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Ambient Intelligence with Wireless Grid Enabled Applications: A Case Study of the Launch and First Use Experience of WeJay Social Radio in Education

Helen Patricia McKenna
Syracuse University

ABSTRACT

Wireless grid and ambient intelligent (AmI) environments are characterized as supportive of *collaboration*, *interaction*, and *sharing*. The conceptual framework advanced for this study incorporated the constructs of innovation, creativity and context awareness while offering emergence theory — emergent properties, structures, patterns and behaviors — to frame and investigate a wireless grid enabled social radio application which was theorized to be potentially transformative and disruptive. The unintended consequences and unexpected possibilities of wireless grid and smart environments were also addressed.

Using a single case study, drawing upon multiple data collection methods, this research investigated the deployment and use experience of WeJay, an application incubated through the Wireless Grids Innovation Testbed (WiGiT), from the perspective of beta trial participants. Guided by the broad research question — *Do wireless grid enabled applications, such as WeJay social radio, add to the potential for new and transformative outcomes for people, information and technology when deployed in an academic setting?* — this empirical study sought to: a) learn more about the launch experience of this first pre-standards wireless grid enabled application among WiGiT members and selected Syracuse University students and faculty; b) understand how this application was interpreted for use; c) determine whether novel and unexpected uses emerged; d) investigate whether wireless grid enabled environments fostered innovation and creativity; and e) elicit

whether a conceptual relationship was emerging between wireless grid and AmI environments, focusing on context-awareness and ambient learning.

While this early stage of diffusion and first user sample was a key limitation of the study it was also the core strength. Although challenged by the *state of readiness* of WeJay, study findings supported the propositions that WeJay fosters innovation and creativity; that novel and unexpected uses were generated; and that the theorized relationship between wireless grid applications and embedded awareness does exist. Recommendations for enhanced tool readiness were made and embedded smartness was found to be both desirable and beneficial. This research makes a contribution as a bridge study for future research while having theoretical and methodological implications for research and practice. Social, emotion/affect, and human-centered computing (HCC) dimensions emerged as rich areas for further research.

Keywords: ambient intelligence (AmI); ambient learning; context awareness; creativity; edgeware; emergence theory; emergent learning; emotion/affect; human-centered computing (HCC); information and intelligent systems (IIS); information interaction; information sharing; innovation; robust intelligence (RI); social media; social radio; WeJay; wireless grids

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By

H. Patricia McKenna

B.A. University of New Brunswick, 1976
M.L.S. McGill University, 1980

DISSERTATION
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PREFACE & ACKNOWLEDGEMENTS

This research study of first use experiences with WeJay, a wireless grid application in beta form, presented unique challenges. Because the study was emergent in nature, an unstructured approach with minimal guides, rules, and supports was used. Research questions were investigated from the perspective of participants as 'people' (Verganti, 2009:54) rather than solely as 'users'. The objective was to understand new and potential meanings and interpretations for use and "what people *could* love in a yet-to-exist scenario" (Verganti, 2009:55) or, in a scenario they were assisting in shaping. As such, those who participated were invited to enter the imaginative realm and move beyond the limitations of existing frames of reference (Orlikowski & Gash, 1994) while valuing and drawing upon experience with existing social media tools and environments. I sincerely thank all faculty and students who were brave enough to enter this unexplored territory with me in the pursuit of greater understanding and insights.

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CHAPTER ONE: INTRODUCTION

The study of ambient intelligence (AmI) with wireless grid enabled applications is both critical and timely because such technologies and applications are innovations designed to address the gaps and breakdowns becoming more evident and less acceptable in the use of everyday information and communications technology (ICT)[1]. Further, the emerging area of network science (Kocarev & In, 2010:8) highlights the increasing complexity of developments in ICT noting that "social networks are built on information networks that depend on communication networks, which in turn are built on physical networks."

Statement of the Problem

Information and Communication Technologies provide challenges and surprises during everyday use. Service disruptions such as downed power lines may occur or, an Internet shutdown could happen through 'denial of service' and other unexpected occurrences. When using social media tools such as Facebook, communicating beyond the intended audience or group may occur. Further, compatibility issues may arise when attempting to share information between devices.

[1] UNESCO (2009:120) defined ICT "as a diverse set of technological tools and resources used to transmit, store, create, share or exchange information" which "... include computers, the Internet (websites, blogs and emails), live broadcasting technologies (radio, television and webcasting), recorded broadcasting technologies (podcasting, audio and video players, and storage devices) and telephony (fixed or mobile, satellite, visio/video-conferencing, etc.)."

This research study was motivated by the problem of ICT challenges and surprises which present opportunities to explore next generation innovations such as wireless grids and ambient intelligence (AmI) in search of new understandings, insights, and solutions. Wireless grids are defined as:

> A human centric open access gateway to shared resources for mobile and wireless electronic devices interconnecting at least one device to at least one other device or resource. A device can establish a grid and become a member of one or more wireless grids (McKnight (Ed.), 2012:20).

Ambient intelligence (AmI) finds its roots in ubiquitous computing and is variously referred to as pervasive computing, proactive computing, and the Internet of Things (Dourish, 2011:15). AmI is defined as:

> … the embedding and integrating, on a mass scale, of technologies that are sensitive and responsive to humans in everyday environments in increasingly invisible and unobtrusive ways (De Ruyter & Aarts, 2009:1039).

Information & Communications Technology (ICT) Challenges

The study of wireless grids is motivated by the fact that situations occur in daily life where our usual communication systems break down or surprise us in one way or another. For example, one may experience breakdowns in communication in regions, communities, and neighborhoods in the event of a 'downed power line', the absence of service in remote or underdeveloped areas, or during a catastrophic event. One need only think of the major breakdown in communications that occurred during the catastrophic Haiti earthquake in 2010 (Jackson, 2010). Further, if governments choose to shut down communication services including Internet and mobile phone communications, as occurred in Egypt in 2011, the need to communicate persists and becomes more pressing. Grassroots groups such as

Commotion Wireless (King, 2011) are attempting to fill this void and respond to an 'Internet shutdown' through the development of mobile ad hoc networks (MANETs)[2]. Commotion Wireless incorporates the notion of 'device-as-infrastructure' technologies into their project solution (2012). This example provides a strong statement on the need for alternate means of communication while illustrating the emerging motivations for wireless grids. Additionally, one may experience an unintended consequence of using social media such as Facebook where one communicates beyond one's intended group or audience if privacy settings are not invoked or understood. And yet another type of breakdown in communication may occur when trying to share information among devices or connect one device with another and incompatibilities or barriers to easy and smooth operations are discovered (e.g., smartphone with printer, etc.). These types of communication issues give rise to challenges and surprises for people in their interactions with information, with technology, and with each other. The Wireless Grids Innovation Testbed (WiGiT) provides a framework in which these and many other issues pertaining to wireless grid infrastructure for Information and Communications Technology (ICT) can be explored and addressed (Doran, 2011).

Cisco (2011) claims that computing devices are growing rapidly so that "by 2020 fifty billion network devices will roam the earth ... seven devices per person ... this will change how we work in ways never before imagined." Aruba Networks

[2] Katsaros et al. (2010:23). MANETs are referred to as infrastructureless dynamically self-configuring networks. Other ad hoc networks include wireless sensor networks (WSNs), wireless mesh networks (WMNs), and vehicular ad hoc networks (VANETs). "Ad hoc networks consist of wireless hosts that communicate with each other in the absence of a fixed infrastructure; each host acts as a relay that forwards messages toward their destination."

(2012) promises "next-generation network access solutions for the mobile enterprise." Nokia (Belostock, 2011) is focused on the use of 'open' Near Field Communications (NFC) to allow NFC-enabled devices to interact and share information (as in tapping or swiping two devices) while 'secure' NFC is intended for mobile financial transactions. Pearlman (2011) is concerned with the integrity or 'area of coherence' of a mobile call or video stream on a smartphone, proposing to "increase wireless capacity by a factor of 1,000." Hall-Tipping (2011), drawing on nanotechnology research, argues for the freeing of energy, going so far as to say that "the grid of tomorrow is no grid". This thinking contributes to possible rival claims and alternative perspectives, making it important to revisit this perspective in Chapter Five, in considering whether wireless grids have, over the past decade, been eclipsed by other technologies or rendered all the more timely, necessary, and critical.

Wireless Grids Innovation Testbed (WiGiT) Lab

The Wireless Grids Innovation Testbed (WiGiT) Lab (Miller, 2011) is a collaborative initiative of Syracuse University and Virginia Tech (Virginia Polytechnic Institute and State University). Funding support is provided by the National Science Foundation (NSF), Partnerships for Innovation (PFI) program. Wireless grids are defined as an emerging form of network where devices can be connected in a peer-to-peer, ad hoc, and on-the-fly manner. The network can be quickly formed and dissolved, as needed. A variety of resources can be created and shared including storage, central processing unit (CPU) power, and information.

Network connections across heterogeneous devices (smartphones, sensors, edge devices[3]) are facilitated, enabling ad hoc, distributed interactions in dynamic locations through mobile, nomadic and other networks (McKnight et al., 2004). The Wireless Grids Innovation Testbed (WiGiT) provides an environment for research, evaluation, testing, and training in support of the emerging industry serving new markets for the innovations being incubated (Ramnarine-Rieks, McKnight & Small, 2011). As applications are developed which build upon the capabilities of wireless grid infrastructure, the opportunity to imagine and explore new possibilities for use is provided through the WiGiT Lab.

Attentive to the Wireless Grids Innovation Testbed (WiGiT) mission statement to "enhance our relationship with technology" to "realize our human potential", this research investigated whether wireless grid enabled applications add to the potential for new and transformative outcomes for people and their information interactions in new technology-pervasive landscapes. Whereas wireless grids have been established in terms of proof of concept based on earlier iterations of a wireless grid enabled application (McKnight Howison, & Bradner, 2004) and viability of use has been theorized (McKnight, Sharif, Van de Wijngaert, 2005; Van de Wijngaert & Bouwman, 2009), study of the use of an actual wireless grid enabled application emerging from the WiGiT Lab has only now become possible.

[3] Sheldon (2001). "... routers, switches, routing switches, IADs (integrated access devices), multiplexers, and a variety of MAN/WAN access devices that provide entry points into enterprise or carrier/service provider core networks ... The trend is to make the edge smart ... Edge devices may translate between one type of network protocol and another."

Although Aruba Networks have already undertaken deployments of wireless grids (EE Times, 2004; Travis, 2004) it should be noted that a distinction exists between the definition of wireless grid as conceptualized by Aruba and that envisioned by WiGiT researchers. According to McKnight[4], for Aruba, wireless grid "pertains to an array of wifi routers managed as a grid" with a "focus ... close to the physical network." Aruba Networks (2012) is known for its Mobile Virtual Enterprise (MOVE) product whereby the "architecture unifies wired and wireless infrastructures into one seamless network access solution …" for organizational settings. By contrast, McKnight claims that wireless grid is "abstracted away to a virtual space of users, machines and heterogeneous networks" by WiGiT researchers.

WeJay Social Radio

WeJay was the first application to emerge from the Wireless Grids Innovation Testbed (WiGiT) Lab at Syracuse University's School of Information Studies, providing an example of an early stage, pre-standards wireless grid for the real world. In a deployment agreement announced with Syracuse University (Miller, 2011), the WeJay™ tool was described as "a social radio edgeware[5] gridlet™." For this research study, the WeJay beta product accommodated Windows (Win7 and Vista) and Mac (versions above 10.5.8) platforms, although the intent going forward is to include mobile devices. After downloading and installing

[4] McKnight, Lee W. (2011). Email correspondence, 18 November.
[5] McKnight (Ed.), (2012). "… software that operates at the edges of networks (hence 'edgeware') in order to take advantage of the capabilities of grid architecture."

the product, users are able to create a radio station. Within the radio station a show can be created by dragging content from the iTunes folder or other folders to the playlist. Playlist content can then be broadcast in a streaming fashion for others to listen to and chat about within the WeJay environment. The WeJay interface appears in Figure 1.

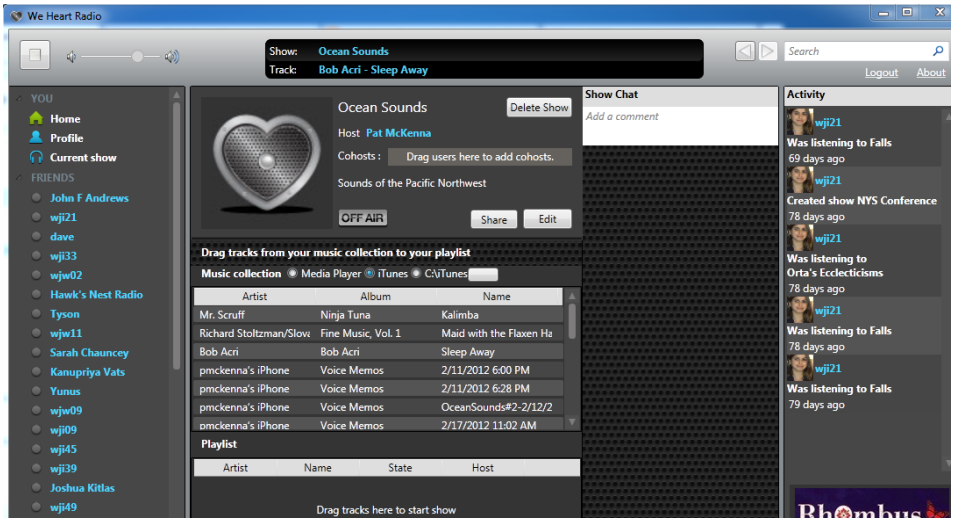

Figure 1: WeJay Interface

Notification of broadcasts can be shared with others through Facebook in a link to the Weheartradio website which streams show content over the Internet. According to Miller (2011), WeJay "enables a community of people to dynamically interact using various forms of content." The beta version allowed streaming of only podcast and mp3 music file types. WeJay has a friending feature and a list of friends appears in the left panel. Friends can be invited to cohost a show enabling them to contribute content to the show from their iTunes and other folders. In the beta iteration of WeJay, radio show content is available for listening only when the show is live and streaming. When the radio show is finished the content is no longer available and as such, is not archived, stored or made persistent. This type of

listening experience can be described as synchronous, requiring that listeners tune in at a specific time while the show is being aired.

WeJay connects with other social media platforms and Facebook was the example made available in the beta version. When Facebook friends receive a WeJay broadcast invitation they click on a link sending them to the Weheartradio website where they can listen to the show. The Weheartradio interface appears in Figure 2.

Figure 2: Weheartradio interface

While the WeJay social radio application may seem like just another Internet-based music/media software application (e.g., Spotify, Pandora, Turntable.fm, etc.) it was important to identify its' uniqueness as a wireless grid enabled product, untethered, yet able to connect and interact with Internet based social network sites (SNSs) as defined by Boyd & Ellison (2007). Boyd (2010) described SNSs as 'networked publics' with particular constraints and affordances that "shape how people engage with these environments" and "introduce new

possibilities for interaction" such that "new dynamics emerge that shape participation."

This case study of the launch and use experience of WeJay social radio among a sampling of WiGiT members and Syracuse University students and faculty was one of the first studies of a public wireless grid application in beta form to emerge from the WiGiT Lab. As such, this study sought to: a) learn more about the launch experience of a wireless grid enabled application; b) understand how this application was interpreted for use; c) determine whether novel and unexpected uses emerged; d) investigate whether wireless grid enabled environments fostered innovation and creativity; and e) elicit whether a conceptual relationship was emerging between wireless grid and ambient intelligent environments (e.g., context awareness for ambient learning[6] and interaction).

Theoretical Perspective

This study investigated the launch and use experience of WeJay, a wireless grid social radio application at the beta trial, pre-standards stage, among WiGiT members and selected Syracuse University students and faculty. The overarching research interest was the potential for new and *transformative*[7] *outcomes*. This study was concerned with what happens when radio becomes a social media tool where people have the autonomy to create their own radio station, include their

[6] Bick et al. (2007). "Ambient learning denotes new ICT embedded into the environment leading to advanced e-learning scenarios."
[7] Amabile (1996), "evidence that the product breaks away from the *constraints* of the situation as typically conceived."

content of choice, and share the broadcast within and across communities of interest.

Of further research interest was how the WeJay application was interpreted for use and whether novel and unexpected uses emerged. Also under study was the question of whether the wireless grid environment fostered innovation and creativity; and finally, this research inquiry sought to elicit whether a conceptual relationship was emerging between wireless grid and ambient intelligence (AmI) environments, particularly in relation to the context awareness dimension of AmI as it pertains to ambient learning and interaction. In coming to a clearer understanding of AmI, Dourish and Bell (2011:14-15) trace the varying terminology beginning with Weiser's notion of *ubiquitous computing* in 1991 which was interpreted in the mid nineties as *context-aware computing* research by EuroPARC and Georgia Tech. Philips used the term *ambient intelligence (AmI)* which was accepted by the European Commission. IBM researchers used the term *pervasive computing* and by 2004 researchers at MIT were using the term Internet of Things (IoT). This research study prefers the AmI usage which is concerned with human-centered computing (HCC) and the "personal, social, and cultural contexts" (Sebe, 2009:350) for the interactions of people, technology, and information.

Wireless grid and AmI environments have been characterized as supportive of *collaboration*, *interaction*, and *sharing* and as such, this study drew upon the social and socio-technical dimensions of emergence theory as a theoretical framework. Focus was placed on the key constructs of *creativity, innovation*, and

context awareness in relation to use experience, elucidations for use, and interpretations of the beta trial product, while allowing for other constructs of interest to emerge. The conceptual framework advanced for this study incorporated elements of innovation theory, creativity theory and ambient intelligence (AmI) while offering emergence theory — emergent properties, structures, patterns and behaviors — as a lens through which to frame and investigate a wireless grid social radio application which was theorized to be potentially transformative and disruptive. Within the context of the study the unintended consequences and unexpected possibilities of wireless grid and AmI environments were addressed.

Emergence Theory

This study was guided by emergence theory (Pierce & Artemesia, 2009; Bailey, 2006; Lin & Cornford, 2000; Sawyer, 2005) — emergent properties, emergent structures/processes, emergent patterns/attitudes and emergent behaviors — as a way of investigating wireless grid environments from a social and socio-technical perspective. Wireless grid enabled environments are characterized as collaborative, interactive, sharing-supportive, and mobile. Ambient intelligent (AmI) environments share the same characteristics and are additionally context aware in terms of location, time, resources, and situation. Emergence theory offered a theoretical lens through which to investigate the launch and use experience and the interpretations for use of wireless grid and ambient intelligent environments in relation to the constructs of creativity, innovation, and context awareness in social networked environments.

Corning (2002) sought to overcome the ambiguous and contradictory understandings of emergence and emergence theory by offering to redefine the concept as a "subset" of the larger 'emergent phenomena'[8]. From the perspective of sociocybernetics and the socio-technical, Bailey (2006) draws on models of emergence advanced largely by Buckley, Luhmann, Miller, and Mihata to propose a typology of emergence as an aid to understanding and as a framework for analysis. Beginning with a dichotomous twelve item list (e.g., linear/nonlinear, static/dynamic, non-evolutionary / evolutionary, simple/complex, two-level hierarchical/multi-level hierarchical, transformational/new variable, etc.), Bailey (2006:23) refines the topology to a four-dimensional table of emergence offering a "comparative framework for analyzing disparate types of emergence" and "hypotheses about the phenomenon of emergence". Bailey's typology of emergence for social systems is noteworthy because this current research study is concerned with the types of dynamic, ad hoc, adaptive features characterized by wireless grid enabled environments and ambient intelligent environments. The flavor of such environments might be detected in the work of Miller (2010) who refers to a 'smart swarm' concept as "a group of individuals who respond to one another and to their environment in ways that give them the power, as a group, to cope with uncertainty, complexity, and change." Bradley & McDonald (2011:200) distinguish 'social swarms' which "form quickly around some ephemeral concern and then

[8] Corning (2002). "... vast (and still expanding) universe of cooperative interactions that produce synergistic effects of various kinds, both in nature and in human societies."

dissipate with little trace" from 'social unions' "which are more organized and long-lived."

In the socio-technical context, Lin & Cornford (2000) refer to emergence as the "sense of systems altering their character through use." And from an information systems development (ISD) perspective, within a socio-technical change context, Luna-Reyes, Zhang, Gil-García & Cresswell (2005:103) propose an initial framework but call for more research on "the specific role of artifacts in shaping practices and other social processes."

Bruckman (2011), concerned with creativity and innovation, discusses the astounding outcomes of online collaboration and, as if in anticipation of wireless grid enabled applications, wonders what the next big thing will be. Kelly (2010) considers the history of technology as a way of understanding the evolving and emergent nature of technology and the larger potentially transformative question of 'what technology wants' which he claims includes ' increased diversity, complexity, and beauty'.

Context-Awareness

Using an emergence theory perspective, this study explored context awareness as part of the social intelligence dimensions of The Extended Ambient Intelligence (AmI) Model (De Ruyter, 2009; 2010) while being attentive to social shaping of technology theory (SST) (MacKenzie & Wajcman, 1999), the theory of instinctive information sharing (Wang & Chan, 2011) and the unintended consequences (Tenner, 2011) of technologies, as in 'unexpected possibilities'.

Turning to the 'context-aware' dimension of wireless grids afforded by the increasing capabilities of devices used in wireless grid networks and by wireless sensor networks, one could argue that an important connection is emerging with ambient intelligence (AmI)[9], ambient technologies[10], and ambient information[11]. Ernst (2008:9) identifies the context-aware component of ubiquitous computing as being able to "detect the location, time, nearby people and other aspects of a person's physical environment." Wireless grid enabled sensor networks and other technologies embedded in our environment allow for the gathering of data from new sources and locations which can be made available as context aware information in the form of 'ambient information'. As such, computing is said to be increasingly migrating from the desktop to mobile, nomadic, and embedded spaces in everyday life to possibly constitute the infrastructure surrounding human activity (Canny, 2001 in Sebe, 2009:353). This human-centered computing (HCC) understanding of AmI would seem to have much in common with the depiction of the wireless grid as "an emerging infrastructure that will fundamentally change the way we think about and use computing" (Ramnarine-Rieks et al., 2011:3-4; Treglia, McKnight, Kuehn, Ramnarine-Rieks, Venkatesh, & Bose, 2011:3) creating coherence with the research opportunities agenda for HCC articulated by Sears, Lazar, Ozok, &

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[9]De Ruyter & Aarts (2009:1039). AmI refers to the embedding and integrating, on a mass scale, of technologies that are sensitive and responsive to humans in everyday environments in increasingly invisible and unobtrusive ways.

[10] Bick, Schnitzer, Pawlowski, & Seghers (2007). Ambient technologies are described by five key characteristics: embedded, context-aware, personalized, adaptive, anticipatory.

[11] Garía-Vázquez & Rodríguez (2009). In the context of 'activities of daily living' ambient information systems (AIS) are said to "describe a large set of applications that publish information in a highly non-intrusive manner adhering to Mark Weiser's concept of 'calm technology'. AIS is an Information System with the additional features of mobility, pervasiveness, and adaptability (Russ, Hesse, & Müller, 2008).

Meiselwitz (2008) for the National Science Foundation (NSF). To the extent that WeJay, this first wireless grid application has built in awareness capabilities, connects with devices having context-aware capabilities or with social network sites (SNSs) supporting context-awareness, it could be said that an intersection is occurring between wireless grid and ambient intelligence environments.

In the case of the current research, the WeJay beta trial context of study represented a real-world academic university environment — WiGiT members at other universities and Syracuse University — which featured the interactions of selected students and faculty. The university context is the real-world of work for faculty and student assistants and the real world of learning and interaction for students.

Creativity and Innovation

Dyer, Gregersen, & Christensen (2011:3) claim that "one's ability to generate innovative ideas is not merely a function of the mind, but also a function of behaviors." This relationship between mind and behaviors is perhaps evident in the use of *mindful interactions* by Rubleske, Kaarst-Brown, & Strobel (2010) when looking at innovation in a public library context in terms of the generation of ideas for new services. Within interactions, the public library innovator is focused on 'new service possibilities for customers'. Hargadon & Bechky (2006) argue for the study of creativity in relation to social context and interactivity, as in, 'momentary collective processes' and the 'alignment of fluctuating variables'. Studying the potential for creativity and innovation in this way may be amenable to the ad hoc,

mobile, adaptive, and dynamic nature of wireless grid and ambient intelligence environments. In this study the broad and overarching research questions focus on the launch experience of the WeJay beta trial, the use experience of the wireless grid enabled environment, elucidation of uses enabled by the product, and interpretation for use of the product and interpretations of the product itself. Based on the social affordances of wireless grid and AmI environments — collaboration, the 'interaction dynamic', and sharing — these aspects of the WeJay social radio application were investigated in relation to the constructs of creativity, innovation, and context awareness.

Reviewing the literature on creativity, Hennessey & Amabile (2010:582) note that 'variables of interest' for the social psychology of creativity have greatly expanded, incorporating 'social influences and processes' and 'social creativity' (Mouchiroud & Lubart, 2002; Fischer & Giaccardi, 2007; Shneiderman, 2007) and "the effects of social networks on creativity in an organizational setting" (Perry-Smith, 2006) are now being studied. In the context of creativity, Hennessey & Amabile (2010:584) note that autonomy has for some time been advanced as 'fostering creativity' in work environments.

Unintended Consequences

A related key consideration in studies of information technology (IT) use, of emergence, and indeed of creativity and innovation is the unintended consequences — beneficial or detrimental — that may emerge (Markus & Robey, 2004). Connections are made in the research literature between 'side effects' or unintended

consequences and the 'emergent structures' of interactions (Goldstone, Griffiths, Gureckis, Helbing, & Steels, 2009). Although wireless grid applications may be developed with intended uses, once deployed to the "wisdom" of individuals and groups (Surowiecki, 2004), the potential for additional innovation exists. This is particularly true for wireless grid and ambient intelligent environments featuring ad hoc, mobile, interactive, anywhere/anytime, and adaptive characteristics. Of particular interest is what Tenner (2011) refers to as the 'unexpected possibilities' of the unintended consequences of technologies.

Conceptual Framework

The Phillips Research Experimental Lab conducted research around 'social interactions in ambient intelligent environments' (De Ruyter, 2010). The Phillips Lab was a controlled setting, removed from the 'real world' context. Earlier studies of a theoretical nature were conducted with wireless grids among students and faculty (McKnight et al., 2004; McKnight et al., 2005; Van de Wijngaert & Bouwman, 2009; Ramnarine-Rieks et al, 2011). This current study is the first of its kind to investigate an actual academic enterprise environment with selected students and faculty interacting with the first in a series of wireless grid applications to be launched through the WiGiT Lab, albeit a pre-standards, beta.

The conceptual framework used to guide this case study of the WeJay beta trial is presented graphically in figure 1, as an articulation of the study design. This model depicts:

a) the underlying **wireless grid environment** characterized by a concern with **people, information and technology**

b) the overlay of an **AmI environment** studied within the context of a wireless grid environment where both environments are characterized by **collaboration, interaction, and sharing**

c) **Emergence theory** as the theoretical perspective to investigate:

   i. the beta trial WeJay social radio application and what it enables

   ii. user experiences and interpretations as emergent

d) Constructs **of creativity, innovation, and context awareness** to understand the emergent interactions enabled by social radio application use (WeJay) in wireless grid and AmI environments

e) Outcomes as evidenced through the capture of data (using four methods) aligned with the research questions and propositions:

   i. Novel/Unexpected uses / Novel ideas

   ii. Transformative/Disruptive outcomes

   iii. Unintended consequences and Unexpected possibilities

f) The use of measures supported or predicted in the literature in the analysis and interpretation of data. Consideration of the Consensual Assessment Technique (CAT) to assess the creativity and innovativeness of ideas generated.

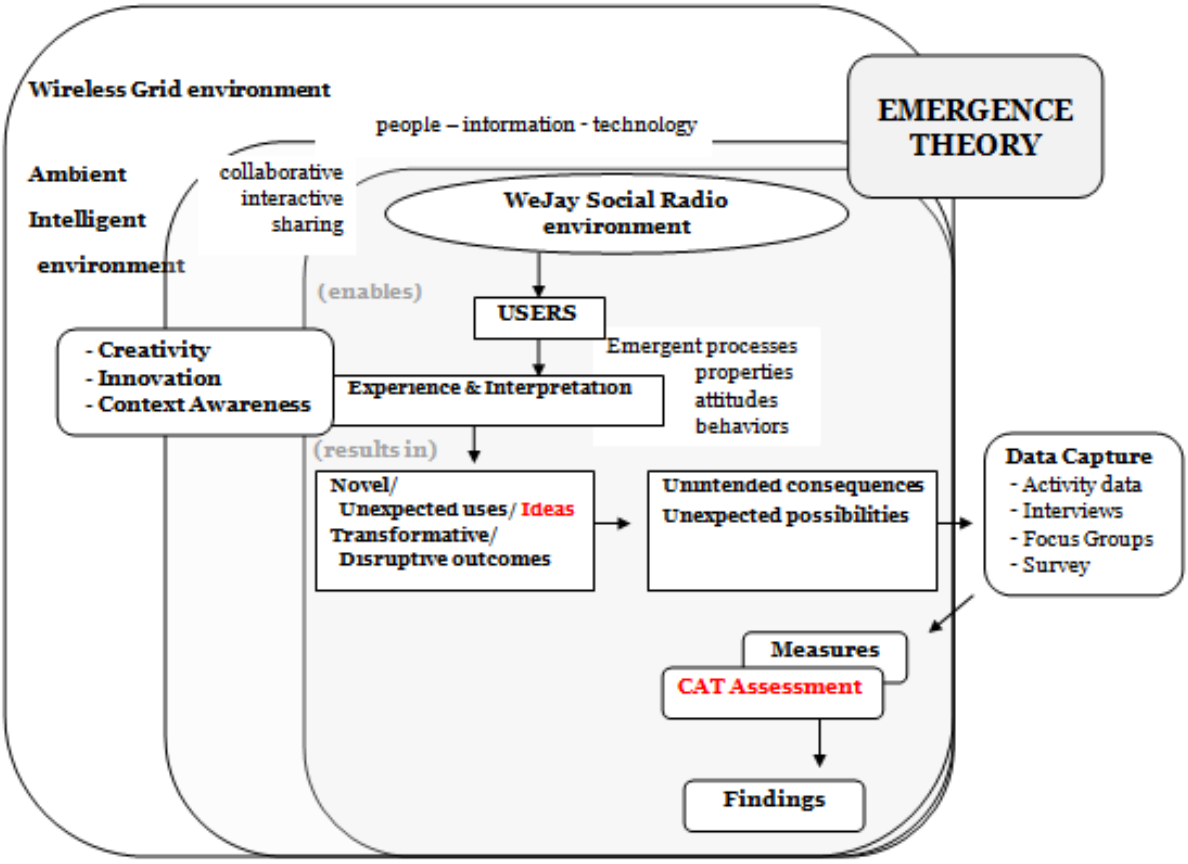

Figure 3: Conceptual Framework: AmI in Wireless Grid Applications (WeJay)

The model points to the capture of data (findings) in support of research questions and propositions for specific factors (measures) supported or predicted in the literature and specified below:

- emergent **social attitudes** & **contexts**
- **readiness** of WeJay (infrastructure conditions)
- **idea/use breaks from constraints** of situation as typically conceived
- **interpretations/meanings** generated
- idea/use **improves** upon WeJay
- **new, useful,** & **appropriate ideas** envisioned for use
- location, presence, resource, or situation **awareness**
- **smartness**

Research Questions

This research study was guided by the broad question: *Do wireless grid enabled applications, such as WeJay, add to the potential for new and transformative[12] outcomes for people, information and technology when deployed in an academic setting?* This research investigated the additional questions:

Q1: *What was the experience of participants involved in the beta trial launch of the wireless grid enabled WeJay social radio application?*

Q2: *How was the WeJay social radio application being interpreted for use during the beta trial/demo across selected segments of Syracuse University students and faculty and among WiGiT members?*

This case study addressed these questions using an *emergence theory framework* as a lens through which to explore whether the following propositions (and other possible propositions that may have emerged from the research data) were supported by the WeJay beta trial/demo application environment.

Proposition A

Novel and unexpected uses (e.g., beyond simple file sharing and other basic and generic documented capabilities, features, and functionalities) of the WeJay wireless grid enabled edgeware[13] application will be developed by users during the deployment.

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[12] (Amabile, 1996). "evidence that the product breaks away from the *constraints* of the situation as typically conceived."

[13] WiGiT, 2011. Edgeware is a new class of applications that can dynamically make use of content and resources present in devices - phones, pc's, cameras, printers, screens, etc. - connected by a wireless grid.

Proposition B

The WeJay wireless grid application fosters an environment for innovation, as in "transformation[14] *of a new idea into a new product or service, or an improvement in organization or process"* (Heye, 2006:253).

Proposition C

The WeJay wireless grid application fosters an environment for creativity, as in "novel and useful ideas" (Amabile, Conti, Coon, Lazenby, & Herron, 1996:1155) *for users.*[15]

Proposition D

A conceptual relationship is emerging between wireless grid enabled environments and ambient intelligent (AmI) environments in terms of the generation of new types of information, in new places, facilitating the presence of 'ambient information' in the form of context awareness, as one of many possible examples.

Although largely exploratory, a composite type descriptive-exploratory-explanatory single case study using multiple methods was used to address the research questions and propositions for this study. Quantitative and qualitative data collection methods were used, as depicted in the Data Capture Plan in Figure 7, and described in detail in Chapter Three.

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[14] Amabile (1996:31). "... evidence that the product breaks away from the *constraints* of the situation as typically conceived."

[15] Amabile (1996:35). "A product or response will be judged as creative to the extent that a) it is both a novel and appropriate, useful, correct or valuable response to the task at hand, and b) the task is heuristic rather than algorithmic."

Purpose of the Study

The purpose of this study was to investigate the potential of wireless grids as next generation technologies for education, in terms of their ability to support creativity, innovation, and intelligent information environments. Specifically, this study investigated the use experience and understanding of faculty and students in an academic setting when engaging with a new form of social radio scenario which they were invited to assist in shaping. The study was conducted with faculty and students at distributed Wireless Grid Innovation Testbed (WiGiT) member universities and selected Syracuse University faculty and students.

The study explored whether the WeJay tool was usable and how it would be used within the real world context of students and faculty. Given the state of readiness of the tool it was understood that use may not be possible for all participants, In such cases, exposure to the tool was gained through viewing a brief video which described the features and functionality and participants were then invited to imagine how they would use the tool.

The study utilized an unstructured approach with minimal supports and influences while encouraging maximal exploration. Study participants were invited to download and install the tool; create a radio station; create a radio show with content of their choice; host or cohost the show with another individual; and stream the show for shared listening within WeJay, with Facebook friends, and with others who wished to tune-in to the Weheartradio broadcast on the Internet.

Activity data was captured on whether, how, and to what extent the WeJay tool was used. This data was enriched with evidence gathered through interviews and focus groups which inquired into the WeJay experience. Through these individual and group interviews this study sought to learn about interpretations for use, particularly in educational settings. The study also explored how the tool could be improved (innovated); whether people felt creative in the WeJay environment and if ideas were generated (fosters creativity); and if novel and unexpected outcomes occurred (transformative outcomes) during the course of the study.

Finally, the study explored the embedded awareness features of WeJay and engaged participants in conversations on smartness and embedded information intelligence in wireless grid and social media environments.

Significance of the Study

This study is significant for five reasons, as follows: first, this study addresses gaps in the literature by moving beyond theoretical research on wireless grids and earlier iterations of wireless grid enabled application use studies to a case study of the launch and first use of a wireless grid enabled application to emerge from the Wireless Grids Innovation Testbed (WiGiT). Second, this study offers insight into the launch experience of an initial deployment of a pre-standards wireless grid application, in early stage diffusion. Study findings enable generalizations to broader deployments of the WeJay social radio application that are occurring in parallel, a little behind, or those that may be coming next. Generalizations may also be possible to other emerging wireless grid enabled

applications. As such, this study serves as a bridge study to future work, thus making a contribution to the literature. Third, this study investigated the innovation and creativity potential of wireless grids based on WeJay use while seeking to shed light on any unintended consequences and unexpected possibilities that may have emerged. Fourth, this research study advanced the notion of a conceptual relationship between the environments enabled by wireless grids and ambient intelligence (AmI). Finally, as technology-pervasive environments evolve and the distinction between work and everyday contexts blur, this study has implications for further research on academic and other settings where people regularly interact.

In summary, this chapter has provided an introduction to the research study, a statement of the research problem, and an overview of the theoretical perspective of emergence theory together with the conceptual framework which was used for the framing of the investigation into the problem. The main research question was articulated — *Do wireless grid enabled applications, such as WeJay, add to the potential for new and transformative outcomes for people, information and technology when deployed in an academic setting?* — while providing context for the sub-questions of the study and the underlying propositions guiding the investigation. The nature of theorizing on wireless grids was outlined and it is against this background that the current study provided an opportunity to investigate the first pre-standards, beta trial deployment of WeJay, the first in a series of wireless grid enabled applications to be incubated from the Wireless Grids

Innovation Testbed (WiGiT). WiGiT member universities and Syracuse University provided the setting for this study where selected students and faculty had the opportunity to participate in a study of the launch and first use of the WeJay beta tool.

Chapter Two provides a review of the literature on wireless grid enabled applications and a review of the emergence theory literature contributing to the theoretical perspective advanced for this research. In support of the underlying propositions and conceptual framework for this study a review of research literature on innovation, creativity, ambient intelligence (AmI), context awareness, and unintended consequences is presented. A review of other related literature relevant to this study is also provided including emotion/affect, readiness, and social networking.

CHAPTER TWO: LITERATURE REVIEW

In Chapter One an introduction and background to wireless grid enabled applications and their contemporary relevance was provided. In particular, the purpose, rationale, theoretical framework, and significance of this research study were provided along with the broad research questions and underlying propositions. In this chapter a review of the literature on wireless grids research is provided together with a literature review of the research theory and concepts for the theoretical perspective, emergence theory. In support of the conceptual framework and propositions for this study a review of the research literature encompassing creativity, innovation, ambient intelligence (AmI), context awareness, and ambient learning is provided. A review of the literature on measures, metrics, and assessment techniques for innovation and creativity is also presented. Wireless grid and AmI environments have been characterized as supportive of *collaboration*, *interaction*, and *sharing* and a review of this evolving landscape is included followed by literature pertaining to unintended consequences, readiness, emotion/affect, social networking and other related theory. Because the WeJay wireless grid environment under study is a social radio application, literature reviewed represents a largely social and socio-technical perspective.

Wireless Grids Research

The notion of wireless grids emerged from the confluence of the explosion of novel technologies for use in a wide range of wireless networks; new business models for the spectrum market; and at least three related computing paradigms —

web services, grid computing, and peer-to-peer (P2P) computing (McKnight et al., 2004:26). Research to date has contributed much theorizing on wireless grids (McKnight, Lehr & Howison, 2007; McKnight, 2007) in terms of capabilities and potential as a new distributed resource sharing network concept involving mobile, nomadic, or fixed-location devices and a "changing landscape of information resources" (McKnight et al., 2004:24). Addressing the challenge of integrating wireless grids with wired grids, Hwang & Aravamudham (2004) advance a middleware proxy-based architecture while Gaynor, Moulton, Welsch, LaCombe, Rowan, & Wynne (2004) focus on the development of sensors and sensor network infrastructures for two specific types of applications (e.g., emergency medical and supply chain warehousing). Considering the evolving computing environments afforded by emerging grids technologies, McKnight et al. (2007) address the challenges of coordinating, not just device but also user behavior, in wireless grid contexts. Wireless grids hold potential in many areas, including collaboration (Marsden, 2011; Ramnarine-Rieks, McKnight, & Treglia, 2009), cyberlearning and collaborative learning (Ramnarine-Rieks et al., 2011), emergency response and law enforcement information sharing (Treglia et al., 2011), value from a user perspective (McKnight, Sharif, & Van de Wijngaert, 2005), and information sharing (Treglia et al., 2011; Van de Wijngaert & Bouwman, 2009).

Li, Feng, Zhou, & Shi (2009) conducted a survey of the literature on wireless grids and clouds, noting that wireless grids research began emerging in 2002 with a steady increase to 2006 when peaking occurred, giving way to publications on cloud

computing in 2007 and a combination of wireless grid and wireless cloud publications in 2008. Li et al. (2009:262) noted the categorization of wireless grids as: 1) ad hoc; 2) mobile; and 3) context-aware. Further they describe three categories of ad hoc networks as: a) mobile ad hoc networks; b) wireless mesh networks; and c) wireless sensor networks. Manvi & Birje (2010) conducted a review of the literature on wireless grid computing noting that 'Gridnet' may become as prevalent in the future as the Internet is now. Gridnet would allow for a new conception of resource sharing based on wireless grid connectivity of the vast array of personal devices. An overview is provided of the many unique challenges of wireless grids together with the range of standards, many of which are said to be in the early stages of development. Brooks, Robinson, & McKnight (2012:92) offer a conceptualization for a secure wireless cloud, claiming that: "Wireless grids can take ubiquitous computing to the next level by providing seamless wireless extensions to the wired grid."

