts and activities and these constituent assumptions will become even less visible. However, if a person says, "*we manage what people know*", the assumptions can be probed.

While nominalised processes are less open to negotiation, they are, in turn, more easily reconstrued as part of other happenings in discourse. This capacity is often exploited within disciplines that construct technical and taxonomic meanings such as science. What was once itself a 'happening' becomes a *participant* in another happening. Rather than "a sensually experienced world of unfolding processes involving actual people, things, places and qualities, reality comes to be experienced virtually as a generalised structure of abstractions" (Rose

1998:263-4). There is a trade-off between economy of meaning and the possibility that members of a community may not share the same common ground for understanding a particular nominalisation.

## RESEARCH AIMS

This paper has the following aims:

- To explain the role of nominalisation in the construal of tacit knowledge by IT professionals
- To explain a grammar-based interview method
- To explicate tacit knowledge embedded in nominalisation through the grammar-based interview method
- To compare the amount of nominalisation in the grammar-based interview responses with responses in content-based interviews

## RESEARCH SITE

This field research was conducted over four months in an Australian media organisation. The subjects were all working on a project to redevelop a CMS for the host organisation. The CMS project team consisted of four members: a Project Manager, an Information Architect and two individuals with software engineering experience, Technologist 1 and Technologist 2. As the team members have been working on the project for different durations they were faced with the problem of establishing common frames of reference.

The existing CMS had been in place for five years and was used by various groups of content-makers in the organisation such as journalists. The system had been built by an external consultant but was supported and maintained in-house. The Project Manager described the system as having reached 'technical end of life'. The project aimed to determine whether it should be modified, a new system developed in-house or an external package purchased. This aim was referred to by the project team as the 'make, buy or reuse' strategy. To meet this end the project team gathered requirements from stakeholders and some users for a potential system that might satisfy their needs. The interviews in this study focused on this work activity.

## METHODOLOGY

This research compared two interview methods: a grammar-based interview method developed by the researchers and a content-based interview method intended to reflect existing practice in interviewing by systems analysts in organisations. The grammar-based and content-based interviews were conducted by different interviewers who were blind to each others' processes. The interviewer conducting the grammar-based interviews was an Information Systems academic currently working in computational linguistics and trained in the grammar-based interview protocol that was developed by the researcher. While he was not a linguist by training, he had experience in linguistic analysis through his research in computational linguistics. The content-based interviews were conducted by an experienced systems analyst. The Content-based Interviewer had had an extensive career in IT consulting which he continued to practice alongside a career in academia. The interviewer was asked to draw upon this experience by employing the interview strategies he would use as a consultant in the content-based interviews.

### The grammar-based interview method

The grammar-based interview method uses questions that *elaborate* or *unpack* grammatical features in a person's talk to explicate tacit knowledge. These features, referred to as features of *under-representation* are instances when the grammatical choice that a person has made condenses or abstracts meaning. The particular grammatical feature that this paper focuses on, but which is only a part of the grammar-based interview technique, is *nominalisation*. As the first section of this paper detailed, nominalisation is the compacting of a process into a *nominal group*.

In order to unpack an instance of nominalisation, the grammar-based interview method requires two fundamental activities of the interviewer:

- identifying an instance of nominalisation in the interviewee's response to a question. The under-represented knowledge embedded in the nominalisation is at this point tacit.
- asking the interviewee a question that prompts them to elaborate the nominalisation into *processes*, *participants* and *circumstances*. At this point the knowledge is rendered visible, in the sense that it is articulated, though not in the sense that it is codified.

For example, an interviewee might say:

“We performed a system evaluation.”

In this clause system *evaluation* is a **nominalised process**. The interviewer should pick up on this and might ask the following question:

“How do you evaluate the system?”

This question reformulates the nominalisation *system evaluation* as the **process to evaluate** and should prompt the interviewee to give a response such as:

“We interviewed users to find out their opinions and we test the system performance.”

