The Context Quintet: Narrative Elements Applied to Context Awareness[1]

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Abstract

For a computational device to be context aware, it needs to be sensitive to physical, social, and task situations. While answering the five basic narrative questions of Who, What, When, Where and Why can provide a tremendous amount of understanding and context to a story, making a computational or communications device sensitive to these same questions provide a simple yet powerful structural guidelines for context awareness in device interface design.

1 Introduction

In our drive to design an ever increasing level of intelligence into our computational and communications devices, one promising subcategory of artificial intelligence is context awareness. If a device could be more aware of its own physical and task context, and aware of the user's social context, then it could potentially use this information to make better decisions on the user's behalf. The topic of context awareness is common within the research domains of pervasive computing, wearable computing and mobile computing. Devices that can be carried in the palm of the hand like a cell phone, or carried in a stylish shoulder bag like a laptop, are getting smaller, lighter, and far more powerful. As this happens, basic level communications and computational capabilities drop in price, further encouraging pervasiveness. If people are going to interact with devices that are plentiful, personal and small enough to always be with them, then these devices should also be aware of what is happening around them and what the user wants to do with them. It is a common metric of intelligence for both people and machines to quantify and qualify how much they know about the world around them. Another metric of intelligence is the ability to understand enough about the world to recount it in a story.

2 Story Context

Telling and understanding stories are intelligent acts, as is suggested by Marvin Minsky in his book *Society of Mind.* (Minsky, 1988). Storytelling is a natural and infinitely pervasive way for people to share information about the world. Most of our common daily communication with each other is in the form of stories. We thrive on stories. We express who we are through our personal stories. From an exceptionally early age we are told stories which begin the formation of

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our moral and cultural identity. Along with the chemical element carbon, stories are the other basic element of our being. We are carbon and story-based beings. Given that story or narrative is so important to the way we think and live, it is reasonable, therefore, to look to narrative for clues about designing systems that communicate personally and cross culturally with people. It is in fact surprising that narrative is not a more prevalent component of interface design.

2.1 Relationship as Context

In storytelling, the storyteller establishes story context in part through the channel of *relationship* with the audience. (Martin, 1996) The words the storyteller uses in the story (assuming oral or written and not a visual story form) certainly go a long way toward establishing context as well. But it is the relationship with the audience that the teller establishes early on that is the conduit of the story context. That relationship is dependent on attributes of the situation – a situational context: whether the audience is composed of children, adults or mixed, whether the audience is composed of mostly men, women, or mixed, whether the audience is familiar or unfamiliar with the teller, and so on. Knowledge of the initial status of the relationship and an awareness of how that relationship changes over time is key to knowing what information the storyteller must relate and how to relate it. A woman telling a story to a group of women from her own culture does not need to specify many details about femininity, for instance, because both teller and audience share a common cultural definition.

One challenge for computational devices is that they were never children, nor gendered. Their inherent inhumanity makes them capable of only approximating the nature of this relationship as context conduit. As interface designers and researchers, we design the basic building blocks of these devices in a small enough granularity such that users can do the bulk of the work toward creating a relationship. That is, the devices provide the handles for relationship, in the form of customisable icons, reprioritizable interface elements, automatic linking of address book and calendar entries, etc., but it is the user who must work to grasp these handles. There is nothing unusual or wrong about this, but context awareness somewhat shifts the paradigm. If a device's awareness could allow it to actively improve the relationship between itself and its user, then it truly could become a personal device. As Karl Kroeber suggests, narrative represents a continuous potentiality for change. It folds and unfolds in on itself, "…transmuted by the very process of absorbing the meanings it has initiated." (Kroeber, 1992) Similarly, Lieberman & Selker refer to context as iterative and "…a state that is both input to and generated by the application persists over time and constitutes a feedback loop." (Lieberman & Selker, 2000)

2.2 Point of View as Context

If relationship is a conduit for context, then *point-of-view* is an effect or result of context. Context means seeing from a point-of-view, often from somebody else's point-of-view. When an audience knows the context of a story, they have essentially adopted and accepted the point-of-view of the storyteller. They have accepted the world provided to them, the relationship is thoroughly established, and the conduit is open. From this point on, the storyteller has both power and the responsibility to either give them what they expect/ask for or give them what they don't expect/ask for. What one asks for is not necessarily what one needs. When a user asks for the contact information of a particular person, a context unaware device would simply do a database lookup and provide the information. A context aware device might provide the information and, according to an awareness of the situation based on current time, date, calendar information, and recently performed tasks, may also provide additional information or offer to perform a set of tasks for the

user – order tickets, get the weather forecast, retrieve a traffic report, send someone a simple SMS message, or all of the above.

This is more than a simple logical progression. If a user is making a query about the location of a theatre or asking where a particular movie is playing, it is a logical progression to assume that he wants to see that movie, therefore next offering to purchase tickets is a sort of first order logic. If a person asked the same question to another person who knows them, a response of: *But I thought you wanted to see Greece?*, might seem nonsensical to a first order logic system. But to the receiver, such a response might not only make sense, but also make him reprioritize his evening such that instead of needing movie tickets, he goes home to work on his conference paper.[2]

3 Context Quintet

Given the context conduit of relationship and point-of-view as a result of communicated context, one method for approaching context awareness in intelligent devices is to employ the five often used narrative queries that go a long way toward establishing context in fiction or non-fiction stories. While this is nowhere near an exhaustive deconstruction of story context, these queries and their respective answers constitute an easily approachable structure for applying narrative context to context awareness research. The five queries are simply: *Who, What, When, Where,* and *Why*. When we listen to stories, we need most if not all of these questions answered in order to make sense of the story world, to make us feel comfortable with the characters, motivations, setting, etc. Not all of these questions need to be promptly answered to successfully deliver story context. How storytellers get audiences to not care about certain questions at different times is beyond the scope of this paper. But a personal communications and/or computation device that is aware of most, though not necessarily all of the answers to these questions would be acutely aware of the user's context. The questions below are listed in order from easiest or most straightforward to most challenging for a device. The ordering can also be interpreted as near-term to long-term technology delivery.