The wireless grid enabled WeJay social radio application, the focus of this study, is at the pre-standards stage and early stages of diffusion. In earlier research assessing wireless grids from a user perspective, McKnight et al. (2005) concluded that "social and mental changes" would be required to navigate the various diffusion stages, including "changes in the coordination and pricing mechanisms, and even ... in the technology itself." Indeed, much has changed between then and now affecting and influencing people, information and technology. And it is this ongoing change; the ever-evolving notions of sharing, collaboration, and interaction;

and the emergent possibilities brought about through "cooperative interactions that produce synergistic effects" (Corning, 2002) which contributed to the rationale for using an emergence theory perspective for this study.

Emergence Theory

This study drew on elements of the long and varied history of emergence theory as a sensitizing mechanism when investigating the launch and use of the wireless grids beta trial/demo of the WeJay social radio application among Wireless Grids Innovation Testbed (WiGiT) virtual members and selected Syracuse University students and faculty. Based on the research literature which is discussed in this section, a visual picture of emergence theory in social networked environments is depicted in Figure 2. Relationships between elements in Figure 2 remain indeterminate at this point with insights to be contributed through the data analysis, findings, and interpretations of this research study in Chapters Four and Five.

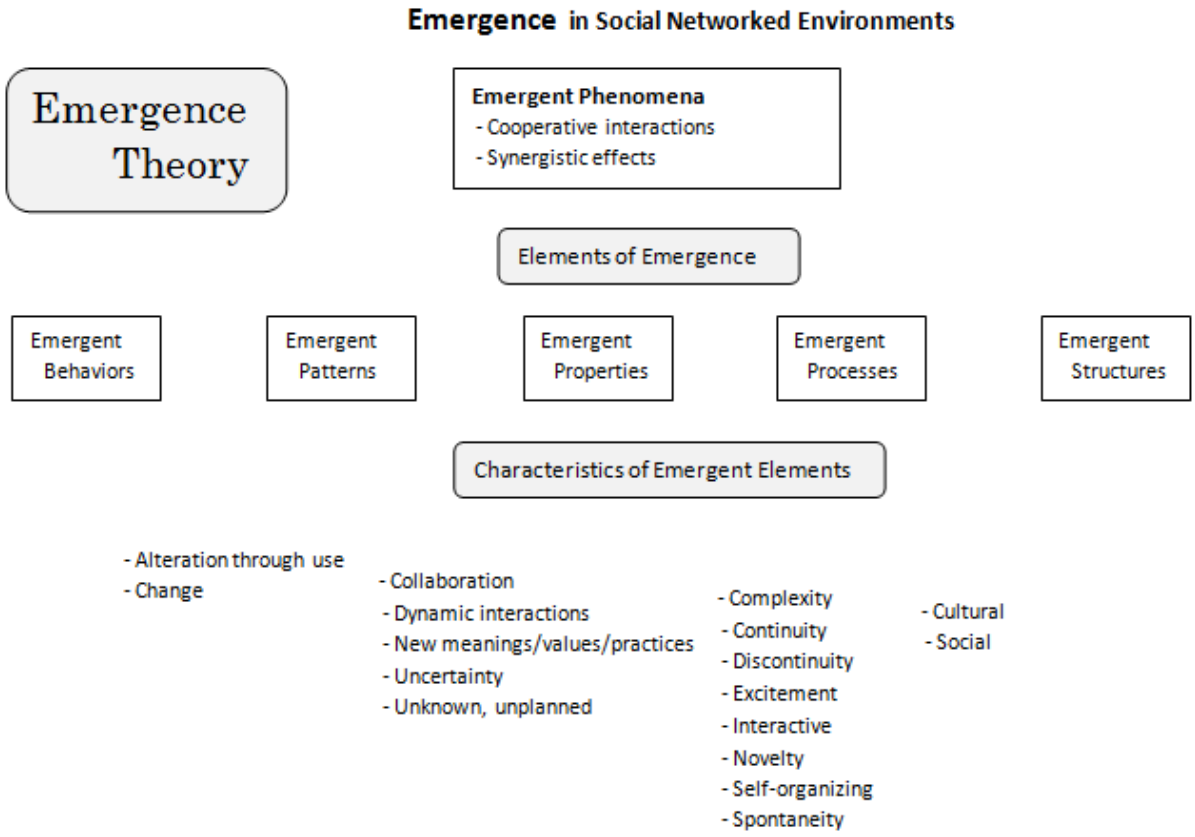

Figure 4: Emergence in Social Networked Environments

Reflecting on Clayton's (2004) work on *Mind and Emergence*, Jackelén (2006:624) notes the power and pervasiveness of the emergence concept, referencing "processes in nature, politics, economics, social life, and our individual minds." With a healthy skepticism about the use of emergence, Jackelén identifies a range of reasons in support of the potential for the concept — 'explanatory potential'; offers the suggestion of 'spontaneity, novelty, surprise, and excitement'; pushes beyond 'austere determinism and strict probability'; 'keeps novelty and predictability in balance—enough surprise to keep boredom away and enough orderliness to keep chaos at bay'; and 'significant things can emerge from insignificant starts'. This picture of emergence as depicted by Jackelén is relevant to the WeJay beta trial

product, an early stage product with generic characteristics (e.g., capabilities, features, and functionalities) that at first may seem insignificant but may yield significant things when released for trial to beta trial participants.

Whereas a 'naturalistic framework' confined notions of emergence, Jackelén notes that Clayton investigates the 'transcendent' potential of the concept, possibly beginning to rethink the metaphor of the 'ladder'. Jackelén challenges the metaphor of the ladder as an adequate description, claiming that "complexity and emergence are being used to define new approaches not only to natural processes but also to social and cultural processes." Jackelén proposes that if we are to learn what emergence has to reveal then the "language, images, and models of emergence" become very critical, adding that:

> There is a need for metaphors and visualizations that are superior to ladders in expressing the interplay of continuity and discontinuity, of relatedness and distinctness.

Jackelén wants the 'both-and' of 'levels and loops' and whatever else it may take to adequately visualize the concept of emergence — polytopes[16] are offered as a way of extending our notions — which can neither be 'neatly conceptualized or boxed' — thus preserving the very essence of emergence, the novelty. In the context of wireless grids, one is reminded of the challenge noted by McKnight (2007) regarding "the dynamic inter-operation, integration, and dis-integration of networks, applications, and users, in real time" reflective of the need for new models of emergence elucidated by Jackelén.

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[16] WolframMathWorld (2011). "used to mean a number of related, but slightly different mathematical objects."

Bailey (2006) views emergence as multidimensional and attempts to clarify the concept through the development of a typology. In a social systems theory context Bailey introduces us to the notion of *emergent properties* referencing the work of Buckley (1998) who articulated "a complex of elements or components directly or indirectly related in a network of interrelationships of various kinds, such that it constitutes a dynamic with emergent properties." Looking to the work of Mihata (1997) we are further introduced by Bailey to an extension of Buckley's work so as to include *'patterns'* or *'structures'* with 'dynamic interaction' as one of several critical elements.

McDonald & Weir (2006) describe a domain independent, conceptual model for exploring emergence based upon meta classes of emergence. McDonald (2006) elaborates the meta classes — structure, memory, novelty, function, measurement, symbolism, localisation and context, and hierarchy — in a study of emergence in complex learning communities (CLCs). Phenomena along fifteen dimensions were studied, including for example creativity, eLiteracy, and learning, and all were found to be 'emergent' with differing characteristics when categorized in the meta class matrix.

This current study is concerned with emergent properties, attitudes, behaviors, and patterns in relation to wireless grid and ambient intelligent (AmI) environments and the potential for innovation and creativity. Within the bounded context of a beta trial of the WeJay social radio application among selected students

and faculty in a university context, interactions were investigated making it useful to think of Johnson's (2001:181) description of *emergent behaviors* which:

> like games, are all about living within the boundaries defined by rules, but also using that space to create something greater than the sum of its parts.

Also worth noting is that within the context of emergency response, Marsden (2011) discusses the coordination of team activity and behavior in response to 'unforeseen and emergent contingencies'.

Emergent Structures

In the context of social organizations, Bradley & McDonald (2011:20-21) describe 'emergent structures' as "processes, content-categorization schemes, organizational networks, hidden virtual teams, and the like that are unknown or unplanned before social interactions but emerge ..." the discovery and tracking of which contributes to "a better understanding of 'how things work' ..." Bradley & McDonald (2011:15) go on to describe emergence as one of "six fundamental principles or defining characteristics" of 'mass collaboration' whereby:

> The behaviors cannot be modeled, designed, optimized or controlled like traditional systems. They emerge over time through the interactions of community members. Emergence is what allows these communities to come up with new ways of working or new solutions to seemingly intractable problems; it is the source of innovation as good ideas appear and rise in prominence through collaboration.

In the context of multiplayer games and virtual worlds, Pearce & Artemesia (2011:42), citing the work of Bar-Yam (1997), describe emergence in terms of:

> ... how complex, often decentralized systems self-organize in ways that cannot be predicted by their underlying structures or rule sets, nor by the individual behavior of agents within the system.

Path Dependence and Path Creation

In the context of path dependence and path creation theory, Henfridsson, Yoo, & Svahn (2009) discuss the interplay of *residual structures* — "still practiced residue of previous social formations ... that is retained in order to make sense of the current dominant structures" — and *emergent structures* (Williams, 1980) as "new meanings, values, and practices that are continually being created."

Path dependence theorists view "paths as process" where change occurs in small cumulative steps. Path creation, on the other hand, seeks to intentionally deviate ('mindful deviation') from the processes of path dependence but maintain the delicate balance of being sufficiently disruptive to initiate a new path while not exceeding the disruption threshold that would engender resistance and the perception of undue risk (Garud & Karnøe, 2001; Garud, Kumaraswamy, & Karnøe, 2010).

> Entrepreneurship involves an ability to exercise judgment and choice about time, relevance structures and objects within which entrepreneurs are embedded and from which they ... deviate mindfully to create new paths.

If a wireless grid enabled application can be found to fit within, or complement existing structures and perform some beneficial role or enhance existing products or services, this affords the possibility that an acceptable balance may be found between "novelty and familiarity" (Hargadon & Douglas, 2001). In the context of a review of creativity theory, Hennessey & Amabile (2010:578) note the work of Sternberg (2001) on creativity in relation to *intelligence* and *wisdom* where the potentially disruptive nature of creativity seems to be recognized and the balancing

effects of wisdom and intelligence in facilitating stability in the change process are identified. This understanding of creativity would seem to reinforce notions of path creation:

> ... intelligence is most often used to advance existing societal agendas, whereas creative thinking often opposes these agendas and proposes new ones. Wise people recognize the need to strike a balance between intelligence and creativity/the old and the new to achieve both stability and change within a societal context.

Considering innovation from a Schumpeterian perspective, McKnight & Kuhn (2011) use the Internet economy as an example of the 'creative destruction' principle articulated by Joseph Schumpeter where the losses brought about by change are balanced out by the creative potential enabled by open innovation.

The 'path creation' entrepreneur views the world as 'emergent' or "constantly in the making" and a key characteristic is "persistence with flexibility" (Garud & Karnøe, 2001)

> Besides the creation of a shared space, translation … also implies the transformation of the idea through interactions. Such transformation is required to overcome resistance and indifference. It also sets the basis for generating buy-in required to mobilize a critical mass around an idea.

Emergent Properties

Drawing on the work of De Landa (1997:17), Pearce & Artemesia (2011:38) refer to emergence as "the unplanned results of human agency" and the "unintended consequences of human decisions" while noting that 'emergent properties', synergistic and interactive by nature, are more amenable to study by inductive methods, discouraging the use of reductive methods. According to Aziz-

Alaoui (2006), emergent properties "are typically novel and unanticipated". It is through observation and elicitation of emergent properties, patterns, and behaviors afforded by wireless grid and ambient intelligence (AmI) environments that the broad and overarching questions for this study, together with the underlying propositions were investigated.

Using emergence theory as the theoretical lens the constructs of creativity, innovation, and context awareness were used as a way of investigating the research questions and propositions for this study. A visual overview of the research literature reviewed in the following sections for the theoretical constructs for emergence in social networked environments — creativity, innovation, and context awareness — is presented in Figure 3.

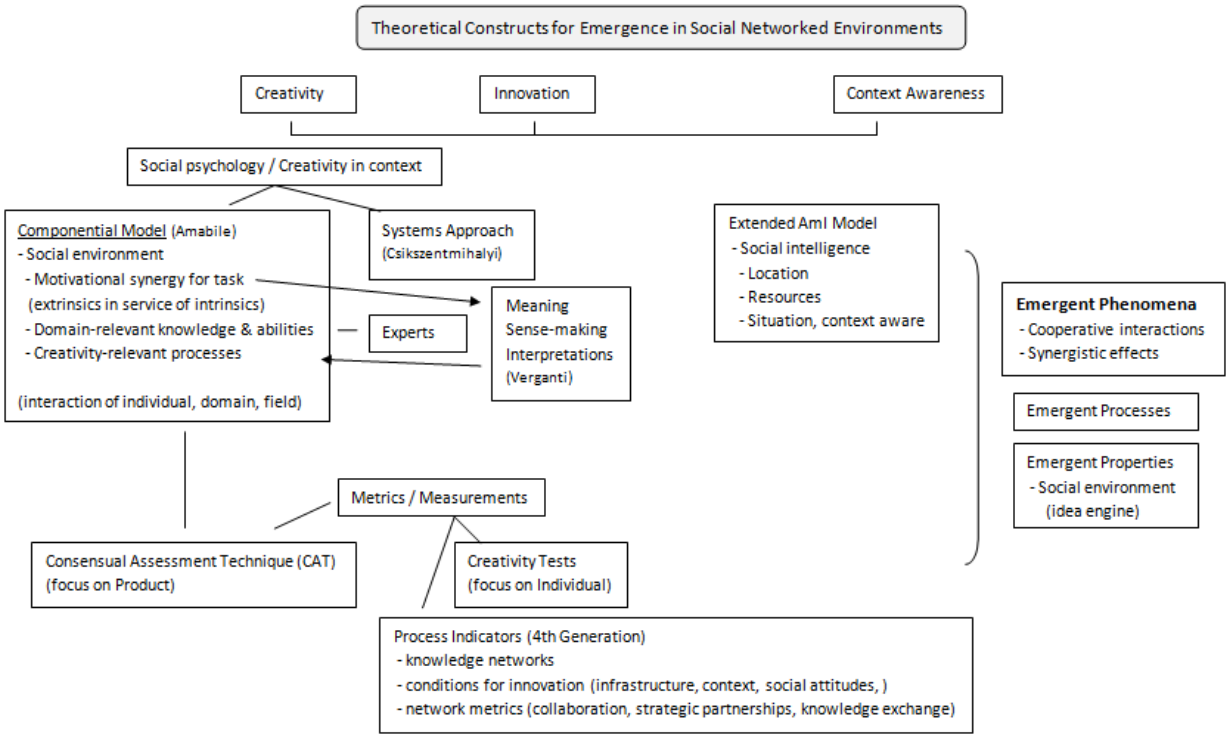


Figure 5: Theoretical Constructs - Emergence in Social Networked Environments

Creativity and Innovation

Approaches to the study of creativity are many and varied and Sternberg & Lubart (1999:4-10) developed a typology consisting of seven approaches — mystical, pragmatic, psychodynamic, psychometric, cognitive, social-personality, and confluence. This study draws upon the 'confluence approach' which emphasizes the importance of multiple components (componential). Intrinsic motivation, domain-relevant knowledge and abilities, and creativity-relevant skills as articulated by Amabile (1996) in the *social psychology approach*. This approach encompasses the *componential model* and the *systems approach* (Csikszentmihalyi, 1988; Amabile, 1996; Hennessey & Amabile, 2010) with an emphasis on "the interaction of the individual, domain, and field". The social psychology approach is particularly relevant to this study of social networked, wireless grid and ambient intelligent environments because it incorporates and accommodates: a) thinking on both creativity and innovation; b) social and contextual dimensions and their influence on creativity; and c) multi-lens, multi-level, and interdisciplinary perspectives pertaining to collaboration, interaction, and sharing.

In determining what is meant by the term creative, Csikszentmihalyi (1996:1) in *Creativity: flow and the psychology of discovery and invention* argued that "an idea or product that deserves the label 'creative' arises from the synergy of many sources and not only from the mind of a single person." Referred to by Shneiderman (2007:25) as a 'situationalist researcher', Csikszentmihalyi claims that "It is easier to enhance creativity by changing conditions in the environment

than by trying to make people think more creatively." If, as Csikszentmihalyi (1996:1) claims, there is a need for a long time period to facilitate creativity, then in the timeframe of this brief beta trial it may be that few if any creative ideas would be generated:

> ... a genuinely creative accomplishment is almost never the result of a sudden insight, a lightbulb flashing on in the dark, but comes after years of hard work. (1996:1)

However, another characteristic of note about 'emergent processes' is the accelerating effect that information and communications technology (ICT) such as the Internet can have on processes that would normally play out over years, resulting in feedback, interactions, and outcomes that "can happen in a matter of months, weeks, or even days" (2011:38-39). Keeping in mind this accelerating effect of ICT, then Csikszentmihalyi's claim may have less relevance in the context of 'emergent social processes' in wireless grid and ambient intelligence environments.

Csikszentmihalyi relates creativity to meaning; "creativity is a central source of meaning in our lives" and fulfillment and while a variety of things can contribute to fleeting moments of excitement (e.g., sports, music, etc.), "creativity also leaves an outcome that adds to the richness and complexity of the future." Csikszentmihalyi seems to encompass 'new ideas' and 'new things' within the concept of creativity and in turn the notion of an innovation, in proposing the view that:

> ... creativity results from the interaction of a system composed of three elements: a culture that contains symbolic rules, a person who brings novelty into the symbolic domain, and a field of experts who recognize and validate the innovation.

The third element — experts who recognize and validate the innovation — relates to Amabile's *consensual technique for creativity assessment* where a product is deemed creative, relative to the judgments by experts (1996:41-43). The use of the term expert has the 'requirement' of 'special' "familiarity with the domain of endeavor in which the product was made" (Amabile, 1996:61). Based on her research, Amabile (1996: 62) notes that "creativity may be something that is difficult for people to describe, but is still relatively easy for them to identify with a good degree of reliability." Amabile & Kramer (2011:53-54), discussing *inner work life*, connect 'positive emotion' with 'creative problem solving' in work environments and claim increased creativity when leaders are perceived positively:

> as collaborative, cooperative, open to new ideas, able to develop and evaluate new ideas fairly, focused on an innovative vision, and willing to reward creative work.

The chance of people participating increased "when people saw that a new idea was treated as a precious commodity—even if it eventually turned out to be infeasible." Amabile & Kramer (2011: 55) refer to 'work environment effects' including perceived challenge, autonomy, adequate resources, and adequate time for tasks. As well as emotion and perception being key factors influencing creativity in *inner work life*, so too is motivation according to Amabile & Kramer, specifically 'intrinsic motivators' including "interest, enjoyment, satisfaction, and challenge of the work itself" (p. 55-56). A key finding is that "... making progress (being productive and creative) leads to positive inner work life" (p. 68-69). In an earlier, seminal work

entitled *Creativity in context,* Amabile (1996:15) articulates the social psychology of creativity using intrinsic motivation as the key principle, where she states that:

> It appears that when people are primarily motivated to do some creative activity by their own interest in and enjoyment of that activity, they may be more creative than they are when primarily motivated by some goal imposed on them by others.

Amabile (1996:17) is concerned with 'social influences on creativity' claiming that "largely because they affect motivation, social factors can have a powerful impact on creativity." As a social media tool it would seem that a beta trial of WeJay social radio would provide an appropriate environment within which to investigate the potential for creativity.

Social interactions have been referred to in this paper in relation to ambient intelligence (AmI) environments and emergent structures and here we note the interest in social influences by Amabile in relation to creativity. It is worth noting that Westley (2008) describes the *social innovation dynamic* as:

> an initiative, product or process or program that profoundly changes the basic *routines, resource and authority flow* or *beliefs* of any social system.

For social innovations to be successful, Westley claims they must have 'durability' and 'broad impact' and as such, will be 'disruptive'. In Westley's social innovation dynamic, the process is characterized as non-linear and resilient and as part of an 'adaptive cycle'.

Regarding intrinsic motivation, Amabile (1996:17) states: "the drive to engage in some activity because it is interesting and involving appears to be essential for high levels of creativity. And intrinsic motivation can be significantly

affected by the social environment" and "any motivation that arises from the individual's positive reaction to the task itself" (1996:115). Updating earlier thinking on creativity, Amabile would build upon and revise the principle of intrinsic motivation to include, 'other aspects of social influence on creativity'. For Amabile (1996:17), the focus on social psychology gives way to "a comprehensive systems view that includes interacting networks of factors, influencing — and being influenced by — creativity." Although controversial, Amabile (1996:38-39) argues for a *continuum of creativity* in 'products and processes' "where ordinary individuals are doing everyday things in appropriate ways that are somewhat novel, to the highest levels of creativity where geniuses are producing notable work that transforms fields and even societies." Amabile points to the importance of considering the three components of creativity (e.g., domain-relevant skills, creativity-relevant processes, and intrinsic task motivation) on their own and in terms of their intersection with each other.

While emphasizing the importance of intrinsic motivation for creativity theory, Amabile (1996:274) acknowledged that "under certain circumstances, certain types of extrinsic motivation can add to rather than detract from creativity." Extrinsic is described as "any motivation that arises from sources outside the task itself" including "expected evaluation, contracted-for reward, external directives" (1996:115). Addressing the motivational component of creativity, Amabile's (1996:259-260) componential model introduces the notion of *extrinsics in service of intrinsics* with regard to intrinsic motivation and extrinsic motivation,

conceptualized as 'motivational synergy'. Where extrinsic motivations such as evaluation, surveillance, task constraint, competition and the like, form part of the 'social environment', Amabile initially recommended removal of such elements, de-emphasis, or a placing of emphasis on the informational nature of the activity as it was thought that extrinsic motivation would undermine intrinsic motivation. Later, Amabile came to recognize the value extrinsic motivations (e.g. "rewards that involve more time, freedom, or resources to pursue exciting plans") can have for intrinsic motivation when presented as "informational —- constructive, non-threatening, and work-focused." Key to the extrinsics in service of intrinsics dynamic is the maintaining of the fine balance between a 'sense of confidence' and 'self-determination'. Amabile predicted that where research studies draw on this 'synergistic combination' of intrinsic and extrinsic motivation "the most exciting new insights—and new questions—about creativity" would emerge. For example, more recently in *The progress principle*, Amabile & Kramer (2011:88) illustrate the 'progress principle' with a feature on the *Secrets of the videogame designer* where, using the example of massively multiplayer games (MMOG) such as World of Warcraft (WOW), the external and visual presence of the 'progress bar' on the screen is a constant reminder to the gamer of the degree of 'progress' together with other 'achievement markers'.

The componential model of creativity developed by Amabile (1983) was modified (1996:271) to: a) acknowledge "the nonlinear nature of the creative process"; b) incorporate a 'social environment' dimension; and c) replace 'creativity-

relevant skills' with the more comprehensive 'creativity-relevant processes' notion. Regarding the element of *transformation*, Amabile (1996:31) cites research by Jackson & Messick (1965) where creativity is judged to be 'outstanding' based on the presence of four concurrent 'aesthetic responses' — surprise, satisfaction, stimulation, and savoring. *Stimulation* is described as "the response to *transformation* in the product, evidence that the product breaks away from the *constraints* of the situation as typically conceived." Amabile points to the research work of Feldman, Marrinan, & Hartfeldt (1972) who show that 'transformational power' can be used by judges in the rating of products, although Amabile notes that this is a judgment that is rarely if ever used.

The notion of *experts* also appears in the work of Verganti (2009) on innovation and creativity, from a design-driven perspective, and would seem to be relevant to investigations of 'interpretations for use' of the WeJay social radio applications. For Verganti, design pertains to "making sense of things" (2009:21) and he points to the importance of identifying and interacting with the *interpreters of meaning* for innovations; of listening, of engaging in *design discourse* in the research process (2009:xi). Cognizant of 'incremental innovations', Verganti is interested in 'breakthrough innovation' where a 'radical change in meaning' is generated. Verganti claims that meaning is embedded more deeply in our world and it is with the assistance of *experts* which he refers to as *radical researchers* — "managers ..., scholars, technology suppliers, artists, ... designers" — that interpretations of meaning, drawing on understandings of "the evolution of society,

culture, and technology", can occur (2009:5). Verganti's emphasis on the importance of deep cultural meaning brings to mind the work of Kaarst-Brown & Robey (1999) who identify the value and timelessness of cultural insights; insights contributing to shifting appreciations and implications for innovation and creativity in relation to information technology (IT) culture in an organizational setting, based upon five archetypal perspectives.

Verganti (2009:36) claims that "Meanings result from interaction between user and product" where a simple 'context of use' can become an 'envisioned context of use' through interpreters and interpretation (2009:118). This study was attentive to Verganti's notion of "radically innovating what things mean" particularly during the investigation of 'interpretations for use' that a wireless grid application such as the WeJay social radio may generate. Of interest were interpretations based on listening to and interacting with beta trial users / demo participants — many of whom are expert in various ways — and the stories of their experiences and responses. Contrasting radical researchers with typical creative teams, Verganti (2009:152) offers six areas of comparison (e.g., output, process, assets, quality of metrics), only a sampling of which is provided in Table 1.

Table 1: Verganti's Comparison of Radical Researchers with Creative Teams

	Radical Researchers	**Creative Teams**
Output	Proposals, vision framework	Answers; ideas
Process	Depth	Speed
	Research & experimentation	Brainstorming
Assets	Knowledge	Methodology
	Scholar (unique expertise)	Neophyte (ignorance of constraints)
	Relationships	Processes
Quality of metrics	Robustness of the vision	Number & variety of ideas
	Impact of the vision on society	Solution to a problem

Christensen (2003:xviii) distinguishes between technologies which are *sustaining* (e.g., which may be *discontinuous* or *radical* in character or of an *incremental* nature) and *disruptive* technologies. Technologies of a sustaining nature "improve the performance of established products" while disruptive ones "underperform established products" and offer "features that a few fringe (and new) customers value." Fringe features generally include such things as being "cheaper, simpler, smaller" and often more convenient. In a more recent work entitled, *The innovative university*, Christensen & Eyring (2011:18) refer to online learning as a disruptive technology in the higher education space. Literature reviews of innovation (Garcia & Calantone, 2002), innovation management (Eveleens, 2010), and the conceptual dimensions of innovation (Ram, Cul, & Wu, 2010), point to the relationship with creativity and value.

Creativity Measures

Sternberg (1999:37) provides a detailed discussion of the range of methods used to study creativity, including: psychometric, experimental, biographical, historiometric, and biometric along with associated issues. While noting the critiques of creativity tests (Hocevar & Bachelor, 1989), Amabile points to the different value contributed by tests on the one hand and creative assessments on the other (1996: 40). Amabile proposed the Consensual Assessment Technique (CAT) as a method of subjective assessment for general measures of a product's creativity. The CAT has been used for a range of tasks including artistic, verbal, and problem solving. Amabile (1996:79) claims that the CAT is "robust, yielding

subjective assessments of creativity even when the procedure is varied to some extent." Guidelines provided by Amabile (1996:79) for participants and judges in the use of the CAT include:

Table 2: Consensual Agreement Technique - Participant & Judge Guidelines

Participants:
- tasks should allow variability in acceptable responses;
- all participants be provided with the same materials and guidelines;
- the task should be one where most participants can produce an observable product or response.

Judges:
- be provided with the same materials and guidelines given to participants;
- should have at least a moderate degree of familiarity with the domain in which the products were produced, and the level at which they were produced;
- should view all products (or a substantial subset) before making ratings;
- be told to rate products relative to one another;
- work independently

Amabile argues that while the Consensual Agreement Technique (CAT) involves more time to administer than standardized creativity test, it offers more flexibility in circumstances of use, in terms of relevance to many domains and tasks. Further, because the CAT involves working with real-world products with participants, Amabile claims that the technique allows for increased validity.

To the extent that the beta trial of WeJay and its interpretation for use by beta trial participants can be construed as the task category of 'ideas for high-tech product' then it would fit within Amabile's 'problem solving tasks' framework and the CAT could be used to assess whether wireless grid environments — in the form of WeJay social radio — foster creativity and innovation. Although initially focused on creativity, Amabile recognized the importance of innovation and developed a more integrated and comprehensive model of creativity and innovation (Amabile,

1988). Baer, Kaufman, & Gentile (2004) extended the CAT to writing products and potential utilization in educational spaces (Amabile & Pillemer, 2012:6).

Csikszentmihalyi approached creativity in terms of 'problem finding' (1976), from a 'systems view' (1988), and culture (1993, 1994). Cognizant of the 'definition of creativity debate' (*Creativity Research Journal*, 1995), Csikszentmihalyi articulates the question as:

> ... whether an idea or product needs social validation to be called creative, or whether it is enough for the person who has the idea to feel that it is creative.

The work of Stein (1953) is referenced who proposed objective and subjective portions to creativity. Although the issue is still up for debate, Csikszentmihalyi admits to preferring subjectivity but since it is unworkable he developed the 'systemic perspective' "which relocates the creative process outside the individual mind."

In keeping with notions of judges and experts for the determination of creativity and the synergistic and interactive nature of emergent properties, Bradley & McDonald (2011:216) define 'idea engine' as:

> A social environment in which participants can enter an idea for social validation and contribution. Other participants can support and augment the idea, ignore it, or refute it. Like answer marketplaces, idea engines are designed specifically to enable mass collaboration around ideas so that the best, most supported, and most viable ideas are vetted and advanced by the collective.

Shneiderman, Fischer, Czerwinski, Myers, & Resnick (2005) report on the considerable research efforts around *creativity support tools*. As part of the *creativity support tools* workshop, Gerhard (2005:71-72) emphasizes the importance

of collaboration and interaction, linking creativity with 'distributed intelligence'. Gerhard argues for 'meta-design' where the design process is opened to users since "creativity requires open systems that users can modify and evolve." In these evolving open systems environments, Gerhard claims that 'mismatches' can occur due to unanticipated problems. Mismatches are "perceived as breakdowns and conceptual collisions" and offer the potential for new opportunities, insights, and knowledge. Gerhard relates mismatches to Hippel's (2005) work where one is encouraged to think, not in terms of a completed product or solution but rather, in terms of "conditions, contexts, and tools for users that allow them to be creative in further evolving artifacts and organizations." It is in this sense that the beta WeJay social radio product was presented to participants as a wireless grid application based on open source specifications (McKnight (Ed.), 2012) inviting collaboration, interaction, and sharing around its potential for modification and evolution.

Innovation Measures

Andrew, Haanaes, Michael, Sirkin, & Taylor (2009:15) conducted a survey on innovation measurement, finding uncertainty about what to measure. A key metric proposed by the authors is the 'number of new ideas' generated. A similar measure of creativity is that of 'fluency' used in standard creativity tests such as the Torrance Tests of Creative Thinking (TTCT) (Torrance, 1962). Drawing on Guilford's (1967) work, TTCT focuses on the components of fluency, flexibility, elaboration, and originality. Amabile indicates that measures such as 'fluency' which "reflects the number of responses made" and 'flexibility' which "reflects the

number of different categories of responses" are algorithmic in nature and as such, cannot be considered creative. Amabile argues that conceptually the definition of creativity is that "a creative response is a novel and appropriate solution to a heuristic task" such that "the task must be open-ended to some degree" in that "some search for solution paths is required" (1996:133).

Rose, Shipp, Lal, & Stone (2009) propose two frameworks for measuring innovation: the first focusing on the firm/organizational level and the second focusing on investments. In developing their frameworks the authors develop conceptual relationships between intangible and tangible assets involved in the innovation process. Acknowledging shortcomings of the frameworks, the authors note, for example, the inability of the first framework to capture details on open source innovation. WeJay, the focus of this current study, is an example of an application enabled by an innovation based on open source specifications (McKnight (Ed.), 2012).

Emerging out of the considerable discussion and research on the metrics of innovation with science, technology, and innovation (STI), indicators have been organized into an evolving categorization of 'generations' (Milbergs & Vonortas, 2006) from:

> 1st (1950s-60s, linear inputs) to;
> 2nd (1970s-80s, outputs) to;
> 3rd (1990s, innovation indicators including benchmarking and ranking) to;
> the current 4th (2000+, process indicators)

The 4th generation also includes an emerging focus on metrics such as knowledge, networks, and conditions for innovation (infrastructure, context, etc.) which reflects

recent research on wireless grids. Indicators within *network* metrics point to the importance of collaboration, strategic partnerships, and knowledge exchange. The *conditions for innovation* metric is of particular interest to this research study since the focus of this metric is upon infrastructure conditions, social attitudes, metrics that capture context, to name a few. Milbergs & Vonortas (2006) claim that any number of metrics could be conceived, placing emphasis on the need for "indicators that 'intelligently': a) describe the main characteristics of the innovation system and its dynamics and b) look forward in anticipation of likely broad developments." However, Milbergs & Vonortas express uncertainty about the existence of 4th generation metrics, referring to them as 'ad hoc' and 'of limited value' until an international effort is undertaken to coordinate and harmonize 'metrics definitions and innovation models'.

The Evolving Collaboration, Interaction & Sharing Landscape

In earlier research (McKnight et al., 2005), wireless grids were studied from a user perspective using factors from Rogers' diffusion of innovations model which explores variables influencing the rate of adoption of an innovation — relative advantage, compatibility, complexity, trialability, observability, and network effects. Drawing on focus group data, the study determined that wireless grid diffusion and use would travel a complex path, requiring changes in the technology, pricing, and social and mental models. Later, a study of factors explaining the use of wireless grids addressed 'context-related characteristics' — e.g., trust in

communication partners — in relation to 'willingness to share' (Wigngaert & Bouwman, 2009).

This current iteration of a wireless grid enabled application, the beta WeJay social radio product, emerges in a changed environment. Boyd & Ellison (2007) provide insight into Social Network Sites (SNSs) in terms of definition, history, and scholarship and Boyd (2010) outlines evolving notions of privacy in 'networked publics' and 'emergent genres of social media'. Issues of information flow, information sharing, and people's interactions with information and with each other are addressed by Boyd (2010) and Baym (2010b). Richter, Riemer, & vom Brocke (2011) discuss the Internet Social Networking (ISN) phenomena where SNSs, as Internet technologies, are leveraged for social network interactions in relation to enterprise contexts. The authors conclude that research is fragmented, tending to focus mostly on students and platforms such as Facebook. The rapid pace of change facilitated by technological and other factors requires a rethinking of processes and behaviors around new social media, providing the possibility of new opportunities for information sharing, collaboration, and interactions. Indeed, Dunkels, Granberg, & Hallgren (2011) ask the question: "what does the setting for learning, knowledge exchange and behavior look like?" Using the music industry as an exemplar, Baym (2010a; 2010c) studied what appeared to be the surface issue of file sharing but is more fundamentally the issue of information sharing and information and content flow in relation to social and economic exchange. One of several areas of social value identified by Baym (2010a:11) is 'audience creativity'.

Erickson (2010) discusses interactions that are emerging among people and places (networked interactions) and 'emergent sensemaking' related to location-based information (geo-location) and distributed communities. It is worth noting that Marsden (2011) addresses the role of wireless grids in relation to geospatial technologies in the context of emergency response teams. Focusing on a comparative study of Jaiku and Twitter, Erickson claims that although similar, differing features of these products (e.g., absence or presence of threaded conversation) influence social patterns, communal bonds, and organizing practices in different ways. Papacharissi (2011:1,6,8) refers to Erickson's use of 'peripheral awareness and ambient community' in relation to the information sharing, conversation, ambient journalism (Hermida, 2010), and social awareness features of Twitter — "an ambient, always on social awareness environment, where news-related and social information is shared." Using the 'news values' of instantaneity, crowdsourced elites, solidarity, and ambience, Papacharissi (2010:19) conducted an analysis of Twitter data on the uprising in Egypt. The *ambience* value was found to, contribute to and construct, an ambient information sharing environment.

AmI, Context Awareness, Ambient Learning

The concepts of ambient intelligence (AmI), context awareness as a dimension of AmI, and ambient learning are discussed and synthesized as analytic tools for this study.

AmI

At this early stage of diffusion, the current research study was attentive to the *diffusion of innovations theory* (Rogers, 2003). If considered as 'future information technologies' (Röcker, 2010), wireless grid and ambient intelligence technologies may not fit so easily within traditional technology diffusion and acceptance models. Claiming a possible lack of appropriateness, Röcker calls for adaptations to existing diffusion and acceptance models which focus, for example, on ease-of-use and visibility factors. The embedding of technologies into our environments gives way, instead, to invisibility factors and other context awareness elements, including social and situational. As such, wireless grid and ambient intelligence technologies which are variously characterized as ad hoc, mobile, embedded, context aware, and adaptive, "will not only break the constraints of time [anytime mobile applications] and place [anytime, context aware information] but will also vary significantly regarding their degree of autonomy" (Röcker, 2010).

In a study of the assessment of wireless grids from a user perspective, McKnight et al. (2005:172) refer to a wireless grid application capable of becoming a 'location-aware device'. More recently, Marsden (2011) uses the term 'stigmergic coordination' in describing the geospatial potential of wireless grids in coordinating emergency response teams. For Marsden, stigmergic "refers to how an individual behaves as part of a collaborative team effort, engaged in a complex task" in relation to emergency situations. Marsden draws on the theoretical perspective of Nardi (1996) in discussing behavior which is characterized as spontaneous and

unplanned yet seemingly purposeful. The work of Polanyi (1966) and others is referenced around tacit knowledge and its reshaping in collaborative environments. Aided by geospatial technologies in conjunction with wireless grids, adaptive collaboration is addressed using geographically coded information, dynamically generated and shared.

De Ruyter (2010:108; 2011), from the perspective of ambient intelligence (AmI), argues that 'interactive' systems focus on 'usability' and also on the "potential to elicit specific experiences" from users. This current study places a strong emphasis on use experience and usability of the tool. De Ruyter further claims that interactive systems are no longer standalone and are part of a larger ecosystem. It should be noted that wireless grids emphasize the ability of one or more devices to connect and form a network. A wireless grid application such as WeJay can also connect with existing infrastructures such as the Internet. Finally, De Ruyter contends that the concept of 'embedding' technologies into the 'fabric of everyday life' goes beyond "technical integration into an environment and requires a deep understanding of the contextual setting." For this reason the current study is concerned with additional elements such as the socio-technical environment and various types of awareness, including context awareness.

Context Awareness

This study investigated the launch and first use experience of a wireless grid enabled application in light of the AmI thinking of Röcker (2010), DeRuyter (2010) and others. De Ruyter (2010) articulates context awareness as one dimension of

ambient intelligence (AmI) and a part of the larger area of awareness research (Markopoulos, De Ruyter, & Mackay, 2009). The European Commission (2011) funded the *Ambient Creativity* project (2007-2013) contributing to the "2009 Year of Creativity and Innovation, through education and culture." The project claims that digital technologies have facilitated the emergence of 'ambient creativity' whereby "a large public (not necessarily professionals) develops its own creativity in producing and diffusing multimedia works and stimulating back, general public and professionals, as never before." Small & Arnone (2011) focus on the linkage between reading, technologies, and 21st-century literacies and the critical role played by public libraries in fostering 'creative reading'. Advising on a new research agenda for new media technology-pervasive learning environments, Arnone, Small, Chauncey, & McKenna (2011:190) point to the necessity of understanding how these environments, which may be equated with wireless grids and AmI, "enable us to function differently and more expansively through real-time information creation and sharing, multi-person interactions, mixed-reality." In a recent discussion with McKnight and Kaarst-Brown (meeting, 22 September 2011), McKnight anecdotally reported on observing how "people fall in and out of the mind set" enabling them to, in one moment grasp the understanding of wireless grid enabled environments, as in 'get it' and in the next moment proclaim, "now I forgot it". Perhaps it can be said that we are currently occupying imperfectly bridged mixed-reality. Environments described by Borgman (2008:38-39) as spaces "that combine digital content and real-world spaces" enabling "new modes of interaction, new audiences, and new

models of assessment." As such, wireless grids as emergent technologies are in-the-making and open to interpretations for use, in support of these new environments.

