

# Qualitative Analysis for Trust Management: Towards a Model of Photograph Sharing Indiscretion

Simon N. Foley  
Department of Computer Science,  
University College, Cork, Ireland  
s.foley@cs.ucc.ie

Vivien M. Rooney,  
Department of Applied Psychology,  
University College, Cork, Ireland  
vivrooney@gmail.com

## Abstract

Grounded Theory provides a useful approach for eliciting and justifying subjective characteristics of individuals. A Grounded Theory analysis is carried on individuals who share pictures, with a view to developing a trust management policy model of indiscretion regarding the sharing of photographs.

## 1 Introduction

Psychologists, taking a social constructionist perspective, argue that *identity* is derived from recognizing, classifying, understanding, judging and otherwise conceiving and thinking about selfhood [22]. These are what characterize the individual and make them who they are.

From a Trust Management perspective [2], identity is regarded more in terms of determining some unique identifier for the individual than necessarily characterizing who they are. While schemes such as X509 [4] or SDSI [20] may provide identifier/naming frameworks for principals (including individuals), authorization attributes [2, 9] provide characteristics that further define the principal. Authorization attributes tend to be specified in terms of artifacts from the system with which the individual interacts. For example, their role, their clearance, their identification and the actions that they may engage, within an organization. They characterize the individual in terms of what they may do, and do not usually consider who they are, in the psychological sense.

We are interested in developing trust management schemes that better reflect the psychological identity of the individual. For the purposes

of this paper, the problem is considered from the perspective of the electronic sharing of photographs. A conventional security/trust management approach might consider photograph sharing in terms of security artifacts such as access-control lists and group attributes (friends, acquaintances, etc.). However, in reality, decision making around picture sharing is based on a much richer set of characteristics which part of the individual's identity. For example, in our study we found that some people can be quite indiscreet, arbitrarily disseminating personally meaningful photographs if they believed that they could not be identified as the originator. In addition to indiscretion, many other characteristics are possible for an individual when it comes to sharing photographs. Identity tends to be subjective and the challenge is to devise a reliable method whereby relevant characteristics of the individual can be systematically elicited and justified for the problem domain.

Reputation schemes [14] could be thought of as providing a simple characteristics of the self. For example, Slashdot *Karma* gives an indicator of the individual's standing in that message board community. While apparently informative, it is unclear whether the subjective Karma attribute is actually a reliable indicator of how individuals see themselves within this community. Computing research on reputation metrics has tended to focus more on algorithmic and technical issues and not any systematic methodology for determining and justifying the attributes that make up the reputation.

We argue that Grounded Theory analysis [5] of semi-structured interviews can provide a methodological basis for eliciting attributes about identity when developing trust management policies. Grounded Theory is a qualitative research method commonly used in psychology for generating theory demonstrably grounded in data. A frequent application of Grounded Theory is in the area of health research. It has also been used to help elicit requirements in Software Engineering [21] and Compliance [3]. In the security domain, for example [7, 18, 1, 10], Grounded Theory has been used to help understand user behavior as part of better security (system) design, but not specifically for the derivation of trust management policies which is the subject of this paper.

The remainder of the paper is organized as follows. Section 2 provides an overview on the use of Grounded Theory for qualitative analysis. A Grounded Theory analysis was carried out on photograph sharing and some of its results are discussed in Section 3. This analysis was used to identify and justify attributes related to the issue of photograph sharing and Section 4 develops a trust model based on a number of these attributes.

## 2 Qualitative Analysis using Grounded Theory

When experience with technology is confined to a particular perspective, for example, one restricted to a scientific mode of discourse, the result is partial, needing to be complemented by others [19]. Experiences with technology involve emotions, values and ideals, however, these aspects are neglected because they are considered too subjective [16]. Subjectivity, we are taught, is problematic because it undermines rationality. The Western tradition of scientific research values rationality, along with the comforting notion that a truth exists, one that is immune to interpretation, instead being detached, objective and unchanging [8]. Furthermore, from a rationalist point of view, users of technology are unlikely to experience resistance, doubt, ambiguity and suffering [16]. Among the aspects of user experience that need to be included when we consider experiences with technology are affective responses, concerning purpose, aspiration and relationships.