This response elaborates the nominalisation as **material processes of interviewing**, **mental processes of finding out** and **material processes of testing**. It also contains an additional nominalisation *performance* which is a candidate for another grammar-based question. In this way the questioning protocol is iterative as further unpacking will explicate tacit knowledge of greater delicacy

### Interview schedule

Each subject was interviewed by each interviewer every month over four months, producing a total of thirty two interviews. For a pair of interviews with a subject the first was conducted by the content-based interviewer and the second by the grammar-based interviewer within the next week.

## TRANSCRIPTION

The grammar-based and content-based interviews were transcribed by the researcher and divided into clauses. A sample of 150 clauses was selected from each interview: 50 clauses from the beginning, 50 clauses from the middle and 50 clauses from the end. Where the interview contained less than 150 clauses the entire interview was sampled. Table 3 in Appendix B details the sample size for each interview. The 24 samples formed a total corpus of 3096 clauses.

## DATA ANALYSIS

The data analysis in this research is hybrid in method as the linguistic analysis performed on the corpus was both quantitative, in the sense that it counted features in language, and qualitative, in the sense that it involved the expertise of a linguist in identifying those features. The hypothesis driving the linguistic analysis was that the amount of **nominalisation** a person would produce in the grammar-based interviews would be less than the amount they would produce in the content-based interviews. The logic behind this hypothesis was that the grammar-based interviews would unpack nominalisation to form **processes**, **participants** and **circumstances** and thus there would be fewer remaining instances of uncontested nominalisation in the talk. In addition to this corpus-based approach, we performed detailed linguistic analysis on examples of the unpacking of nominalisation in the grammar-based interviews. This analysis was qualitative as the instances were selected on the basis that they exemplified the interview method.

The linguistic analysis was performed using Systemic Coder (O'Donnell, 2002). Systemic Coder is a software tool that allows a user to code a corpus with linguistic features through a graphical interface. The program permits the user to define a schema of features, segment a text into units and then apply the schema to the units. Each clause containing a nominalisation was counted in the corpus. Nominalisations that occurred in a question and subsequently in the response were not included in the count. This was to minimize the effect of interviewee repeating what the interviewer had asked. In these instances the subject's repetition of the nominalisation is an intervening variable.

## RESULTS

A repeated measures ANOVA was performed on the corpus of grammar-based interview responses and the corpus of content-based interview responses. The corpus contained 24 interviews. We investigated the within-subject effect of interview type for each subject in each round. As Figure 1 suggests, there was significantly less nominalisation in the grammar-based interview responses compared to the content-based interviews responses [F(1,11)= 48.8, p=0.0002].

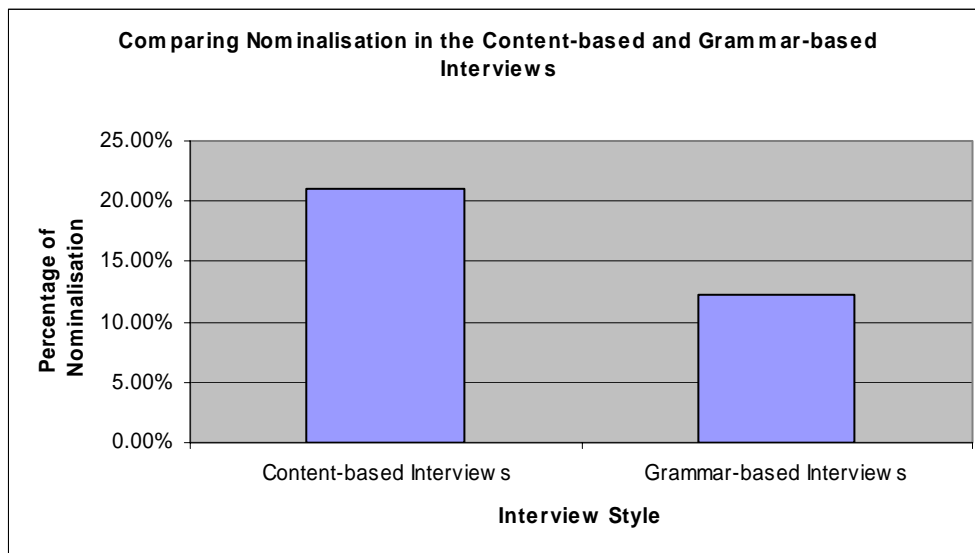


Figure 1: Comparing Nominalisation in the Grammar-based and Content-based interview styles.