Ambient Learning

Bick, Schnitzer, Pawlowski, & Seghers (2007), in developing *Standards for ambient learning environments,* claim that ambient learning "denotes new ICTs embedded into the environment leading to advanced e-learning scenarios." Citing the work of Lindwer, Marculescu, Basten, Zimmermann, Marculescu, Jung, & Cantatore (2003), Geddes (2004) describes scenarios for Ambient Intelligent Learning (AMIL) environments while Li et al. (2009) provide a survey of developments in learning and AmI environments, noting the challenges facing ambient learning. More recently, Specht (2010) considers the use of ambient technologies in support of learning and Scott & Benlamri (2010) describe ambient learning environments supported by context-aware services. Focusing on organizational environments, Deng (2010) draws on the work of Williams (2001) in discussing *emergent learning* which is referred to as "the relatively unplanned learning which occurs spontaneously in order to cope with emergent issues." Characterized as an incremental type of learning, emergent learning is said to arise from a confluence of factors included 'unexpected situations'.

Trevenna (2010:97) proposes the Transformative Emergent Model (TEM), described as "a synergy of many previous urban planning models with theory from Futures and other disciplines, as well as emergent principles ... that together create a unique form of empowerment for the individuals, the organization and the

community." It is worth noting that Samat (2011:831) categorizes the 'futures field' into five areas:

> 1) environmental and geosciences treat the Earth and its various components as typical out-of-equilibrium systems with dissipative processes; 2) infrastructure and socio-technological systems emerge through the diffusion of investment capital, with the endogenous transformation of the urban system; 3) social, political and economic sciences are being reshaped away from the notion of economic equilibrium, and describe social emergence by means of agent-based models; 4) human life, mind and information sciences are evolving with the development of complexity models in neuroscience, immune systems, epidemic modeling, social media technologies and artificial intelligence; 5) business and management science involves examining the viability of successfully undertaking transactions in a complex adaptive system, in which the systemic structure evolves over time.

Of particular interest to this research study is category 2) infrastructure and socio-technological systems; category 4) human life, mind and information sciences and category 3) social, political and economic sciences. Regarding information sciences, Samat (2011:837) refers to intelligent applications as encompassing a range of things in mobile communications management. Reference is also made to digital technologies which "have permitted the development of multimedia interactive systems, with the integration of text, images and sound." Samat notes that "Forward looking teachers see the necessity of bringing social media technologies into the classroom with the sharing of information, and this is likely to transform the learning process in the 21st century."

In summary, this section provided a brief overview of three concepts underlying the notion of smart information environments. *Ambient intelligence (AmI)* is presented as the embedding of information in everyday environments in support of human activities; *context awareness* is discussed as a dimension of AmI,

incorporating socio-technical, situational, and other factors; and *ambient learning* is covered as an educational environment enabled by AmI. As such, these concepts are employed as analytic tools for this study, enabling new ways of understanding, conceptualizing, and discussing human-centered computing and information interactions. Embedded and invisible technologies have been with us for some time now and Mosher (2012:65) refers to the Internet as an invisible technology which, in global terms, is "the most important engineering feat in modern history." As AmI technologies become increasingly interwoven into the fabric of daily living, and as wireless grid technologies begin interacting with and complementing Internet and other technology infrastructures, conversations about use experience and interpretations for use of AmI and wireless grids become ever more pressing.

Unintended Consequences

In relation to legislation (e.g., Telecommunications Act of 1996) affecting developments around the information highway, Neuman, McKnight, & Solomon (1998:41) point to the effects of the 'law of unintended consequences' for technology, markets, and policy practices. Popularized by Merton (1936), research on unintended consequences — beneficial, detrimental, or perverse — appears in studies of information technology (IT) use (Markus & Robey, 2004); emergence (Goldstone et al., 2009); and creativity and innovation. The WeJay wireless grid application was developed with an intended use for social radio. Once deployed in the beta trial/demo, the potential for additional innovation exists, particularly in

social networked wireless grid and ambient intelligent environments featuring ad hoc, mobile, interactive, anywhere/anytime, adaptive, and other characteristics.

Tenner (2011) articulates the notion of 'unexpected possibilities' as an understanding of unintended consequences of technologies and other developments. With increased complexities in systems it becomes more difficult to work with unintended consequences since a remedy for one unintended consequence could contribute to another. Indeed, 'safety technology' observes Tenner "can be a source of danger". Admitting that he had not always liked unintended consequences, Tenner states that he has come to appreciate them, claiming that they are the "essence of what makes for progress." A further observation by Tenner is that "invention could benefit from emergencies ... from tragedies ... from calamities." Tenner makes reference to work by researchers at the University of Maryland (Brent Goldfarb & David Kirsch) who claim that the period of the Great Depression yielded a significantly higher level of major technological innovations. Tenner argues that "unfortunate events can have a paradoxically stimulating effect on creativity" which leads him to think in terms of *unexpected possibilities*. Such possibilities encourage a revised and more positive view of unintended consequences, opening the way for learning potential. This study is attentive to both the unintended consequences and unexpected possibilities of AmI in wireless grid enabled applications.

Readiness

Readiness in the research literature tends to refer to technology readiness in the sense of whether people are ready to use and/or adopt a technology. For example, Parasuraman (2000) developed a *technology readiness index (TRI)* with the four components of *optimism*, *innovativeness*, *discomfort*, and *insecurity*. The index was revised and abbreviated by Parasuraman & Colby (2001) and it is interesting to note the development of the tool to study positive and negative feelings and beliefs about technology.

However, readiness can also refer to the technology itself as evidenced in *technology readiness assessment (TRA)* in government documents literature (DOD, 2011) where issues of maturity, risk, and the like are used to determine the *technology readiness levels (TRLs)*. Smith (2005:8) addressed limitations of the TRLs approach and offered an alternative evaluation framework for readiness, allowing for "a more nuanced determination of product or technology readiness." Asthana & Olivieri (2009:3) advanced what they consider to be a novel *software readiness index* to quantify reliability and readiness along the five dimensions of *functionality*, *operational quality*, *known remaining defects*, *testing scope and stability*, and *reliability*. More recently, Olivieri (2012:1) extended the software readiness index to incorporate both hardware and software, using a systems approach in developing a *systems readiness index (SRI)*. Readiness criteria, often viewed as unidimensional, are instead considered by Olivieri to be multidimensional. Olivieri further claims that "there are no firmly established

standards of assessing software readiness." As such, the readiness of the pre-standards WeJay beta product was studied in what is perhaps a rather fluid understanding of standards for readiness.

Other Related Theories

Other theories relevant to this study include *social shaping of technology* (SST) theory which was developed in 1985 (MacKenzie & Wajcman, 1999) and challenges technological determinism through encouraging "creative engagement with technology." As well, a *theory of instinctive information sharing* is advanced by Wang & Chen (2011), challenging rational and utilitarian beliefs. In support of this theory, Wang & Chen developed and validated the construct, "need for information sharing", calling for a rethinking of existing models and theories around sharing and cooperation. Building on the social context work of Amabile and others, creativity is being studied in relation to *social network theories* (Perry-Smith, 2006; Sosa, 2011). Emotion/affect has been found to be integral to the study of creativity and innovation (Amabile & Kramer, 2011), technology readiness (Parasuraman, 2000), and AmI (Sebe, 2009:354). The domain of emotion research (Lopatovska & Arapakis, 2011) is identified as important for the study of interactions in computing environments, human information behavior, perception, and much more. The dimensional approach to emotion by Scherer (2005:720) conceptualizes emotions as having positive or negative valence and active/aroused or passive/calm characteristics. Within this 'semantic space', emotions are equated with the following relative tendencies, depending upon their placement:

a) active-positive emotions tend toward high power/control
b) active-negative emotions tend toward obstructive
c) passive-positive emotions tend toward conductive
d) passive-negative emotions tend toward low power/control

Recent research suggests the importance of 'gamification' (McKenzie, 2011) as a factor in the diffusion, adoption, and use of applications involving location-awareness, where "an aspect of *game play*" is present. Cramer, Ahmet, Rost, & Holmquist (2011) caution that the gamification aspect of location-sharing applications may give rise to 'social conflicts', pointing to the importance of social context and the inherent motivations.

Measures

This literature review has shown that products have been measured, assessed, and interpreted for use, from a social perspective, in many ways. While tests and measures of creativity and innovation in relation to people and products can provide counts for example, of how many ideas have been generated based on the use of a product, Amabile (1996:133) argues for the use of the consensual assessment technique (CAT). Using the CAT, a product is deemed creative relative to the judgments by experts (1996:41-43). Because of the dynamic and ad hoc nature of wireless grid enabled environments and their 'emergent properties' which are synergistic and interactive by nature, Pearce & Artemesia (2011:38) suggest that such properties are more amenable to study by inductive methods. Amabile (1996:40) acknowledges the different contributions made by creativity tests on the one hand (designed to determine 'creativity-relevant processes') and subjective

assessments of a product on the other ("useful for broad overall measures of a product's creativity).

In investigating the research questions and propositions of this study, focus is placed upon assessment in relation to the constructs, their dimensions and measures, identified in Table 3.

Table 3: Constructs, Dimensions, and Measures Assessed

Constructs	**Dimensions**	**Measures**
Innovation	*conditions for innovation*	infrastructure conditions social attitudes context
	fosters environment for innovation	evidence the product breaks away from the constraints of the situation as typically conceived (transformative)
	interpretations for use	uses employed uses envisioned
Creativity	*novel and unexpected uses*	new & appropriate uses employed new & appropriate uses envisioned
Context awareness	*toward AmI in wireless grids environments*	location, resources, situation awareness

Summary

This chapter provided a review of the literature on wireless grids and an overview of this emerging field and its possibilities. With a long and varied history in many domains, largely socio-technical aspects of the emergence theory literature are reviewed in support of the theoretical perspective advanced for this research. Regarding the underlying propositions and conceptual framework for this study, a review of the research literature was presented on creativity; innovation; ambient intelligence (AmI) and context awareness; the landscape of collaboration,

interaction and sharing in social networked sites (SNSs); emotion/affect; readiness; and the unintended consequences and unexpected possibilities of information technologies. Measures and assessments for creativity and innovation were reviewed together with a discussion of measures for readiness.

Chapter Three presents the methodology employed for this study including data collection methods; data analysis techniques; validity, reliability, and trustworthiness; ethical treatment; and materials used.

CHAPTER THREE: METHODOLOGY

The previous chapter provided a literature review; a rationale for the use of emergence theory as a theoretical framework to guide this research study; and measurement and assessment techniques for the study of the constructs — creativity, innovation, and context awareness — supporting the research questions and underlying propositions for this study.

In this chapter, framing of the study is discussed and the nature of possible personal bias the researcher sought to mitigate during this research. The research design for the study is presented together with the rationale for using a single multi-method case study. Within the methodological context of the study the research questions are outlined followed by the propositions addressed by the study. The unit of analysis is developed followed by the identification of data collection techniques and the logic connecting research data with the propositions. A WeJay study protocol is provided for the research, inclusive of both WeJay beta trial users and demo viewer participants, accommodating the 'state of readiness' of the beta product. Data collection protocols are discussed as well as survey instrument development. The data analysis techniques of explanation building and content analysis are presented; the criteria for interpretation of findings are discussed; and issues pertaining to validity, reliability and trust are addressed. This chapter concludes with a discussion of ethical treatment and materials used in the research study.

Framing the Study

This case study was guided by the broad research question: *Do wireless grid enabled applications, such as WeJay, add to the potential for new and transformative outcomes for people, information and technology?*

The study investigated the launch and beta trial experience of the first Wireless Grids Innovation Testbed (WiGiT)-incubated software application. The WiGiT Lab is situated at the School of Information Studies, Syracuse University and features a virtual distributed research framework of universities and other members. Specifically, the use experience of selected Syracuse University and WiGiT member students and faculty, with the WeJay social radio edgeware[17] tool, was investigated. This distributed academic setting and the beta trial of a next generation wireless grid tool provided the framework for the methodology of this study.

Personal Biases

The researcher has worked as an information and systems consultant for more than two decades with many individuals, groups, and organizations in support of their particular information needs and interactions with information and communications technology (ICT). A possible source of bias relates to the researcher's tendency to be particularly excited by the benefits and potential of new and evolving applications and technologies. This potential bias was moderated and

[17] WiGiT (2011). Edgeware is a new class of applications that can dynamically make use of content and resources present in devices - phones, PCs, cameras, printers, screens, etc. - connected by a wireless grid.

balanced by an understanding and appreciation for the practice perspective and the practical purposes and uses of information technologies. The researcher has provided a range of services including feasibility studies, prototyping, testing, assessment, implementation, training, and support related to the use of new and legacy products for library and information services across diverse settings (e.g., government, business, nonprofit, professional associations, and academic institutions). The researcher's consulting services are particularly attentive to the ongoing identification of new and existing information applications of benefit to clients while being balanced by the information application needs and requirements of practice settings. The researcher is also attentive to the unimagined needs that may be of benefit to practice settings and this study provided an opportunity to probe the imagination of beta trial and demo viewer participants. During data collection the researcher followed protocols, ensured that all participants understood the details and purpose of the study, and remained mindful of the importance of refraining from offering views and opinions.

Research Design

This research used a single case study approach incorporating the strategy of relying on theoretical propositions (Yin, 2009:130) and the analytic technique of explanation building, a type of pattern matching (Yin, 2009:136). The use of a *single case study* is appropriate for this research since the first use experience of WeJay by faculty and students represents a *critical case* as the first application emerging from the Wireless Grid Innovation Testbed (WiGiT) to be studied in an academic

environment. Further supporting the use of a single case study is the *revelatory* nature of the case in that it allowed for the study of an application that had not, until now, been available to researchers.

More generally, a case study approach allowed for an in-depth study of the contemporary issue of ambient intelligence (AmI) within a wireless grid environment in support of the use of social media for education. Another feature of this study making it amenable to case study research was the beta trial environment which did not allow for manipulation of participant behavior by the researcher (Yin, 2009:11).

As an initial research study among early stage users of the first wireless grid beta product, this case study is largely *exploratory* (Yin, 2009). However, as this case draws upon theory to drive the propositions under study it is also a *descriptive* type of case study. It could be said that the study has elements of the *instrumental* (Stake, 1995) in that it seeks to contribute insight into AmI with wireless grids. To the extent that the study seeks to understand AmI with wireless grids using the WeJay case, this case also has elements of the *intrinsic* (Stake, 1995).

A mix of qualitative and quantitative research was used in this study with descriptive statistics to summarize the data collected and present an analysis of findings. Inferential statistics were not used in this research due to the small sample size and the 'state of readiness' of the WeJay beta product studied.

The research design for this study is depicted graphically in Figure 4 — identifying the participants and contexts; the focus of the study (WeJay launch and

beta trial use experience); the methods for data collection (activity data, interviews, focus groups, and survey); the analytic techniques employed (explanation building, content analysis, and descriptive statistics); analytic generalization using emergence theory; and the unit of analysis.

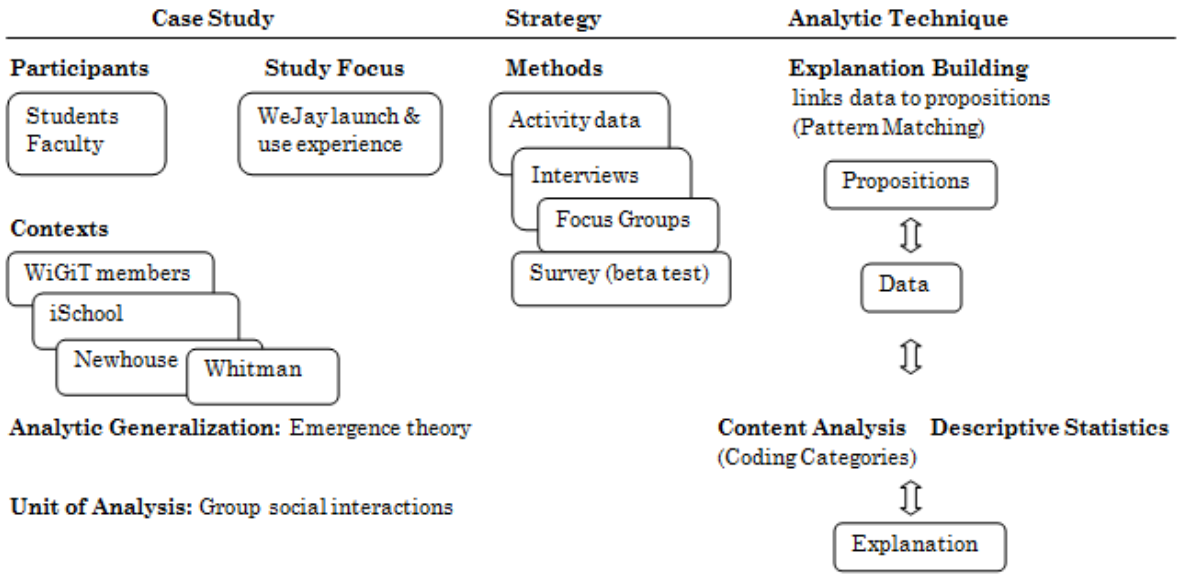


Figure 6: Research Design: Initial WeJay Beta Launch & Use Experience Study

Four methods of data collection were used in this study to respond to the research questions and propositions. The four data collection methods include: *activity data*, *interviews, focus groups*, and a *survey*. A description and rationale for each method is provided below.

Activity data represents a method of data collection where real time usage data was captured to a database as participants used the WeJay beta trial application and interacted in the wireless grid environment. Activity data represents actual use, generating usage statistics which were analyzed and presented descriptively through charts and graphs.

Interviews represent a method of data collection where data was gathered individually from participants, guided by general questions. This method of data collection provided a means of debriefing and dialoguing around the use or demo viewing experience and an opportunity for richer data gathering, contributing to greater understanding.

Focus groups represent a method of data collection where data was gathered through a group interview setting, guided by general questions. Responses were elicited through group interaction of participants and their shared understanding of the WeJay beta trial or demo experience. The focus group method had the potential to provide a rapid means of rich data gathering.

Survey represents a data collection method where a combination of closed and open ended questions contribute information on trends and on the attitudes, beliefs, and opinions of respondents (Creswell, 2012:376). In this study, interview and focus group protocols and data collected through these methods, contributed to the survey development process for an instrument unique to AmI and the wireless grid beta trial environment. As such, the survey instrument was pre-tested and administered as a first attempt in determining its effectiveness in measuring the understanding, perceptions, and feelings of beta trial and demo participants (Moore & Benbasat, 1991).

Activity data representing actual use served to guide and enhance interview and focus group protocol questions, contributing validity to the experience data emerging from focus group and interview sessions. In instances where activity data

provided confounding or unaccounted for activity, in-depth interviewing afforded by both focus groups and interviews (Trochim, 2006) was used to probe further, clarify, and provide additional understanding into the WeJay experience. In this way, the four collection methods supported the triangulation of data for greater validity and reliability (Yin, 2009:114-118).

Rival Design

It could be argued that a *rival design* would be preferable where the researcher would conduct a pre-test to get a sense of participant expectations and hopes of the technology before beta trial usage was initiated. The actual 30 day beta trial usage would then be run, followed by a post test involving debriefing interviews, in view of baseline expectations and beta trial experience, allowing for comparisons. However, because this research study was concerned with a pre-standands WeJay beta trial product, the phenomena is so new or transformative that participants would not be able to anticipate what the capabilities might be or provide meaningful advance feedback.

Qualitative Research

How one positions oneself paradigmatically is very much related to the research design process, strategies, and methodological choices. As a researcher-practitioner, the researcher is positioned as a social constructivist which Creswell (2009:8) describes as one who poses "broad and general" questions allowing the construction of meaning to emerge from participants and through interaction with participants. As such, a qualitative approach as a social constructivist was well

suited to this study of the social networked environment of wireless grids and ambient intelligence which are characterized as supportive of collaboration, interactivity, and sharing. Secondly, a study of the use experience, and interpretations for use by early stage first users of the WeJay social radio application, offered a unique research opportunity in which a qualitative approach afforded the gathering of a deeper, richer understanding of the particular context for deployment — an academic environment.

Generally, the social constructivist will not begin with a theory but will "inductively develop a theory or pattern of meaning" (Creswell, 2009:8). This research began with emergence theory — emergent properties, structures, patterns and behaviors — and inductively worked toward the development of meaning and explanation building. Because the overall theoretical framework for this research study – emergence theory – acknowledges the evolving, dynamic, and developing nature of everyone and everything, emergence theory may be perceived as supporting both inductive and deductive approaches.

Using a multiple method single case study approach, the research questions and underlying theoretical propositions for this study were addressed.

Research Questions

Although case studies usually feature 'why' and 'how' questions (Yin, 2009:8-9), in this study the overarching research question was an exploratory one which, as the responses emerged, provided guidance on the 'how', explanatory dimension of the question.

— *Do wireless grid enabled applications, such as WeJay, add to the potential for new and transformative outcomes for people, information and technology when deployed in an academic setting?*

The first question investigated was a mix of a descriptive and an exploratory 'what' question which served to support and further develop the four propositions under inquiry in this study.

— *What is the experience of participants involved in the beta trial launch of the wireless grid enabled WeJay social radio application?*

The second question investigated was an explanatory 'how' question and was intended to shed light on the underlying propositions of the study.

— *How is the WeJay social radio application being interpreted for use during the beta trial across selected segments of Syracuse University students and faculty and among WiGiT members?*

Propositions

The propositions in this research study were intended to bound the study, guide attention to what was specifically under study using the constructs identified (e.g., creativity, innovation, and context awareness), provide direction on sources of evidence, and suggest other alternative explanations to be investigated. The propositions, constructs, and data collection techniques appear in Table 4.

Table 4: Theoretical Propositions, Constructs, and Data Collection Techniques

Theoretical Proposition	Constructs	Data Collection Technique
A. Novel and unexpected uses of the WeJay wireless grid enabled application will be developed by users.	Creativity Innovation	- Activity data - Interviews (self report) - Focus group - Survey
B. The WeJay wireless grid application fosters an environment for innovation, as in "transformation of a new idea into a new product or service, or an improvement in organization or process." (Heye, 2006)	Innovation	- Activity data - Interviews (self report) - Focus group - Survey
C. The WeJay wireless grid application fosters an environment for creativity, as in "novel and useful ideas" (Amabile, 1996) for users.	Creativity	- Activity data - Interviews (self report) - Focus group - Survey
D. A conceptual relationship is emerging between wireless grid enabled environments and ambient intelligent (AmI) environments in terms of the generation of new types of information, in new places, facilitating the presence of 'ambient information' in the form of context awareness, etc.	Context awareness	- Activity data - Interviews (self report) - Focus group - Survey

By definition and design, wireless grid enabled applications and ambient intelligence (AmI) environments support the social features of collaboration, interaction, and sharing. In theory, the propositions advanced by this research study would be supported by the features afforded by wireless grid enabled applications and AmI environments. Past research identified issues of concern within wireless grid applications related to complexity, trust, sharing, and uncertainty, to name a few. Through an analysis of evidence emerging from data collected using multiple methods, patterns were identified and matched for insights in relation to: a) the propositions advanced and b) patterns in the literature upon

which the propositions were based. Data gathering protocols and instruments (Appendix A-D) were designed to capture information relevant to the construct dimensions — *conditions for innovation*, *interpretations for use*, *novel and unexpected uses*, *fosters environment for innovation*, *AmI in wireless grid environments* — and their more detailed measures identified in Table 3.

Unit of Analysis

The unit of analysis for this study, guided by the primary research question (Yin, 2009:30), is group social interactions. However, as data was collected and 'discoveries' emerged, this study retained the flexibility needed to revisit and revise the unit of analysis. In case study research the unit of analysis can take many forms (Yin, 2009:33), some more concrete (e.g., individuals, small groups, organizations, partnerships) while others are less so (e.g., communities, relationships, decisions, projects). Recalling the broad research question — *Do wireless grid enabled applications, such as WeJay, add to the potential for new and transformative outcomes for people, information and technology when deployed in an academic setting?* — the unit of analysis of the social networked WeJay space was identified as *group social interactions* for activity data. Similarly, in the case of WeJay beta/demo participants in focus group settings, the level of analysis was the group and the unit of analysis was *group social interactions*. In the case of interviews and the survey, the individual (participant) was questioned regarding the group social interaction environment of WeJay social radio, based either on: a) the WeJay beta trial experience or b) a WeJay beta trial demo experience.

In summary, the 'unit of analysis' was *group social interactions* in the WeJay wireless grid environment in relation to the key constructs of *creativity*, *innovation* and *context awareness*. As such, this study sought to learn about and generalize findings to other WeJay product deployments and other ambient intelligent (AmI) and wireless grid enabled applications and deployments.

Logic Linking Data to Propositions

The analytic technique of *explanation building* (Yin, 2009), a type of pattern matching, was used as a mechanism for relating the data collected back to the propositions of the study. Using the lens of emergence theory, explanation building was undertaken using the key constructs of *creativity, innovation*, and *context awareness* in relation to use experience, elucidations for use, and interpretations of the interactive social environment of the beta trial and demo viewer experience of the product which was theorized to be potentially transformative and disruptive. Information relevant to the construct dimensions — *conditions for innovation*, *interpretations for use*, *novel and unexpected uses*, *fosters environment for innovation*, *AmI in wireless grid environments* — and their more detailed measures identified in Table 3, were used. Other constructs of interest that emerged, having direct relevance to this study, were incorporated into the explanation building process.

The explanation building process also involved the identification and addressing of possible *rival explanations*. For example, Hall-Tipping's (2011) claim, based on nanotechnology research, that "the grid of tomorrow is no grid" would

seem to offer an alternative perspective on wireless grids. The researcher remained open to the possibility that wireless grids have, over the past decade, been eclipsed by other technologies. Similarly the researcher remained open to evidence of the unintended consequences of wireless grid and AmI environments and associated unexpected possibilities.

Criteria for Interpretation of Findings

Criteria for the interpretation of findings included: a) the ratio of WeJay beta trial/demo viewer participants who: generated new ideas; implemented one or more of these ideas; determined that the idea was not yet implementable; or determined that new uses can be made possible by the context b) frequencies of interactions and c) extent of other emergent behaviors, attitudes, patterns and activities.

As criteria for interpretation of case study findings, Yin (2009:35) insists that theory development must be part of the research design and it is this theory development that guided the data collection process. Yin (2009:33-34) also suggests the alternative strategy of determining and addressing rival explanations emerging from data (e.g., interview, focus group, and survey data). This research study began with several theoretical propositions and remained open to other rival explanations. During data collection the researcher investigated the propositions, anticipated rival explanations, and allowed for other explanations to emerge.

Important criteria for the analysis of data and subsequent interpretation of findings was the assessment data provided by participants through interviews, focus groups, and surveys around 'interpretations and ideas generated' based on the

WeJay beta trial/demo viewing experience. Assessment drew upon Amabile's Consensual Agreement Technique (CAT) guidelines for judges, identified as part of Table 2 and presented here in Table 5.

Table 5: Consensual Agreement Technique (CAT) Guidelines for Judges

Judges:	- be provided with the same materials and guidelines given to participants; - should have at least a moderate degree of familiarity with the domain in which the products were produced, and the level at which they were produced; - should view all products (or a substantial subset) before making ratings; - be told to rate products relative to one another; - work independently

Consensual Assessment Technique (CAT)

The Consensual Assessment Technique is important to this study because of its extensive use in relation to the assessment of creativity and innovativeness. Assessment is used in the sense of a product or service being judged by 'experts' to be innovative or creative. The term 'expert' is used in the sense of 'domain knowledge', as in, "familiarity with the domain of endeavor in which the product was made" (Amabile, 1996:61). Amabile uses the example of artistic products such as cartoons, haiku, and collage, finding "high levels of agreement in subjective judgments of creativity." In the context of innovation, Verganti (2009) makes use of the 'expert' in relation to interpretation and meaning generation as a creative and innovative activity. For the purposes of this study, the research questions and four propositions were considered in relation to the constructs of creativity, innovation and context awareness and their dimensions and measures, as identified in Table 3.

This study entertained the possibility of extending the use of Amabile's Consensual Assessment Technique (CAT) beyond the assessment of products and services to include 'ideas'. Amabile encourages expansion of the use of the CAT tool arguing that it "can be adapted for very different kinds of tasks" (1996:62). Amabile claims that "judges should work independently" (1996:79) and as such, expert assessments may be elicited as part of the interview protocol. Amabile's claim was made in 1996 and it is now 2011/2012 and a very changed environment has emerged in social media spaces perhaps opening new possibilities for assessment. The CAT could be suitable to this study because the technique allows the researcher and other individual participants to act in the role of 'expert' in assessing the creativity and innovativeness of ideas. Further, the very nature of social networked environments such as WeJay, allow for the emergence of 'experts' through the collaborative, interactive, and sharing activities of participants. Indeed, changed social networked environments could contribute to knowledge about new modes of use for the CAT. It was hoped that the chat feature of WeJay, for example, may reveal 'expert' assessments through participant interactions. However, data from the chat feature was not available to the researcher in this iteration of the WeJay product. In the case of focus groups, the possibility of other focus group members providing expert assessments of each others' work was considered while in the case of interviews and surveys, expert assessments were taken into account. Self report data provided through the various collection methods, although not part of the CAT, was considered in relation to the interpretation of findings.

Amabile (1996:65) noted the possible difficulty of applying the CAT "to products that are at the frontiers of a particular domain of endeavor" and it could be that wireless grid enabled applications such as WeJay fall into this category. Amabile (1996:65) proposed that such "products are so different that no one is sufficiently familiar with the domain to serve as an 'appropriate' judge - perhaps because the products create their own new domain." Indeed, this is precisely why the CAT may yield useful data since this study has access to WiGiT members who may be considered 'expert' in the new domain of wireless grid enabled applications. This study also had access to iSchool faculty and students considered expert in new social media such as that proposed by the WeJay social radio application under study.

Amabile (1996:79) argues that because the CAT focuses on "actual products made by actual subjects it affords greater validity." Baer argues for the use of domain experts rather than university students (Henshon, 2009) when using the CAT. Participants in this study consisted largely of faculty, doctoral, and masters level students. In many cases doctoral students were highly skilled domain experts. In the case of the present study the focus was upon actual ideas generated during use within an actual product environment. However, because radio shows could not be made persistent in this iteration of the tool, the shows (as artifacts) were not available for assessment using the CAT. Through the various data collection methods, ideas (as artifacts) emerged and this information was used during content analysis in the development of the coding glossary. Further, this information was

used to inform assessments of creativity and innovation, although the CAT was not fully implemented in this study.

Data Collection and Analysis

Attentive to the importance of consistency, validity, and reliability, data collection and analysis for this research study was guided and supported by the key case study elements of: a) a case study protocol; b) a case study database; and c) a chain of evidence (Yin, 2009).

Data Collection Process

The importance of referring back to the broad research question, the research questions, and the underlying propositions under study was critical during data collection to maintain focus. As distinct from a survey instrument containing questions intended for survey participants, the various protocols developed for this study (e.g., focus group protocol and interview protocol) were intended as tools for the investigator (Yin, 2009:86), ensuring that questions were asked and the study was kept on track during the data collection process. Another key protocol developed for this study was the WeJay Study Protocol to ensure consistency in working with study participants.

Table 6: Consensual Assessment Technique (CAT) Guidelines for Participants

Participants:	- tasks should allow variability in acceptable responses; - all participants be provided with the same materials and guidelines; - the task should be one where most participants can produce an observable product or response.

The WeJay Study Protocol was attentive to the guidelines provided by Amabile (1996:79) for participants when using the Consensual Assessment Technique (CAT) as indicated in Table 6.

WeJay Study Protocol

The protocol for this study of the wireless grid WeJay social radio application supported a beta trial scenario and a demo viewer scenario. The WeJay Study Protocols appear below.

WeJay Study Protocol: Beta Trial and Demo Viewer Participants

a) WeJay social radio beta trial and demo viewer participants were introduced to the wireless grid application and its generic characteristics (e.g., capabilities, features, and functionalities) through a brief video of the product made available following consent to register and participate in the study.
b) Participants were instructed to create or imagine creating a radio station for the purposes of collaboration, sharing, and interactivity.
c) Key functionality within the beta trial WeJay social radio application was tracked and delivered to a database enabling activity data analysis by the researcher (e.g., show creation, profile creation, etc.)
d) Using Amabile's (2011) notion of 'the progress principle' the data activity collection method was augmented with the option to contribute to a daily diary enabling participants to contribute daily thoughts around use of the product. Amabile developed a protocol or 'guidelines for daily journaling'

(2010:189) and emphasized the richness of the data that emerged from this technique for both the researcher and the participant.

e) Focus groups and interviews were conducted with WeJay participants to gather data about the product based on constructs and measures in Table 3.

f) Keeping in mind Amabile's Consensual Assessment Technique (CAT) the researcher as focus group facilitator and interviewer monitored for expert assessments of novelty, creativity, or innovativeness. In the case of focus groups, participants were monitored to see if they provided expert assessments of each others' work.

Although a type of self-report, the daily diary could constitute Reis's (2011:4) concept of 'daily life protocols' and the "rationale for daily life measures" of real life thought and interaction. Reis argues that "daily life methods allow researchers to describe behavior as it occurs in natural contexts" and thus "make available a different kind of information ... that provides a novel and increasingly valuable perspective ..." Reis (2011:5) refers to 'ambient attributes of the physical environment' to which one could add, *ambient attributes* of the virtual or wireless grid environment.

As information was provided, investigative and interpretative skills were critical in discerning whether converging or contradictory details were emerging (Yin, 2009:71-72). In the latter case, further investigation was necessary involving email follow up with participants, review of beta trial activity data, and the

distributing of a survey instrument. As such, data analysis and interpretation occurred concurrently with data collection.

Research Site, Sampling Frame, Selection & Demographics

The sample for this research study was early stage of diffusion where these first users undertook to use the WeJay wireless grid social radio application, based on early stage usage capabilities while exploring possible adaptations. Tellis (1997) argued that "Case study research is not sampling research" referring to the work of Yin, Stake, and Feagin for further support. While Tellis believed that case selection is important so as "to maximize what can be learned", it has been noted by Curtis, Gesler, Smith, & Washburn (2000) that the sampling aspect of case study research "seems to receive less attention in methodological discussion." Curtis et al. argue for the importance of discussions of *sampling* which they take to mean the *selection of cases*. To this end, Curtis et al. (2000: 1003) offered an adaptation and interpretation of six criteria identified by Miles & Huberman (1994) which they argue are important for the rigour of case study research – *sampling parameters*; *relevance to conceptual framework*; *potential to generate rich information*; *analytic generalizability*; *potential to generate believable explanations*; *ethics*; and *feasibility* (Curtis et al., 2000:1004). In alignment with the thinking of Curtis et al. and Miles & Huberman, this current research study includes a discussion of sampling and the particular composition and context of this case.

Trochim (2006) advises that a *sampling frame* can be “a procedure that you follow as the actual basis for sampling” while a *sample* is referred to as “the group

of people who you select to be in your study." Using the email lists for a) members of the Wireless Grids Innovation Testbed (WiGiT); b) iSchool faculty and students; and c) Newhouse faculty, a recruitment letter was sent via email to all individuals. Babbie (2010:208-209) advises that the sampling frame "be consonant with the population" under study – "a list of the elements composing the study population."

For this study, to ensure that data was being collected from appropriate individuals, sample inclusion criteria were developed and identified. *Nonprobability sampling* is used where, according to Leedy & Ormrod (2010:211) "the researcher has no way of forecasting or guaranteeing that each element of the population will be represented in the sample." Using a type of nonprobability sampling, *purposive sampling*, described as 'sampling with a purpose in mind' (Trochim, 2006), this study sought to gather information from individuals who are highly knowledgeable about wireless grids (e.g., WiGiT members) on the one hand, and on the other, from individuals who are less familiar with wireless grids but well informed about social media for education (e.g., iSchool faculty and students, Newhouse faculty). Within purposive sampling, this study draws upon *theory or concept sampling* (Creswell, 2012:208) enabling the beta trial experience of WeJay participants to be understood in relation to the sensitizing literature on emergence theory and the constructs of creativity, innovation, and context awareness. Many techniques are available to the researcher within purposive sampling. For example, because the *activity data method* revealed that many different ideas and possibilities were being generated during the WeJay beta trial usage, *maximal variation sampling* was employed to

engage participants in interviews and focus groups to look more closely at the type and nature of creativity, innovation, and idea generation, as well as a few instances of the noticeable absence of these. This type of sampling acknowledges that we may have much to learn from those not considered to be 'experts' (Trochim, 2006). The researcher also undertook some *expert sampling* bringing together those deemed to be particularly knowledgeable about wireless grids applications and social radio and other educational social media. To ensure that critical input was not missed, *snowball sampling* was used whereby these experts or key informants recommended other individuals for interview or focus group participation.

a. Sample inclusion criteria

Inclusion criteria for this research study consisted of the following:

1. Current *students* and *faculty* in selected contexts of Syracuse University
2. *Age* diversity beginning at 18 years and older
3. *Gender* consideration and perspectives
4. Focus on people, information, and/or technology within the domain *area of study* by students and *area of research* by faculty and students
5. Familiarity and expertise with wireless grids and/or new social media for education

More specifically, for focus group and interview participation, individuals believed to be 'key informants' (Yin, 2009:107) were sought. Yin uses the term 'informants' while Babbie (2010:195) distinguishes between informants ("someone well versed in the social phenomenon" under study) and respondents (participants in the study). The current study sought 'key informants' from among study participants. This determination was made based on:

i. beta trial activity data usage where a high degree of activity, interaction, and artifact creation was noted
ii. beta trial activity and/or help data where interaction, ideas, or issues were raised
iii. suggestions made by beta trial participant and interviewees from focus groups and interviews

b. Contexts

This research study consisted primarily of two contexts based on the potential to provide the greatest opportunity for gathering useful data specific to the research questions and propositions. A third context was actively sought and the opportunity arose to gain entry to a fourth context. For the most part, all of these contexts are overlapping and the addition of each provided for increased participation in the study as well as increased domain skill and coverage.

1. Syracuse University Wireless Grids Innovation Testbed (WiGiT) Lab members (including other universities) having familiarity and expertise with wireless grids

2. School of Information Studies (iSchool) students and faculty having familiarity and expertise with social media for education

3. Newhouse School of Public Communications faculty and students having familiarity and expertise with social media for education.

4. Whitman School of Management faculty and students having familiarity and expertise with innovation in relation to social media and emerging technologies

Since the WiGiT Lab is located within the iSchool, it was understood that WiGiT members may also be part of the iSchool and vice versa. Further, WiGiT membership is interdisciplinary encompassing faculty and students in other contexts (e.g., law, communications, business, engineering, computer science, etc.).

c. Matching Sample Data across Methods

Sample data was matched across the four methods of:

1. *Activity data* (database capture of data from WeJay participant activity and interactions)
2. *Interviews*
3. *Focus Groups*

4. Survey

During data collection and analysis, triangulation across the four methods occurred to ensure consistency and corroboration. Where confounding data appeared, within or across methods, further investigation was conducted to account for inconsistencies that emerged. Further investigation involved looking at several additional types of literature, most particularly, emotion in social networking environments, interaction in intelligent technology environments, and readiness (of software).

d. Gender Balance

Consideration was given to *gender balance* in the sample, providing the option of later exploring this variable, perhaps in ad hoc analyses which, given the small sample size, was not feasible for this study. In any case, gender data was gathered as part of the collection of demographic data, a condition of registration for the beta trial and participation in the research study. In relation to creativity, Amabile (1996:78) claims to have "found a marginally significant sex difference" among males and females in earlier studies. Reference is also made to some 'intriguing' research on teacher perceptions of creativity in school children (Amabile, 1996:205) by gender, among other things, and the 'detrimental effect of competition on creativity' by gender (Amabile, 1996:240).

e. Sample Size

Increased levels of specificity in design require an increase in the *sample size*. The current research design focuses upon primarily two contexts. Marshall

(1996:523) notes that sample size for qualitative research tends to be small and that appropriateness of size "is one that adequately answers the research question." In addressing the issue of sample size, Marshall points to considerations such as the complexity of the research question and data saturation where "new categories, themes or explanations stop emerging from the data." In a study of PhD dissertations using qualitative interviews, Mason (2010) found the mean sample size to be 31, with case studies "having the highest mean number of participants" as 36. Citing Jette, Grover, & Keck (2003), Mason notes that "expertise in the chosen topic can reduce the number of participants needed in a study" and citing Lee, Woo, & Mackenzie (2002), Mason observes that "studies that use more than one method require fewer participants." Many researchers seem to agree that saturation often occurs at a lower sample size level, generally not exceeding 60. Creswell (2013:209) advises that sample size for qualitative research may range from 1 or 2 to 30 or 40 and that the "overall ability of the researcher to provide an in-depth picture diminished with the addition of each new individual or site."