One difficulty in approaching the affective and subjective components of experiences is their complexity. Methodologically, the convenience of many methods lies in the results produced. Hence, the attraction of means of inquiry such as questionnaires, where results are obtained quickly and in a form readily adaptable to the requirements of designers. However, if we approach user experience in an holistic manner, the complexity and fluidity of our behaviour necessitates methods of inquiry that are correspondingly complex and fluid [12]. Qualitative methods of inquiry are ideal for such purposes, having the capacity to accommodate such requirements, as well as seeking to include the contextual and personal meaning of data.

The research method of Grounded Theory (GT) was first described by Glaser and Strauss in 1967 [11], since then it has evolved, and the constructivist approach to the method, as described by [5] was used for this paper. A feature of GT is the systematic procedures applied to the data, for example, those of constant comparison and coding. These ensure theoretical development that is both valid and reliable. Similarly, the use of written memos explicates the process of labelling and categorisation. Thus the emergent theory is demonstrably grounded in the data. Formulating a theory in advance of data analysis could lead to the imposition of a framework, thereby influencing both process and outcome. While the GT analytic process seeks to identify patterns in human experience, the subjective voices of participants - the meaning of experience for them - is retained. GT is particularly appropriate where participants are likely to produce a reflective account [17], and is therefore suitable to the study of photograph sharing, where personal significance is likely to be attached to the material. The theory that emerges

does so as a result of a prolonged and intense engagement with the data, using the GT techniques.

### 3 Analysis of Photograph Sharing

This research began with a question concerning photograph sharing. The approach to addressing this question sought to understand how people made sense of sharing photographs. Thus semi-structured interviews were considered to be the most appropriate approach to gaining an insight into the individual's perspective. The semi-structured interview allows space for the exploration of participant experiences. Rather than a structured interview or questionnaire being used, the semi-structured interview facilitates a dialogue between the researcher and participant [15]. This approach seeks to lessen the weight of preconceived ideas concerning the content of the interview, instead allowing the dialogue to unfold, and as it does so, to take unexpected directions, thereby facilitating the exploration of individual experiences.

Seven interviews were audio recorded (duration: three hours and fifty minutes) and transcribed in their entirety (the text forming a document of just over thirty-six thousand words). The transcribed material was coded line by line. This analytic technique aimed at capturing the process taking place in the data, as described by the participant.

The initial coding sought to capture the meaning, or the phenomena, summarizing the actions therein, in light of the research question. This process accounted for each piece of data, with a view to the development of categories. Throughout this process the technique of constant comparison was used to compare segments of data and their assigned codes, with other data and codes. The purpose in doing so is to ensure that the labeling was proceeding in a valid manner. Initial coding is provisional, and subject to change as the process of constant comparison indicates nuanced relabeling of data, as the process develops iteratively.

The validity of the emergent theory relies on the painstaking nature of the coding as well as its transparency, for which memos provide an audit trail. Memo writing continued throughout the process of analysis, explicating, *inter alia*, initial ideas and possible categories. During the subsequent phase of focused coding, theoretical integration began: the initial codes were sorted and integrated, and from this synthesis of the codes, an abstract understanding of photograph sharing emerged. This process is iterative and carried out in tandem with memo writing as the conceptual framework is

developed. Conceptual integration of the categories gave rise to theoretical development, suggesting relationships between the identified categories. For the purposes of illustration, the appendix provides short extracts from two interviews conducted as part of the study on photograph sharing.

In the attempt to understand experience from the perspective of the individual, then, there is a focus on their unique way of making sense of a phenomena. Using GT methods gives an opportunity to delve into this way of making sense. Rather than making a claim to be definitive in its scope, the validity of what emerges lies in the explication of the method used and the conclusions reached, ensuring transparency such that a reader can follow the steps taken, understanding them in the context of the research. Along with this commitment to transparency and reflexivity, participants are the focus. In this research, their experience, imbued with values, ideals and aspirations, as played out against the background of photograph sharing, was elucidated.