The two major kinds of nominalisation present in the interviews were *technical nominalisation* and *managerial nominalisation*. Technical nominalisations are nominal groups about artefacts and procedures to do with technical systems. Managerial nominalisations are nominal groups about artefacts and procedures to do with managing phenomena in organizations. Table 2 gives examples of instances of technical and managerial nominalisation that occurred in the content-based interviews and were unpacked in the grammar-based interviews.

Nominalisation type	Example
Technical nominalisation	<i>Non-functional requirements</i>
	<i>vendor evaluation</i>
	<i>open source solution</i>
	<i>traceability model</i>
	<i>requirements management plan</i>
Managerial nominalisation	<i>documentation</i>
	<i>communication</i>
	<i>knowledge</i>
	<i>deliverables</i>

Table 2: Examples of technical and managerial nominalisation from the content-based interviews and their corresponding congruent form

The following sections explain two examples of nominalised processes occurring in the content-based interviews that were unpacked in the grammar-based interviews: *traceability* and *communication*.

### Unpacking ‘Tracing requirements’

The subjects employed the nominalisations *tracing* and *traceability* to describe the potential of an artefact to enter into a relationship with another artefact in requirements analysis. The way the subjects use the term *tracing* makes and restricts various subject positions, that is, potential roles that people or things may occupy in requirements analysis. The nominalisation assumes that *something or someone can trace something to something or someone*.

Extract 1 is an example from the fourth grammar-based interview with the Project Manager. Here the interviewer tries to understand how the Project Manager construes the relationship between technical artefacts in the *process*, *tracing*. The Project Manager uses a grammar that constructs the relationship with a spatial

metaphor and the act of tracing as movement in this space. The question in turn 5 is an attempt to unpack the directionality of such movement that the Project Manager appears to be having problems describing.

Turn	Speaker	Talk
1	Interviewer	So what now constitutes tracing?
2	Project Manager	Tracing is, is a connection or a link between requirements from, from a, from problems to features and features to requirements so from essentially tracing between requirements that might be at a different level so from high level to low level and also from problems to requirements so with problems being just a different way of expressing or
3	Interviewer	Problems is akin to requirements?
4	Project Manager	Well, they're in a different space really. They're in. There is the problem space and there's the solution. The requirements being more in the solution space because they're the system requirements and the problems being more in the problem space but there's some sort of analysis that happens in between moving from the problem to the solution
5	Interviewer	Would you say that requirements map the problem to a solution space?
6	Project Manager	Yes

Extract 1: Project Manager, grammar-based interview 4.

If we move from this instance-level perspective to look at how the participants construe *tracing* across the entire corpus, we see that there is a systematicity to their construal that suggests a way of thinking about *tracing* that is implicit in their talk. Table 4 in Appendix C shows the *processes* and *participants* that were used in clauses about tracing in the grammar-based interviews. These were clauses where the subjects were responding to a question about what *tracing* and *traceability* mean. The majority of these processes are *material processes* that are metaphorically *relational*. The 'materiality' of these processes suggest action in the physical world but their metaphorical 'relationality' signals the part that they play in the construction of the high-level technical abstractions of requirement analysis. For example, consider the process *to cover*. In its material sense *to cover* means *to physically lay one thing over another*, as in the following:

"I covered my eyes with my hands."

The meaning is, however, relational when *cover* is used as follows:

"It really means that one requirement artefact covers off or covers the scope of the one it is tracing to"

The clause above is the third example *to cover* in Table 4 in Appendix C. The meaning of *cover* here is to do with one participant 'dealing with' or 'addressing' the other. This is relational in the sense that it is about an abstract relationship rather than a tangible action: the requirement does not literally place itself over the scope. The requirement in this clause is the users' opinions about their needs constructed as a 'thing'.