For quantitative studies Creswell (2012:146-147) advises that larger sample sizes be used to minimize sampling error. For surveys, Creswell recommends 350 participants and for correlational studies, 30 participants (per variable), suggesting that these estimates can be improved upon by the use of sample size formula tables which take into account a variety of factors. Regarding a survey, Leedy & Ormrod (2010:213-214) advise that for smaller

populations where n=100 or less that the entire population be surveyed; where n=500 (plus or minus 100) that half the population be surveyed; at n=1500 around 20% of the population is surveyed and beyond 5000 a sample size of 400 is sufficient.

Taking into consideration this guidance on sample size, the current study focused on two contexts with a conservatively estimated sample size in the range of n=90. It was thought that adding a third context would increase this to n=160. In fact, the achieved sign up for the study was n=71 and of this, the actual number of responding participants was n=34. Variables of interest in relation to the key constructs of creativity, innovation, and context awareness included: age, gender, prior use of social radio tools, student/faculty, and subject area (domains). The sample size achieved for this study does not support the development of statistical significance or generalizability given the different constructs and variables of interest. However, quantitative data drawn from database activity data is used to summarize and describe the data and what it shows in the form of descriptive statistics (Trochim, 2006). In turn, this quantitative data is matched up with qualitative data providing supportive evidence for interview, focus group, and survey data findings. In this way, quantitative and qualitative data are analyzed and interpreted together to infer meaning.

This study included two focus groups with a total of six participants (the original estimate was 16-24), 22 interviews (25-30 was the original estimate), 20 survey respondents, and activity data gathered from 42 WeJay beta trial users. A

total of 34 individuals participated in one or more of the focus group, interview, and survey data collection methods as illustrated later in this chapter in Table 12. All data collection methods consisted of a mix of faculty and students with a higher proportion of students, as anticipated.

Recruitment

Participants were recruited for the study by sending a 'recruitment message' (Appendix E) inviting participation in this research study.

Exclusion criteria included:

a) Students under the age of 18;

b) Individuals involved in parallel or subsequent deployments of the WeJay social radio application that do not constitute an 'initial deployment'

Initially the 'recruitment message' was intended to be distributed in the following ways:

a) As a mass emailing to students, faculty, and staff across the Syracuse University campus (including distance)

b) As a 'tweet' from the Syracuse University Twitter account, containing a link to the 'recruitment message' on the Wireless Grids Innovation Testbed (WiGiT) Lab website at the Syracuse University, iSchool

c) As a 'tweet' from the Wireless Grids Innovation Testbed (WiGiT) Twitter account, containing a link to the 'recruitment message' on the Wireless

Grids Innovation Testbed (WiGiT) Lab website at the Syracuse University, iSchool

d) As a news item on the Wireless Grids Innovation Testbed (WiGiT) Lab website (Internet) at the Syracuse University, iSchool

e) As the content of an article in the Syracuse University Daily Orange newspaper

f) As a new item in the SU Today News Service

However, given the 'state of readiness' of the WeJay social radio application, recruitment was undertaken in a more limited and controlled fashion. It should be noted that prior to initiating the research study the researcher raised several issues with the WeJay developer concerning the privacy, stability, data availability, and functionality of the tool. Readiness related issues and constraints are outlined in Table 7.

Table 7: WeJay Readiness Issues and Constraints

	WeJay/Weheartradio – Issues	**Constraints**
a)	Designated WeJay/Weheartradio.com research private space to conduct the beta trial	Only a common public space was available
b)	Persistence of shows	Shows available only during airing
c)	Chat data availability to researcher	Chat data not available
d)	Data available to researcher at regular intervals	Data dumps irregularly available
e)	System stability and availability	System downtime (April 20-27)

Initially the recruitment message was sent to members of the Wireless Grids Innovation Testbed (WiGiT). Little if any response was received to this recruitment email perhaps because: a) it appeared to be perceived as 'spam' and b) it was

couched in the terminology of research, rendering the practical uses, application, and overall fun of the research study less evident to those being recruited.

The researcher decided to take a more personalized approach, establishing email contact with each individual and evolving the recruitment message. As a WiGiT member, the researcher was provided email contact information for WiGiT members. Based upon the response and use experience of WiGiT participants, a decision to extend the recruitment message to the School of Information Studies was made. The Principal investigator is a faculty member at the Syracuse University iSchool and the student researcher is a Syracuse University iSchool doctoral student, enabling access to this segment of the population of students and faculty for this study.

Encouraged by those signing up for the study, recruitment was extended to S. I. Newhouse School of Public Communications faculty through contact information provided at the Newhouse website. One Newhouse faculty member offered to encourage student participation in the study while another offered to discuss, via Skype, the possibility of social media contact with Newhouse students via Twitter. IRB (Institutional Review Board) approval for recruitment via social media was sought and approved. Testing of this approach yielded no response from current Newhouse students.

Through a Whitman faculty member the recruitment message was sent to 90 students. Evolving the recruitment message to attract individuals from the varying contexts, the term ambient intelligence (AmI) was extended to incorporate the

concept of *ambient journalism* for Newhouse individuals and to *ambient business* for Whitman faculty and students (Appendix F – Alternate Recruitment Communications).

An Excel spreadsheet tracking all individuals recruited and responses received was maintained. In total, invitations to participate in the research study were sent through direct email contact to 1546 individuals (207 faculty and 1339 students). Indirect contact through faculty encouragement brought the recruitment total to approximately 1666 individuals (e.g., a Whitman faculty member encouraged 90 students to participate and a Newhouse faculty member encouraged an unspecified number of students to participate). Recruitment counts by context and individual type are presented in Table 8.

Table 8: Recruitment Counts by Type and Context

Recruitment (n= 1,666+)			
Context	**Faculty**	**Students**	
WiGiT Members	19	13	
iSchool	58	1325	
Newhouse	129	Indirect – (faculty encouraged)	30+
Whitman	1	Indirect - (faculty encouraged)	90
Visual & Performing Arts	0	1	
Totals	**207**	**1339**	**=1546 +** 120+
			= 1,666

Participant Involvement

When individuals elected to participate in the research study they responded by following a link to a website developed by the researcher where they could register for the study. Additional information was provided in a link to an electronic consent form. The study registration process used a Google form to gather demographic information about the registrant in a live spreadsheet (Appendix G).

When a registration occurred the researcher vetted the information and registered the participant at the Weheartradio.com site with an anonymized, unique username and photo. The study participant was then directed to the Weheartradio.com website (Appendix H) where, using the login details provided by the researcher, the WeJay application could be downloaded and installed for use (Appendix H). Any activity undertaken by the registrant from this point to the end of the beta trial was tracked and made available to the researcher by the WeJay developer in 'data dumps' at 5 intervals throughout the trial period (e.g., 2 February, 10 February, 20 February, 5 March, 6 June).

Demographic Data

A total of 71 individuals registered to participate in the research study. As part of registration sign up for the research study, demographic information was collected including gender, age range, and participant type. Response to age was optional in an attempt to minimize barriers to participation. Consequently, demographic data for age is extensive but incomplete. The age range for the 45 males who signed up to participate in the study was 18 to 60 while the age range for females was 19 to 57. A total of 12 faculty signed up, 9 males and 3 females. Doctoral students totaled 14 with 9 males signing up and 5 females. The majority of students who signed up were graduates at the master level, totaling 29 while undergraduates totaled 16. This information is summarized in Table 9.

Table 9: Summary of Research Study Demographics – Initial Sign Ups

Type	Male	Age Range	Female	Age Range
n=71	45	18 - 60	26	19 - 57
- Faculty	9	40s; -	3	-
- Doctoral	9	30s;50;60s; -	5	20s;30s; 50s
- Graduate	16	20s;30s;40s;50s	13	20s;30s
- Undergraduate	11	Teens; 20s; -	5	Teens; 20s; -
Incomplete data (-)		14		7

For those who signed up to participate and remained committed and responsive throughout the study, research study demographics including gender, age range, and participant type are summarized in Table 10. As illustrated, it is important to note that participation in the study dropped from 71 sign ups down to 34 active participants (Leedy & Ormrod, 2010:216).

Table 10: Summary of Research Study Demographics – Actual Participants

Type	Male	AgeRange	Female	AgeRange
n=34	20	22 - 60	14	20 - 57
- Faculty	3	40s; -	3	-
- Doctoral	7	30s;50s;60s;-	5	20s;30s;50s
- Graduate	8	20s;30s;50s	6	20s;30s; -
- Undergraduate	2	20s	0	
Incomplete data (-)		4		4

A key constraint articulated by many participants, whether respondent or non-respondent, was the element of *time* which is referred to as *participant availability* for the purposes of this study. Incentives were not provided for participation in the study, however, participants were informed of the valuable contribution to research that they would be making through their participation in the study. Compared to downloading an app (application) for a mobile device where installation is automatic, downloading and installation of the WeJay application was considerably

more time consuming and error prone due operating system incompatibilities and other constraints. As such, factors such as more time, learning, and 'figuring out' what to do were required on the part of participants.

Recruitment, retention, and adherence challenges in research studies although well documented in the health sciences literature since they can present "serious threats to both the internal and the external validity of a research study" (Gul & Ali, 2010), appear to be less discussed in the information sciences literature.

Graphically, study sign up and actual participation by type, appears in Figure 17 A-1 (Appendix I) with the highest drop off occurring among grads, undergrads, and faculty while interest and participation by doctoral students showed a higher level of persistence. Graphically, sign up and actual participation by gender appears in Figure 18 A-2 (Appendix I) with a higher percentage of males signing up than females although females showed a slightly higher tendency to remain engaged with the study. Graphically, sign up and actual participation by age appears in Figure 19 A-3 (Appendix I) with a span of six decades noted among sign ups, dropping to five decades among actual participants. Analyzing the age data more closely, Table 11 shows exit rates are highest among teens (100%), followed by those who chose not to provide age data (62%), and then those in their 20s (52%). Individuals in their 50s and 60s showed no exit rate (0%) and those in their 30s showed an exit rate of 42%.

Table 11: Participant Exit Rate by Age

Age Range	Exit Rate
Late teens	100%
20s	52%
30s	42%
40s	50%
50s	0%
60s	0%
Unknown	62%

This study began by involving participants in a 30 day beta trial where *activity data* was gathered. The researcher believed that time was of the essence. As participants registered and downloaded WeJay, follow up contact was made with each participant, inviting further participation in the form of focus groups or interviews. Because beta trial users may use the product once or twice and not have the time or motivation to return for further use, the researcher believed it was important to follow up on the use experience as soon as possible. In an attempt to arrange focus groups and interviews with participants following one week of beta trial use, the researcher found that many individuals required more time to engage with the WeJay tool, due to their already busy schedules. The researcher continued to follow up with participants and the 30 day beta trial was allowed to run for four months.

Training

A WeJay Resource Center space was made available to participants containing: a brief instructional video about WeJay describing the download/install process; a video outlining the generic characteristics (e.g., features, capabilities, and functionalities); a sample of original audio content; instructional tips; a diary form

to submit use experience and reflections; and sign up forms for interviews, focus groups, and the survey (Appendix H). The researcher offered to respond to any inquiries regarding the product, resulting in the generation of email data during the study.

A combination of quantitative and qualitative data collection methods were used for this research study as described below.

Qualitative Data Collection

Qualitative data collection methods for this study included focus groups, interviews, and open ended survey questions. Protocols were developed for focus groups and interviews (Appendices A-B) and a survey instrument (Appendix D) to gather survey data. Email and diary data also formed part of the qualitative component of the study. Critical to responding through the interview, focus group, and survey process was exposure to the WeJay product and the associated Weheartradio.com website where: a) WeJay was downloaded and b) shows being broadcast from WeJay could be made available more broadly for live streaming. Two brief videos were made available to participants to provide: a) a guide to the download and installation process and b) a demonstration of product use. In instances where WeJay was downloaded and installation failed, or functionality failed following installation, the videos provided participants with exposure to the product.

The use of each qualitative data collection method for this study is discussed below.

Focus Group Rationale

Regarding the use of focus groups, Liamputtong (2011) notes the resurgence of focus group use in qualitative research, citing Kroll, Barbour, & Harris (2007) in their claim that the method "can provide results quickly." Citing Morgan (2002), two types of focus group research are identified: a more structured approach typically used in market research and a less structured approach used in social science research. In the latter case, group interaction is encouraged with less focus on the moderator who facilitates rather than controls the discussion. Liamputtong argues that: a) "the aim of focus groups in social science research is to understand the participants' meanings and interpretations" and b) the less structured approach lends itself to "the social construction of knowledge and praxis/practices." This is in keeping with both the seeking of 'meaning and interpretation' and the social constructivist approach of this research study. Liamputtong, citing Wilkinson (2004), describes a focus group as "an informal discussion among a group of selected individuals about a particular topic" and as such, has been referred to as 'a group interview' or a 'collective conversation' (Kamberelis & Dimitriadis, 2008) "with more than one participant per data collection session." Because creativity in online social media environments was one of the key constructs under study in this research, it is worth noting here that in advancing a 'theory of collaborative creativity,' Aragon & Williams (2011:1877) cite Dunbar (1997), who claimed that "conversation was a driver of collaborative creativity." The online collaborative conversations that occurred during the WeJay beta trial can be continued and enriched among

participants in the focus group environment. Liamputtong notes the size of focus groups as typically 6-8 individuals where the objective is not consensus but rather, citing Hennink (2007), to "encourage a range of responses which provide a greater understanding of the attitudes, behavior, opinions or perceptions of participants on the research issues." This 'range of responses' notion is in keeping with the emergent attitudes and behaviors which this study sought to elicit. Rather than consensus, the objective of this type of study was one of understanding. Finally, Liamputtong (2011), citing Conradson (2005:131), notes that focus groups "offer possibilities for researchers to explore 'the gap between what people say and what they do' …" which was particularly relevant in this research for comparing activity data (what people do) with focus group, interview, and open ended survey data (what people say).

Bazeley (2002), citing Morgan (1993), notes that "Interviews and focus groups generate different information, reflecting public versus private views" and citing Kaplowitz (2000) on interviews, which enable a "preparedness to deal with more sensitive issues." Given the potentially transformative and disruptive nature of wireless grid enabled applications, the researcher was aware that WeJay may conjure up one or more sensitive issues for participants, as in, privacy and trust issues. Similarly, the researcher was aware that the invisible nature of ambient intelligent (AmI) environments and the associated awareness capabilities related to presence, location, and resources, may give rise to sensitive issues for participants. Finally, the researcher was aware that these issues of sensitivity may pertain also

to the unintended consequences and unexpected possibilities dimensions of this research study.

Interview Rationale

Boyce & Neale (2006) note that in-depth interviews represent a research technique used with "a small number of respondents to explore their perspectives" to garner more "detailed information about a person's thoughts and behaviors." These authors add that such information could provide context for 'outcome data' to develop a more comprehensive picture of the research questions and propositions under study. Boyce & Neale further suggest that interviews can be used in place of focus groups where a participant is not able to take part in a focus group or where there is a need to distinguish individual from group opinions. In this research study, the focus was primarily upon the group interaction experience in the WeJay environment. However, being able to distinguish individual from group opinions was relevant for the assessment of ideas and of 'idea generation', in considerations regarding the Consensual Assessment Technique (CAT).

Further supporting the use of interviews for this study, Kvale & Brinkmann (2009:116) argue that this method is "particularly suited for studying people's understanding of the meanings in their lived world, describing their experience and self-understanding, and clarifying and elaborating their own perspective on their lived world." Social media tools are everywhere present in the academic world of students and faculty and this study sought to learn in greater detail about the WeJay use experience within this context. Yin (2009:106) regards interviews to be

an ‘essential source’ and “one of the most important sources of case study information.” For Yin, the interviewer must work on two levels at once so as to follow one’s ‘line of inquiry’ while being ‘friendly’ and ‘non-threatening’ with open-ended questions and the use of ‘how’ questions to get at ‘why’ questions. Kvale & Brinkmann (2009:82) see the qualitative interview as a craft requiring a high degree of skill where "knowledge is produced socially in the interaction between interviewer and interviewee."

Quantitative Data Collection

Quantitative data collection was conducted using the activity data collection method as another source of evidence. Two qualitative data collection methods used in this study (interviews and focus groups) contributed to the development of a survey instrument for the gathering of quantitative and qualitative data.

Activity Data Rationale

As described in the research design section of this document, activity data provided real time usage information, captured to a database as participants engaged with the WeJay beta trial application and interacted in the AmI and wireless grid environment. Activity data represents actual use, providing evidence of what participants really did, filling the gap referred to earlier in the discussion of focus groups. Liamputtong (2011), citing Conradson (2005:131), discussed the gap 'between what people say and what they do', making way for the use and value of activity data (what people do) to be employed in comparisons with focus group, interview, and open ended survey data (what people say).

Survey Rationale

Although the use of a *survey* as a fourth method would contribute additional value to this study, the three methods used (interviews, focus groups, and activity data) contributed sufficient rigor for this initial pre-standards beta trial. With the extension of the beta trial period from 30 days to four months, the opportunity arose to develop and pre-test a survey instrument among these first pre-standards beta trial participants to measure their use experience (Moore & Benbasat, 1991; Kahveci, 2007). Focus group and interview information was highly valuable in contributing to the refining of questions for the survey instrument (Boyce & Neale, 2006). As such, the researcher believed there could be some value in conducting this initial survey in what could become a series of such surveys in the establishment of trend lines (Creswell, 2012:376, 379). It was also believed that the survey method could provide another perspective on the data (Marshall, 1996:524) and that such an instrument could serve as a valuable tool for researchers to further refine when: a) studying the deployment of future WeJay iterations and other wireless grid enabled applications; and b) studying one or more of the constructs of creativity, innovation, and context awareness in relation to ambient intelligence (AmI) and wireless grid enabled applications.

Pre-Testing of Data Collection Protocols & Instruments

A critical part of preparing to conduct the research study was the pilot-testing of protocols. For this research study the interview protocol and the focus group protocol were each tested in different ways. The protocols were tested, not

with potential participants in the main study but with other expert and comparable individuals, in order to elicit feedback to improve the clarity of measures for the main study.

Specifically, the interview protocol was tested, via Skype, with another student in my cohort, Sarah Chauncey, who had used the WeJay beta trial product. Chauncey and the researcher, together with four other WiGiT students, participated in a 'beta of the beta' trial of the product in September 2011. Chauncey was also conducting another parallel research study focused on a beta trial of the WeJay product in a specialized high school setting.

During pilot-testing of the interview protocol, seeming redundancy was found among questions although, rather than collapsing questions 2 and 3; 5 and 6, all questions were kept in an effort to probe further, in slightly nuanced ways. In the case of questions 1, 4, 5, and 6, slight rewording for clarity was undertaken. Four new questions were introduced near the end to elicit participant recommendations (questions 14-17). Questions 1-3 of the Focus Group Protocol, Part B were introduced into the Interview Protocol as questions 20-22 to elicit participant recommendations. The interview protocol took 10 minutes to administer with an additional three minutes when the recommendation questions were added, increasing the interview time to 15 - 20 minutes.

Following refinement, the interview protocol was tested with one Canadian female university student (University of Victoria (UVic)) at the undergraduate level in psychology/environmental studies. Unfamiliar with the WeJay beta trial product,

a four-minute demo video was prepared (using Camtasia and Screencast.com) based on a remix of a demo developed by WiGiT students during the September 2011 'beta of the beta trial' and more recent slide content excerpted from a presentation by McKnight (December 2011) to Syracuse district school officials. This demo was used to sensitize the UVic student to the application, inviting her to imagine the product, based on additional brief descriptive elements from the WeJay developer as follows:

a) WeJay is a social radio for distributed audio sharing (participatory listening experience)

b) Seeded by online Social Networks and leveraging the strengths of broadcast radio and the interactive capabilities of the Internet

c) Groups program online radio streaming from computers, tablets, or phones

d) Instant message based chat and activity streams based on friends / preferences

e) Decentralized – local & global – Internet radio station(s)

f) Tracks music usage with interactive social networks (e.g., Facebook) based on existing industry standard licensing models

g) WeJay user as listener, broadcaster/station owner, radio show creator, with co-hosting of playlists

h) Supports major mobile platforms

The student was highly engaged and responsive to the demo and the revised interview protocol. For this interview protocol test via Skype, a version was developed for 'demo participants'. It was found that the revised protocol expanded the interview time to slightly less than 30 minutes. Protocol testing revealed that responses yielded data relevant to the research questions and propositions, the

conceptual model, and the key constructs of interest – creativity, innovation, and context awareness.

Using the same demo video, a mini-focus group was organized, in person, to test the focus group protocol with three individuals: a female undergraduate UVic student in her fifth year of an English Literature/French Literature program; a female former academic librarian; and a male engineer/physicist/researcher. Together the three individuals watched the demo video and then responded to focus group protocol questions posed by the researcher. The focus group protocol was administered in 32:18 minutes. Participants agreed that the WeJay tool was interesting and compelling but an actual hands-on use experience was preferred. Although disparities of age, social media tool use, and contributions to the discussion existed between the student and the other two participants, interactive discussion occurred and common prior use experiences and understandings were found in relation to podcasts, information sharing, and the imagined value of real time interactivity.

The video demo, followed by the focus group interview, appeared to stimulate mutual learning, discovery, engagement, imaginative exercises, desire to learn more about the use potential of social media tools, and other creativity related activity, in keeping with the intent of the focus group instrument. The focus group and interview protocols were again revised introducing slight rewording and repositioning of questions. The revised interview and focus group protocols were reviewed by another doctoral student for clarity, ease of understanding, alignment

of questions with the conceptual model, alignment of questions with measures and considerations of the Consensual Assessment Technique (CAT), leading to slight revisions. An additional question was included in both protocols by the researcher.

The focus group protocol was then pilot-tested in an online session using Adobe Connect with five university students: four male and one female, attending colleges in the state of New York, with the exception of one male student attending university in the United Kingdom (UK). Another doctoral student (Sarah Chauncey) acted as a co-facilitator during the session and was face-to-face with the group of students who were studying in diverse domains (e.g., chemistry, biochemistry, broadcasting/design, and environmental studies). Chauncey briefly exposed the students to the WeJay product. The researcher then came online with the students and the co-facilitator and the students viewed the 'demo video' of the WeJay product. The researcher administered the focus group protocol during a session lasting one hour. The students were very engaged; responsive; wanted to ask many questions from the moment they viewed the product; were surprised that they liked the product; wondered if there was a cost; wanted a beta trial at their college/university; in their assessment 'novel ideas' had been generated through the WeJay exposure experience; and wondered if they would be able to have a copy of WeJay. The focus group protocol was found to be effective and one additional question was introduced.

During the third month of the research study a survey instrument was developed to measure the use experience of participants based on information and

insights from several interviews and one focus group. The instrument was peer tested and reviewed by a three member Doctoral Committee which led to the introduction of open ended questions following 6 survey questions, matrix questions, and the addition of 3 items for a total of 25 questions. The survey was again peer tested and then reviewed by Committee members resulting in the addition of 3 items for a total of 28 survey questions. The survey instrument was then successfully submitted to the Institutional Review Board (IRB) for approval upon realization that additional time was available to explore this potentially valuable means of expanding perspectives on the data.

Pre-testing the data collection protocols and survey instrument proved to be a critical step in the research process. This activity contributed greater alignment of the protocols and the instrument to the research study, resulting in more focused and richer data.

Data Capture Plan

A plan for the capture of data is outlined in Figure 7 which relied primarily on recruiting participants through the WiGiT Lab membership and the iSchool.

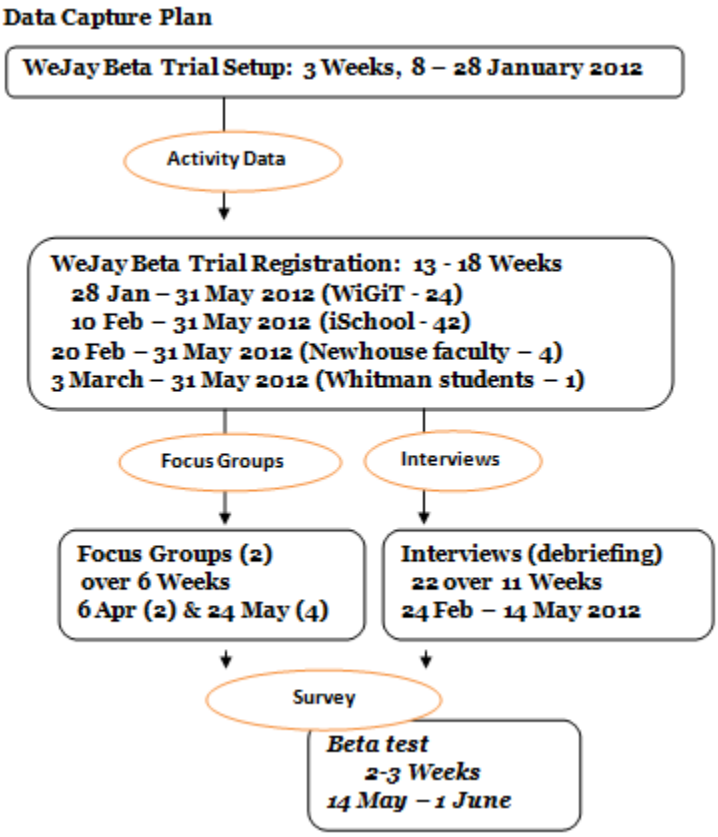


Figure 7: Data Capture Plan

The greater part of January was spent preparing for the WeJay beta trial by developing the various materials and tools in support of the trial (Appendix H). When the Weheartradio.com webspace became available for use in late January and the WeJay tool was activated, the research study began. Recruitment was initiated among WiGiT members in late January, extended to iSchool faculty and students in February, followed by Newhouse faculty in February, and to Whitman students in March. Interviews were scheduled from late February to mid May while a focus group occurred in early April and another in late May. The survey instrument was

developed, tested, and IRB approved in April and May and administered to participants from mid May to early June.

Data Collection Overview Chart

Multiple sources of evidence were drawn upon to ensure trustworthiness of the data collected. Triangulation of data sources was conducted revealing whether there was corroboration or lack of corroboration of evidence, when 'events or facts' from one of the multiple data sources support or contradict each other. Yin refers to this type of triangulation as *data triangulation* (Yin, 2009:116). The concurrent mixing of methods contributed to *methodological triangulation*, a second type of triangulation (Stake, 1995; Yin, 2009:114-118) utilized in this research study. Corroborated data gathered through different methods contributed to what Yin (2009:115) refers to as *converging lines of inquiry*.

Table 12 provides an overview of the data collection methods used in this research study – activity data, interviews, focus groups, email/diary data, and survey. Each data collection method is accompanied by a description, purpose, and identification of outcomes.

Table 12: Data Collection Methods, Description, Purpose, and Outcomes

Data Collection Method	Description	Purpose	Outcomes
FOCUS GROUPS			
Focus Groups	A focus group protocol was administered to two focus groups consisting of WeJay beta trial users (Syracuse University students and faculty) who agree to participate. Focus groups were conducted on two occasions during the four month beta trial period. Focus group questions were framed around the launch and use experience of the wireless grids edgeware WeJay application.	This type of open ended focus group protocol sought to elicit what may be new and unexpected for participants using the WeJay application or viewing a demo of the application and whether innovation and creativity emerged during the use experience. The focus group protocol was also intended to elicit information about the launch experience. Focus group data contributed to survey instrument development.	Determination of whether new or transformative ideas and innovations occurred based on a combination of self report and consideration of Amabile's (1996) CAT and the notion of expert judges. Determination of whether a wireless grid application fosters an environment for creativity and innovation based on a combination of self report and consideration of Amabile's (1996) CAT and the notion of expert judges. Findings from the focus group data enable the ability to generalize to other WeJay deployments and to the launch of other wireless grid applications. Elucidation of ambient intelligence.

Data Collection Method	Description	Purpose	Outcomes
ACTIVITY DATA			
Activity Data	Observation and analysis of WeJay beta trial participant use data was conducted.	Observation of WeJay beta trial participant use provided an opportunity to note whether artifact creation had occurred using the WeJay application. Analysis of WeJay generated activity assisted in determining whether innovative and creative activity had occurred.	Determination of whether new or transformative ideas and innovations occurred based on a combination of self report and consideration of Amabile's (1996) CAT and the notion of expert judges. Determination of whether a wireless grid application fosters an environment for creativity and innovation based on a combination of self report and consideration of Amabile's (1996) CAT and the notion of expert judges. Findings from the observation and artifact analysis data enables the ability to generalize to other WeJay deployments and to the launch of other wireless grid applications. Elucidation of ambient intelligence.

Data Collection Method	Description	Purpose	Outcomes
INTERVIEWS			
Participant Interviews	An interview protocol was administered to WeJay beta trial users and demo viewers (WiGiT member and Syracuse University students and faculty) who agreed to participate. Interview questions were framed around the launch and use experience of the wireless grids edgeware WeJay application.	This type of open ended interview protocol: a) sought to elicit what may be new and unexpected for participants using the WeJay application and whether innovation and creativity emerged during the use experience. b) allowed for the emergence of themes, patterns, connections, influences, solutions, and other elements Interview data contributed to the development of a survey instrument. Information emerging from interview data contributed to a greater understanding of the launch experience of the wireless grids social radio application making it possible to generalize to broader deployments of the social radio application in parallel, coming next, or those to come in the near future.	Determination of whether new or transformative ideas and innovations occurred based on a combination of self report and consideration of Amabile's (1996) CAT and the notion of expert judges; whether a wireless grid application fosters an environment for creativity and innovation based on self report. Interview data findings enable generalizing to other WeJay launches and the launch of other wireless grid applications. Elucidation of ambient intelligence.

Data Collection Method	Description	Purpose	Outcomes
SURVEY			
Survey	A survey instrument was developed, tested and administered to WeJay beta trial participants. Survey questions were framed around key findings emerging from the interview and focus group data.	This type of generic survey questioning enabled the development of general findings about the launch experience and the use experience of the wireless grids edgeware WeJay application. Findings also provide information on the ratio of users who generated new ideas, either individually or collaboratively.	Determination of whether new or transformative ideas and innovations occurred based on self report; whether a wireless grid application fosters an environment for creativity and innovation based on self report. Findings from the survey data enable the ability to generalize to other WeJay deployments and to the launch of other wireless grid applications. Elucidation of ambient intelligence.
EMAIL/DIARY			
Diary data	A diary data form was made available to participants.	Diary data was intended to provide a space where participants could record their daily use experience.	Findings from diary data provide spontaneous use experience comments, questions, and findings.
Email data	Participants were encouraged to communicate through email about their WeJay experience. All follow up with participants occurred through email.	Email data was intended to allow a space for participant – researcher side conversations and support.	Findings from email data provide spontaneous use experience comments, questions, and findings.

To add clarity, richness, and greater understanding to the use experience, *interviews* and *focus groups* were conducted with participants who showed varying

degrees of interaction during the beta trial based on activity data, as in, none to a high degree. As the researcher anticipated, some participants were not able to get beyond the registration and download steps. The WeJay video demos made available as part of the registration process ware intended to sensitize participants to the social radio environment enabling beta trial use. The researcher recognized that the demos could also be used prior to, or as part of the interview and focus group process, where beta trial use was not experienced or, to refresh the mind of the beta trial user about the WeJay experience.

More in-depth study participation took one or more forms, based on user exploration of the WeJay social radio application as users, listeners, and creators. Beta trial/demo viewer participants were required to complete consent forms (electronic or written) to participate in any of the following ways. As:

a) Focus group participant (Appendix A: Focus Group Protocol; Consent Form 1)
b) Interview participant (Appendix B: Interview Protocol; Consent Form 2)
c) Survey participant (Appendix D: Survey Instrument; Consent Form 4)

Active and committed participation was determined by participant engagement with one or more of the data collection methods used during the research study — activity (WeJay use), interviews, focus groups, and the survey. Email and diary activity associated with WeJay use, or attempted use, was also tracked and analyzed in relation to data collection methods. WeJay activity was identified by tool use including – profile creation and editing, username editing,

location data, photo, show creation, cohosting, and social media use (e.g., Facebook). Research study participation by data collection method is summarized in Table 13.

Table 13: Summary of Participation by Data Collection Method

	Activity (WeJay)	**Interview**	**Focus Group**	**Survey**	**Emails**	**Diary**
n=71	32 (35 web)	22	6	25	41	5
- inactive	8					
- login only	18					
- incomplete				3		
- unreliable				2		
Actual	**32**	**22**	**6**	**20**	**41**	**5**
Total Active Participants = 42						
Total Active Participants responding by Interview, Focus Group, Survey = 34						

An important consideration in survey research is whether respondents are 'competent to answer' (Babbie, 2010:258). In two instances, respondents confirmed by email that they did not have time to engage with the beta product or demo and as such, their survey responses were considered to be unreliable. In three instances, survey respondents exited the survey after the first screen. Two individuals (one of whom had been interviewed) reported by email an inability to respond to the survey questions. The third individual had also been interviewed and reiterated in responses to the first three questions what had been communicated in the interview. In relation to surveys specifically but to data collection more generally, Courser (2008) discussed the notion of the *completed interview* while Basson (2008) discussed the concept of *completion rate* and the three components of *response rate*, *contact rate*, and *outcome rate*. Courser (2008:112) uses the term *breakoffs* to describe instances where "a respondent has answered fewer than 50% of the applicable questions"

and *partial completion* as instances where "the respondent has answered between 50% and 94% of the applicable questions" with 94% or higher designated as *completed interviews*. As such, the three survey responses that were deemed incomplete would constitute Courser's notion of *breakoffs* where the respondent exited the survey after the first screen of questions. In all other cases, respondents replied to all closed (required) survey questions and optional, open-ended questions (non-required) received a 42.5% response rate.

Basson (2008:112) observes that the term *completion rate* has been used to describe "the extent of cooperation with and participation in a survey." While acknowledging that inconsistent use of the term can contribute to ambiguity, Basson encourages that "readers of the literature should interpret the term with caution." Basson enumerates several uses of the term completion rate as: a)" the portion of a questionnaire that has been completed"; b) delineation of "the number of eligible individuals who do not complete a questionnaire and those who do" calculated as "the number of questionnaires completed divided by all eligible and initially cooperating sample members." In the case of the current research study 'all eligible and initially cooperating sample members' (n=71) received a link to the online survey. Basson points to the importance of clearly indicating the use of this understanding of completion rate since it is "an important indicator of item nonresponse in self-administered survey." Basson adds that *completion rate* is further understood as "an umbrella term to describe the extent of sample participation in a

survey" in terms of *response rate* ("indicates the proportion of the total eligible sample that participates in the survey"), *contact rate* ("indicates the proportion of those contacted out of all eligible sample members"), and the *cooperation rate* ("indicates the proportion of the contacted sample that participates in (or consents to participate in) the survey"). These three component rates within the umbrella, referred to by Basson as *outcome rates* "are often used as criteria for evaluating the quality of survey data" and as such are important for the researcher to define.

Research study participation across multiple data collection methods is summarized in Table 14. The presence of 'demo viewer' is shown here as in, those who were unable to use WeJay and viewed the two brief demo videos made available to provide exposure to the tool.

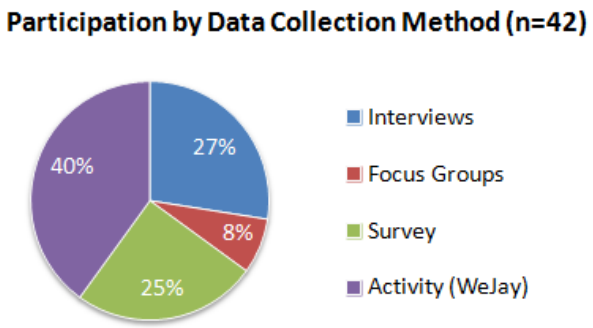
Table 14: Participant Activity across Multiple Data Collection Methods

n=71	**Activity Data +Interview**	**Activity Data +FocusGroup**	**Activity Data + Emails**	**Interview + Diary**	**Interview + Survey**	**Focus Group + Survey**
Responses	15	6	24	5	12*	4
- logged in	5 (demo viewer)		11			
- inactive	2 (demo viewer)		7			
Actual	**22**		**42**	**22**	**10**	**4**
*2 incomplete surveys						

Participation by data collection method and the number of unique participants (42) is illustrated in Table 15 accompanied by a graphic view.

Table 15: Participation by Collection Method

Collection Method	Participants	Unique
Interviews	22	22
Focus Group	6	6
Survey	20	6
Activity (WeJay)	32	8
Actual Participation	**42**	**42**



Analysis and Interpretation

The analytic technique of explanation building, a form of pattern matching, was used for analysis and interpretation in this single case study (Table 16).

Table 16: Propositions, Constructs, and Data Analysis Techniques

Propositions	Constructs	Data Analysis Techniques
A. Novel and unexpected uses of the WeJay wireless grid application will be developed by users.	Creativity Innovation	- Content analysis of data using coding categories - Explanation building and pattern development - Referring back to the literature review data - Referring back to the research questions and propositions
B. The WeJay wireless grid application fosters an environment for innovation, as in "transformation of a new idea into a new product or service, or an improvement in organization or process."	Innovation	- Content analysis of data using coding categories - Explanation building and pattern development - Referring back to the literature review data - Referring back to the research questions and propositions
C. The WeJay wireless grid application fosters an environment for creativity, as in "novel and useful ideas" for users.	Creativity	- Content analysis of data using coding categories - Explanation building and pattern development - Referring back to the literature review data - Referring back to the research questions and propositions
D. A conceptual relationship is emerging between wireless grid environments and ambient intelligent (AmI) environments in terms of the generation of new types of information, in new places, facilitating the presence of 'ambient information' in the form of context awareness, etc.	Context awareness	- Content analysis of data using coding categories - Explanation building and pattern development - Referring back to the literature review data - Referring back to the research questions and propositions

Yin (2009:141) suggests that with explanation building, "the goal is to analyze the case data by building an explanation around the case." Advising against a 'narrative form' which tends to have less precision, Yin recommends that explanations reflect

"some theoretically significant propositions." As such, this study draws upon the four 'theoretically significant propositions' identified in Table 16 and supported by the literature review in Chapter Two.

Yin (2009:143) notes the absence of documentation regarding the process of explanation building for explanatory case studies, adding that it is iterative in nature, involving a constant comparison of the data with the theoretical propositions and making revisions to the propositions as needed. In this way the data was interrogated and "the evidence is examined once again from a new perspective in this iterative mode" (Yin, 2009:143). Using this technique an explanation was constructed while considering 'other plausible or rival explanations,' illustrating how such alternate explanations would or would not be untenable, based on the circumstances of the case. This analytic technique is not without its challenges and Yin (2009:144) advises on the importance of regularly referring back to the research questions guiding the study; use of the case study protocols guiding the data collection process; use of the database for the storage and analysis of all data at any time; and establishing a 'chain of evidence' to follow.

All steps of the data analysis process are fully described for clarity and integrity but also to enable replication (Miles & Huberman, 2002:395). These same authors advise that in data analysis it is important to 'seek formalization' and at the same time 'distrust it' (2002:396) which is to say that this study valued the importance of order and structure while allowing enough flexibility for the data to speak and for unexpected meaning to emerge.

In achieving a 'high-quality analysis', Yin (2009:160-161) offers guidelines which this study closely incorporated – exhaustive addressing of *all the evidence* in relation to possible rival explanations; *all major rival interpretations* for key research questions so that the analysis demonstrates rigorous and extensive use of as much evidence as possible, being careful not to leave any data "(inadvertently) ignored"; addressing of the *most significant aspect* of the case study; use of *prior, expert knowledge* by the researcher in the case study capturing "awareness of current thinking and discourse about the case study topic."

In summary, data analysis and interpretation involved the careful scrutiny of interview, focus group, activity, email/diary, and survey data as well as background and research literature, materials, and other artifacts associated with the case study. Analysis of quantitative and qualitative data for this study is described in the following sections.

Quantitative Data Analysis

Activity Data

Activity data was tracked and captured in a database for analysis where beta trial participants conducted activity in the WeJay product, in keeping with the activity data protocol (Appendix C). For example, through profile creation, participants typically described their interests. Twelve individuals created a user profile. Participants were given an anonymized username at sign up and 16 individuals de-anonymized, in most cases providing their own name, a version of their name, or they created a radio station name for themselves. In 10 of these

cases, participants uploaded a photo. In 23 instances, participants chose to indicate their location. Just under half of active users created one or more shows, some of which were demo attempts and in one case a very active user created 15 shows, a number of which ran for several hours at a time. Two individuals shared show compositions with the researcher who attempted to make the shows persistent with assistance from the developer but this feature did not become available to participants during this beta trial period. Show content ranged from a wide selection of music to other content pertaining to the environment, to science and engineering news, and to science and technology podcasts paired with popular music. The social settings feature enabled connection with Facebook as an example of leveraging other social media platforms. Eleven participants notified Facebook friends of their shows. An overview of activity within WeJay and at the Weheartradio.com website is depicted in Table 17 by all who signed up for the study and by those who responded to interviews, focus groups, and surveys.