## **4 A Qualitative Model of Sharing Indiscretion**

In this section we explore the use of Grounded Theory analysis as the basis for an approach to eliciting a trust management policy for photograph sharing. Our intention is not to provide an exhaustive model that considers all aspects of photograph sharing, rather it is to explore how grounded theory could be used to help elicit trust management policies. For the purposes of this paper, we consider just one aspect of picture sharing: a model of the potential for indiscretion when sharing photographs that might be considered sensitive and/or personally meaningful.

### **4.1 An Exploratory Approach**

The Grounded Theory analysis (Section 3 and Appendix A) identified a range of categories that provide understanding for the meaning of photograph sharing for a selection of individuals from a user-population. These categories provide the attributes in terms of which a general trust management policy model for the broader user-population is constructed. These categories/attributes are treated as discrete probabilistic variables, representing the probability of their occurrence with respect to an entity of interest. For example, the probability that a particular photograph contains a child, the probability that a particular individual is deceitful, the probability that the holder is willing to share a photograph.

Interdependencies between categories/attributes can be identified as part of the Grounded Theory analysis. For example, an individual’s willingness to share a photograph may be based on whether they own the photograph, how personally meaningful the photograph is to them and their own inclination for deceit, etc. This gives rise to a network of dependencies between attributes which, for ease of exposition in this paper we chose to encode in terms of a Bayesian Network. This provides a model of the knowledge about the domain elicited during the Grounded Theory analysis. Similar model building strategies have been used in the social and health sciences; for example, [6]

## 4.2 Deciding Whether to Share a Photograph

A person (the holder) in possession of a photograph makes a decision on whether and how to share a photograph. As the holder of the photograph, the individual has the ability to share the photograph regardless. The Trust Management question is one of how indiscreet would it be to share the photograph. This question is cast based on the attribute/category information available on the entities involved: the holder of the photograph, the recipient, the subject in the photograph and the photograph itself.

The Influence Diagram [13] in Figure 1 provides an abstract model for indiscretion over the sharing of photographs.

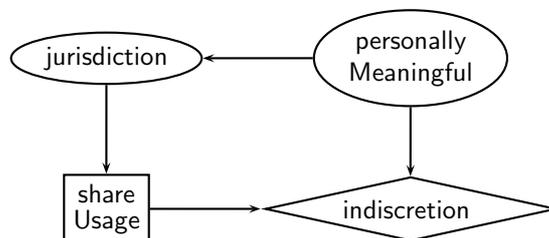


Figure 1: Abstract model of photograph sharing indiscretion

Probability variable `personallyMeaningful` represents the likelihood that the photograph has some personal meaning for the holder. For example, the more personally meaningful then the less likely that the holder will widely share the photograph. In practice, a holder also has her own personal value system regarding photograph sharing which can influence her sharing decisions. The variable `jurisdiction` provides the holder’s belief on whether the photograph could be shared.

Decision variable `shareUsage` represents the possible photograph sharing

decisions that can be made by the holder. Note that if holder choses, she can decide to share the photograph in a manner that is at variance to her own jurisdiction on the photograph. Utility function *indiscretion* indicates the extent to which the holder’s usage of a photograph is careless. It is a function  $\text{indiscretion} : \text{personallyMeaningful} \times \text{shareUsage} \rightarrow \mathfrak{R}$  for which we defined, in an ad-hoc manner, intuitive weights. For example, deciding to share a personally meaningful photograph with a wide audience indicates a high degree of indiscretion, while privately sharing a photograph that is not likely to be personally meaningful indicates a low level of indiscretion.