The Information Architect acknowledged that *traceability* is about the team being able to justify their requirements analysis decisions. In fact, if we look at the grammar that the team members used to talk about *tracing*, it confirms that *tracing* is about justifying the relationship of technical artefacts. The team refer to *tracing* at the surface or overt level as if it is a *material* action but use *processes* that are, from a subsurface or metaphorical perspective, *relational*: in simple terms they dress the inactive up as active. The construction of users' opinions as things and use of metaphorically relational processes to talk about *tracing* is part of the way the project team's grammar operates implicitly to solidify their analytical approach. It is part of their genuinely-held belief that they are engaging in work activity that is analytical and rigorous. By tacitly rendering the perspective of the users as objects they provide themselves with stable artefacts to manipulate.

What are the consequences of thinking about *tracing* in this way? It appears that the masking of 'relationality' as 'materiality' allow the team to avoid negotiation with the users and stakeholders over requirements. The privileging of 'relationality' seems to be part of the way the technologists maintain power in requirements analysis. It allows them to pay 'lip-service' to interpersonal negotiation with the users while effacing the role of users in requirements analysis. On a practical level, this was seen by the way the project team involved only a small group in the order of a dozen users out of a large population of around 500 users in their analysis.

Figure 1 shows how the team conceive of *tracing* as a binary mapping between *requests* and *features* of the system. However, as this figure visualises, the *requests* and *features* occupy different domains of meaning-

making. Alternative ways of approaching the activity of *tracing* would be to render the user's opinions as dynamic or fluid. Instead of *relational processes* of abstraction, this would necessitate *mental* and *verbal processes* of negotiation. Such processes occur when technologists actively engage with users through interviews or informal meetings.

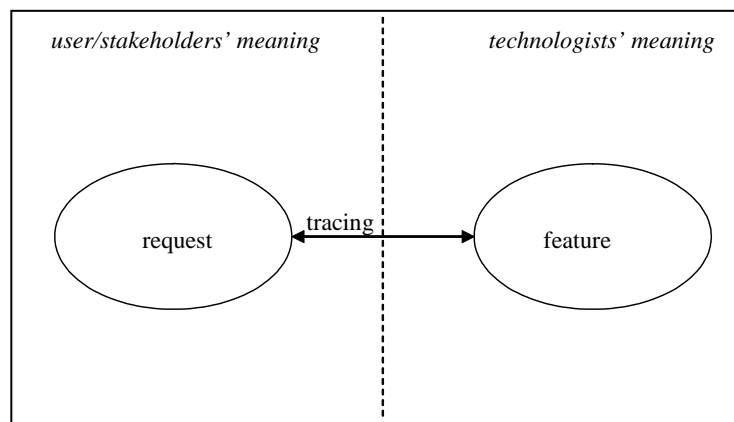


Figure 2: Tracing between two kinds of meaning.

### Communication: 'achieving clarity'

Another instance of the *nominalisation* of a *process* is seen when the subjects talked about activities of *communication*. They referred to *communication*, *documentation*, *agreement* etc. One interesting instance was the Project Manager talking about how he knew when *agreement* had been reached in a meeting. This discourse is presented in Appendix D in Extract 2. In this extract *clarity* is the nominalisation of a quality, the state of *being clear*. It is associated with two *nominalised processes* in the Project Manager's talk: *communication* and *agreement*. The interviewer begins to unpack what it means to *be clear* in Turn 3 of Extract 2 by probing for who are the *participants* associated with obtaining *clarity*. In Turn 16 Extract 2 of the Project Manager says:

"I'm attempting to find the clarity to provide to someone else."

This uses the following grammatical construction:

*participant + process + nominalisation + circumstance*

At this point *clarity* still remains packed-up as a concept. The interviewer responds to this by seeking to confirm whether the Project Manager is in fact the *agent* or the *medium* associated with the process of *obtaining clarity*. In his response in Turn 18 the project manager says:

"I'm just trying to make things clear."

This uses the grammatical construction that follows:

*participant + process*

Here, the *clarity* that was previously a *participant* is now a process of *making things clear*. The Project Manager suggests in Turn 18 that this process involves his gut feeling about when it is complete. *Clarity* in Extract 2 is a participant in processes of possession and transaction such as *to get*, *to provide* and *to give*. For example in Turn 12 the Project Manager says:

"We would just be attempting to get more clarity than we had."