Table 17: Summary of Types of WeJay Activity

	n=71	**n=34 - Activity (WeJay) by Responding Participants**
Profile creation	14	12
Name change	14	9
Photo Upload	12	10
Location indication	25	18
*Show creation	22	21
Facebook link	11	10
Weheartradio.com	35	19
* 68 shows created by 22		* 67 shows created by 21

Although participants could text chat during WeJay use, this data was not available to the researcher as part of the dataset requested and received from the

developer on 5 occasions during the data collection period. Similarly, 'activity stream' data – a record of show listening activity by WeJay users – was not made available to the researcher for analysis. However, search data for searches conducted during WeJay use was made available to the researcher and an analysis revealed that this appeared to be a little used feature of the software. The majority of searching appeared to be conducted by the researcher.

A detailed view of WeJay activity data is presented in Table 43 A-1 (Appendix I) for participants who drew on their experience to respond to an interview, focus group or the survey. Cohosting refers to the ability to invite another individual to cohost a show. Prevalence of cohosting was in evidence in the activity data collected and in the data reported during one of the focus group sessions. Other activity in evidence by participants but not included here is the uploading of photos for shows created.

For the 37 individuals who signed up for the study but did not respond to the opportunity to participate in an interview, focus group or the survey, a detailed view of WeJay activity data is presented in Table 43 A-1 (Appendix I). As such, these individuals are considered to be non-respondent and are not considered in the data analysis. However, comments received from some of these individuals through email correspondence, in relation to the information provided in Table 44 A-2, may provide insights regarding participation and engagement, contributing possible value for future studies. A key constraint articulated by many participants, whether

respondent or non-respondent, was the element of *time* which is referred to as *participant availability* for the purposes of this study.

Survey

In administering a survey instrument, analysis of survey data was expected to generate findings on the ratio of users who generated new ideas; those who sought to implement new ideas; ideas not yet implementable due to 'the state of readiness' of the product or other circumstances; and new uses made possible by the context. Analysis of survey data generated from the instrument was also expected to yield findings on the frequency of interactions and other activities pertaining to the WeJay beta trial environment. Similar to demographic data, survey instrument data was analyzed to generate descriptive statistics to describe and summarize the nature of responses. Open ended questions were coded for content analysis. Findings were compared with the findings from interview, focus group, email/diary, and activity data.

Qualitative Data Analysis

In analyzing each source of qualitative data discussed below — focus groups, interviews, and open ended survey questions — the protocol or instrument used for each was designed to elicit information pertaining to the constructs of interest — creativity, innovation, and context awareness. In turn, the constructs of interest were considered in relation to: use experience; elucidations for use; interpretations of the beta trial product; and interpretations of the wireless grids and AmI

environment, while allowing for other constructs of interest to emerge. Email/diary data was also included in the data analysis.

To assist in the content analysis process for focus groups, interviews, email/diary data and open ended survey data, the coding scheme outlined in Table 18 was used as the basis for the development of a coding glossary (Appendix J), in keeping with the conceptual framework, the underlying propositions, and the constructs used to operationalize this study.

Table 18: Coding Categories

Coding Categories (preliminary)				
Creativity		**Innovation**		**Context Awareness**
Novel		**Transformative**		
Novel	*Creative*	*Unexpected*	*Innovative*	*Context-Aware (WGs - AmI)*
Ideas beyond file sharing	Novel ideas with value - new and appropriate uses employed - new and appropriate uses envisioned	Unintended consequences; Unexpected possibilities	Interpretations for use - uses employed - uses envisioned	Resources (new resources)
Ideas beyond documented features	Unexpected uses	Uses employed	Fosters environment for innovation - "radically innovating what things mean" - evidence the product breaks away from constraints of the situation as typically conceived	Location (new places)
		Uses envisioned	Conditions for innovation - infrastructure conditions - social attitudes - context	New deliveries/interactions
			Change (social)	Situations (new situations)
			Change (mental) (e.g., WeJay social radio in relation to Internet based Spotify, etc.)	
			Context	
			Relationships	

The researcher recognized that overlap may occur in some of the coding categories because of the fluid nature of the relationship between the constructs, particularly innovation and creativity. The 'how' and 'why' questions guiding this research were considered in relation to the patterns, themes, insights, and discoveries emerging from an analysis of the data. In this way, content analysis facilitated the explanation building and pattern matching process, iteratively comparing findings against propositions.

Interview Analysis

Interview data consisted of 22 interviews conducted with participants over a three month period, from the 24th of February to the 14th of May, who engaged with the WeJay beta trial — either through actual use or demo viewing. A 25 question protocol was used to conduct each interview. The interview protocol for WeJay beta trial users (Appendix B) was administered to fifteen individuals while a slightly revised version (Appendix B) was administered to seven 'demo viewers' who were not able to use the beta product. Demo viewers were invited to 'imagine' usage of the product based on their viewing of one or more brief videos of the tool. Interviews lasted approximately 30 minutes in the first few cases but as the researcher continued to learn from interviewees the interviews gradually reached around 60 minutes in duration, in keeping with Kvale & Brinkmann's notion of (2009:82) knowledge being produced socially through the interaction of researcher and interviewee. Interview transcripts were transcribed by the researcher to review the content and gain greater awareness of data and the patterns emerging.

Interview data was organized for coding in an MS Access *interview database* by the researcher. The data was then read and parsed into 756 text segments and a coding glossary was developed based on terms drawn from key constructs of the research study — ambient intelligence (AmI), creativity, innovation — and the propositions related to wireless grid enabled environments. In this way the data was approached in a deductive manner. An inductive approach to the data was also incorporated whereby terms were allowed to emerge from the data and then incorporated into emergent coding categories (Creswell, 2009:187).

To begin the coding process a Second Coder was engaged to separately code all data coded by the First Coder (the researcher). To test the process, data from two interviews containing 72 text segments was coded by the First and Second Coders. This initial test also enabled the researcher to determine the degree of coding category agreement between the coders. The resulting coding comparison is summarized in Table 19.

Table 19: Test Coding Agreement Results for Interview Data

Category Agreement - Interviews		**Disagreement**
Main (Top) Category	Subcategory	
91.66%	75%	8.33%
Reviewed and revised		
91.66%	84.72%	8.33%

In order to raise the level of agreement on the subcategory level, areas of disagreement were identified by the researcher which the First and Second Coders then discussed. In part, the coding disagreement was found to occur because:

> a) the researcher introduced new codes during the coding process, affecting the consistency with earlier coded items. Since the Second Coder coded the

majority of the text a few days later than the First Coder, the Second Coder had the benefit of the fully revised code set;

b) the researcher tended to take what participants said literally in a more 'in vivo' like sense, not inferring frustration unless the interviewee stated or demonstrated frustration. The Second Coder tended to make inferences about such things as the emotional state and the skill level (with the tool) of the interviewee, conveyed through the text.

c) the researcher recognized the need to review the coding glossary again and collapse a few items, split out one or more items for greater clarity, and more clearly define a few items.

Item b) refers to instances where the first and second coder agreed on the top category *Creativity* but not on the Subcategory of *Creativity – Novel Ideas – Positive*. Based on these insights it was agreed by the Coders that the practice of inference in coding would be allowed, supplementing information conveyed in direct statements. The researcher again revised the coding glossary and reviewed and revised the coding of the 72 text segments resulting in a subcategory agreement level of 84.72% with the top category agreement remaining at 91.66%.

The coding categories were repeatedly checked and developed (Creswell, 2009:187-188) in an effort to develop a "mutually exclusive (distinct from each other) and exhaustive" (Zhang & Wildemuth, 2009:8) coding glossary. A sample of the coding glossary appears in Table 20 and the full document is located in Appendix J. A definition is included for each code term variable (Creswell, 2009:187) and one or more text segment examples were provided to guide the coding process. As such, this information assisted in operationalizing the key constructs defined in Chapter Two – creativity, innovation, and context awareness – around this study of ambient intelligence (AmI) in wireless grid environments.

Table 20: Coding Glossary Sample Excerpt

Category Code	SubCategory Code	Definition	Text Segment Example
Ambient Intelligence (Aml)	Smartness	Embedded knowing aligned and interactive with user needs and interests, preferences, incorporating personalized, adaptive and anticipatory elements.	... it is kind of like recognition software whereas if I'm playing a particular radio show maybe down in the corner or somewhere you could have displays of artists from the 80s or playing a 90s radio type theme, artists from the 90s.
Ambient Intelligence (Aml) - Context Awareness	General	Refers to the embedding and integrating, on a mass scale, of technologies that are sensitive and responsive to humans in everyday environments in increasingly invisible and unobtrusive ways (De Ruyter & Aarts, 2009:1039). Aml	... certainly being able to connect to people I know on ... WeJay is cool. But I would feel as if it was even more social if some of these context awareness things could make connections for me that I couldn't necessarily just make on my own. ... song annotations would be really cool ... that's

It should be noted that one or more codes were applied to each text segment by the First and Second Coders. Saldana (2009:62) identifies the application of multiple codes to a text segment as *simultaneous coding* (Miles & Huberman, 1994) which is known variously as multiple, double, overlap, nested, or embedded coding. Although Saldana goes on to caution that simultaneous coding should be employed sparingly, the use of this type of coding in the present research study is justified on the basis that:

a) participants often refer to multiple things in any given text segment, revealing the complexity of what occurs in human interactions and in 'social', human-computing interaction environments;

b) coding for emotion, also known as 'affective coding' (Goleman, 1995; Saldana, 2009:86) was applied to text segments, where applicable

While *process coding* (Saldana, 2009:77) was not explicitly targeted as a coding method, the coders were attentive to elements associated with this approach pertaining to emotion, interaction, and action descriptive of the WeJay experience. At this point it is worth noting that an emergent aspect of the study that occurred during the interview process was that of the emotional experience of participants. Drawing on the "Alternative dimensional structures for the semantic space for

emotions" (Scherer, 2005) discussed in the work of Lopatovska & Arapakis (2011:582), a number of positive and negative emotions were introduced into the survey instrument. Following this survey question, another open ended question was included which allowed participants to describe in their own words how they felt during their WeJay use/demo experience. Similarly, positive and negative emotions were introduced into the coding glossary based on data emerging from the interview text segments.

The remaining interview text segments (684) were then coded by the First and Second Coders and a coding comparison was conducted with the results displayed in Table 21.

Table 21: Coding Agreement Results for Interview Data

Category Agreement - Interviews		**Disagreement**
Main (Top) Category	Subcategory	
93.12%	78.57%	6.76%
	Reviewed and revised	
93.12%	92.06%	6.76%

The researcher again revised the coding glossary and reviewed and revised the coding of the text segments on the subcategory level where disagreement occurred, resulting in a subcategory agreement level of 92.06% and a top category agreement of 93.12%. The Coders then proceeded to work with the focus group data discussed in the next section.

Focus Group Analysis

Focus group data was organized for coding in an MS Access *focus group database* by the researcher. The data was then read and parsed into 104 text segments. Using the same coding glossary developed for the interview text

segments, the First and Second Coders proceeded to code the text segments from two focus groups. The first focus group was comprised of two participants while the second focus group had four participants. Coding terms continued to be added to the coding glossary during this part of the coding process. A coding comparison was conducted with the results displayed in Table 22.

Table 22: Coding Agreement Results for Focus Group Data

Category Agreement – Focus Groups		**Disagreement**
Main (Top) Category	Subcategory	
94.2%	88.46%	6.8%
Reviewed and revised		
99.04%	94.23%	.06%

The researcher reviewed and revised the coding of the text segments on the subcategory level where disagreement occurred, resulting in a subcategory agreement level of 94.23% and a top category agreement of 99.04%.

The researcher noted that saturation began to occur when coding interviews 19 to 22 of the 22 interviews conducted, showing that the emergence of new information (Creswell, 2012:433) was less in evidence. Similarly, while coding the second focus group data, saturation was also in evidence.

The Coders then proceeded to work with the open ended survey data discussed in the next section.

Survey Analysis

Open ended survey data was organized for coding in an MS Access *survey database* by the researcher. The data was then read and parsed into 94 text segments. Using the same coding glossary developed for the interview text segments, the First and Second Coders proceeded to code the text segments from 11

open ended survey questions from 20 respondents. The text segments also included two survey questions contained in an 'other' option where participants provided open ended responses. Coding terms continued to be added to the coding glossary during this part of the coding process. A coding comparison was conducted with the results displayed in Table 23.

Table 23: Coding Agreement Results for Survey Data

Category Agreement - Surveys		**Disagreement**
Main (Top) Category	Subcategory	
90.4%	78.7%	9.6%
Reviewed and revised		
91.49%	91.49&	8.51%

The researcher reviewed and revised the coding of the text segments on the subcategory level where disagreement occurred, resulting in a subcategory agreement level of 91.49% and a top category agreement of 91.49%.

Email/Diary Data Analysis

Email correspondence and diary data were organized for coding in an MS Access *email/diary database* by the researcher. The data was then read and parsed into 46 text segments. A coding comparison was conducted with the results displayed in Table 24.

Table 24: Coding Agreement Results for Email/Diary Data

Category Agreement – Email/Diary		**Disagreement**
Main (Top) Category	Subcategory	
82.6%	65.2%	17.4%
Reviewed and revised		
93.48%	91.49%	6.52%

Using the same coding glossary developed for the interview text segments, the First and Second Coders proceeded to code the text segments from 25 individuals – 19

participant respondents and 6 non-respondents. Coding terms continued to be added to the coding glossary during this part of the coding process.

Initial Email/Diary agreement was lower for two key reasons:

a) the content tended to be free form and was not guided by protocol questions

b) the email/diary text segments are provided by 19 participants, consistent with other data method contributors. However, the inclusion of email correspondence of 6 individuals who generated activity data but did not have the benefit of having participated in any of the other data collection methods contributed to a divergent experience and understanding

Comments from the 6 non-participating individuals may provide insights valuable to the study and future studies. Further, these contributions were included for analysis to challenge the researcher's coding emphasis, allowing for emergent shifts. The researcher reviewed and revised the coding of the text segments on the subcategory level where disagreement occurred for participants, resulting in a subcategory agreement level of 91.49% and a top category agreement of 93.48%.

Inter-Coder Reliability

The coding of qualitative data supported the organization of raw data for systematic analysis in preparation for interpretation by the researcher. The presence of a Second Coder for inter-coder reliability contributed trustworthiness to the study. Feedback from the Second Coder also served to contribute greater integrity to the coding glossary, influencing reliability of the tool for potential use in future research studies.

An overview of the inter-coder comparison of the data coded from each collection method is provided – interviews, focus groups, open ended survey

questions, and email/diary data. With the exception of the email/diary data (where response was freeform and unguided by researcher questions) the inter-coder comparisons provide a question-by-question comparison within top (main) categories and subcategory. Agreement and non-agreement counts per question are indicated at each category level, the number of text segments for each question, and the percentage of agreement for each. Totals are then provided for each of these elements. Inter-Coder analysis for all coded data is provided in Appendix K. Additional details are also available for: a) details for Coder 1 and Coder 2 matching code assignments; b) Coder 1 code assignments; and c) Coder 2 code assignments.

This inter-coder comparison provides evidence of a high level of coding agreement. Conducting a coding comparison following the completion of coding for each data collection method contributed to the high level of coding agreement while enabling a repeated review of difference, a recoding for agreement, and a revision of the coding glossary to accommodate code addition, expansion, and refinement.

Triangulation

The use of a second coder for inter-coder reliability during content analysis is a form of *investigator triangulation* (Yin, 2009:116 citing Patton, 2002; Denscombe, 2010:347) contributing to a third type of triangulation used in this study.

Validity and Trustworthiness

By design, this research study was adaptive and flexible allowing for a revisiting of design elements during the course of the research. Any shifts that

occurred from the initial research design were acknowledged and documented to maintain rigor, integrity, and trustworthiness of data. (Yin, 2009:71).

The researcher acknowledges the omnipresence of bias in research (Leedy & Ormrod, 2010:216) and sought to identify and mitigate such influences. For example, to ensure consistency during data collection, protocols and instruments were used to guide the beta trial process, interviews, focus groups, and the survey. The researcher was also careful to consistently administer these protocols and the instrument. To ensure reliability so as to "minimize errors and biases" this study used a *case study protocol* to guide and document all steps of the study including data collection (Yin, 2009:49-41, 45). In this way, the study is fully 'auditable' allowing the researcher to retrace steps or enabling other researchers to repeat the study.

Discussing bias and issues that may compromise trustworthiness of interview data, Eisenhardt & Graebner (2007:28) argue that by "using numerous and highly knowledgeable informants who view the focal phenomena from diverse perspectives", adverse effects on data can be mitigated. Further, these same authors reason that with such a mix of 'varied informants' there is less likelihood for there to be "convergent retrospective sensemaking and/or impression management" by informants. Individuals from the WiGiT and iSchool contexts may be characterized as ‘highly knowledgeable’ with the potential to view the WeJay tool and social media applications from ‘diverse perspectives’. Babbie (2010:260-261) and Creswell (2012:277-278) point to the importance of the ‘use of language’ by the researcher in

mitigating bias in research work. Attentiveness and sensitivity to the use of language was important in this research, particularly when conducting interviews and focus groups, so that a balance was maintained that allowed probing for more depth on the one hand while being careful regarding the potential to influence participant responses on the other. Barta, Tennen, & Litt (2012:108-109), in the context of diary research, discuss the concept of *measurement reactivity* – "systematically biasing effects of instrumentation and procedures on the validity of one's data" – citing Webb, Campbell, Schwartz, & Sechrest (1966) who claimed that "almost any measurement method is likely to generate reactivity." This study was attentive to the types of participant 'reactivity' that may occur in focus group settings, online group settings during the WeJay beta trial, and individual interviews.

Yin (2009:40-41) identifies criteria for assessing the quality of case study research based on *construct validity*, *internal validity*, *external validity*, and *reliability* which are addressed in the following sections.

Construct Validity

Yin (2009:40-41) stresses the importance of "identifying correct operational measures for the concepts being studied." Wireless grid enabled environments are characterized as collaborative, interactive, and sharing-supportive. Ambient intelligent (AmI) environments share the same characteristics and are additionally context aware in terms of location, time, and situation/context. Emergence theory — emergent properties, emergent structures, emergent patterns and behaviors —

offers a theoretical lens through which to investigate the launch experience, use experience, and interpretations for use of wireless grid enabled and ambient intelligent environments in relation to the constructs of creativity, innovation, and context awareness in social networked environments.

Use of a survey instrument provided the opportunity to review findings with participants since many had already participated in focus groups or interviews and had used the WeJay tool (generated activity data). The use of multiple methods (e.g., activity data, interview, focus groups, and survey) contributed to the reliability of the study while the presence of multiple perspectives enhanced construct validity (Yin, 2009:183). Using multiple sources of evidence also contributed to construct validity while enabling the triangulation of data for corroboration of evidence.

Internal Validity

Identification of the unit of analysis (— social group interactions —) contributed to internal validity in this study of the WeJay social radio use experience in the wireless grid environment. The use of pattern matching as a type of explanation building was used in this research study as an analytic technique and both content analysis and explanation building contributed to internal validity (Yin, 2009:136). Rival explanations, claims, and interpretations were addressed to strengthen internal validity.

External Validity

Yin (2009:42-44) refers to *external validity* as a test of generalizability — the extent to which case study findings apply beyond a particular case. Offering

alternatives for generalizability, Lee & Baskerville (2003) challenge conceptions of deductive and inductive. The authors point to the limiting notion of generalizability as referring only to 'statistical, sampling-based generalizability' and offer a series of alternatives through the presentation of a *generalizability framework* consisting of four types of generalizing and generalizability: *empirical to empirical (EE); empirical to theoretical (ET); theoretical to empirical (TE) and; theoretical to theoretical (TT).* In extending the notion of generalizability, Lee & Baskerville hope to encourage researchers to use these new alternatives and claim 'broader relevance' for their research.

As a single case study this research sought to generalize findings to broader deployments of the WeJay social radio application that were occurring in parallel, a little behind, or those that may be coming next. Generalizations may also be possible to other emerging wireless grid enabled applications. As such, this case study was not seeking to generalize findings to some particular population (statistical generalization) but rather, through the use of a theoretical framework building upon emergence theory, *analytic generalization* (Yin, 2009:43-44) was used to theorize about the launch and use of WeJay, the wireless grid social radio application under study, and such theorizing may apply much more broadly.

Reliability

Reliability refers to whether the activities in a study can be repeated by other researchers. To ensure reliability so as to "minimize errors and biases" this study used a *case study protocol* to guide and document all steps of the study including

data collection (Yin, 2009:49-41, 45). In this way, the study is fully 'auditable' allowing the researcher to retrace steps or enabling other researchers to repeat the study.

Response bias in survey response is considered more crucial than response rate (Creswell, 2012:391-392). Of the 34 active participants, 25 responded to the survey and 5 responses were incomplete or deemed unreliable from lack of tool use. Leedy & Ormrod (2010:216) indicate that survey response rates tend to be less than 50% and "the more nonrespondents there are, the greater the likelihood of bias." In the case of response bias, *wave analysis* was used to compare early responses with late responses, for consistency in response on key variables. Specifically, data from the first five survey responses (May 13-14) were compared with data from the last five survey responses (24 May – 1 June). A partial view of the wave analysis appears in Table 25 for questions pertaining to: *AmI* and *context awareness* (q10, q12) and *creativity and innovation* (q16, q17, q23, q24). Other variables of interest compared included satisfaction in relation to *readiness* (q2, q4, q5); *emotions/affect* (q14); and WeJay as *social* (q8). A legend appears to the right of Table 25, indicating what each response means (e.g., s = satisfied, etc.).

Table 25: Wave Analysis of Survey Responses (partial view)

Wave Analysis (Survey beta test)												
	Early Responses (May 13-14)							Late Responses (May 24 – June 1)				
ID		006	010	012	016	029	------	034	027	033	001	032
	Q#											
1	q2	s	n	s	s	s		vs	s	s	vs	n
2	q4	su	su	p	a	a		p	p	a	a	p
3	q5-1	vs	s	s	vu	s		vs	vs	s	s	n
4	q5-2	s	n	s	n	s		s	n	n	s	n
5	q5-3	s	s	s	n	s		vs	s	vs	vs	vs

Legend

a - adequate
n – neutral
p – plenty of features, not fully functional
s – satisfied
su – somewhat unsatisfactory
vs – very satisfied
vu – very unsatisfied

An additional approach to ensuring reliability for this study was the development of a *case study database* using NVivo software for all data collected. Microsoft Access databases were also used for the coding of data, glossary generation, inter-coder reliability analysis, and content analysis in support of the interpretation and reporting of findings. Further, developing a 'chain of evidence' (Figure 8) contributed to reliability, beginning with the research questions and propositions, using a case study protocol (guiding and linking data collection protocols and instruments to questions), and tracing linkages with data throughout the iterative collection, analysis, and interpretation of data, including report development (Yin, 2009:122-123).

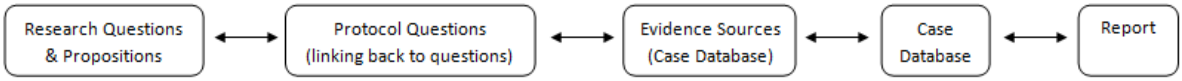


Figure 8: Chain of Evidence

In combination the four methods used in this study contributed trustworthiness, reliability, and validity to the findings, yielding in turn a robustness and rigor to this research study.

Ethical Treatment

In keeping with ethical treatment guidelines, an Institutional Review Board (IRB) application was completed and submitted with Dr. Marilyn Arnone as the Principal Investigator and Patricia McKenna as the student researcher for this study. IRB amendment and modification procedures were followed in seeking approval for revised data collection protocols, survey instrument development and revisions, and other revisions (Appendix L). Research study participation involved electronic consent form agreement approved by the IRB. Consent forms described the nature of the research, the expectations of participants, and the option for participants to decline participation at any time during the study.

Consent forms indicated that interviews were being audiotaped, focus group sessions were being videotaped, and activity data was being captured to a database. Data from audiotapes and videotapes was transcribed and anonymized by the researcher, stored in a secure area and all recordings will be destroyed upon completion of the research study. Where participant quotations are used in the research, the researcher anonymized the quotations. Participants were informed that they would be shown a summary of the research results and interpretations and may choose to have particular comments or responses deleted from consideration in the data analysis which they feel misrepresent their actual beliefs or perceptions.

Data anonymization

As part of the agreement to participate in this research study, participants completed a brief form including name and demographic information (Appendix G) which was captured by the researcher. Upon submission of this information a *unique username* was generated by the researcher for use with WeJay. When the username was captured to the WeJay beta trial database, a *unique user ID* was generated. From this point on, the unique user ID was used to identify participants thus supporting the anonymizing of data. The researcher advised that data identifying participants (e.g., first name, last name, and email) was to be held in a confidential table in the database and made available only to the student researcher conducting this study and the researcher's doctoral committee members. Other individuals involved with system data generation, data capture, and database management of this information were instructed on the importance of confidentiality and the ethical requirements of the Syracuse University Institutional Review Board (IRB).

Study participants were instructed on the importance of confidentiality while acknowledging that in any group setting, including the WeJay beta trial environment and focus groups that the actions of others cannot be controlled.

It should be noted that the researcher received activity data from WGC's (Wireless Grids Corporation) WeJay server and as such, this data also exists in 'proprietary cloud spaces' similar to those of Google, Amazon, and the like.

Materials

For this research study a focus group protocol was developed (Appendix A), an interview protocol (Appendix B), an activity data protocol (Appendix C), and a survey instrument (Appendix D). A registration page was developed to support research study sign up and demographic data collection (Appendix G). Through registration, beta trial participants were given access to the Weheartradio.com website (Appendix H) and the WeJay tool (Appendix H). Two brief instructional videos supporting use and demonstration of the WeJay beta trial product were developed and made available to participants through a WeJay Resource Centre webspace (Appendix H).

All activity data and was securely stored on a server at the Wireless Grids Innovation Testbed (WiGiT) Lab. Any audio and video recordings were securely stored with only the principal investigator, Dr. Marilyn Arnone, the researcher, Patricia McKenna, and the researcher's doctoral committee members allowed access. Recordings are scheduled for destruction once all analyses have been completed and reports and publications that summarize the data have been distributed.

Summary

This chapter on methodology provided an overview of the single case study research using multiple methods of data collection (e.g., activity data, focus groups, interviews, and a survey) for this study. The unit of analysis for the study was discussed, data collection methods, and the analytic technique of explanation

building as a type of pattern matching for the analysis of data and interpretation of findings. The organization of data was discussed together with the technique of content analysis and coding. Flaws, problems and challenges were identified and discussed. Issues of validity, reliability, and trustworthiness were addressed as well as ethical considerations, and materials used.

Chapter Four presents an analysis of the interview, focus group, diary/email, and open ended survey question data using the analytic approach of content analysis. Analysis of survey data is presented, concluding with a summary of findings.

CHAPTER FOUR: ANALYSIS AND FINDINGS

By creativity we mean imaginative activity … in which an original product emerges … Creativity manifests itself in insights.

- Kaptelinin & Nardi (2006:208, 210)

The previous chapter provided an overview and rationale for the methodology adopted for this research study including a discussion of the research design; data collection and analysis methods; validity, reliability and trustworthiness; and ethical treatment. The interview and focus group processes conducted with participants, based on usage of WeJay (tool activity) or exposure to WeJay through the viewing of two brief videos (demo viewer), were discussed. Information provided in interviews and focus groups contributed to the development of a survey instrument which was administered to participants. Email correspondence and diary entries also formed part of the emergent data collection picture.

This chapter presents a qualitative and quantitative analysis of the data collected during the study through the four collection methods employed — *tool activity usage*, *interviews*, *focus groups*, and *survey* — in relation to the research questions and propositions for this study. As such, this chapter represents a pulling together of the four types of data in relation to the theoretical perspective articulated in Chapter One. Descriptive statistics are used in the presentation of the data analysis and findings. Overall, an analysis of the data collected contributed to a range of findings related to the research questions and propositions.

Using the conceptual framework for ambient intelligence (AmI) in wireless grid enabled environments presented in Chapter One, data analysis in relation to

the research questions and propositions was conducted using a cross-method approach. The conceptual framework appears below in Figure 9.

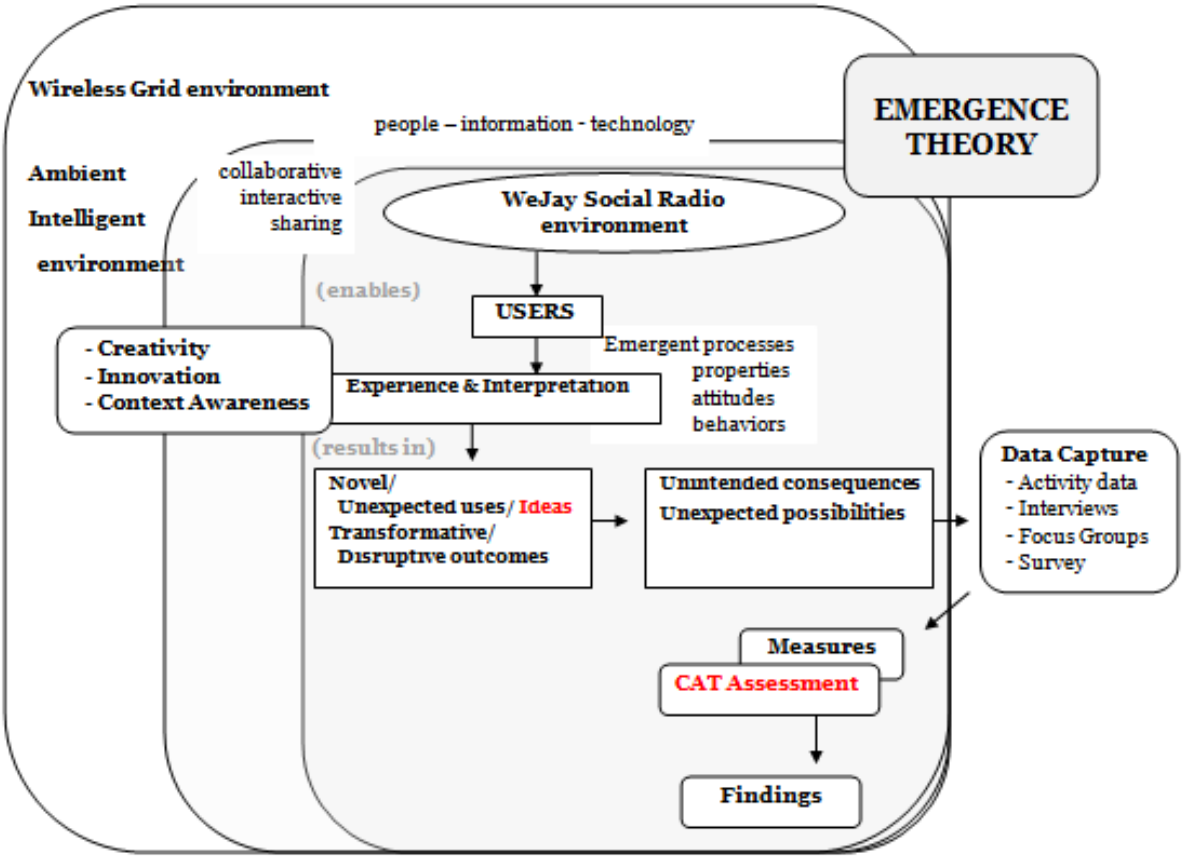


Figure 9: Conceptual Framework: AmI in Wireless Grid Applications (WeJay)

The overarching research question asked in this study was:

> Q: *Do wireless grid enabled applications, such as WeJay, add to the potential for new and transformative outcomes for people, information and technology when deployed in an academic setting?*

The two subquestions asked in this study were:

> *Q1: What is the experience of participants involved in the beta trial launch of the wireless grid enabled WeJay social radio application?*
> *Q2: How is the WeJay social radio application being interpreted for use during the beta trial across selected segments of Syracuse University students and faculty and among WiGiT members?*

It is important to note that this study considered these questions from the perspective of participants as 'people' (Verganti, 2009:54) rather than solely as 'users'. This perspective was used in order to understand new and potential meanings and interpretations for use and "what people *could* love in a yet-to-exist scenario" (Verganti, 2009:55) or in a scenario they were assisting in shaping. As such, participants were invited to enter the imaginative realm and move beyond the limitations of existing frames of reference (Orlikowski & Gash, 1994) while valuing and drawing upon experience with existing social media tools and environments. The researcher recognized early on that the WeJay beta trial presented unique challenges to participants in that the study: a) appealed, on the surface, to those interested in social media tools, particularly radio/broadcast media; and b) was emergent in nature contributing to an unstructured environment with minimal guides, rules, and supports.

Table 4 in Chapter Three illustrated the theoretical propositions tightly bounding the key constructs of this research study in relation to the data collection methods used. An abbreviated version is presented here, including only the propositions and constructs, as Table 26.

Table 26: AmI with Wireless Grids: Theoretical Propositions and Key Constructs

Theoretical Proposition	**Constructs**
A. Novel and unexpected uses of the WeJay wireless grid enabled application will be developed by users.	Creativity Innovation
B. The WeJay wireless grid application fosters an environment for innovation, as in "transformation of a new idea into a new product or service, or an improvement in organization or process." (Heye, 2006)	Innovation
C. The WeJay wireless grid application fosters an environment for creativity, as in "novel and useful ideas" (Amabile, 1996) for users.	Creativity
D. A conceptual relationship is emerging between wireless grid enabled environments and ambient intelligent (AmI) environments in terms of the generation of new types of information, in new places, facilitating the presence of 'ambient information' in the form of context awareness, etc.	Context awareness (AmI)

With the theoretical perspective of Emergence Theory in mind, together with the conceptual framework encompassing the research questions and propositions for this study, the data analysis and findings are presented based on the analytic techniques of *content analysis* and *explanation building*. Contributing further support and solidification to the findings, an analysis is then presented of data received through administering of the survey instrument developed during the study. Findings from this first use of the instrument are assessed and triangulated with the content analysis data.

Analysis and Findings

Abbreviating the research questions and propositions for viewing at a glance, what appears is an ordered and sequential arrangement with possible parallel

connections across the columns of questions (Q) and propositions (P), as depicted below.

Q. Transformative Outcomes	P_A. Novel and unexpected uses
Q1. Experience of participants	P_B. Fosters innovation
Q2. Interpretations for use	P_C. Fosters creativity
	P_D. Wireless Grid & AmI relationship

However, the flow of information in the research study, based on participant experience, occurred in a more interrupted, conditional, and tentative manner in keeping with the nature of interactive environments and situated action described by Suchman (2009) and discussed by Dourish (2001:70-73). Some participants were excited to begin the beta trial only to become disappointed when they were unable to easily and effectively install the WeJay application. Others installed the application without difficulty or incident and enjoyed a glimpse of early WeJay capability and potential while still others were frustrated by product stability issues and limited functionality. Some participants appreciated the ease of use and friendliness of the WeJay interface while others experienced confusion, uncertainty, and error messages which further compounded the situation. In addressing the research questions and propositions it was important to consider the enabling and constraining factors in arriving at a more in-depth understanding of the experience and perceptions of participants. As such, the *readiness* of the WeJay application figured prominently for participants in terms of the features and functionality and the current affordances and constraints constituting the *socio-technical environment*. Also important was the emotional experience of using, or not being

able to use, the tool. Taken together, the *emotion/affect* variables, along with factors in the socio-technical environment, influenced *engagement* with the tool and perceptions around autonomy/control, social aspects, and content considerations. When the WeJay experience was discussed with participants in interview and focus group settings and in email correspondence, the knowledge and understanding produced (Kavle & Brinkmann, 2009:82) and shared between interviewee and researcher served as an additional support. The research study protocols used by the researcher became critical in assisting to navigate around readiness issues, bridging readiness gaps, and scaffolding participants beyond constraints and current tool impediments, to create a space for discussion and the generation of ideas for use, potentials, and possibilities. In some cases participants opted not to engage in an interview or focus group with the researcher, providing an explanation in some cases (e.g., no time, application was confusing, WeJay was not worth the effort) while others responded to the survey based on some, or no, WeJay exposure. The researcher/participant journey during the research study is depicted in Figure 10.

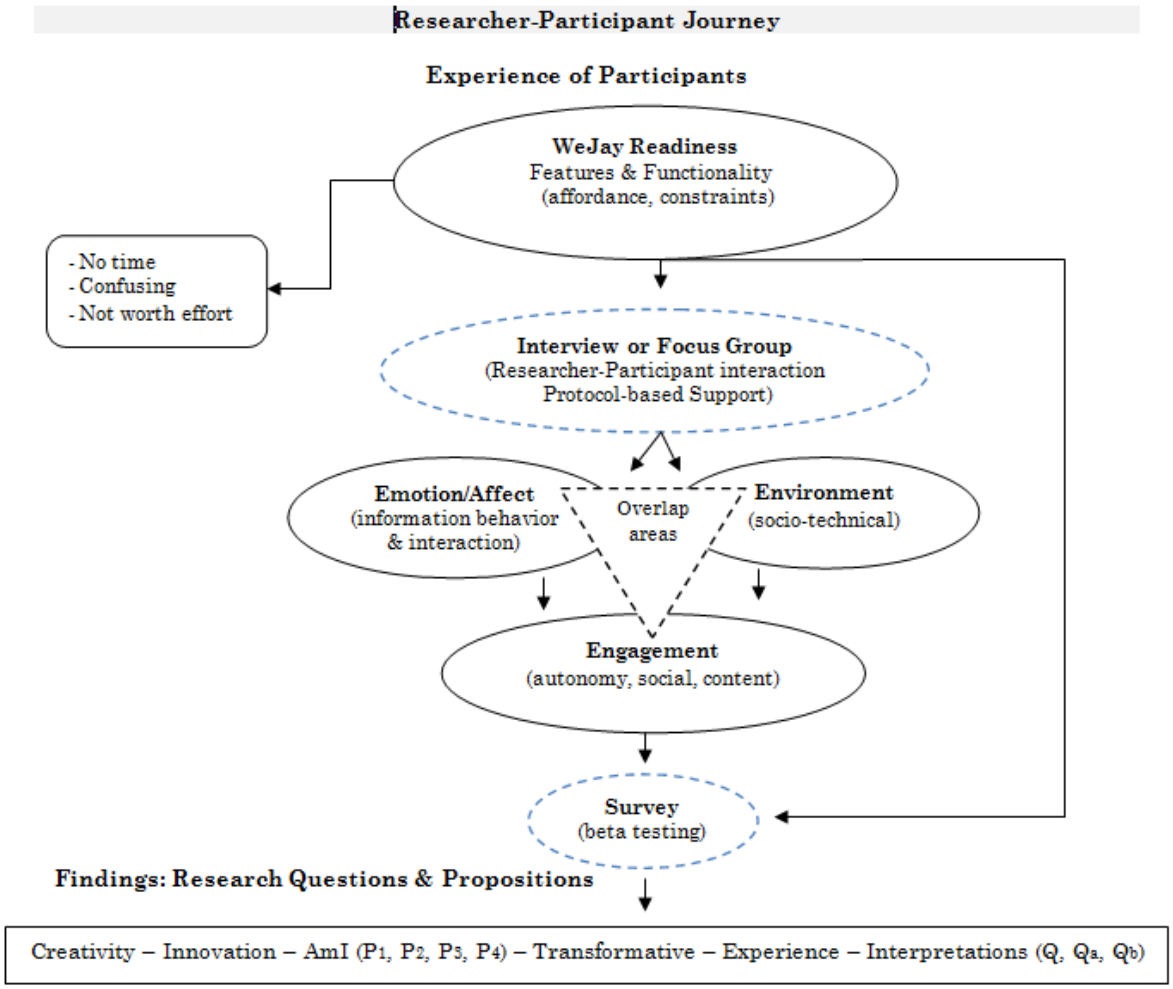


Figure 10: Researcher- Participant Journey

To the extent that emotion/effect, environment (socio-technical), engagement or any combination of these elements are apparent in the research literature reviewed in Chapter Two, they cannot really be considered unanticipated (Bazeley, 2009: 8). Indeed, emotion and social were foreshadowed in Figure 2 (Emergence in Social Networked Environments) of Chapter Two, where 'excitement' and 'social' appeared. However, it is the particular relationships and interactions revealed in the data analysis that is of interest here in enabling a richer understanding and more comprehensive response to the research questions and propositions. In this way, allowing for discussion around emergent issues and situations, contributed to

the potential for increased dimensionality related to the research questions and propositions, as illustrated in Figure 10.