### 4.3 Indiscretion in Unconstrained Sharing

For the purpose of presentation, we consider unconstrained photograph sharing, that is, in deciding whether to share, the individual does not consider the identity of the recipient, other than whether the photograph is to be made public, shared privately, or not at all. Thus, the (*shareUsage*) decisions are *none*, *private* and *public*.

The Trust Management question is *how indiscreet is individual when deciding to share a photograph with some subject*, whereby,

- the photograph subject is characterized in terms of attributes: has given consent (to share), contains a suffering subject, contains a child subject, is contains candid subject and whether it is a public occasion;
- the photograph holder is characterized in terms of attributes: holder ownership and holder deceitfulness, and
- the holder decides to share according to *shareUsage*.

These are just some of the categories/attributes elicited during, and can be justified from, the Grounded Theory analysis. As probabilistic variables they may have observed values, for example, a photograph that is explicitly tagged as containing a child subject. Alternatively, the value might be determined from historical or user-profile information. For example, the health worker that tends to have photographs of suffering subjects, or a reputation metric that is used to score user deceit. In this paper we are not directly concerned with techniques for determining these values, rather, we are interested in how the attributes themselves are elicited and their use justified.

Figure 2 provides an example of the sharing model constructed in terms of these attributes related to unconstrained sharing. Dependencies between

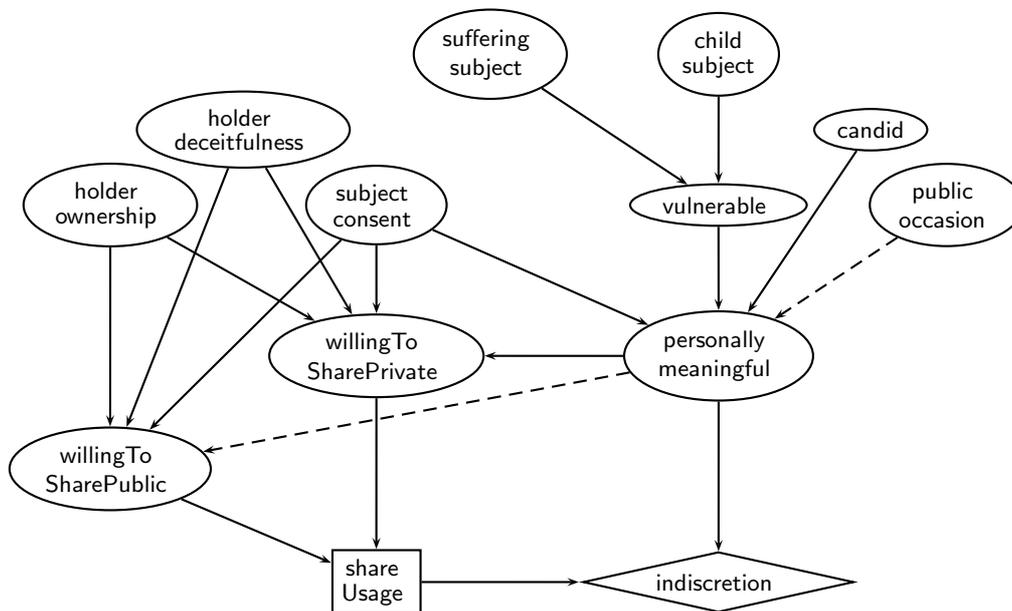


Figure 2: Decisions about unconstrained sharing

attributes were identified qualitatively during the Grounded Theory analysis. Rather than requiring conditional probabilities to be (tediously) enumerated, dependencies were represented in terms of positive (solid line) or negative (dashed line) influences in the direction of the arc connecting attributes. These give rise to simple weightings that can be used to compute the conditional probabilities: a simple Qualitative Bayesian Network [23].

For example, the probability that a photograph is personally meaningful is directly proportional to the probability that its subject is candid, while it is indirectly proportional to the probability that it reflects a public occasion. While convenient for this paper, this approach can lead to a somewhat coarse-grained interpretation for the conditional probabilities, which could be manually adjusted by the analyst. In practice, it would be more effective to use all of the qualitative operators in [23] and/or to use machine learning over the attribute/category data sets in order to build a more precise model. This is a topic for future research.