This is a view of *clarity* as a tangible gift that can be exchanged. The Project Manager 'gives' or 'takes' the clarity 'to' or 'from' the stakeholders. This is the coercive rather than collaborative sense of *make* in *making things clear*. It also renders *clarity* as if it is an objective 'thing' "feeding into the selection criteria" and allowing the Project Manager to assert completion or exhaustivity about when *clarity* is achieved.

The consequence of thinking about *agreement* in this way is that the possibility of interpersonal negotiation about meaning by the members in a meeting is reduced. The grammar-based probing by the interviewer has the Project Manager acknowledge that the aim of *making things clear* is about the *mental process* of understanding. In a similar way to the example of *tracing*, the Project Manager 'dresses-up' what has been construed as relational and static as interpersonal and active.

The implicit mind-sets or ideological positions that have been described in the two examples of the unpacking of *tracing* and *clarity* in the grammar-based interviews remained unchallenged in the content-based interviews. The



question of exactly what is meant by these two nominalisations did not arise and their constituent assumptions remain embedded in the subjects' grammar.

## CONCLUSION AND DISCUSSION

The grammar-based interviews succeeded in unpacking nominalisation in the subjects' talk, while the content-based approach left many nominalisations unchallenged. The functional theory of meaning used in unpacking nominalisation in the interviews assumes that talking is an activity that does not produce artefacts that are purely explicit and 'visible'. Instead, it is an activity that embodies implicit processes, the *how* in what a person says. This position suggests that language may be implicit in two ways: firstly, a speaker may not attend to the linguistic patterns and features that they use when talking, and, secondly, the interpretation of a listener is mediated by that person's own meaning-making. This paper has focused on the first kind of tacit knowledge, the second requiring an infinite regress of reflexivity not readily operationalised in a field study context.

The implications for IS practice interested in understanding tacit knowledge are twofold. The grammar-based interview method provides a way of explicating this tacit knowledge for an individual and a way of identifying and explaining meanings, such as technical and managerial terms and taxonomies that have become entrenched and are directing particular ways of thinking about work activity. The method also raises the question about how we, as IS researchers and practitioners talk about our technical artefacts and the extent to which we examine the assumptions embodied in our language about technology.

## FUTURE WORK

The present study could be extended through training an interviewer in the host organisation to use the grammar-based technique and asking them to assess whether the technique helps them in their in-house interview programs. The researchers are currently involved with an organisation in the insurance industry where they will conduct another field study in which the grammar-based interview method will be used to understand the tacit knowledge involved in appraising team members' progress on IT projects through performance reviews. A training seminar will be held at the end of the interview schedule to train managers conducting the performance reviews in the grammar-based method. It is hoped that there will be opportunity for a follow-up ethnographic study to track the impact that the grammar-based method has on the interviews that these managers subsequently conduct in their organisation.

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## **APPENDIX A: GLOSSARY OF SYSTEMIC FUNCTION TERMS USED IN THIS PAPER**

### ***Agent***

The participant in a clause that cause the process to happen

### ***Circumstance***

A circumstance is an entity in a clause that extends, elaborates or projects meaning, typically as an adverbial group or prepositional phrase.

### ***Congruency***

A congruent meaning is literal rather than metaphorical.

### ***Grammatical Metaphor***

Grammatical metaphor refers to a variation in the way a meaning is expressed (in contrast to lexical metaphor which refers to a variation in the meaning that is expressed).

### ***Nominalisation***

A nominalisation is the ‘packing-up’ or condensing of an action, quality, circumstance or conjunction as a nominal group.

### ***Nominal group***

A nominal group is referred to in traditional grammar as a noun.

### ***Material process***

A verb about a tangible action or physical occurrence.

### ***Medium***

The participant that is associated with the process in a clause but which does not cause the process to happen.

### ***Mental process***

A verb about cognitive or emotional activity such as thinking or feeling.

### ***Participant***

A participant is the entity in a clause that is associated with the process. It is typically a nominal group.

### ***Process***

Traditional grammar refers to processes as verbs. They are the activity that is ‘occurring’ in a clause.

### ***Relational process***

A verb about an abstract relationship between two entities.

### ***Unpacking***

To unpack a nominalisation is to provide a congruent translation of its meaning.