What might at first be construed as a gap in the conceptual framework between the *enables* element for users, inhibiting or limiting their experience and interpretation for the *results in* element, actually served to create the space for the *emergent* dimensions of the study to take shape. The *enables* and *results in* elements of the conceptual framework are highlighted with an underline in Figure 11.

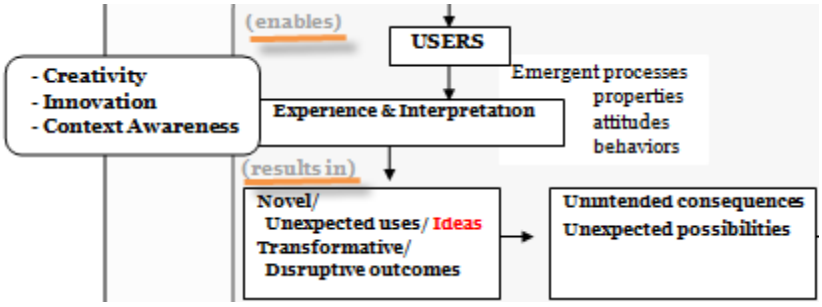


Figure 11: Conceptual Framework: 'Enables – Results In' Space

Within the context of the researcher-participant journey of this research study, each component of Figure 10 – *readiness*, *emotion/affect*, *environment (social-technical)*, and *engagement* – is analyzed in relation to the research questions and propositions. Following this analysis, other related influences and concerns are noted and discussed.

Reviewing briefly the content analysis work for this study which was described in the previous chapter, Table 27 represents a fragment of Table 17 from Chapter Three. The preliminary coding categories drawn from research study propositions formed the basis for the development of the fuller, richer coding glossary during content analysis.

Table 27: Coding Categories (preliminary) fragment

Coding Categories (preliminary)		
Creativity	**Innovation**	**Context Awareness**
Novel	**Transformative**	

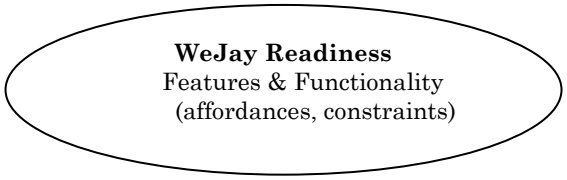
The analytic process of coding the data emerging from participant interviews, focus groups, emails/diary, and open ended survey questions served to evolve the terminology and relationships emerging around the research questions and propositions as evidenced in the coding glossary sample in Table 28. The complete coding glossary appears in Appendix J.

Table 28: Coding Glossary Sample

Coding Glossary (Sample)	
Main Category Code	**Sub Category Code**
Ambient Intelligence	Smartness
Ambient Intelligence (AmI) - Context Awareness	Location Presence Recommending Resources Situation
Creativity	Autonomy - User Control Motivational aspects Tool-fostered
Creativity - Novel Ideas	Assessment – Negative Assessment – Neutral Assessment – Positive

Readiness

Throughout this research study reference was made to the 'state of readiness' of the WeJay beta product and the degree to which actual use was possible. WeJay in beta form was usable in some capacity by many participants. Where participants were not able to use the product, two brief videos were made available for viewing, enabling exposure to, and understanding of, the tool. The experience of WeJay users and viewers revealed the range and variety of ways in which the product was perceived to be ready or not, for



use. Participant response made it possible to study the state of readiness and 'infrastructure conditions' (Milbergs & Vonortas, 2006) for WeJay as a Wireless Grid enabled tool. In turn, readiness provided a mediating lens through which to consider the research study questions and propositions.

The five dimensions (quantitative metrics) of Asthana & Olivieri's (2009:3) software readiness index discussed in Chapter Two, appear in Table 29, adjacent to what could be considered comparable categories that emerged during content analysis coding for readiness in this research study.

Table 29: Readiness - Quantitative Metrics Mapped to Qualitative Coding

Software Readiness Index	Content Analysis Coding
Software functionality	> Readiness – Features – Functionality
Operational quality	> Readiness – Content > Readiness – Synchronous / Asynchronous
Known remaining defects	> Readiness – Improvements > Readiness – Instability > Readiness – Barriers
Testing scope & stability	> Readiness – Beta Trial > Readiness – Environment – Interaction – Systems > Readiness – Stability
Reliability	> Readiness – Barriers (downtime)

The complete content analysis for readiness is presented in Table 30, showing comparative prevalence in percentages across data collection methods. Content analysis percentages show the frequency of category use against the number of text segments coded per method (e.g., 46 Email/Diary segments, 104 focus group segments, 756 interview segments, and 94 survey segments). Definitions for coding categories are provided in the Coding Glossary (Appendix J). Looking at the SubCategory Code column there is a higher percentage of *likes* than *dislikes* for readiness. However, there are also noticeable percentages for the *improvements*

category. The term *learning curve* was contributed by respondents and was used in the sense of requiring some time to learn how to install and/or use the tool. Email correspondence showed noticeable percentages in the *learning curve* and *barriers* to use categories.

Table 30: Readiness – Content Analysis

Readiness – Content Analysis (E=46 FG=104 I=756 S=94)					
Main Category	**SubCategory Code**	**%Email**	**%FG**	**%Interview**	**%Survey**
Readiness	Barriers	39.13%	6.73%	7.67%	13.83%
	Beta Trial	6.52%	1.92%	2.78%	9.57%
	Commercialization	0.00%	2.88%	0.53%	4.26%
	Continued use	0.00%	0.96%	3.44%	0.00%
	Dislikes	0.00%	2.88%	3.57%	0.00%
	Experience - Positive	4.35%	0.96%	0.93%	1.06%
	Features	0.00%	0.00%	1.19%	0.00%
	Improvements	13.04%	15.38%	11.90%	12.77%
	Instability	13.04%	0.00%	0.00%	11.70%
	Learning Curve	21.74%	10.58%	5.29%	4.26%
	Likes	2.17%	8.65%	4.89%	0.00%
	Synchronous / Asynchronous	0.00%	5.77%	3.84%	4.26%
Readiness – Content	Access	4.35%	9.62%	6.35%	3.19%
Readiness - Environment	Interaction - Systems	6.52%	6.73%	14.81%	5.32%
Readiness – Features	Communication Options	2.17%	4.81%	4.37%	4.26%
	File Types	4.35%	4.81%	6.22%	3.19%
	Functionality	10.87%	6.73%	13.23%	2.13%
	Interface	2.17%	13.46%	3.17%	5.32%
	Listeners	4.35%	6.73%	0.79%	4.26%
	Mobile Applications	4.35%	5.77%	2.91%	1.06%
	Playlist	10.87%	2.88%	0.66%	4.26%
	Search	0.00%	2.88%	2.12%	2.13%
	Website	6.52%	0.96%	4.10%	1.06%

Considerable discussion occurred in interviews and focus groups around the *synchronous* nature of the WeJay tool, a feature which some participants liked as it allows for togetherness in classroom settings and in friend and group listening scenarios. On the other hand, participants noted that because content (a radio show) is not persistent, if one missed a synchronous broadcast it was not possible to listen *asynchronously* at a more convenient time or in another time zone. As such,

what one participant referred to as the 'transient' nature of the synchronous environment, rendered the show content inaccessible, diminishing the potential value of the space for information sharing. This in turn affected the motivation to use the tool and the desire to return to the space as a social media place of interest.

Conversations with participants around *continued use* of WeJay beyond the beta trial and research study revealed an overwhelming interest in ongoing use of the tool. However, as evidenced by the low content analysis coding (0% to 3.44%) for this category, *continued use* was predicated upon improvements in tool functionality; an enhanced feature set; greater interoperability with existing computing devices (environment – interaction – systems); and leveraging of more and other social media space options, in addition to that of Facebook (environment – interaction – systems). As such, *continued use* appeared to be highly related to factors pertaining to engagement, also articulated as a type of intrinsic motivation (Amabile & Kramer, 2011:34).

Although the *content – access* category appears in this table, it is discussed more fully in the engagement section below, further illustrating the way in which any given category is not singular in nature but rather, may be woven into relationships with one or more different variables of interest.

The *beta trial* itself emerged as a readiness issue where some participants challenged the absence of a highly structured environment where specific goals and purposes were enumerated. Other participants valued the freedom and autonomy afforded by the less structured approach used in this beta trial. Activity data

provided evidence that a number of both students and faculty opted to de-anonymize and change their assigned, anonymous user name to their actual name. In other cases, participants developed a radio show name or provided profile details identifying themselves through their email address. The absence of a highly structured environment with minimal guidance gave way to sharing and collaborative behavior and manifestations of emergent learning and behavior where one participant provided a tutorial to another on how to use the tool. In another instance a participant invited a friend/colleague to engage with the beta trial. During an interview, this participant suggested that the friend/colleague be contacted by the researcher (snowball sampling). Although this individual had already been invited to participate in the research study by the researcher (without success) it was the example of participation and encouragement provided by a friend/colleague/peer that influenced this person to engage with the WeJay tool and then formally sign up for the study, based on follow up by the researcher. In another case, a participant tweeted about the WeJay experience; discussed the beta trial with family/friends/students; encouraged his mother in another state to cohost with him; and recounted interpretations for use of the tool emerging from a discussion his father had with students in a class he was taking. This example of minimal structure within a collaborative space in an academic virtual environment is worth noting for the types and range of emergent behavior and learning that occurred. It is also worth considering in relation to the recently rolled out MITx learning

environment prototype (Hardesty, 2012) and the nature of the engagement and creativity described by Hardesty.

Within the context of readiness and the WeJay experience, the emergence of learning and other dimensions such as experimentation became evident. An overview of the content analysis for emergent aspects is presented in Table 31, showing embedded or underlying elements and is, for some categories, another way of viewing readiness (e.g., in the case of affordances and constraints). Instances of emergent behavior pertained to insights around engagement; the importance of modeling which enabled participants to be able to see what others were creating in WeJay and how they were using the tool; conversations initiated by participants with family, friends, peers, and others about the WeJay tool and interpretations for use; and the types of experimental behavior that participants were motivated to explore. For example, one participant stated, " I tried to actually hack the system" while another said "I just wanted to experiment" and two individuals separately developed ideas for games which they began to implement and test but did not complete during the beta trial.

Table 31: Emergent Aspects Coding: Cross-Method Content Analysis

Emergent Aspects – Content Analysis (E=46 FG=104 I=756 S=94)					
Main Category	**SubCategory Code**	**%Email**	**%FG**	**%Interview**	**%Survey**
Emergent	Learning	2.17%	0.00%	2.25%	0.00%
	Patterns	0.00%	0.00%	1.85%	0.00%
	Processes	0.00%	0.00%	0.79%	0.00%
Emergent - Attitudes	Social Media - Negative	0.00%	0.00%	0.93%	0.00%
	Social Media - Neutral	2.17%	0.00%	0.53%	0.00%
	Social Media - Positive	4.35%	3.85%	5.16%	0.00%
Emergent - Behavior	Conversations	2.17%	4.81%	0.00%	1.06%
	Engagement - Constraints	32.61%	2.88%	4.50%	6.38%
	Engagement - Positive	2.17%	3.85%	5.56%	1.06%
	Experiment	6.52%	0.96%	5.16%	3.19%
	Modeling	0.00%	2.88%	0.00%	0.00%
Emergent - Properties	Constraints	32.61%	8.65%	12.30%	12.77%
	Affordances	8.70%	6.73%	6.88%	6.38%

Returning to the discussion of readiness items, the *experience – positive* category reflected the real time diary comments (Amabile & Kramer, 2011:5) that emerged as participants provided usage feedback during or following their experience of a use episode with the tool. The *interaction – systems* category is discussed below in the Environment – Socio-technical section while the *file types* item is included in the content section of engagement.

The *communication options* item refers to the addition of features and functionality to the WeJay tool including: 'voice over' that would allow live speaking to be incorporated into a broadcast; the ability to record within WeJay allowing for the creation of original content; the editing of show and *playlist* content; the annotating of show content to provide background details to listeners; and scheduling of shows to permit broadcasting at specific times. While participants appreciated the audio feature for broadcasting and listening and the text feature for chatting, there were requests for a voice-in-real-time option. Further in support of

original content creation, and also related to autonomy and user control, was the expression of interest in the incorporation of a recording feature. Some participants recorded content externally using the GarageBand application (Mac). This content could then be used to create a show for broadcast in WeJay. Many participants used existing music content they had purchased elsewhere for show creation and broadcasting in WeJay. Being able to engage in content curation and edit the *playlist* so as to delete and rearrange items based on listener response, in real time, was emphasized.

The *interface* was described by some participants as simple and easy to use with little if any improvement required while others found the interface to be confusing and inadequate and in need of major revisions. Indeed the interface presented one of the more contradictory aspects of participant response, requiring a closer examination for possible underlying issues. In fact, the interface issue extended beyond the WeJay tool to the Weheartradio *website* interface where WeJay broadcasts can be shared more widely over the Internet – a feature which was not used by some participants. In other cases, participants used the Weheartradio site when they were unable to access or use the WeJay tool.

This leads to the issue of readiness around awareness of *listeners,* a feature not yet available in WeJay or at the Weheartradio website. Participants wanted to know if others were listening to their broadcasts and if so, how many people were listening and did listeners stay and listen for awhile. The number of listeners and the duration of listener tune-in were perceived as indicators of value to participants

as in, was the show of interest to others and sufficiently engaging to be worth taking the time to listen. Thus the listening by others to one's show served as a type of assessment (Amabile, 1996) where peers, friends, colleagues would be considered experts, providing feedback through listening. The competitive aspect of attracting larger numbers of listeners to a radio station was mentioned by several male participants, an expression of extrinsic motivation (Amabile, 1996).

A capability that some participants expected and others anticipate will come, is that of a WeJay *mobile application*. With mobile devices increasingly becoming a frame of reference for music listening, information sharing, social interaction and the like, it was expected by some that WeJay would be supported in the mobile space. One focus group participant exclaimed, "I kept thinking how can I get this on my phone" while in diary correspondence, another individual commented, "I am very disappointed that I cannot download WeJay radio on my iPhone" and by email the same participant communicated that it "would make a difference if I could use my iPhone to access the trial." Other participants questioned the viability of using WeJay on a mobile device, concerned with constraints such as battery life.

Regarding *search* readiness, many participants reported not having used this functionality and the activity data confirmed this self-reported information. Some individuals reported on the use of search on the Windows platform and others reported differing search experiences on the Mac, underlying the inconsistency of features and functionalities across the two slightly differing interfaces. One participant reported the cumbersomeness of finding and friending people within

WeJay. Indeed the issue of search provided an unexpected and emergent entry into discussions with participants around *ambient intelligence (AmI)*, specifically, aspects of *context awareness* and *smartness* within social media environments. Participants were generally not cognizant of AmI features in the WeJay tool. The content analysis for AmI is presented in Table 32.

Table 32: AmI Coding: Cross-Method Content Analysis

AmI – Content Analysis (E=46 FG=104 I=756 S=94)					
Main Category	**SubCategory Code**	**%Email**	**%FG**	**%Interview**	**%Survey**
Ambient Intelligence (AmI)	Smartness	0.00%	2.88%	5.42%	5.32%
Ambient Intelligence (AmI) - Context Awareness	General	0.00%	2.88%	7.01%	5.32%
	Location	0.00%	0.00%	1.19%	0.00%
	Presence	0.00%	3.85%	2.51%	0.00%
	Recommending	0.00%	1.92%	3.31%	2.13%
	Resources	2.17%	1.92%	1.59%	1.06%
	Situation	0.00%	0.96%	0.79%	0.00%

When discussions were initiated around the 'presence awareness' indicator in the friends section of the interface (e.g., when a friend is using WeJay at the same time as you, a green button displays), participants tended to immediately acknowledge this feature, noting the ubiquity of this type of functionality across other social media spaces (e.g., Skype, etc.). In the words of one individual, "I guess I take that stuff for granted in social media, so I just assume that it's there." Another participant mentioned the *activity stream*, an area of the interface capturing information on shows listened to by friends, as an example of AmI.

WeJay in beta form enabled the creation of a user profile and show descriptions although these details are not yet leveraged in any way and as such, remain as largely static displays of information. When asked whether the WeJay experience would benefit from the leveraging of this information to provide more

intelligent interaction with users about content, participants agreed that the sharing of this information for more dynamic and smarter (ambient) rendering would be both useful and desirable. However, while participants have come to expect social media environments to make meaningful recommendations to them based on their interests, a series of conflicting perceptions emerged. While skepticism was expressed about the accuracy of recommendation systems such as Amazon, appreciation was also acknowledged. When systems accurately recommended items of interest to users, this capability was referred to as 'creepy' or 'scarily accurate'. Articulated by one participant, referring to Pandora, "it's not really social but it almost feels social. Like it knows me." Referring to the WeJay environment, this individual added, "I would feel as if it was even more social if some of these context awareness things could make connections for me that I couldn't necessarily just make on my own." Another participant, while admitting to liking the concept, made reference to concerns with control, commenting that:

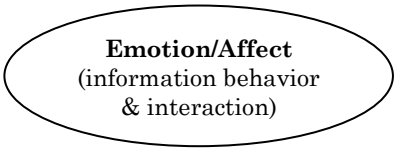
> "ambient, which means that, take the information you provide and use that as a source for figuring out what you might want to do next … that's probably not a bad thing. That's the general method that you can tune things to your own liking. It's a certain amount of personal control that I personally will hate to lose as it goes on and on."

An important delineation was made between the leveraging of information pertaining to interests as opposed to other personal types of information – "something where it might make recommendations to me based on my musical tastes as opposed to just location or education or basic demographic features." Amabile (1996:112-120) came to recognize the importance of expanding the

componential model of creativity to include the *social environment*. Similarly, De Ruyter & Aarts (2009:1041-1043) evolved their human-centered interfaces framework to form The Extended AmI Model, incorporating a *social intelligence* set of dimensions to complement the ambient and system intelligence components in support of emotion/affect factors.

Familiar with the 'surveillance' dimension of AmI and concerned very much about personal privacy, one participant self-identified as probably an 'outlier' regarding perceptions of AmI, indicating a preference to avoid social media. Further discussion revealed that this individual does use social media, albeit in a discerning manner, and derives considerable benefit and enjoyment.

Emotions/Affect – Information Behavior & Interaction



During interviews and focus groups, participants repeatedly made reference to emotions when responding to their use or demo viewing experience with WeJay. In some cases the emotion expressed or intimated was a positive one, in other cases it was a negative one, and on occasion mixed emotions as in, both positive and negative, were indicated. For example, in the words of one participant:

> "some of the constraints I mentioned surprised me in the sense that I couldn't change songs once they were in order so I guess that's a negative surprise. I was pleasantly surprised I could upload my own music."

The content analysis across data collection methods (interviews, focus groups, and open ended survey questions) as well as email/diary data, showed the consistent

presence of emotion. In the case of email/diary data, participants most often reported on issues around access to, and use of, the product and as such, the disappointment emotion is evident. All 22 interview participants were coded for at least one positive emotion while 15 participants were coded for at least one negative emotion. Emotion was coded for 5 of the 6 focus group participants with 4 individuals coded for positive emotion and 3 coded for negative emotion. A comparative analysis of coding for emotion across data collection methods is presented in Table 33. Initially the emotion categories were developed for the survey instrument and contained only 5 positive items and 4 negative. The coding glossary was expanded during the coding process to contain 13 positive items and 9 negative items. As such, the development of meaningful comparisons between the content analysis data and survey data for emotion is limited. The coding glossary also allowed for the 'surprised' item to have both positive and negative valence, not just positive as in the case of the survey instrument.

Table 33: Emotion Coding: Cross-Method Content Analysis

Emotion – Content Analysis (E=46 FG=104 I=756 S=94)					
Main Category	**SubCategory Code**	**Email**	**Focus Group**	**Interview**	**Survey**
Emotions - Negative	Annoyed	2	0	2	2
	Bored	1	0	3	0
	Confused	2	0	2	3
	Disappointed	6	0	5	3
	Frustrated	1	1	10	2
	Impatient	1	0	2	0
	Surprised	0	1	5	1
	Unsatisfied	0	0	0	6
	Worried	0	1	2	0
Average		**1.44444**	**0.33333**	**3.44444**	**1.88888**
Emotions - Positive	Adventurous	1	0	0	0
	Comfortable	0	0	6	0
	Enjoyment	2	1	15	3
	Enthusiastic	4	2	5	2
	Excited	1	2	19	4
	Happy	0	0	4	0
	Impressed	0	3	2	0
	Interested	1	9	54	3
	Peaceful	0	0	0	1
	Pleased	0	0	3	0
	Safe	0	0	2	0
	Satisfied	0	0	3	13
	Surprised	1	4	18	0
Average		**0.76923**	**1.61538**	**10.07692**	**2**

Positive affect has been discussed in relation to creativity as an influence although initially without clear outcomes (Amabile, 1996:239). More recently, using a diary study, Amabile & Kramer (2011:51) found "a definite connection between positive emotion and creativity." In the Amabile & Kramer study, *creative thinking* was defined as "coming up with an idea, solving a problem, engaging in problem solving, or searching for an idea." Further, creativity is linked to perception and motivation, with particular intrinsic motivators including "interest, enjoyment, satisfaction" (Amabile & Kramer, 2011:55-56). Creativity was linked less to extrinsic motivators such as promised rewards, competition, or deadlines (Amabile

& Kramer, 2011:56), although competition, as indicated in relation to listener volume and retention, was mentioned by several male participants in this study.

Although content analysis revealed greater prevalence overall in positive emotion coding than negative emotion coding, the research literature suggests a greater power for negative events or setbacks (Amabile & Kramer, 2011:92-93) than for positive events or progress. In other words, there is an 'asymmetry' for example, in emotions such as happiness and frustration such that:

> The effect of a setback event on happiness was over three times as strong as the effect of a progress event on happiness, and the effect of a setback event on frustration was almost twice as strong as that of a progress event on frustration (Amabile & Kramer, 2011:217-218).

While more positive emotion may have emerged from the WeJay experience than negative, the latter may have a stronger power for participants. The demand and desire for improvements in the WeJay tool is noteworthy in relation to emotional experience. Since barriers contribute to setbacks, Amabile & Kramer (2011: 92) argue for the removal of barriers and situations that inhibit progress events.

Environment (Socio-technical)

When participants were able to experience use of the tool or come to an understanding of the tool so as to imagine use of the tool, the importance of the environment emerged in a variety of ways, illustrated by the content analysis in Table 34.

Table 34: Environment (Socio-technical) – Content Analysis

Environment (Socio-technical) – Content Analysis (E=46 FG=104 I=756 S=94)					
Main Category	**SubCategory Code**	**%Email**	**%FG**	**%Interview**	**%Survey**
Readiness - Environment	Interaction - People	2.17%	9.62%	0.00%	8.51%
Readiness - Environment	Distinctiveness	0.00%	5.77%	0.66%	3.19%
Readiness - Environment	Peer-to-peer	0.00%	3.85%	2.12%	0.00%
Readiness - Environment	Collaboration	2.17%	13.46%	5.16%	1.06%
Readiness - Environment	Interaction - Systems	6.52%	6.73%	14.81%	5.32%
Readiness - Environment	Social	23.91%	17.31%	16.67%	15.96%
Readiness - Environment	Sharing	8.70%	31.73%	19.84%	14.89%

The content analysis findings showed coding for 7 categories pertaining to the WeJay environment. Of these, the most frequently coded category was that of *sharing*, where 201 text segments referred in some way to the concept of sharing. This was followed by 170 text segments coded for *social* and 127 text segments coded for *interaction*. Participants discussed the sharing of music via a WeJay broadcast, the sharing of podcast content, but also the importance of shared listening experiences – sharing the experience of listening to WeJay programming together. In this way sharing became social and features such as chat enabled interaction to occur in this shared, social context. One participant interpreted WeJay to be a space where he could create a curated mix of music as a way of illustrating to his friends and peers that his musical tastes and interests mattered and were valid. If he could generate an audience, he reasoned, this would serve to demonstrate interest thus indicating that the music he was broadcasting garnered listening support and as such, was not simply 'garbage', in the words of his roommates.

Participants emphasized the importance of being able to interact with friends, colleagues, students, peers, and in short, with people they already knew.

People were less inclined to use the tool if their friends were not using it or if people they knew could not be convinced to use the tool. In the words of one interviewee, "when I see many of my friends using WeJay I think in that case I feel like I may want to use WeJay." It was important that the environment support awareness, again bringing in the AmI and smartness dimensions, enabling participants to become aware of what content might be of interest to them; whether content was currently being broadcast; and when content would be broadcast. The WeJay and Weheartradio space had a static, lonely feel and participants were seeking a smarter, dynamic environment, supportive of their interests and their need for social interactions.

Participants were seeking a space that supported interaction with other social media environments and in some cases, environments other than Facebook. One participant suggested that WeJay become a feature of other social media environments while another recommended that WeJay leverage other existing and established social media spaces.

It was not apparent to most participants that WeJay supported a peer-to-peer networking (McKnight (Ed.), 2012:22) environment, as in, wireless grid enabled. The importance of sharing among friends and particular communities, in private configurations, was emphasized. That WeJay be clearly identified as having uniqueness and distinctiveness from other social media environments was stressed by participants. Comparisons were drawn with a range of other social media environments and it was generally the autonomy and control factors that emerged

as most important but perhaps not distinctive enough when compared with spaces such as SoundCloud.

Engagement

Dimensions of engagement emerged in the form of articulations of *autonomy and user control*, *social aspects*, and the availability of diverse types of *content*.

Participants articulated *autonomy and user control* as: a) important and compelling aspects of WeJay and b) critical to the creative process. For example, being able to create original content; to select and organize content for show creation (curate content); and to mix and mash content in a unique way was perceived as creative. As such, the WeJay tool was seen as fostering creativity and having the potential to do so in future, improved iterations. An overview of the content analysis for creativity is presented in Table 35.

Table 35: Creativity – Content Analysis

Creativity – Content Analysis (E=46 FG=104 I=756 S=94)					
Main Category	**SubCategory Code**	**%Email**	**%FG**	**%Interview**	**%Survey**
Creativity	Autonomy - User Control	0.00%	10.58%	9.79%	4.26%
	Motivational aspects	4.35%	2.88%	4.76%	0.00%
	Tool-fostered	0.00%	0.96%	2.51%	0.00%
Creativity - Novel Ideas	Assessment - Negative	0.00%	0.00%	0.26%	0.00%
	Assessment - Neutral	2.17%	0.00%	0.79%	0.00%
	Assessment - Positive	2.17%	1.92%	3.57%	0.00%

Further, autonomy and user control contributed to having a sense of being creative and innovative (Amabile, 1996:261). An interviewee indicated that the inability to contribute 'voice over' content between songs to a show while broadcasting, hampered creativity and the motivation to be creative. Regarding assessments for

the creation of novel ideas, few negative or neutral expressions were coded and only in the interview data. Neutral coded items appear in the email/diary data and this reflected correspondence regarding tool use and access difficulty, constraining opportunities to self or other-assess for novel ideas. Positive assessments for novel ideas are evident across all coded data with the exception of open ended survey content.

As for *social aspects*, an individual who logged into WeJay and found an absence of anyone to listen to a show, declined to create a show indicating by email that creating a show would not be a good use of time if there were no listeners. Participants reported the importance of being able to see what others were creating. In the words of one participant, "I liked seeing what other people were doing with their stations. That was my favorite thing." Social aspects also figure strongly in the socio-technical environment section and the AmI portion of the readiness section.

Content was articulated by participants along the three dimensions of access, creation, and diversity. Access refers to the persistence and availability of radio shows. Creation refers to how content can be created for broadcasting in WeJay while diversification refers to the range and diversity of content types supported. The content analysis for the content category is presented in Table 36.

Table 36: Content – Content Analysis

Content – Content Analysis (E=46 FG=104 I=756 S=94)					
Main Category	**SubCategory Code**	**%Email**	**%FG**	**%Interview**	**%Survey**
Readiness - Content	Access	4.35%	9.62%	6.35%	3.19%
Readiness - Content	Creation	0.00%	2.88%	0.00%	1.06%
Readiness - Content	Diversification	4.35%	6.73%	0.00%	5.32%

The access and creation dimensions were discussed in the readiness section. In terms of diversification, participants expressed the desire to create diverse types of shows for various purposes. The readiness of the WeJay beta allowed for the mp3 file format only, accommodating music and podcast sharing which was found to be adequate by some participants. Others pointed to the limitation of a single file format, particularly where expectations exist for the support of multimedia environments for learning. A number of participants wanted to use WeJay to create or share video content for educational purposes; share photos for cultural and educational purposes; mix and mash content created by others in WeJay as a way of generating new content for sharing and instruction; and come to rely on WeJay as a source of content for research, educational, entertainment, and other purposes. Indeed, the discussion of content diversity can be seen as encompassing the innovative dimension of WeJay, particularly in terms of interpretations for use, possibilities, and of meaning. As further evidence of emergent conversations and interactions, some participants derived ideas for interpretations for the use of WeJay through information from a parallel WeJay beta trial that was occurring in in another, very different context. While WeJay was found to have transformative potential by some, others perceived the tool to be more evolutionary in nature. Two individuals, while appreciative of new and innovative technologies, self-identified as laggards when it came to adoption. One of these participants commented that, in the presence of new technologies emerging relentlessly, there is little time available to explore and assess their worth, preferring instead to rely on suggestions and

advice on what to engage with, from others. An overview of the content analysis for innovation is presented in Table 37.

Table 37: Innovation – Content Analysis

Innovation – Content Analysis (E=46 FG=104 I=756 S=94)					
Main Category	**SubCategory Code**	**%Email**	**%FG**	**%Interview**	**%Survey**
Innovation	Adoption - Laggards	0.00%	0.00%	0.40%	0.00%
	Evolutionary	0.00%	0.96%	0.53%	0.00%
	Functionality	0.00%	0.96%	0.53%	0.00%
	Transformative	0.00%	0.96%	2.91%	0.00%
Innovation - Interpretation	Discovery	0.00%	0.00%	0.93%	1.06%
	Meaning	0.00%	4.81%	1.72%	0.00%
	Possibilities	2.17%	13.46%	9.79%	9.57%
	Uses	10.87%	5.77%	13.76%	1.06%

Impact

During interview and focus group conversations, participants were invited to speak about WeJay in terms of impact. In some instances participants reported having been exposed to music they had never heard before. In fact one participant was moved to purchase music by a particular artist as a result of a WeJay broadcast. While sharing a broadcast with friends on Facebook, another participant reported being offered a job, hosting a show with a local radio station. An overview of the content analysis for impact is presented in Table 38.

Table 38: Impact – Content Analysis

Impact – Content Analysis (E=46 FG=104 I=756 S=94)					
Main Category	**Sub Category Code**	**%Email**	**%FG**	**%Interview**	**%Survey**
Impact	Content Promotion	0.00%	0.96%	0.66%	0.00%
	Educational Settings	2.17%	7.69%	2.25%	4.26%
	Information Sharing	2.17%	5.77%	0.66%	3.19%
	Music Awareness	0.00%	0.96%	2.25%	0.00%
	Opportunities	0.00%	0.00%	1.06%	0.00%
	Potential	0.00%	3.85%	2.78%	3.19%
	Research	0.00%	0.00%	0.26%	0.00%

The impact for faculty and doctoral students related to research studies and funding and a number of faculty and students envisioned potential WeJay impacts for educational settings, conditional of course on tool improvements.

Other

When asked about concerns around copyright of content incorporated into shows for broadcast, participants were often under the impression that copyright issues were under the purview of the WeJay authority in terms of any necessary arrangements and requirements. Similarly, participants gave little attention and concern to privacy and security, trusting that these issues were being handled by the WeJay authority. A content analysis for these WeJay related concerns is presented in Table 39.

Table 39: Concerns – Content Analysis

Concerns – Content Analysis (E=46 FG=104 I=756 S=94)					
Main Category	**SubCategory Code**	**%Email**	**%FG**	**%Interview**	**%Survey**
Readiness - Concerns	Copyright	4.35%	2.88%	3.97%	4.26%
	Privacy / Trust	0.00%	3.85%	6.08%	3.19%
	Security	0.00%	0.96%	0.93%	3.19%

Survey responses will now be considered making reference to the content analysis data where possible.

Survey Analysis and Findings

Following up on the content analysis portion of this chapter, survey data analysis is now presented to determine if additional insight can be gained or if the qualitative analysis and findings presented so far can be further solidified.

Results from the *wave analysis* (Table 25) referred to in Chapter Three, where a comparison was conducted on key variables among early and late survey responders to check for response bias, showed some differences. While responses from late responders were similar to early responders, the presence of differences suggests the possibility of response bias (Creswell, 2012:391-392) in the survey data. As such, some responders may not be representative of the sample studied. The key questions compared in the wave analysis pertained to:

a) *AmI* and *context awareness* (q10 –context aware, intelligent, smart; q12 – AmI in relation to Wireless Grids)
b) *creativity and innovation* (q16 – including autonomy and control; q17 – *new ideas generated* - self and other assessment); q23 – *disruptive*; q24 – *innovative* - assessment)

Other variables of interest compared included:

a) *readiness* and types of satisfaction (q2 – satisfaction (experience); q4 – satisfaction (features); q5 – satisfaction (functionality))
b) *emotions/affect* (q14 – positive and negative)
c) *social* (q8 – WeJay as a space supportive of interaction, collaboration, and sharing)
d) *wireless grids* (q28 – improved understanding of and potential)

A number of survey questions focused on readiness aspects in relation to *satisfaction* which is considered to be one of several intrinsic motivators along with the emotion/affect variables of interest and enjoyment (Amabile & Kramer, 2011:55-56). Recalling details from the content analysis, only minimal coding occurred for the satisfaction variable in interview data while an increase was evident in the open ended survey coding. Three survey questions inquired into satisfaction more directly. Firstly, in Q02 satisfaction was explored in relation to the WeJay experience.

Q02. Overall, how satisfied were you with your WeJay experience?

The response is presented below showing 65-80% satisfaction with no dissatisfaction indicated although 20% of responses were neutral. A graphic view of the response is presented in Figure 20 S-1 (Appendix I).

Q02. (n=20)	Very Satisfied	Satisfied	Neutral	Un Satisfied	Very UnSatisfied
WeJay Experience	3 (15%)	13 (65%)	4 (20%)	0	0

In Q4 satisfaction was then considered in relation to WeJay features.

Q04. Think of the features currently available in WeJay. Select the word or phrase that best describes the WeJay social radio environment.

The response is presented below showing 45% adequacy, 45% indication of 'not fully functional' and 10% found WeJay features to be somewhat unsatisfactory. A graphic view of the response is presented in Figure 20 S-1 (Appendix I).

Q04. (n=20)	Feature Rich	Plenty of Features but not fully Functional	Adequate	Somewhat Un satisfactory	Nearly Feature less
WeJay Features	0	9 (45%)	9 (45%)	2 (10%)	0

It is worth noting that 'unsatisfactory' appears in Q04 in relation to the 'social radio environment' although it is not indicated in Q02 in relation to the 'use experience'. Thirdly, survey respondents were asked in Q05 about satisfaction in relation to WeJay functionality on a matrix of 13 items. Participants were neutral on features such as social settings, activity stream, and search, followed by co-hosting and WeJay/Weheartradio website integration.

Q05. Thinking about WeJay in terms of functionality, indicate your level of satisfaction with how well things seem to work.

The response is presented below showing high levels of neutrality on many functionality items with an overall neutrality level of 38.5%.

Q05. (n=20)	Very Un satisfied	Un satisfied	Neutral	Satisfied	Very Satisfied
Installation	1 (5%)	1 (5%)	2 (10%)	8 (40%)	8 (40%)
User interface	0	1 (5%)	6 (30%)	11 (55%)	2 (10%)
Creating a user profile	0	1 (5%)	3 (15%)	9 (45%)	7 (35%)
Creating & describing a show	0	1 (5%)	5 (25%)	4 (20%)	10 (50%)
Locating items for playlist	0	3 (15%)	5 (25%)	7 (35%)	5 (25%)
Adding items to playlist	0	2 (10%)	5 (25%)	6 (30%)	7 (35%)
Co-hosting	0	0	10 (50%)	6 (30%)	4 (20%)
Finding beta users, shows, etc.	0	2 (10%)	9 (45%)	6 (30%)	3 (15%)
Social settings (e.g., Facebook)	0	1 (5%)	12 (60%)	4 (20%)	3 (15%)
Chat	0	0	9 (45%)	9 (45%)	2 (10%)
Activity stream	0	0	12 (60%)	5 (25%)	3 (15%)
Search feature	1 (5%)	2 (10%)	12 (60%)	3 (15%)	2 (10%)
Integration with Weheartradio	0	0	10 (50%)	5 (25%)	5 (25%)
Average	**0.153846 (.77%)**	**1.076923 (5.4%)**	**7.69231 (38.5%)**	**6.384615 (32%)**	**4.692307 (23.5%)**

Overall satisfaction showed levels ranging from 32% to 55.5% with satisfied at 32% (the interface taking the lead, followed by user profile creation and chat) and 23.5% at very satisfied (user profile taking the lead, followed by installation). Overall levels of dissatisfaction were apparent at just over 6%, with very unsatisfied showing .77% (pointing to installation and search issues) and unsatisfied (covering many issues) at 5.4%.

In the content analysis findings it was noted that considerable reference was made to the need for improvements in WeJay. In Q06, survey respondents were asked about their wish list for features and functionality on a matrix of 18 items.

Q06. What would your 'wish list' of features and functionality for WeJay look like?

The response is presented below showing an average 'strongly agree' for *improvements* in features and functionality of 70%, a 36% 'somewhat agreed', with very few neutral or dissenting responses.

Q06. (n=20)	**Strongly Disagree**	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**
Ability to rearrange item in playlist	0	0	1 (5%)	8 (40%)	11 (55%)
Ability to delete items in playlist	0	0	1 (5%)	7 (35%)	12 (60%)
Multiple file types	1 (5%)	0	1 (5%)	6 (30%)	12 (60%)
Voice over feature	1 (5%)	1 (5%)	0	9 (45%)	9 (45%)
Ability to schedule a show	0	0	2 (10%)	8 (40%)	10 (50%)
Make a show persistent to listen anytime	0	0	2 (10%)	10 (50%)	8 (40%)
Annotate shows in the playlist	0	0	8 (40%)	6 (30%)	6 (30%)
Display # of active listeners (WJ & Web)	0	1 (5%)	2 (10%)	7 (35%)	10 (50%)
A like feature for shows	0	0	0	10 (50%)	10 (50%)
A share feature for shows	0	0	1 (5%)	9 (45%)	10 (50%)
A recommend feature for shows, friends	0	0	2 (10%)	9 (45%)	9 (45%)
A follow feature for shows	0	0	2 (10%)	8 (40%)	10 (50%)
WeJay for iPhone, iPad including 'touch'	0	0	2 (10%)	5 (25%)	13 (65%)
Audio recording & editing	0	0	5 (25%)	5 (25%)	10 (50%)
Multimedia including video	0	1 (5%)	4 (20%)	6 (30%)	9 (45%)
Faster load time for dragging to playlist	1 (5%)	0	5 (25%)	4 (20%)	10 (50%)
Smoother play performance	1 (5%)	1 (5%)	2 (10%)	5 (25%)	11 (55%)
Consistency across platforms	1 (5%)	0	2 (10%)	6 (30%)	11 (55%)
Average	**0.277778 1.5%**	**1.277778 1.5&**	**2.333333 11.7%**	**7.111111 35.6%**	**10.05556 69.6%**

Features and functionality showing high levels of importance included mobility at 65%, followed by playlist control and file type diversity at 60% and then platform consistency and stability in performance at 55%. Several items were at the 50% level of interest including: scheduling a broadcast, listener display, like, share, and recording. Recommend (a form of ambient intelligence), voice over, and multimedia (including video) interest levels presented at 45%.

Further related to the readiness issue was Q19 which inquired into what would move WeJay from beta to use. Q19 included a matrix of 11 multiple choice items.

Q19. In your opinion what would move WeJay from beta to use?

The response is presented below showing mobility, cross platform compatibility, and more file types at 80%; build on show and profile details to support social informaton (a form of AmI) at 75%; voice over and video at 65%; playlist control at 60%; audio creation and editing at 55% and improved interface at 40%. A graphic view of the response is presented in Figure 25 S-6 (Appendix I).

Q19. (n=20)	**Responses**
Availability for mobile devices	16 (80 %)
Availability for all platforms (Windows, Mac, Linux, etc.)	16 (80%)
Improved interface incorporating 'touch'	8 (40%)
Build on information to support social information (e.g., interests)	15 (75%)
Voice-over feature during broadcasts	13 (65%)
Audio creation and editing	11 (55%)
Ability to reorder and delete playlist items	12 (60%)
Support for more file types	16 (80%)
Support for more media types (e.g., video, etc.)	13 (65%)
I have no idea	0
Other	4 (20%)

All participants had opinions on this question as evidenced by the absence of response for the 'I have no idea' option. Open ended responses were contributed by 20% of participants where, in one case, clarification was requested on the meaning of 'touch' in the "Improved interface …" matrix item. The importance of 'stability' of the product was contributed here, as well as the need for "tighter [social media] SM integration."