3.1 Straightforward

Some of the questions are easier or more straightforward to answer in a sense because they are already being answered. Devices from many companies already offer interesting solutions.

3.1.1 When

Acquiring and maintaining time and date information is common to all computational devices these days. Even cell phones store calendar appointments like their larger computational counterparts, laptops and desktop workstations. Over-the-air time-date synchronization is also available in most phones and phone systems. Knowing time and date – a *temporal awareness* – is a fundamental component of context awareness because our culture is so dependent on specific time referencing.

3.1.2 Where

[2] To Marvin Minsky and others (Lieberman, Liu, & Barry, 2003), such reasoning is called common sense reasoning, which is being actively applied to storytelling systems of various types. (Barry & Davenport, 2002)

Having a physical *location awareness* means that it is possible to deduce distance, travel speed, and, to some extent, the location's personal meaning to the user based on experience. This can be done on a cell phone on a rudimentary scale using cell tower triangulation, although this is information that consumers and, ironically, most developers do not usually have ready access to. When a device is not mobile, then simple caller ID can work for rudimentary location awareness. But when a device is out of doors, the best technique thus far for location awareness is global positioning systems (GPS). While plug-in GPS modules for PCs have existed for years, GPS functionality is just starting to appear in cell phones.[3] But since GPS uses satellite triangulation, it only works outdoors. For location awareness indoors, researchers and commercial companies are starting to look to 802.11b signal strength triangulation. Already, just by combining both indoor and outdoor location awareness and correlating that with calendar information, a device could learn locations of people and place names, and deduce if the user is where they said they would be or is on their way.

3.2 Under Development

3.2.1 What

What refers to what a user is user doing, what task are they engaged in or trying to achieve – *a task awareness*. Various pattern analysis techniques or case-based reasoning could apply to this area of context awareness. Specifically in the domain of user interface, Cypher, Lieberman and others have written extensively on programming by example or programming by demonstration (PBD), which works like a task context recorder/operator. (Cypher, 1994) (Lieberman & Selker, 2000) Instead of a user learning and employing a symbolic language like C++ or Java to represent context patterns and appropriate corresponding behaviours, PBD draws on the actions a user is already engaged in to learn what the user wants to achieve overall, such that the system can eventually take over the task for the user. A device with the ability to recognize user task patterns and then perform those tasks semi-autonomously would be a very valuable personal device. Coordinating that task awareness with location awareness means that a device could automatically perform simple tasks in the background whenever it is in a user-specified (or service provider specified) location. Coordinating task awareness and location awareness with temporal awareness means that a device could know when it will need to perform certain tasks and either begin them ahead of time or automatically coordinate its efforts with the user.

3.3 Challenging

3.3.1 Who

Determining and managing who – an *identity awareness* – is deceptively difficult. This, of course, is not simply the storage of names and categories that many address book software programs already provide. Nor is this determining what might be called "an absolute identity," with smart card technology, fingerprint readers, or retina scanners. Such identification systems already exist and networked devices can potentially acquire other personal data from internet sources (i.e. passport or social security numbers). More than just identification, identity awareness means managing a complex web of ever changing relationships. On a personal level, we identify each other not just by name, but (primarily) by relationship. Someone is not just "John," but also a family member, co-worker, friend, debtor, teacher, business partner, and so on. We identify

[3] See Motorola phone model i88s, http://idenphones.motorola.com/iden/application?namespace=main

people by what they mean to us. We know the world largely through the relationships we have with its elements. The more remote or disconnected something is, the less is seems we are likely to be interested in it.[4] In stories, the way a character's relationship changes over time is much more important than their name and some initial static classification. Identity awareness seeks to know, for example, what significance is associated with the user meeting with a particular person. Combined with time, location and task, knowing the meaning of *who* could provide insight into implementing a sophisticated model of device task prediction and resource management.

3.3.2 Why

Why is perhaps the hardest question of all. Interface design may never get to this point and perhaps should not try. We very often do not know the why of things ourselves. When someone gives us a *why*, we often counter with a different *why*. The why is so deeply rooted into who we are as human beings that it is absurd to believe that a machine could deduce or even guess a why answer of any real meaning. However, the why of the user's behavior is not nearly as informative from a device as the why of the device's behavior. The more complex and sophisticated the various algorithms of an interface and the more a device employs machine learning methods to absorb bits and pieces of a users life, the more it will need the ability to explain its actions when they are not expected by the user. The relationship between the user and the device would be strengthened through clear expressions of why the device is performing a particular task.

4 Conclusion

Combined with the other four awarenesses, the ability to provide a simple reasoning to the user is more than a safeguard, it also provides a window into the device's point-of-view, if it can be said that a device can have a point-of-view. But certainly the stronger the working relationship between a person and a device with some level of agency, the more *point-of-view* seems fitting. Narrative does not provide a comprehensive method of identifying and expressing context awareness, but for those of us whose lives are built on stories, which is all of us, it can provide a natural method for thinking about and managing the very complex computation associated with context awareness. In addition, narrative offers a universally familiar domain for managing complexity. While the desktop interface metaphor may be particularly comforting to those of us chained to our traditional business desks, narrative metaphors cut across work environments, cultures and ages. Like a sonata, narrative is the music that turns complexity into sophistication.

5 References

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[4] One indicator of interest in this type of awareness is ongoing work on the semantic web, an extension of the world wide web that basically adds meanings to links. http://www.w3.org/2001/sw/

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