## 5 Conclusion

In this paper we outlined how Grounded Theory can provide a useful approach for eliciting subjective attributes to be used in trust management policies. These are the attributes that contribute to characterizing the psychological identity of the individual.

One of the advantages of taking a Grounded Theory approach is that it is a transparent process and provides justification for the theory developed. This theory forms the basis of a trust management policy which we encoded in terms of an Influence Diagram/Bayes Network. We do not consider this work to be limited to using only these model representations and in future research we plan to investigate their encoding into more conventional trust management credentials.

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## A Sample Codings of Interview Extracts

### A.1 Extract from Interview 7 with Geoff

In this extract from his interview, Geoff is talking about taking photographs of people in public places. Names given are not those of the participants.

Initial Coding	Interview	Focused Coding
	[...]	
<i>subjectivity; being reluctant</i>	A: I suppose for me I'm less inclined to be-	reluctant
<i>imagining how he'd feel;</i>	cause it's more about, because I'm like, would	empathy
<i>applying his empathy;</i>	I like somebody to take a shot of me, so I'm	reciprocity
<i>disliking the idea;</i>	sort of reflecting my personal view onto that	being reluctant
<i>being reluctant</i>	so it's not something I'd be comfortable with,	empathy
	I'm less inclined to, if I was somebody who	
<i>imagining how others feel</i>	thought 'I don't mind if anybody takes my	empathy
<i>acknowledging that others</i>	photograph', then I suppose I might think	
<i>might feel differently</i>	there's probably a lot of people out there	empathy
	who feel the same way and that would be my	
<i>comparing photos to art</i>	view, and I would do that, art for art's sake,	content of photos
<i>acknowledging others might</i>	and if somebody objected then they'd ob-	empathy
<i>object</i>	ject, and that would be that then, I'd just	
<i>knowing others feelings</i>	delete it, but I'm probably somebody who,	deleting photos
	I'm more inclined to say, 'would I be comfort-	
<i>using himself as a measure</i>	able' and take it from there, so in that sense	trusting himself
<i>being reserved</i>	I'm probably somebody, would be less public	self awareness
	and more private, but I was thinking as you	
<i>being part of the action</i>	were speaking of situations where you're in	public places
	live event and something is going on, like the	
<i>being in a violent scenario</i>	tsunami or a fire, because I know somebody	
<i>recording events</i>	at work recently who happened to be around	public events
	when the bombings were going on in London,	
	and instantly went, had a video with him, and	
<i>commercial use</i>	videoed a scene and then rang up the BBC	uses of photos
<i>profiting from images</i>	and said, 'look, I've got this footage' and got,	usage of photos
<i>reflecting on others behaviour</i>	I don't know, a hundred quid or whatever,	self awareness
	for doing that, I was thinking, in that kind of	
<i>contrasting himself to others</i>	situation how comfortable I would feel about	self awareness
	that, and I don't know that I would be	

	Q: did they have people reacting?	
<i>explaining actions of others others not reflecting</i>	A: well, they just thought this was a great opportunity, got my camera, so in a sense for them they wouldn't have thought twice about taking those images because, I suppose from their point of view it's like, such is the way things are now that we want to see everything, we want to see what's happening, we want full pictures, and it's almost that's how things have changed culturally, and the media has moved on in every area, so when you think of things like Big Brother and all the reality TV shows you know, is nothing sacred? I don't know, so I suppose there are	empathy empathy
<i>accepting status quo public demand for images</i>	issues of consent and stuff like that, but I know for me, in that situation, I would not be the woman in the Safari Park you know filming my husband being eaten by a lion	demand for images demand for images
<i>company past and present</i>		cultural practices
<i>broadening the scope of change media as intrusive</i>		cultural practices cultural practices
<i>complexity of the issues limiting his participation in intrusion (changes in media)</i>		complexity of issues self awareness self awareness
	Q: did that happen?	
	A: yeah, it did	
	Q: your friend with the footage that he or she sold, made some money out of it, say if it was for a charity or not for profit, do you think that'd be different?	
<i>uses might differentiate</i>	A: well, it might colour it a little bit alright, but then, for me I'd still be thinking about other people, and in that sense I wouldn't want, I'd have to be clear that it would be, if it involved distress to somebody else, I would be, you know, images of a fire or a wrecked bus, maybe, but if it were a case of filming somebody who was actually suffering I think even if it was for charity, that might be a source of distress for somebody else, I guess in that sense I would be loath	different uses of photos empathy
<i>others distress as deciding factor</i>		
<i>images without people differentiating images of suffering people and objects use overrides exploitation of images of suffering</i>		contents of images images of suffering uses of photos images of suffering