In another readiness-related question, participants were asked in Q20 to rate their concerns with the three matrix items of: copyright (of content being shared), privacy, and security.

Q20. Rate the concerns you had during your WeJay experience.

The response is presented below showing relatively strong percentages of unconcern across all items, particularly security, followed by privacy and then copyright.

Q20. (n=20)	Very Concerned	Concerned	Neutral	Unconcerned	Not an Issue
Copyright	2 (10%)	6 (30%)	3 (15%)	8 (40%)	1 (5%)
Privacy	2 (10%)	3 (15%)	5 (25%)	9 (45%)	1 (5%)
Security	4 (20%)	2 (10%)	3 (15%)	10 (50%)	1 (5%)

Nevertheless there was some degree of neutrality which was most pronounced on privacy, followed equally by copyright and security. Noteworthy levels of 'concerned' to 'very concerned' presented on all items, especially copyright and less so on security and then privacy.

Data collection for emotion was introduced into the survey instrument as a nine item (five positive and four negative) matrix question based on insights from interviews and focus group data. Positive emotion response, when not neutral, tended more strongly toward the 'somewhat' to 'strongly agree' range. Were survey respondents actually as emotion-positive as the matrix question responses seemed to suggest or is this only a portion of the fuller picture? The question and the results are provided below with averaging and discussion presented first for positive emotion and then for negative emotion.

Q14. To describe how you felt during your WeJay experience, please indicate your level of agreement with the following terms.

(n=20)	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
Adventurous	0	1	6	10	3
Enjoyment	0	0	2	13	5
Enthusiastic	0	0	4	11	5
Impressed	0	0	5	9	6
Surprised	0	3	11	5	1
Average	**0**	**0.8**	**5.6**	**9.6**	**4**

Negative emotion response, when not neutral, tended toward denial of negative emotional experience, although there was some level of agreement around frustration and impatience.

(n=20)	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
Bored	6	7	5	2	0
Confused	3	6	8	3	0
Frustrated	6	4	5	4	1
Impatient	5	7	4	4	0
Average	**5**	**6**	**5.5**	**3.25**	**0.25**

The survey question was followed by an open ended question inviting other terms that would describe how the participant felt. Positive terms such as interested, excited, and curious emerged although one response indicated an experience that varied from first use to last use. In the open ended response for Q03 this individual provided further details describing the movement from the positive to negative emotion experience and from satisfaction to dissatisfaction. Interview data confirmed a movement on the emotion spectrum from positive to negative for this individual. Looking at the emotion coded content analysis averages for open ended survey question data and the averages for survey question 14, there appears to be a closer coherence on negative emotion data than on positive emotion data.

Given the importance of the social dimension characterizing wireless grid, AmI, and social media environments, and the interruptive elements that emerged for participants associated with the social environment and other aspects of the WeJay experience, Q08 asked for an assessment of the social nature of WeJay.

Q08. In your view is WeJay a social space (e.g., supports interaction, collaboration, and sharing)?

The response is presented below showing a 70% agreement rate, 5% disagreement and a fairly sizeable 25% of respondents who were unsure. The 30% response encompassing disagreement and uncertainty about the social environment of WeJay confirms and synchronizes with the evidence that emerged during content analysis, suggesting that the social environment consitutued one of several interruptive elements for participants during the WeJay experience.

Q08. (n=20)	**Yes**	**No**	**Not Sure**
In your view is WeJay a social space?	14 (70%)	(5%)	5 (25%)

A graphic view of the response is presented in Figure 22 S-3 (Appendix I).

A key construct in this research study is that of ambient intelligence (AmI) in the form of context awareness, intelligence, and smartness in wireless grid environments. AmI emerged during content analysis in relation to features and functionality that would augment and perhaps obviate or lessen the need for search. Participants were asked in Q10 about ways to enhance AmI in WeJay.

Q10. What would make WeJay a more context aware, intelligent and smart space?

The response is presented below suggesting that 59% to 82% of respondents believe that WeJay can be made more context aware, intelligent and smart. Key components appear to be a listener indicator at 70% to 95%, followed by a 'like'

feature at 50% to 90%, and then a recommend feature for shows at 60% to 80%. An ad feature indicated considerable interest but was found to have some detractors as did the use of profile information. Interview and focus group data, support and provide additional insight, into perceptions of the ad feature. In the case of profile information, it is instructive to consider feedback in Q19 around the importance of building on profile information to support social information (75%). Again, interviw and focus group data, support and provide additional insight, into the use of profile information in social media contexts.

Q10. (n=20)	**Strongly Disagree**	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**
Use profile details to suggest users to each other	0	1 (5%)	4 (20%)	11 (55%)	4 (20%)
Use show details to recommend users to each other	0	0	4 (20%)	12 (60%)	4 (20%)
Use ads to enable listeners to locate & buy content	1 (5%)	1 (5%)	4 (20%)	12 (60%)	2 (10%)
Ability to like a broadcast	0	0	2 (10%)	10 (50%)	8 (40%)
WJ & web indicator of # of listeners to each show	0	0	1 (5%)	14 (70%)	5 (25%)
Average	**1%**	**2%**	**15%**	**59%**	**23%**

This question was followed by an open ended one where a number of participants offered comments and one individual expressed a need for more clarity on the question. In Q12 participants were then asked about the enabling capability of wireless grids for AmI.

Q12. I now recognize wireless grids tools can enable AmI systems and environments.

The response is presented below showing 75% agreement and while there was no disagreement, a not insignificant 25% indicated having no idea. Respondents were invited to elaborate and 55% contributed a variety of comments (analyzed as part of the content analysis) showing a range of understanding from, "Wireless grid

through their ubiquity will be an essential tool in creating AmIs" to "Even after using these tools I still really am not sure I understand what Wireless Grids are".

Q12. (n=20)	Yes	No	I have no Idea
WGs as enabling AmI	15 (75%)	0	5 (25%)

A graphic view of the response is presented in Figure 23 S-4 (Appendix I).

Regarding the key constructs of creativity and innovation, participants were asked in Q16 to rate whether they felt creative, in control, autonomous, and innovative while using or thinking about WeJay use.

Q16. Please indicate your level of agreement with the following statements.

When I was using or thinking about how I would like to use WeJay:

Q16. (n=20)	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
I felt Creative	0	2 (10%)	0	10 (50%)	8 (40%)
I felt In control	0	1 (5%)	7 (35%)	7 (35%)	5 (25%)
I felt Autonomous	0	1 (5%)	7 (35%)	9 (45%)	3 (15%)
I felt Innovative	0	1 (5%)	5 (25%)	7 (35%)	7 (35%)

The response showed 50% to 90% of respondents self assessed as feeling creative, 35% to 50% self assessed as feeling in control, 45% to 60% self assessed as feeling autonomous and 35% to 70% self assessed as feeling innovative. While there were no participants who strongly disagreed with any of these items, some indviduals somewhat disagreed and 25% to 35% remained neutral, except in the case of feeling creative where, interestingly, no one remained neutral.

This question was following up by another related question on creativity pertaining directly to the research study propositions. Participants were asked in Q17 to self- and other-assess for the creation of new ideas. 60% self-assessed for new idea creation while 70% indicated they thought about creating one or more new

ideas. A 50% split occurred between those who noticed that other beta trial users created new ideas and those who did not notice. Similarly, a 50% split emerged around those who had conversations with others where new ideas came up. This response points to the emergent conversational environment that was created around use of the WeJay tool.

Q17. In your assessment were new ideas created during your WeJay experience?

Q17. (n=20)	Yes	No
I created one or more new ideas	12 (60%)	8 (40%)
I thought about creating one or more new ideas	14 (70%)	6 (30%)
I noticed that other beta trial users created new ideas	10 (50%)	10 (50%)
Other people I talked to about WeJay came up with new ideas	10 (50%)	10 (50%)

Emergent behavior in the form of conversations about WeJay was also noticed during content analysis among focus group and interview participants, contributing to interpretations for use of the WeJay tool with peers, family, and others. The influence and impact of the parallel WeJay beta trial was also noted in relation to emergent conversations.

The extent to which WeJay was interpreted and assessed for use in educational settings was explored in Q18.

Q18. What is your assessment of the WeJay social radio concept for current use in educational settings?

The response is presented below showing an equal split in some cases, for example, those at the 25% level for *too new for people to grasp* and *exactly what is needed now*. Considered in relation to content analysis categories pertaining to education (e.g., 'interpretations for use' and 'possibilities', 'novel ideas' assessment, 'impact'), the educational dimension was very much in evidence. A graphic view of the

response is presented in Figure 24 S-5 (Appendix I). There is some indication that the tool is being eclipsed by other technologies (15%) while another 15% have no comment.

Q18. (n=20)	**Responses**
Too new for people to grasp	5 (25%)
Exactly what is needed now	5 (25%)
Being eclipsed by other technologies	3 (15%)
No comment	3 (15%)
Other	4 (20%)

Participants were asked in Q22, using a multiple choice format, about WeJay going forward.

Q22. What do you think the future holds for WeJay?

The response is presented below showing a 60% perception of WeJay as an opportunity to realize the unique potential of the core social radio idea, an equal perception of 60% indicating that WeJay is a simple way to implement the wireless grid concept of linking devices anywhere anytime, and a 55% perception of WeJay as a vehicle for the sharing of Open Educational Resources (OERs).

Q22. (n=20)	**Responses**
An opportunity to realize the unique potential of the core 'social radio' idea	12 (60%)
A simple way to implement the wireless grid concept, linking devices anywhere anytime	12 (60%)
A way to create and share multimedia Open Educational Resources (OERs)	11 (55%)
I have no idea	1 (5%)
Other	1 (5%)

The 55% rating for OERs provides further coherence with Q18 and the content analysis data on educational impact and potential. A very small percentage (5%) had no idea regarding what the future holds for WeJay while another respondent provided an interpretation for use of the WeJay tool, as an enabler for college and

university radio stations to draw DJs from across the student body, including distance students.

In assessing WeJay as a potentially disruptive innovation, participants were asked to rate the tool in Q23 on a scale of 1 (not really) to 5 (absolutely).

Q23. Suppose WeJay is implemented on a wireless grid connecting devices anywhere, anytime. Indicate on a scale of 1 to 5 if you think this would be disruptive to existing ways of doing things (e.g., unexpected creation of new markets using different values).

The response is presented below showing a higher concentration (45%) at the disruptive end of the scale than at the lower end (30%) and a significant weight in the center (25%). A graphic view of the response is presented in Figure 27 S-8 (Appendix I).

Q23. (n=20)	Not really	2	3	4	Absolutely
WeJay as Disruptive	2 (10%)	4 (20%)	5 (25%)	8 (40%)	1 (5%)

Participants were then asked to assess the innovativeness of WeJay in Q24.

Q24. In your assessment, is WeJay social radio an innovative tool?

The response is presented below showing a strong tendency toward being innovative with a 60% response for *somewhat innovative* and a 30% for *very innovative*. A graphic view of the response is presented in Figure 28 S-9 (Appendix I).

Q24. (n=20)	Very Innovative	Somewhat Innovative	Not Innovative	Not Sure	Other
	6 (30%)	12 (60%)	1 (5%)	1 (5%)	0

Conceptualized as a wireless grid enabled tool, WeJay was presented as the first in a series of applications to emerge from the Wireless Grids Innovation Testbed (WiGiT). As such, participants were asked in Q28, using a scale of 1 (not

really) to 5 (absolutely), to rate the extent to which their WeJay experience had contributed to an understanding of wireless grids.

Q28. The WeJay experience enabled me to come to a greater understanding of wireless grids and their potential. Rank your response to this statement on a scale of 1 to 5.

The response is presented below showing conflicting results at the upper and lower ends at 20% each. However, an overall tendency toward increased understanding is evident with 55% indicated, as opposed to 30% toward the lower level and 15% occupying the midrange. A graphic view of the response is presented in Figure 30 S-11 (Appendix I).

Q28. (n=20)	**Not really**	**2**	**3**	**4**	**Absolutely**
WGs Understanding	4 (20%)	2 (10%)	3 (15%)	7 (35%)	4 (20%)

In summary, a set of findings strongly supportive of the conceptual framework and theoretical underpinnings for this study emerged from the investigation of the launch and first use experience of the WeJay beta tool among faculty and students in a virtual distributed academic setting. Regarding the overarching research question, early indications from this study are encouraging, regarding the potential for wireless grid applications such as WeJay to contribute to new and transformative outcomes for people, information, and technology. In response to the other two research questions, much was learned about the experience of participants, particularly the importance of tool readiness, and considerable detail was provided on interpretations for use.

Regarding the study propositions, as a tool designed to foster creativity and innovation, the data analysis and findings suggest evidence of this capability. Novel and unexpected uses were assessed to be imagined, demonstrated, and in some

cases undertaken but not completed during the beta trial period. Based on recommended improvements to the tool, further potential exists to foster creativity and innovation. And finally, the conceptualized relationship between ambient intelligence (AmI) and the WeJay wireless grid environment was found to exist. Further, study findings revealed that more developed dimensions of AmI within WeJay would be both desirable and beneficial while respecting people's autonomy and control.

A discussion and interpretation of the study findings is presented in Chapter Five together with strengths and limitations, contributions, and implications and recommendations for research and practice.

CHAPTER FIVE: INTERPRETATION OF THE DATA

… imagination embraces the entire world, stimulating progress … It is, strictly speaking, a real factor in scientific research.

- A. Einstein

The previous chapter provided a presentation of the analysis and findings of the qualitative and quantitative data using the conceptual framework for the study in relation to the research questions and propositions. This chapter provides a summary of the research study, insight into the role of the researcher, and an interpretation in the form of a discussion of the findings in relation to the theoretical perspective and conceptual model elaborated for the study. An assessment of whether and to what degree the research questions and propositions are answered is presented followed by contributions, strengths and limitations, and recommendations and implications for research and practice.

Summary

Information communications technology (ICT) provides challenges and surprises during everyday use in the form of service disruptions, device incompatibilities, and shifting and evolving social media capabilities. This research study was motivated by the problem of ICT challenges and surprises which present opportunities to explore next generation innovations such as wireless grids and ambient intelligence (AmI) in search of new understandings, insights, and solutions. Wireless grids are an emerging form of network for sharing, creating new resources, facilitating connections across devices, and enabling ad hoc interactions. Ambient intelligence (AmI) finds its roots in ubiquitous computing and is variously referred

to as pervasive computing, proactive computing, and the Internet of Things. AmI is the large scale embedding and interweaving of technologies into everyday spaces forming an information landscape around human activity that is constantly in the making. The interplay of technology, people, and information afforded by this landscape, generates and constitutes intelligent environments where we can begin to think of information as ambient. Information resides not just at our fingertips but surrounds us, adapting to our needs and interests in the moment.

The purpose of this study was to investigate the potential of wireless grids as next generation technologies for education, in terms of their ability to support creativity, innovation, and intelligent information environments. Specifically, this study investigated the use experience and understanding of faculty and students in an academic setting when engaging with WeJay, a new form of social radio scenario which they were invited to assist in shaping. The study explored the embedded awareness features of WeJay and engaged participants in conversations on smartness and embedded information intelligence in wireless grid and social media environments.

This study investigated the first public wireless grid application in beta form to emerge from the Wireless Grid Innovation Testbed (WiGiT) Lab.

The overarching research question was:

> *Q: Do wireless grid enabled applications, such as WeJay, add to the potential for new and transformative outcomes for people, information and technology when deployed in an academic setting?*

Two additional questions investigated were:

Q1: What was the experience of participants involved in the beta trial launch of the wireless grid enabled WeJay social radio application?

Q2: How was the WeJay social radio application being interpreted for use during the beta trial/demo across selected segments of Syracuse University students and faculty and among WiGiT members?

These questions gave rise to four propositions which were investigated in relation to the WeJay beta trial/demo application environment. The four propositions are:

Proposition A: Novel and unexpected uses (e.g., beyond simple file sharing and other basic and generic documented capabilities, features, and functionalities) of the WeJay wireless grid enabled edgeware[18] application will be developed by users during the deployment.

Proposition B: The WeJay wireless grid application fosters an environment for innovation, as in "transformation[19] of a new idea into a new product or service, or an improvement in organization or process" (Heye, 2006:253).

Proposition C: The WeJay wireless grid application fosters an environment for creativity, as in "novel and useful ideas" for users.[20]

Proposition D: A conceptual relationship is emerging between wireless grid enabled environments and ambient intelligent (AmI) environments in terms of the generation of new types of information, in new places, facilitating the presence of 'ambient information' in the form of context awareness, as one of many possible examples.

In short, this study sought to: a) learn more about the use experience of a wireless grid enabled application; b) understand how this application was interpreted for

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[18] WiGiT, 2011. Edgeware is a new class of applications that can dynamically make use of content and resources present in devices - phones, pc's, cameras, printers, screens, etc. - connected by a wireless grid.

[19] Amabile (1996:31). "... evidence that the product breaks away from the *constraints* of the situation as typically conceived."

[20] Amabile (1996:35). "A product or response will be judged as creative to the extent that a) it is both a novel and appropriate, useful, correct or valuable response to the task at hand, and b) the task is heuristic rather than algorithmic."

use; c) determine whether novel and unexpected uses emerged; d) investigate whether wireless grid enabled environments fostered innovation and creativity; and e) elicit whether a conceptual relationship was emerging between wireless grid and ambient intelligent environments.

The increase and complexity of ICT issues is highlighted in the developing research domains of network science, wireless grids, and information and intelligent systems (IIS) which encompasses human centered computing (HCC). Wireless grid environments are characterized as collaborative, interactive, sharing-supportive, and mobile. Ambient intelligent (AmI) environments share the same characteristics and are additionally context aware, adaptive, personalized, and responsive.

This study drew upon emergence theory — emergent properties, emergent structures/processes, emergent patterns/attitudes and emergent behaviors — as a lens through which to investigate wireless grid and AmI environments from a social and socio-technical perspective. Emergence theory is evident in the gaming and virtual environments literature and this study found the theory to be particularly suited to wireless grid and AmI research in assisting to understand unknown, unplanned, and unexpected situations involving people, information, and technology. Emergence theory is concerned with that which is in-the-making and with novelty. The creativity and innovation research literature informed the investigation of the assessments of novel idea generation, interpretations for use, meaning generation, and transformative outcomes around the WeJay use experience. The context awareness literature, in particular, and the AmI literature

more generally, provided support for an understanding of intelligent information environments and concerns with social and human centered computing aspects. The software readiness literature assisted with investigating the early stage use of a pre-standards tool while the unintended consequences and unexpected possibilities literature supported understandings around opportunities for innovating the innovation and both seeing and imagining the potential for the unexpected.

Briefly, the conceptual framework for this study incorporated the constructs of innovation, creativity and context awareness while using emergence theory to frame and investigate the early use experience with a wireless grid social radio application which was theorized to be potentially transformative and disruptive.

A single case study, drawing upon multiple data collection methods, was used to investigate the WeJay use experience of students and faculty. As the first application emerging from the Wireless Grid Innovation Testbed (WiGiT) to be studied in a virtual distributed academic environment, the case is considered to be *critical* in nature. The case is also *revelatory* in that it allowed for the study of an application that had not, until now, been available to researchers. Study participants were invited to download and install the WeJay tool; create a radio station; create a radio show with content of their choice; host or cohost the show with another individual; and stream the show for shared listening within WeJay, with Facebook friends, and with others who wished to tune-in to the Weheartradio broadcast on the Internet. As a largely exploratory study, an unstructured approach

with minimal supports and influences were used, encouraging maximal exploration over a four month period.

Data collection methods included: activity data, interviews, focus groups, and survey. Activity data was captured on whether, how, and to what extent the WeJay tool was used. The quantitative activity data was enriched with qualitative evidence gathered through interviews and focus groups which utilized pretested protocols to inquire into the WeJay experience. Based on interview and focus group data a survey instrument was developed, pretested, and administered to participants. While the survey generated quantitative data, the inclusion of open ended questions also contributed to the qualitative dataset.

Content analysis was used to inductively gather insight into the focus group, interview, and open ended survey data. Deductive coding was also used during content analysis, drawing upon the theoretical framework and key constructs for the study. A second coder was engaged to test and refine coding techniques and practices. A total of 1000 text segments were separately coded by each coder and comparatively analyzed for inter-coder reliability (91%-94%). Descriptive statistics were used to present the analysis and findings (n=34). A subset of these individuals responded to the survey (n=20). Several types of triangulation were conducted, namely: data triangulation across multiple sources of evidence; methodological triangulation across different methods and across quantitative and qualitative data; and investigator triangulation through the use of multiple coders.

The main findings of this study were in alignment with the conceptual framework and theoretical perspective. Response to the *overarching research question* showed encouraging results in terms of whether wireless grid enabled applications such as WeJay add to the potential for new and transformative outcomes for people, information, and technology.

All four research propositions were supported by the findings which indicated that the WeJay tool fostered creativity and innovation; that novel and unexpected uses were assessed by participants to have been generated either by themselves or by others; and the theorized relationship between ambient intelligence (AmI) and the WeJay wireless grids environment was confirmed to exist. Additionally, it was found that enhanced dimensions of AmI within wireless grid applications such as WeJay would be both desirable and beneficial with the caveat, in keeping with human-centered computing (HCC), that the importance of people's autonomy and control be recognized, respected, and facilitated.

The WeJay tool proved to be both usable and studyable at this early beta stage. Whether participants were able to engage with the WeJay product or not, their exposure to the tool resulted in an abundance of interpretations for use of the tool, recommended tool improvements, and the identification of future potential uses. More extensive research is required based upon: a) a more stable product with an enhanced and more fully functional feature set and b) a more populous study sample.

Before engaging in a discussion of the interpretation of this research study a brief reflection on the researcher's role is provided.

Reflections on the Researcher's Role

Because case study research involves documents, activity data, observation of events under study, focus groups and interviews with individuals involved as the 'sources of evidence', researcher control was generally not present. However, Yin (2009:11) notes the possibility of informal manipulation during participant observation. While conducting interviews or focus group sessions, protocols were carefully and consistently followed and an unbiased tone and manner was employed. Focus was placed upon listening, learning, probing, and the use of open-ended questions. Where respondents answered more than one question in response to a particular question, all questions were nevertheless asked in sequence, allowing for more complete and rich data to emerge.

Based on considerations of Amabile's Consensual Assessment Technique (CAT), the researcher monitored for dimensions of creativity and innovation emerging from the WeJay beta trial/demo experience and interactions. As moderator in a focus group session, the researcher is regarded as the "instrument" (THCU, 2002). As such, the researcher acknowledged that this was a very key and sensitive role, requiring a particular balance of skills to facilitate the engagement and participation of everyone involved. The researcher was careful to see if other participants in the focus group emerged in the role of 'natural experts or judges' in the assessment of creativity and innovation that emerged.

Ambient intelligence (AmI) in the form of contextual and other types of embedded awareness and smartness tends to be largely invisible, or 'taken for granted', in the words of one participant. As such, the researcher introduced WeJay examples (e.g., presence awareness) and possible capabilities where the functionality and features were not yet in place (e.g., leveraging of show description information to facilitate meaningful connection between WeJay users) into the discussion to encourage and facilitate participant understanding and response. In this way, the researcher played a bridging role to assist participants in navigating around the perceived shortcomings of WeJay features and functionalities (state of WeJay readiness). Where use was not possible for some participants, imagined use was invoked during interviews and focus groups, yielding high levels of engagement and response. This bridging mechanism allowed for the interplay between use and imagined use, confirming the value of work by other researchers such as Felt, Schuman, Schwartz, & Strassnig (2012) who, although using a different technique, engaged people imaginatively in discussions about emerging technologies.

Discussion

Social media environments such as WeJay social radio are characterized by the complexity of interacting variables encompassed in the participation experience. Evidence of emotion/affect, whether positive or negative, was everywhere present during the WeJay beta trial experience. Affordances and constraints of the socio-technical environment influenced the social, sharing, and collaboration dimensions as well as content creation, access, and diversity. Interactions with the socio-

technical environment affected emotions and emotional experience in turn affected interactions with the socio-technical environment. This finding confirms what has been learned by other researchers (Scherer, 2005; Amabile & Kramer, 2011; Lopatovska & Arapakis, 2011). Further, emotion and valence of the emotion (e.g., positive or negative) in relation to the experience of the socio-technical environment, influenced engagement.

What was learned, initially and often, throughout this research study was the importance of autonomy and control for participants during the WeJay use experience. Autonomy and control figured strongly across the key constructs of creativity, innovation, and context awareness, including AmI, generally. This study confirms earlier findings on autonomy and control which are well documented in the research literature in relation to creativity and innovation (Amabile, 1996; Amabile & Kramer, 2011). This study also confirms earlier findings by Sebe (2009) and De Ruyter & Aarts (2009) on the importance of human-centered factors in relation to AmI. Further, this research study lends additional support to the importance of autonomy and control in relation to wireless grids which have been articulated in the research literature in relation to collaborative learning environments (Ramnarine-Rieks et al., 2011; Ramnarine-Rieks & McKnight, 2010).

The pervasiveness and widespread use of social networking sites (SNSs) has contributed to shifting and evolving notions of sharing, social, trust, privacy, and interaction (Chang & Hsu, 2012; Srivastava, Abdelzaher, & Szymanski, 2012; Papacharissi & Gibson, 2011; Zhang, 2010; Baym, 2010b; Boyd, 2010; De Ruyter,

2010; Coenen, Van den Bosch, & Van der Sluys, 2009; Boyd & Ellison, 2007). This study provided further confirmation of the evolving notions of sharing, social, privacy and trust. These and other dimensions of the wireless grid WeJay social radio tool, as a social media space, are addressed below.

Sharing, Social, Privacy & Trust

As illustrated by the relatively higher volume of text segments coded for *sharing* (Table 34), this capability was of great interest to participants who demonstrated a willingness and desire to share music and diverse types of content, including the shared experience of listening with others. In fact, participants felt limited by the ability to share only one file type (mp3), seeking and expecting to be able to share images, documents, video and other multimedia content. The finding of this expectation is in keeping with the notion of mixed-reality environments described by Borgman (2008) as enabling "new modes of interaction, new audiences, and new models of assessment." In earlier wireless grids research, Van de Wijngaert & Bouwman (2009) studied the willingness to share around theorized use of a new peer-to-peer technology. In the 2009 study, *trusted context* was found to be a key factor for sharing. The willingness to share appeared to be strongly in evidence in this study although often within the trusted contexts of designated circles of friends, peers, family, or colleagues. Ariyachandra & Bertaux (2010:696) claim that, in the face of "the enjoyment and desire to get information from social networking", issues of privacy and trust, "appear to be eclipsed." In this respect, it is worth noting that when study participants learned that WeJay radio shows could be

aired through the Weheartradio website, going to wider and unlimited audiences, this sparked interest and excitement about the possibility of reaching and engaging greater numbers of listeners. The importance of real-time feedback was articulated together with an enhanced tool that would provide details on the volume and duration of listening, as indicators of value for the broadcast. Participants wanted to share their content and they also wanted others to share and provide access to content, enabling the remixing of content by others into one's own show for sharing. This type of sharing gives rise to copyright issues on the one hand while also encouraging the use of shared content (e.g., Creative Commons) and Open Educational Resources (OERs). This type of content sharing gives further support to initiatives earlier promoted by Borgman (2008) and McGreal (2012) as part of the notion of ubiquitous learning.

WeJay was generally perceived and understood by participants to be a private space for sharing although this capability had not been built into the beta product. As mentioned above, when participants realized that the sharing of WeJay broadcasts extended more broadly to anyone on the Internet via the Weheartradio website, interest was ignited by the possibility of the number of listeners one could attract to one's radio station, the duration of listening, and the types of commentary that could be achieved. Many participants, when responding to the survey, requested the addition of an indicator of listeners, like and dislike features, and recommending capabilities. The importance of this of type of real-time feedback is in keeping with Amabile & Kramer's (2011: 88) findings around the importance of

progress markers as motivators for people. Further, receiving feedback from valued peers and others would constitute the notion of assessment by experts as articulated by Amabile (1996) and interpretations by experts advanced by Verganti (2009).

The shifting and evolving notions of privacy may also account for the lower levels of concern indicated around privacy. However, a number of factors must be taken into consideration when discussing privacy issues in this study. First, 35% of respondents viewed a demo of the WeJay product. These individuals were unable to use WeJay for one of several reasons related to the state of readiness of the beta product. As such, the experience of viewing a demo of the product as opposed to actual use of the product may affect the reliability of findings around privacy in this study. Further, several participants commented on the time and focus required in 'figuring out' how to install and use the tool in some meaningful way. While time and effort required to 'figure out' an application pertains to ease-of-use and other issues, participants likened the experience to Facebook where using the tool tended to take precedence over considerations of privacy and security. Once a comfort level was achieved with use, which was considered to be a primary objective, exploration of secondary matters could then be undertaken, including privacy and security settings and options.

The evolving nature of social networking environments and their prevalence and wide usage, respond, it would seem, to the need for the "social and mental changes" referred to by McKnight et al. (2005) in assessing wireless grids from a

user perspective. Even participants who self-assessed as knowing nothing about social media, preferring to avoid such environments, turned out, upon more in-depth probing to be users and appreciators of social media. This finding serves to illustrate just how pervasive social media technologies are in our lives, to the extent that we take them for granted and become unaware of their presence. For social media spaces to be regarded as social, participants expected large numbers of people in the environment; a certain level of embedded intelligence in support of social networking; and real-time functionality including mobility, as in anytime, anywhere. Some participants believed that the convergence of social networking and wireless grid enabled applications would set the stage for the next breakthrough in technological development and capability. One approach suggested was that wireless grid enabled applications would need to leverage existing social platforms and networking while another perspective envisioned wireless grid enabled applications being leveraged within existing social platforms and networks. In the words of one participant, "it got me thinking about other aspects of social media and maybe the next frontier of social media." Another participant commented that, "When I saw this communicative radio application running, it created a whole state of new mind, of new thinking. I had to be more creative and find a way of making it work." Whatever the scenario or mix of scenarios that may be possible for the future, some participants demonstrated a high degree of engagement in terms of thinking and feedback while others indicated great interest in the ongoing developments of wireless grid technologies.

Ambient Intelligence (AmI), Awareness, & Embedded Knowing

We learned more about perceptions of AmI generally and about context awareness in social media spaces, more particularly, and the potential for the intersection of the two, as in, ambient intelligence (AmI) in wireless grid enabled environments. The proposition claiming that a relationship is emerging between wireless grid environments and AmI was plausible and was shown to actually exist, at a minimal level, in the current iteration of WeJay. Further, this study found that more developed and extensive forms of intelligence and smartness are desirable in wireless grid tools. Based on the volume of text segments (194) coded for categories of AmI, participants engaged in a wide range of meaningful conversations and survey responses on different types of awareness (e.g., contextual, presence, resource, and situational) and smartness. Some participants noted that awareness systems are a fundamental part of social media spaces and are now 'taken for granted'.

Russ et al. (2009) noted the dichotomous possibilities for ambient information systems (AIS), assisting people to become:

> … *informed*, *inspired* and *liberated* humans profiting from more comfort, physical health and safety to *dependent*, *subdued*, *addicted* creatures who are subject to ubiquitous observation, surveillance and control …

Upon closer scrutiny with participants of embedded, pervasive, aware, and smart technologies, this study provided the opportunity to: a) reach greater understandings around the workings and benefits of ambient intelligent technologies and b) gather thoughtful responses. In the words of one respondent, "I

don't mind the trade off" when sharing profile information "if people know that I like rock music. So if it sends that information off and then it gives me song suggestions back. I think that's a very fair trade." The importance of the information dimension was articulated by another participant who observed that if "I'm defined in my profile as a potential policy maker" and using the example of "a live session where Hilary Clinton is speaking about the Internet", if WeJay "can provide me something that I like, it is an incentive to come back, to be connected all the time."

A critical aspect of this research study was the opportunity afforded to engage in conversation about AmI, a timely issue for human-centered computing (HCC) and Information and Intelligent Systems (IIS), more broadly. In thinking about system intelligence to assist the user, one participant's description was as follows: "you can tune things to your own liking" adding that "it's a certain amount of personal control that I personally will hate to lose as it goes on and on." Yet the same participant observed that, for WeJay "there are some evolutions to be gone through to get to where people can intuitively find things that they are interested in." Concern with the surveillance dimension of social media tools and embedded awareness technologies was highlighted by one participant, echoing Lyon's (2012) concern with *social sorting* and the *culture of surveillance*.

Imaging how it would be possible to achieve beneficial uses and outcomes, one participant envisioned wireless grid enabled applications to be a way of undertaking real-time data monitoring and mining, using health care or vehicle

problems as an example. For example, issues may arise intermittently or as 'rare events' and are often missed or undiagnosed by routine checkups. Persistent monitoring would enable the timely identification of the 'rare events'; the generation of alerts; and the use of this information for response and remedy purposes. This finding echos the thinking of Christakis (2012) who believes that improvements for humanity can be achieved through the use of 'big data' in what is referred to as "the era of computational social science." The culture of surveillance articulated by Lyon forms part of the 21st century social sciences conversation perhaps which Christakis interprets as an opportunity for coming to greater understandings about human behavior and its evolving, emergent nature.

In the context of ambient journalism, Papacharissi & de Fatima Oliveria (2011) speak of the *ambient information sharing environment* constructed in Twitter through tweeting streams which are strongly infused with news, emotion/affect, the drama of events in real time, opinion, and the maintenance of a shared space between new information episodes. This current study serves to extend the value of the *ambient information sharing environment* into conversations and considerations of the benefits of AmI in wireless grid enabled environments. For example, it was suggested that the real time generation, capture, and leveraging of information for immediate exchange and use would contribute to more effective interaction in emergency situations with an improved WeJay tool. Further, persistent tracking and capture of data related to vehicle problems or health issues would contribute to the capture of information on rare or random events, in real

time, enabling immediate diagnosis and response with an enhanced and smarter WeJay application. As such, these interpretations and recommendations illustrate how we as researchers and research participants can influence the development and direction of next generation technologies such as AmI-infused wireless grids. Cognizant of dissent, Böhlen & Frei (2009:911) "take stock of critical voices and expand the discussion around ambient sensing and control in the city to a conceptual kit for thinking about building livable cities for the 21st century." It is possible that this study could serve as a bridge to further research and practice contributing an AmI in wireless grid enabled environments perspective to the conversations and larger concerns with 'livable cities' and spaces 'for the 21st century.'

Looking across the key constructs comparatively, the volume of text segments coded for AmI slightly surpassed those for creativity (189). In the case of innovation categories, coding for text segments totaled 276, 74 of which pertained to possibilities and 104 focused on interpretations for use.

Innovation

While WeJay was considered to be an innovative and potentially transformative tool by some participants, others were unsure or were inclined to perceive the tool as somewhat innovative and more evolutionary in nature. Although WeJay was assessed by participants to have a range of actual and potential impacts, the limited capabilities of the beta version, together with the small sample size in this study, encourage a cautious optimism regarding whether

and to what extent wireless grid enabled applications, such as WeJay, add to the potential for new and transformative outcomes for people, information and technology. That participants wanted to continue using WeJay if recommended improvements, features, and functionalities were implemented, is suggestive of the power of the *perceived value* of the tool. As such, this study further supports the importance of this variable which is found in the literature reviews on innovation by Ram, Cui, & Lu (2012), Garcia & Calantone (2002), and Eveleens (2010).

Related to the proposition that the WeJay tool fostered innovation, was the belief by some participants, that younger individuals would be the population most likely to generate:

a) interpretations for use of the tool

b) novel ideas when using, or thinking about using, the tool.

This research study encompassed individuals spanning five decades with ages ranging from the 20s into the 60s, with evidence that people of all ages were contributing to the innovative endeavor of WeJay through: interpretations for use, interpretations for possible use, and novel idea generation. This finding supports the European Commission's diversity and innovation research literature (2009). In the work group literature, Hennessey & Amabile (2010:580) stressed the importance of the 'management of diversity' while 'interpersonal congruence' in groups was identified as an important variable by Polzer, Milton, & Swann (2002). However, in human centered wireless grid and intelligent information environments, opportunities for reconsidering diversity in new ways exist. For

example, the importance of diversity, incorporating demographic and other individual attributes identified by the European Commission (2009:7) in relation to innovation was mentioned recently in discussions by Fidler (2012) of the workplace of the future:

> "… a combination of different ages, skills, disciplines, and working and thinking styles are significant contributors to innovation and effectiveness."

This current research study supports Fidler's assertion while also contributing important insight into the rationale and value of including faculty and students at all levels (as this study did) and staff, in doctoral and other research studies, and individuals in various domains (e.g., iSchool, Newhouse, Whitman, WiGiT member universities). Other literature that may be relevant to considerations of diversity is the work by Horner Reich & Kaarst-Brown (2001) who addressed seeding innovation within the organization through increasing the Information Technology Quotient (ITQ) across the organization when IT individuals move out of IT into other parts of the enterprise. More recently, Li & Bernoff (2011) looked at involving customers in innovation through the use of social technologies.

Going forward, as new technologies emerge and become more mobile and embedded, it is instructive to consider the literacy perspective. For example, Arnone & Reynolds (2009) point to the importance of the relationship between digital literacy and information literacy and the need for multiple literacies in 21st century learning spaces supporting curiosity, creativity, and innovation.

Creativity

Keeping in mind the range of constraints identified in relation to the state of readiness of the tool and the small sample size for this study, WeJay was assessed by respondents to foster creativity and support the generation of novel ideas (self and other reported). Many interpretations for use, both actual and potential, were identified by participants. While Kreitler & Casakin (2009:202) advise that, "self-assessments of creativity cannot replace assessments by experts", this study involved self-assessments by individuals who were considered to be experts and who self-assessed, assessed, and were assessed by peers. Overall, the assessment of the tool to foster creativity and innovation was underlined by participants with tentativeness, conditional upon improved stability and functionality. It was recommended that a range of enhancements be incorporated into the tool in support of social, sharing, and interaction, relating back to the key constructs of creativity, innovation, and context awareness.

Exploring the relationship between satisfaction (intrinsic motivation) and creativity articulated by Amabile (1996), three questions pertaining to satisfaction were introduced into the survey instrument during this research study. While survey responses shed light on satisfaction around the WeJay use experience and features and functionality that would contribute to greater satisfaction, the nature of social network sites (SNSs) also needs to be considered. In studying satisfaction in social networking usage, Zhang (2010) found satisfaction to be a key determinant of usage along with the important role played by *sense of community (SOC)*. When

the WeJay tool and other wireless grid applications are enhanced to support more robust and effective social spaces, the potential exists for more to be learned about the satisfaction and sense of community variables, particularly in AmI infused wireless grid environments.

Content

The importance of a tool able to support diverse types of content emerged from this study. Further, 'quality of content' as a key factor related to satisfaction, contributes in turn to the perception of value which is in keeping with Zhang's (2010) claim. In the many interpretations for use that emerged and the possibilities envisioned for the tool, being able to create, repurpose, and share specific types of content was an important motivator for continued use. Some participants made reference to the commercialization of WeJay and in this respect, content as perceived value, could have important implications. How WeJay is commercialized is also important in that some participants wondered if an improved WeJay would come with a cost, whereas the preference would be for a free tool. Compared to other social media tools, the expectation would be a freely available tool which would also be in keeping with the open source model. The tool was interpreted for use in research and educational environments where the preference would also be for a freely available tool. At the same time, the 'rush to commercialization' was cautioned against, in terms of the tendency of possibly shortcutting a more developed tool and conceptual environment.

Confounding Findings

This study found that there is something compelling about the WeJay tool which contributed to an appetite for continued use after the beta trial, conditional of course upon implementation of recommended improvements in features and functionality. Despite many negative valence emotions, a tool exhibiting a range of constraints, and a tool which was inaccessible to some participants, enthusiasm for the tool persists. Is there a hidden or confounding variable at play contributing to the continuing interest in WeJay going forward? Is the compellingness related to a willingness to please the researcher? Indeed one participant challenged the researcher during an interview, maintaining that the tool did not foster a sense of creativity even though it would be nice perhaps to indicate that it did to satisfy the researcher. Later in the interview the researcher learned that with one particular enhancement (voice-over), the tool would in fact enable this participant to feel creative and be motivated to be creative. Is the compellingness of the tool in some way related to features attentive to the human-centered interaction allowing for autonomy and control? Or, is the tool compelling because it responds to the aspirations and hopes, on the part of participants, that wireless grid enabled tools could possibly be the next great innovation enabling computing to more completely move from the desktop to begin to form an 'infrastructure surrounding human activity.' As such, the WeJay wireless grid tool is perhaps assisting in realizing earlier claims and envisionings by Canny (2001) and more recently articulated by Sebe (2009:353) in relation to human centered computing (HCC). Further, the

compellingness may be related to what wireless grids researchers such as Ramnarine-Rieks et al. (2011:3-4) and Treglia et al. (2011:3) are referring to when they speak of "an emerging infrastructure that will fundamentally change the way we think about and use computing."