**APPENDIX B: SAMPLE SIZE OF CLAUSES FOR EACH INTERVIEW**

<b>Interview</b>	<b>Subject</b>	<b>Number of clauses</b>
Grammar-based Interview round 2	Project Manager	150
	Information Architect	150
	Technologist 1	150
	Technologist 2	148
Content-based Interview round 2	Project Manager	150
	Information Architect	146
	Technologist 1	150
	Technologist 2	46
Grammar-based Interview round 3	Project Manager	150
	Information Architect	150
	Technologist 1	150
	Technologist 2	141
Content-based Interview round 3	Project Manager	49
	Information Architect	116
	Technologist 1	120
	Technologist 2	109
Grammar-based Interview round 4	Project Manager	150
	Information Architect	150
	Technologist 1	150
	Technologist 2	150
Content-based Interview round 4	Project Manager	136
	Information Architect	100
	Technologist 1	105
	Technologist 2	80

Table 3: Sample size by clause for each interview

## APPENDIX C

Speaker	Process	Process Type	Agent	Medium
Project Manager	to trace	material	requirement	scope
	to cover off	material	requirement artefact	scope
	to cover	material	requirement artefact	scope
	to trace from	material	thing	-
	to trace to	material	thing	-
	to flow from	material	-	original request
	to help uncover	material	tracing	areas where you missed out requirements
	to trace to	material	feature	stakeholder request
Information Architect	to feed into	material	requirement	requirement
	to trickle into	material	requirements	features
	to trickle into	material	features	use cases and test cases
	to be derived	relational	requirement	another requirement
	to derive from	relational	requirement	requirement
	to trace back to	material	-	the source
	to distil	material	we	stakeholder requirements
	to expand into	material	we	use cases
	to track	material	-	where the origin of the requirement is located
	to meet	material	requirement	a need
Technologist 1	to take	material	I	someone's thoughts and concepts
	to translate	verbal	-	someone's thoughts and concepts

Table 4: A sample of processes and participants in clauses about tracing in the grammar-based interviews

## APPENDIX D

Turn	Speaker	Talk
1	Interviewer	So all of this is oriented around arriving at your selection criteria?
2	Project Manager	Yes all of this is about trying to, trying to just get some clarity around both people's perspective because at the moment they're, they're not aware of each's perspective and they and I think they would both have their own view.
3	Interviewer	So who is it that then needs the clarity?
4	Project Manager	Well I'd like to bring them just to get the views debated and to the surface so that they could be properly appraised by the steering committee and the project owner and the project director so that they have all the information in, in front of them basically.
5	Interviewer	Ok so who is it that needs the clarity?
6	Project Manager	Um ultimately, the project director and the project owner.
7	Interviewer	So once you've got the two stakeholders together, how do you ensure that the clarity reaches the project director? What's your process?
8	Project Manager	The project director will be there
9	Interviewer	OK, he's present
10	Project Manager	in the in the in the one in the meeting where they come together and we will document those and just to make them and document them as requirements make note that they will be feeding into the selection criteria for the next round of evaluation.
11	Interviewer	So what the event that tells you that clarity has been reached?
12	Project Manager	I don't know if you could ever say that ultimate clarity has ever been reached. You, we would just be attempting to get more clarity than we had but the, the event that would tell you that clarity has been reached is that you have a set of selection criteria which you think covers all the arguments that have been raised.
13	Interviewer	Who's the you you've been talking about?
14	Project Manager	Myself
15	Interviewer	Right so you're the one that needs the clarity
16	Project Manager	No, I'm, I'd be, I'd be, I'd be, I'm, I'm attempting to find the clarity to provide to somebody else.
17	Interviewer	Ok, so clarity is something you give someone else?
18	Project Manager	Um clarity is something you give somebody else. Clarity is something that you try and uncover I guess and I mean I'm just trying to make things clear so that people understand the issues. and I've got, I don't think it's clear at the moment and I'll have a gut feeling as to when I think it is.
19	Interviewer	Ok, ok, right. So your criteria for having sufficient clarity is your gut feeling?
20	Project Manager	I would think so.

Extract 2: Project Manager, Grammar-based Interview 2, Phase: Communication