## A.2 Extract from Interview 3 with Conor

In this extract from his interview, Conor volunteered to show the images on his camera phone. He is talking about a photograph of his friend John that he had taken recently. Names given are not those of the participants.

Initial Coding	Interview	Focused Coding
<i>(photo of friend)</i>	[...] Q: so, would you give that photograph to others, would you share that?	photo of friends
<i>not for sharing</i> <i>minimizing its significance</i> <i>categorizing the photo</i>	A: no, I wouldn't send it to anyone, its just on my phone, its just a bit of fun, just kind of taking a photograph of him, it wasn't really a big deal Q: would you give it to John?	reason for taking photos significance of image significance of image
<i>showing images to subject</i> <i>minimizing its significance</i>	A: I showed it to him but like you know, we're after a few jars so it didn't really matter like, he was like yeah, ok, whatever, it wasn't like an important photograph I suppose, but its kind of good, he's a good friend of mine	photos of friends significance of image
<i>liking the image</i> <i>liking the friend</i>	Q: would you give it to me, suppose I wanted to use it in a project or something like that, would you give me a copy of that?	photos of friends photos of friends
<i>reflecting on his position</i>	A: that's a good question, mmmm... Q: you're thinking about it, what are you thinking about?	ambivalence
<i>contemplating being found out</i> <i>being easygoing</i>	A: I'm thinking, would he find out about it, like if you said it, I'd be like whatever, you know like, but if it was kind of printed on the front page of your project it would be a different story if someone in the class that knows him as well, or whatever, like, so he might be like 'that's a bit weird', so maybe not, no	image traced to source ambivalence
<i>dissemination of image</i> <i>possibility of subject being recognized</i> <i>subject might object to image use</i>		use of images image traced to source empathy

	Q: do you think you'd have to ask him first	
<i>reflecting on friend's personality</i>	A: well, he's kind of an image conscious guy, so you know, he likes to look good and spend a lot of money on clothes, he might think its	empathy
<i>imagining how friend would feel</i>	not the best photo, so I imagine he might say no as well but having said that I don't think I, well, I know its a bit weird to say this, I wouldn't be in a situation where someone would ask me to do that, I suppose you're suggesting a hypothetical like, but I suppose, no	empathy
<i>social norms prevent such requests</i>		social norms
	Q: is there someone else in that photograph behind him?	
<i>public place</i>	A: it's in the bar, I've no idea	public venue
	Q: there's another guy there	
<i>incidental people in photos</i>	A: a blurry guy, yeah, I think these people here behind us, see that guy there on the left,	images of bystanders
<i>identifying bystanders</i>	he's the <i>⟨student official⟩</i> , now that I look more closely	images of bystanders
	Q: if I wanted that photograph, but I wanted it because the <i>⟨student official⟩</i> was in it, would you give it to me then?	
<i>uses of photo expressed intention of requester</i>	A: it depends for what reason, I suppose, I mean	uses of images uses of images
	Q: suppose you could get John out of it and it had someone you didn't know in it, would you give it to me then?	
<i>being found out stated uses</i>	A: depends if it could be traced back to me, what you're going to do with it, I mean	image traced back to source uses of images