With the release of this first wireless grid application and the study findings on the importance of autonomy and control and a more human-centered computing (HCC) tool, the stage is now being set for the WiGiT Lab to realize the larger potentials for wireless grids based on a range of suggestions and recommendations. A WiGiT response would cohere with the HCC research opportunities agenda articulated by Sears et al. (2008:36) in an earlier National Science Foundation (NSF) workshop and more recently, a vision organized by the NSF (2012) into the broader area of Information & Intelligent Systems (IIS) encompassing HCC, Information Integration and Informatics (III) and Robust Intelligence (RI). This research study also provides a strong statement in support of, and further encouraging, the innovation in cyberlearning environments advanced by Borgman (2008:17), citing a Pew report (Horrigan, 2008) calling for:

> applications and users' data archives [becoming] accessible by different devices anytime, anywhere over fast and widely available wireless and wired networks [adding that] It is hard to overstate the importance of online access becoming decoupled from desktop computing.

It is as though Borgman and Horrigan are anticipating the next generation types of ad hoc, mobile, adaptive networks, and emerging infrastructures and applications afforded by AmI-infused wireless grid enabled technologies.

Unintended Consequences & Unexpected Possibilities

Among possible unintended consequences or unexpected possibilities emerging from the WeJay beta trial is the desire by some to move beyond the constraints of radio as a background source of entertainment and information to a more multimedia-based tool, infused with awareness features in support of more intelligent interactions, sharing experiences, and a wider range of content. Whether this would move the notion of radio from background to foreground could be an unintended consequence of the tool. If WeJay were further developed in support of these capabilities, unexpected possibilities could be realized in terms of revised conceptions and understandings of radio as social.

Discussing web intelligence (WI), Sajja & Akerkar (2012:61) describe how developments around wireless networks and the Internet "have made users of information and communication technology (ICT) do everything in a differently efficient way." This research study argues that the particular combination of social networks and wireless grids, infused with AmI, could contribute to unexpected possibilities beyond simply sharing. In the view of one participant, wireless grid enabled applications such as WeJay, need to combine and leverage information streams from wireless technology and social networks to create new applications. New applications will in turn contribute to changes in behavior, supporting increased interaction and new avenues to grid environments. With new kinds of applications, the unexpected possibilities of wireless grid technologies as social,

intelligent, interactive, and human-centered, with a wide range of educational and other uses, could be more fully demonstrated and realized.

Response to the Research Questions & Propositions

Each research question and proposition is presented below followed by a description of the response provided by this study.

Overarching Research Question Q – Transformative Outcomes

The overarching research question was:

Q: Do wireless grid enabled applications, such as WeJay, add to the potential for new and transformative outcomes for people, information and technology when deployed in an academic setting?

In response to this question, survey respondents were asked to assess the disruptiveness of WeJay, if the tool is implemented on a wireless grid connecting devices anywhere, anytime. Using a 5-point scale, where 1=not really and 5= absolutely, Figure 12 shows a 5% response at the 5 level, a 40% response at the 4 level, 25% at the 3 level, 20% at the 2 level, and 10% at the 1 level. In summary, at the upper end of the scale, the total of 4 and 5 is equal to a fairly high 45% indication of disruptiveness with another 25% of responses in the midrange.

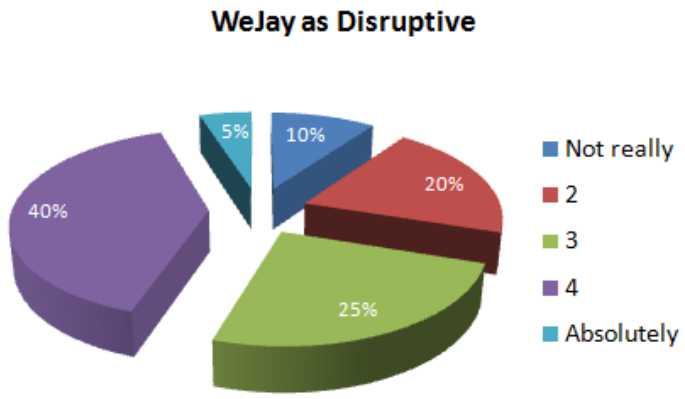


Figure 12: Transformative Outcomes: WeJay as Disruptive.

Research Question Q1 – Use Experience/Outcomes

Two additional questions were investigated in this study. The first of these asked the question:

Q1: What was the experience of participants involved in the beta trial launch of the wireless grid enabled WeJay social radio application?

A range of experiences and outcomes, based on the WeJay experience, emerged during this study, as enumerated below. It should be noted that the list is not exhaustive.

1. Increased **music awareness**
2. Decision to **purchase music** based on WeJay listening experience
3. A **Job offer** from a Facebook friend to host a local radio show
4. The opportunity to think about and **discuss, embedded intelligence-awareness-smartness**
5. Spontaneous de-anonymizing in WeJay (**emergent behavior**)
6. Providing tutorials to others (peer scaffolding, **emergent learning**)
7. Engaged friends-family-colleagues in experience and **conversations** about WeJay

Research Question Q2 – Interpretations for Use

The second research question asked:

Q2: How was the WeJay social radio application being interpreted for use during the beta trial/demo across selected segments of Syracuse University students and faculty and among WiGiT members?

A sampling of interpretations for use, both actual and potential, through exposure to the WeJay tool is provided in Table 40. Potential uses are predicated on an improved tool.

Table 40: Interpretations for Use - Actual & Potential

	Interpretations for Use - Actual	Interpretations for Use - Potential
1	Cohosting a show at a distance & engaging others in conversations around use	Use of each WeJay device as a sensor to generate data for data mining using embedded intelligence
2	Innovative tool to create & share content	Making music together, geographically dispersed
3	Select & organize music in for airing & sharing	Capturing & sharing artifacts, images, video, etc.
4	Education (science & engineering) Entertainment	Incorporating video & multimedia into instruction
5	Significance of jazz in a Texas town in the 30s	Enable voice-over & persistent content Leverage other social media platforms Be leveraged by other social media platforms
6	Doctoral program related, Environmental info, Music, Presidential speeches, Policy, Social change	Sharing current cultural content (music, etc.) as a means to keep in touch with new terms, concepts, and ideas entering a language and a culture
7	Science & engineering (informative podcasts threaded with current music)	Imaginative uses in educational settings
8	Media messages affecting attitudes & behavior	Airing the work of new musicians
9	A tool providing research study opportunities	Leverage in support of research content & work
10	Doctoral research work	Embedded intelligence connecting people & content
11	Modeling content & use as inspiration	Record rural sounds for people in urban spaces
12	Conversing through the chat feature when listening	Tag text content & audio for access & retrieval
		Use of feedback from listeners to validate content

Proposition A – Novel/Unexpected Uses

The research questions gave rise to four propositions which were investigated in relation to the WeJay beta trial/demo application environment.

Proposition A: Novel and unexpected uses (e.g., beyond simple file sharing and other basic and generic documented capabilities, features, and functionalities) of the WeJay wireless grid enabled edgeware application will be developed by users.
Novel ideas and unexpected uses generated during the study are presented in relation to interpretations for actual uses.

Table 41: Novel Ideas & Unexpected Uses - Actual

	Novel Ideas	Interpretations for Use
1	Collaborative activity	Cohosting a show at a distance & engaging others in conversations around use
2	Creation of content	Innovative tool to create & share content
3	Curation of content	Select & organize music in for airing & sharing
4	Games	Education (science & engineering) Entertainment
5	History of place/time through music	Significance of jazz in a Texas town in the 30s
6	Information sharing	Doctoral program related, Environmental info, Music, Presidential speeches, Policy, Social change
7	News	Science & engineering (informative podcasts threaded with current music)
8	Public service announcements (PSAs)	Media messages affecting attitudes & behavior
9	Research grants	A tool providing research study opportunities
10	Research studies	Doctoral research work
11	Sharing	Modeling content & use as inspiration
12	Socializing while listening	Conversing through the chat feature when listening

Novel ideas and unexpected uses generated during the study are then presented in relation to interpretations for potential uses, with an improved tool in Figure 42.

Table 42: Novel Ideas & Unexpected Uses - Potential

	Novel Ideas	Interpretations for Potential Uses
1	Big data	Use of each WeJay device as a sensor to generate data for data mining using embedded intelligence
2	Collaboration in real time	Making music together, geographically dispersed
3	Cultural preservation	Capturing & sharing artifacts, images, video, etc.
4	Education	Incorporating video & multimedia into instruction
	Interactivity – People – Systems	Enable voice-over & persistent content Leverage other social media platforms Be leveraged by other social media platforms
5	Language / cultural evolutions	Sharing current cultural content (music, etc.) as a means to keep in touch with new terms, concepts, and ideas entering a language and a culture
6	Learning	Imaginative uses in educational settings
7	Promotion	Airing the work of new musicians
8	Research	Leverage in support of research content & work
9	Smartness	Embedded intelligence connecting people & content
10	Sounds of nature	Record rural sounds for people in urban spaces
11	Taxonomy of content	Tag text content & audio for access & retrieval
12	Validation of music interests	Use of feedback from listeners to validate content

Proposition B – Fosters Innovation

The second proposition claimed:

Proposition B: The WeJay wireless grid application fosters an environment for innovation, as in "transformation of a new idea into a new product or service, or an improvement in organization or process" (Heye, 2006:253).

In response to this question, survey respondents were asked to assess the innovativeness of WeJay. Using a likert-type scale (e.g., Very Innovative, Somewhat Innovative, Not Innovative, Not Sure), Figure 13 shows a 30% response for Very Innovative, a 60% response for Somewhat Innovative, 5% for Not Innovative, and 5% for Not Sure. In summary, a total of 90% of respondents could see some degree of innovativeness or innovative potential in the product.

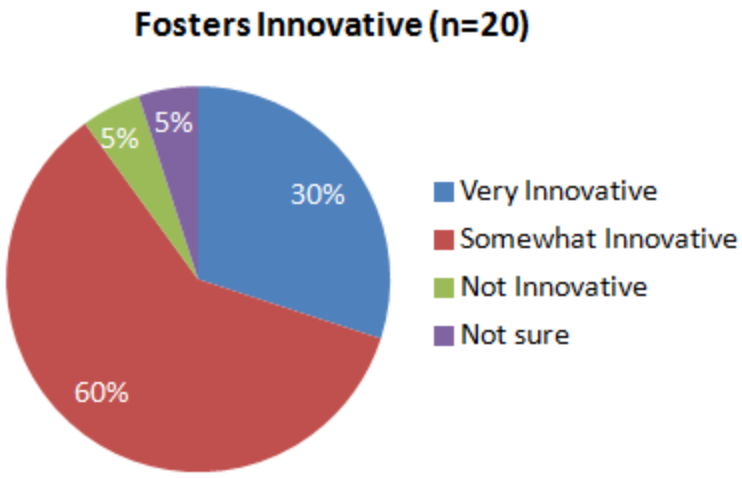


Figure 13: WeJay as Innovative

In probing deeper to capture the capability of the tool to foster innovation, survey respondents were asked to assess the statement: *When I was using or thinking about how I would like to use WeJay, I felt Innovative*. A likert-type scale was used and 35% Strongly Agreed, 35% Somewhat Agreed, 25% remained Neutral, and 5% Somewhat Disagreed. In summary, the perceived ability of the tool to foster innovativeness is present, with a combined somewhat and strong response of 70%, somewhat moderating the overall perceived innovativeness of the tool at 90% (60% and 30%) in Figure 13.

Proposition C – Fosters Creativity

The third proposition claimed:

Proposition C: The WeJay wireless grid application fosters an environment for creativity, as in "novel and useful ideas" for users.

Survey respondents were asked to assess idea generation in four ways. As indicated in Figure 14, 60% indicated they created one or more ideas while 40% indicated they did not. 70% indicated they thought about creating one or more ideas while 30% indicated they did not. A 50% - 50% split was indicated by those who noticed other users created new ideas and those who did not notice. Similarly, a 50% - 50%

split occurred for those who indicated idea generation during conversations with others and those who did not experience this effect. In summary, significant levels of idea generation were self assessed among respondents exposed to the WeJay product.

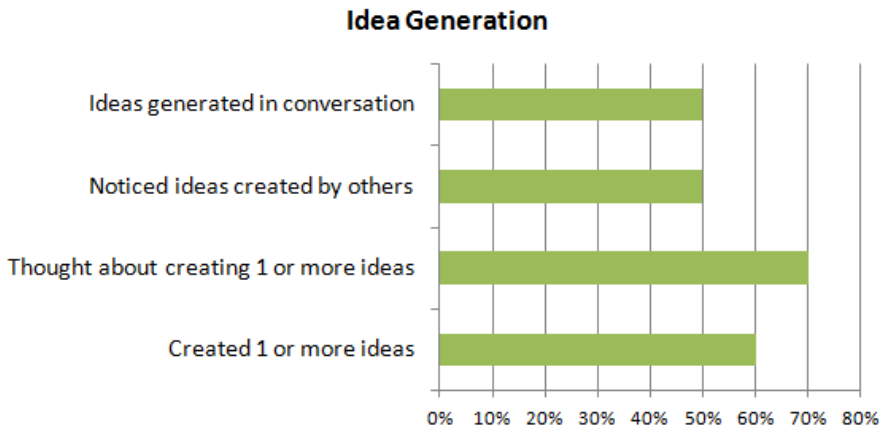


Figure 14: Idea Generation with WeJay Exposure

In probing deeper to capture the capability of the tool to foster the novelty associated with creativity, survey respondents were asked to assess the statement: *When I was using or thinking about how I would like to use WeJay, I felt Creative*. A likert-type scale was used and 40% Strongly Agreed, 50% Somewhat Agreed, 0% remained Neutral, and 10% Somewhat Disagreed. In summary, the perceived ability of the tool to foster creativity is present, with a combined somewhat and strong response of 90%, with no one remaining neutral.

Proposition D – Wireless Grids Enable AmI

The fourth proposition claimed:

Proposition D: A conceptual relationship is emerging between wireless grid enabled environments and ambient intelligent (AmI) environments in terms of the generation of new types of information, in new places, facilitating the presence of 'ambient information' in the form of context awareness, as one of many possible examples.

Survey respondents were asked to assess the statement: *Through my WeJay experience I now recognize wireless grids tools can enable ambient intelligent (AmI) systems and environments*.

Figure 15 shows a 75% agreement rate with this statement.

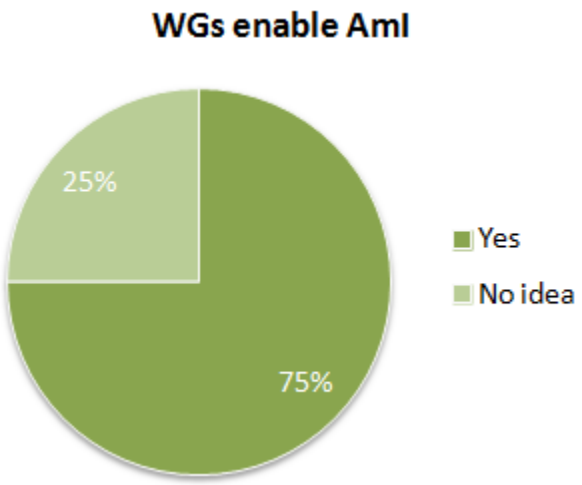


Figure 15: Wireless Grids Enabling Ambient Intelligence (AmI)

However, 25% of respondents indicated a lack of understanding of this statement. In another question respondents were asked to rank the statement: *The WeJay experience enabled me to come to a greater understanding of wireless grids and their potential*. Using a 5-point scale, where 1=not really and 5= absolutely, respondents indicated a 20% response at the 5 level, a 35% response at the 4 level, 15% at the 3 level, 10% at the 2 level, and 20% at the 1 level. In summary, at the upper end of the scale, the total of 4 and 5 is equal to a fairly high 55% indication of understanding, with another 15% of responses in the midrange and a 20% to 30% rate at the lower end. Levels of understanding around wireless grids appear to be increasing, aided somewhat by this study, although the need for more information and understanding persists.

The many and varied interpretations for use of the WeJay tool and the potential uses identified, based on recommended enhancements, suggests that this first wireless grid application is emergent and in-the-making. By extension, the same is true for wireless grids more generally. In coming to an understanding and appreciation of the minimal embedded intelligence in WeJay, suggestions for more robust intelligence are desirable going forward.

Strengths, Limitations, Challenges & Mitigations

This research study was attentive to rigor throughout all aspects of the research process. A key limitation of the study was the early stage of diffusion and first use of a pre-standards tool. Yet this early stage of diffusion and first use of a pre-standards tool is also the core strength, contributing critical and revelatory information, insights, and understanding. Based upon what was learned from this study, this research assists in providing recommendations for broader use, relevant to other deployment environments going forward. Further, study findings enable analytic generalizations to theory in deployments of the WeJay social radio application that are occurring in parallel, a little behind, or those that may be coming next. Such analytic generalizations may also be possible to other emerging wireless grid enabled applications.

Wireless grids present a challenging research space as a relatively new and emerging domain of study. As such, the use of a single case study was employed to address the mix of exploratory, descriptive, and explanatory questions of interest in this case. Although use of a single case study is generally discouraged (Yin, 2009)

there are instances where problems posed by the single case approach are justified. Two such instances provided the rationale for choosing a single case study approach in this research: 1) the argument that a study of the launch of WeJay, the first in a series of wireless grid applications to be incubated from the Wireless Grids Innovation Testbed (WiGiT), represents a *critical case* (Yin, 2009:47) for investigation of the theoretical propositions advanced and the findings may assist with the guidance of future research in the emerging domain of wireless grids; 2) the *revelatory* (Yin, 2009:48-49) nature of wireless grid applications.

Flyvbjerg (2011:302) points to several misunderstandings about case study research including: a) subjectivity and b) the single case study. Regarding, the former misunderstanding, Flyvbjerg responds that "intensive, in-depth case studies typically report that their preconceived views, assumptions, concepts, and hypotheses were wrong and that the case material has compelled them to revise their hypotheses on essential points." Regarding the latter issue of the single case, Flyvbjerg cites Ragin (1992:225) who considers single case studies to be "multiple in most research efforts because ideas and evidence may be linked in many different ways." In this research study, propositions were iteratively reviewed based on the guidance provided by Yin (2009:143) regarding the process of explanation building for explanatory case studies. This research study confirmed the presence of AmI in wireless grid environments and revealed that enhanced dimensions of AmI would be beneficial and desirable. Further, evidence was collected from multiple sources and triangulated for convergence. In a number of instances conflicting responses

contributed to non-converging data. Conflicting data that emerged in this study is discussed later in this chapter in terms of the research opportunities presented going forward.

While the use of multiple sources of evidence is a key advantage of case studies (Yin, 2009:118-119), the challenge to the researcher is: a) more work involved in using a variety of methods; b) more cost than when using one single method; c) the need for the researcher to master multiple techniques for data collection; and d) failing to use, or to use effectively, one or more potential sources of data forfeits the chance to investigate particular issues or develop converging lines of inquiry. For example, regarding item d), the 'state of readiness' of the WeJay beta trial product did not allow for the persistence of shows and the analysis of this type of artifact. Nor was chat data available to the researcher for assessment, as to the codeability of this qualitative data source, limiting the richness of this data in relation to the study of the WeJay beta trial product.

Considerations to keep in mind when reviewing the survey analysis and findings include the fact that the survey instrument was: a) developed during the research study drawing upon the interview and focus group protocols and upon data from participants; and b) being administered for the first time to participants. Further, survey responses revealed the potential for bias when subjected to a *wave analysis* (Creswell, 2012) and as such, this would indicate a possible threat to validity.

Looking more closely the results of the *wave analysis* conducted on the survey data and the possibility of response bias, some survey respondents did not have the exposure and interaction with the WeJay product and demo materials experienced by participants who were sufficiently engaged to participate in an interview or focus group. This may have contributed to the possibility of bias in the wave analysis findings. The survey instrument, although developed from interview and focus group findings and pre-tested during the study, was administered for the first time. While this may be a limitation of the data collected in this way, survey responses also served to complement, extend and solidify the data gathered in other ways. As such, the survey instrument contributed to a more well-rounded and robust analytic process and triangulated set of findings. Actual behavior during WeJay tool use was compared to self-reports and attitudes and opinions expressed during interviews and focus groups were analyzed in relation to survey responses.

Rival Claims, Explanations, & Theoretical Frameworks

This research study investigated several theoretical propositions and throughout the process, to strengthen internal validity, remained open to the emergence of other rival explanations, claims, and alternative theoretical frameworks. In response to Hall-Tipping's (2011) claim that "the grid of tomorrow is no grid", this early stage study suggests that the grid[21] is possibly very much alive and well. Further, this study suggests that it is perhaps how we employ the

[21] McKnight (Ed.), (2012). A grid is a collection of distributed resources that are shared among a group of users. It schedules and coordinates resources to offer a diverse collection of services over a network of connected devices. It defines methods to define, create, discover, and manage distributed services.

combination of wireless technologies and social media to access and utilize the grid (Pearce & Venters, 2013:130-139) in novel and unexpected ways, as articulated above in the section on 'Unintended Consequences & Unexpected Possibilities', that is the innovative challenge.

When given the opportunity to assess the WeJay social radio concept for use in educational setting, it is perhaps noteworthy that only 15% of survey respondents chose the option that WeJay was "being eclipsed by other technologies" and an equal percentage had no comment. Another 25% agreed that WeJay is "exactly what is needed now" and 25% indicated that the tool is "too new for people to grasp." Using this guidance with caution, given the small sample size and possible limitations of the survey instrument, the perception of WeJay relevance and potential for the educational space appears to be encouraging.

While other theoretical frameworks offering alternative avenues of investigation and explanation into the WeJay use experience (e.g. *activity theory*, *social shaping of technology (SST) theory* (MacKenzie & Wajcman, 1999), a *theory of instinctive information sharing* (Wang & Chen, 2011) and *social network theories* (Perry-Smith, 2006; Sosa, 2011)) were considered during this investigation, emergence theory provided a unique lens at this early pre-standards stage. More specifically, emergence theory was particularly supportive of an unstructured environment where tool use and viewing experiences could accommodate multiple, anticipated, and unexpected outcomes. Going forward, one or more of these alternative theories could effectively be employed. Indeed, activity theory was used

in a parallel WeJay study at another location among a special sample of high school students.

Implications and Recommendations

From the recruitment pool targeted of over 1500 individuals, this research study was able to capture the interest of 71 individuals who signed up while retaining the engagement of 34 individuals who actively participated. As such, low participation levels diminished the potential for robust social and interactive experiences, leading many participants to lament the absence of a more populous WeJay space. Given the state of readiness of the tool, a smaller trial at this early pre-standards stage allowed for the discovery of important recommendations in support of tool enhancements for future trials and larger scale studies.

In terms of future research, this study demonstrated that wireless grid applications are usable, can now be studied, and with improvements, promise to be engaging, with many interpretations for use and much untapped potential. The theorized conceptual relationship emerging between wireless grid enabled environments and ambient intelligence (AmI) was found to exist at a minimal level in the current iteration of WeJay and is desirable by participants in more extensive forms. This would seem to constitute the notion of ET (empirical to theoretical) generalizability as described by Lee & Baskerville (2003:235-237) and discussed in Chapter Three in the External Validity section. As such, this study was able to engage in analytical generalizations (Yin, 2009:43), where case study findings are generalizable to theory (Lee & Baskerville, 2003:236). This case study was not

seeking to generalize findings to some particular population (statistical generalization). Rather, through the use of an AmI with wireless grids conceptual model, *analytic generalization* was used to "generalize a particular set of results to some broader theory" (Yin, 2009:43). Because the study findings support the four propositions theorized in the study, empirical to theoretical (ET) generalizations apply. Pending improved stability and a range of recommended improvements in the WeJay application, the stage can now be prepared for more populous studies and more extensive research to test the replication of these findings for generalization.

Future Trials

While many participants appreciated the largely unstructured approach used during this beta trial, others recommended a more structured, guided trial. In a future trial it may be instructive to conduct a comparative, dual (structured and unstructured) trial where participants can opt for the trial choice they feel most comfortable with. When asked about the length of the beta trial (February – May 2012) the majority of respondents indicated the time period to be just right – information of possible value for future trials.

Survey Instrument Development & Validation

Survey responses contributed to insights regarding how the instrument can be refined and improved for future use. For example, the prevalence of neutrality in some survey responses deserves further examination. Did participants simply not care about the items in question? Were the items in question not well understood?

Were the questions unclear? Was the respondent fatigued at that point in the survey? Certain questions did not receive neutral responses which would suggest the presence of other issues or difficulties in questions where neutrality surfaced. This guidance from respondents also serves, according to Fink (2009), to improve the validity (accuracy) and reliability (consistency) of the instrument going forward.

Contributions

This study makes several types of contributions as: a bridge study; an approach to new technology impact studies; and to the use of theory in emerging research domains. Contributions are depicted in Figure 16 and described below.

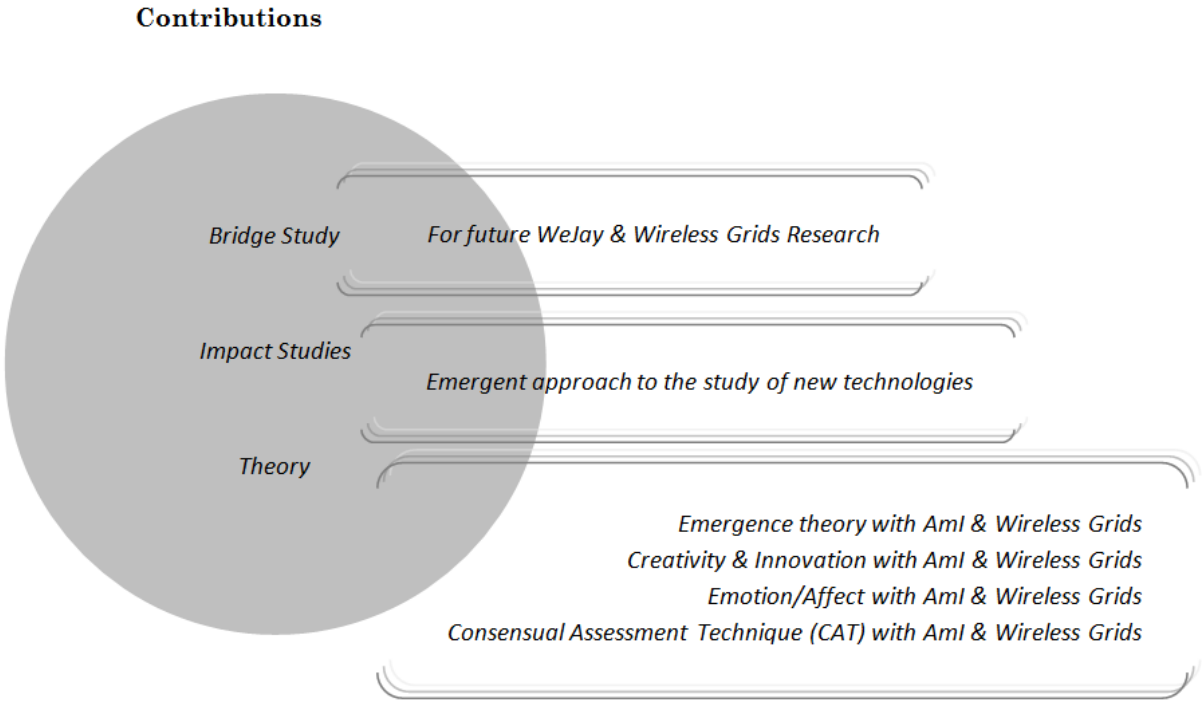


Figure 16: Research Study Contributions

Bridge Study

As an early stage exploratory study, this research constitutes a contribution to the literature and serves as a *bridge study* for further research into WeJay and other wireless grid enabled applications. *Focus group, interview,* and *other protocols* developed to guide this research study may contribute to the efforts of other WiGiT researchers in relation to WeJay or other wireless grid enabled applications. Indeed, expressions of interest from other researchers have already begun. The *survey instrument* which was developed, tested, and administered during this research study may constitute a contribution of possible interest to other researchers, providing as it does, further opportunities for validation of the instrument. Based on the educational and other interpretations for the use of the WeJay tool, there may be implications for further research in academic environments as well as workplace, everyday life, and other contexts (e.g., global locations, distributed collaboratives, mixed media environments, etc.) where people regularly interact in technology-pervasive learning environments.

Approach to the Study of New Technology Impacts

An important contribution of this research is the generalizability of the emergent approach for use in the study of new technology impacts in other contexts with other products and tools. Using the case study protocol and other procedures and rationales documented in the methodology section (Chapter Three), the research approach can be replicated and modified for use in other research and practice settings. Use of this approach is further supported by the data collection

protocols (Appendices A-C) and instrument (Appendix D). This emergent approach is particularly useful for anyone wishing to investigate an early stage product or idea, maximizing what can be learned, to inform the nature and direction of further developments while determining the value, if any, for everyone involved.

Theoretical Contributions

Because *emergence theory* has not been developed in relation to wireless grid and ambient intelligence environments, its use in this research study represents a possibly wider application for the theory, potentially enabling this paper to make a contribution in the emergence theoretical space. As this research brings together the *domains of wireless grids and ambient intelligence (AmI)*, a contribution to the literature in one or more of these domains is initiated by this study.

The importance of *emotion/affect* found in the WeJay environment contributes to the wireless grid literature, opening up opportunities for further research in relation to social, sharing, and privacy. Further, there may be a potential to study emotion/affect in relation to innovation, creativity, and ambient learning in AmI-infused wireless grid and human-centered computing (HCC) spaces.

Amabile's (1996) consensual assessment technique (CAT) was considered in this study for the assessment of novel idea generation, interpretations for use, and innovativeness of the WeJay tool. Due to the state of readiness[22] of the beta product and the nascent understanding of wireless grids, the CAT was not applied during

[22] The absence of a persistence feature enabling shows to be available (as artifacts) for viewing and assessment.

this study of wireless grid and AmI environment. However, the use of the technique for assessment holds promise for a future iteration of the WeJay tool and for wireless grid environments, more generally.

Implications for Research

A wide range of implications for research emerged from this study pertaining to emotion/affect, the wireless grid concept, globalization, methodologies, and creativity, as discussed below.

Emotion/Affect

This study showed confirmation of the presence of emotion/affect during the WeJay experience and by extension, the importance of the positive and negative valences of this dimension for wireless grid and AmI environments. However, it was not possible to undertake the measuring of emotion valence in relation to the key constructs (e.g., creativity, innovation, and context awareness) since significance could not be achieved with the small sample size and the current state of readiness of the beta tool. Because the presence, importance, and influence of emotion/affect is strongly indicated across the creativity (Amabile, 1996; Amabile & Kramer, 2011), innovation (Amabile, 1996; Verganti, 2009; Amabile & Kramer, 2011), and AmI literature (DeRuyter & Aarts, 2009) and increasingly in the social network sites (SNSs) literature (Papacharissi & de Fatima Oliveria, 2011), this area remains ripe for further research. Additionally, as discussed by Zhang (2010), the interaction of variables (satisfaction, social, sharing, etc.) in social media spaces is complex in

nature. This complexity, in relation to emotion/affect, was evident through the WeJay use and demo experience, representing another rich area for research.

Conflicting Data or Research Opportunities

Aspects of WeJay which elicited conflicting responses include, but are not limited to: ease of use/lack of ease of use; interface (liked/disliked); synchronous/asynchronous (liked/disliked); direct/indirect communication; groomed/ungroomed content; and radio as background/radio as foreground. While perceptions of these aspects of WeJay are presented here in dichotomous fashion, it may be that this is not an accurate characterization. For example, one participant described his WeJay experience as having varied from first use to last use with a movement from satisfaction initially, to dissatisfaction, when the application began to fail for reasons unknown. As technologies shift and change, what constituted 'ease of use' on the desktop yesterday may appear confusing today in mobile environments. Where a synchronous environment may be suitable for a face-to-face classroom situation, it may not support distance learning environments which are more amenable to asynchronous communication. Although we might like certain features of an interface (some of the time) we may not like other aspects. Direct versus indirect communication and information sharing becomes an issue in real-time environments where accuracy of details, although critical, may be compromised. Referring to prepared texts or broadcasts and even text chat itself, one participant observed that the immediacy and intent may be lost, commenting that – "translation of what you intend to say to text and from the text to what you

would intend for them to hear or understand" gets filtered, preferring instead the spontaneous interactive audio exchanges in real-time critical situations. Another participant, emphasizing further the importance of real-time audio for WeJay, noted the value of intonation and other aspects of voice, critical to more nuanced information sharing and interaction. As such, the suggestion for a "taxonomy of sounds" tool, in support of interaction in a more immersive environment emerged, allowing for the ability to pick and choose audio segments for listening and sharing.

While more and diverse content was recommended, as in not just music, one participant expected more 'context' to be provided and more in the way of 'default content' to guide the use experience, pulling one in and providing more diverse content to keep one there. This individual interpreted WeJay to be an "expressive medium" and finding it to be "somewhat more open and freelance" suggested that the tool could benefit from the development of groomed and ungroomed sections. At this early pre-standards stage, this participant described the beta tool to be more of a framework as opposed to a full-fledged implementation.

In short, more and closer attention to the seemingly conflicting aspects which emerged in this study may provide many opportunities for future researchers and for wireless grid developers.

Understanding Wireless Grids

An area of possible interest to researchers is the emergence of what would seem to be the compelling nature of wireless grid tools such as WeJay. Participants, for the most part, indicated an interest in using an improved and enhanced version

of the tool. Further research may provide insight into whether wireless grids are in fact compelling and if so, why the tool seemed able to capture some fundamental aspect of the imagination of participants.

Related to, and confounding the seeming compellingness of WeJay (described as 'intriguing' by one participant), is the finding that the wireless grids concept is difficult to grasp and wireless grid enabled tools do not appear to be well understood at this time. For example questions include: What differentiates them from other social media tools? What is their potential? Why would I want to use them in view of the array of other social media tools? As such, a clear and simple demonstration of differences in relation to other social media tools, wireless technologies, and Internet based technologies, is highly desirable in itself and for future research trials. In other words, there is a need for more clarity around the wireless grid concept. While one participant commented during an interview that people do not need to know what wireless grids are technically, the survey response for this individual indicated that despite having heard about wireless grids for some time, together with having used WeJay during the beta trial, the wireless grid concept was still not understood. As emergent technologies which are in-the-making, wireless grids present opportunities to create and imagine. This study offered the opportunity of contributing to the conception, understanding, and shaping of a wireless grid application and by extension, to wireless grids more generally.

Global Dimensions

The global space for AmI in wireless grid applications was touched upon directly and indirectly in this study. For example, a number of students attending Syracuse University from other continents including the southern hemisphere, Asia, and Africa, participated in the research study. All provided interpretations of use for the WeJay tool and expressed a high degree of interest in more extended use of the tool for global engagement and by extension, for wireless grids applications generally. Students from India attempted to engage friends in India in the WeJay listening experience. However, geo-locks enabled on the WeJay tool and at the Weheartradio website, prevented access outside of the United States and the United Kingdom. A Syracuse student based in East Africa during the beta trial experienced the same geo-lock access difficulty when attempting to use the tool and when encouraging others in Africa to engage with the listening experience. While global use of WeJay and other wireless grid enabled applications may pose particular challenges beyond the scope of this study, and while this study is unable to generalize to international contexts, the extent and nature of interest in the WeJay tool demonstrated during this study suggests there is an opportunity for future research in the global space.

Creativity in Social Media & Wireless Grid Enabled Environments

This study found that participants generally felt creative in the WeJay space and more often than not, self-assessed to have generated novel ideas during their use or viewing experience. A more stable and enhanced wireless grid enabled tool

may also allow further exploration into divergent thinking around the notion of 'time to creativity'. Earlier research by Csikszentmihalyi (1996) suggested that creativity, in the form of novel idea generation, would take a much longer time to generate than that possible during a brief four month beta trial period. More recent research involving 'emergent processes' in technology-pervasive virtual communities, suggests a rethinking of this understanding in terms of the accelerating effects possible. For example, what would normally play out over years "can happen in a matter of months, weeks, or even days" through the results of real-time feedback and interactions" (Pearce & Artemesia, 2011:38-39). Research with wireless grids in this area would have important implications for both research and practice.

Methodological Approaches for Emergent Data Collection

Drawing on research techniques by Amabile & Kramer (2011:5), the use of a diary (Google form) to capture the real time use experience of participants was attempted during this research study, enabling a glimpse of the potential for this type of data gathering mechanism. If this type of feature could be incorporated more seamlessly into the tool being studied, more interactive functionality and considerable benefit could be derived for both researcher and participant in future trials of WiGiT products. As such, the use of a diary feature has implications for both research and for practice in the AmI and wireless grids space.

Implications for Practice

As indicated already, some of the implications for research identified above may also have implications for practice. During interviews and focus groups, participants consistently developed interpretations for the use of WeJay in relation to their particular areas of interest. Interpretations for the use of WeJay are work-related, personal, and directed toward learning and sometimes entertainment for learning. Although we may think of the academic research space for this study as a somewhat artificial one, possibly detached from the 'real world,' it is very much the real world of work, study, and research for students and faculty. As such, this study has important implications for practice in academic settings.

Regarding the workplace of the future, Fidler (2012:12) points to the importance of "novel thinking and adaptability", of "situational adaptability" defined as the ability to "respond to unique, unexpected circumstances of the moment" where it is believed that such "skills will be at a premium in the next decade." As such, this research study may have implications for practice in terms of the importance of novel idea generation and emergent, adaptive behavior in ad hoc and uncertain environments.

The blurring of workplace and spaces of practice with home, personal, and everyday living in technology-pervasive environments challenges us, in the words of one participant, "to be more creative" requiring "a whole new state of mind, of new thinking." In working with AmI-infused wireless grid environments in ways that support the development of a new information landscape, we have the opportunity

to influence change. Insight provided by this research study suggests that such change be human-centered while recognizing, respecting, and supporting people's need for autonomy and control in technology-pervasive environments.

In this study the ambient intelligence (AmI) concept is preferred as one of several possible articulations of embedded intelligence. The term ambient captures the notion that information is naturally embedded in our environment. For example, through one or more human senses we can detect the change in seasons, as in, the coming of autumn. Assisted by, and interacting with embedded technologies, opportunities exist for meaningful and elegant ways of working together in designing effective, appropriate, and respectful intelligent environments. As such, wireless grids are beginning to form part of the ambient information and pervasive-technologies landscape of the 21st century. The challenge for both practice and research is to figure out ways in which wireless grid and embedded technologies can support us to become, in the words of Russ et al. (2009) more "*informed*, *inspired* and *liberated* humans profiting from more comfort, physical health and safety" rather than "*dependent*, *subdued*, *addicted* creatures who are subject to ubiquitous observation, surveillance and control." Ambient intelligence (AmI) with wireless grid applications offers the potential for unexpected possibilities for us to transform how we interact with technology, information, and each other in the 21st century.

GLOSSARY OF TERMS

Ad hoc environment for wireless grid	it demands a combination of distributed (because connection to centralized control cannot be guaranteed) and centralized architecture (to be scalable, and allow efficient provision of services) (McKnight (Ed.), 2012:21)
Ambient Intelligence (AmI)	refers to the embedding and integrating, on a mass scale, of technologies that are sensitive and responsive to humans in everyday environments in increasingly invisible and unobtrusive ways (De Ruyter & Aarts, 2009:1039)
AmI technologies	described by five key characteristics: embedded, context-aware, personalized, adaptive, anticipatory (Bick et al., 2007)
Ambient learning	denotes new ICT embedded into the environment leading to advanced e-learning scenarios (Bick et al., 2007)
Context awareness	detect the location, time, nearby people and other aspects of a person's physical environment (Ernst, 2008)
Creativity	novel and useful ideas (Amabile, 1996)
Edge devices	... routers, switches, routing switches, IADs (integrated access devices), multiplexers, and a variety of MAN/WAN access devices that provide entry points into enterprise or carrier/service provider core networks ... The trend is to make the edge smart ... Edge devices may translate between one type of network protocol and another (Sheldon, 2001)
Edgeware	a new class of software applications enabling ad hoc connection of people, devices, software and services in a personal cloud, supported by personal cyber infrastructure (Treglia et al., 2011); applications that can dynamically make use of content and resources present in devices - phones, pc's, cameras, printers, screens, etc. - connected by a wireless grid (WiGiT, 2011); software that operates at the edges of networks (hence 'edgeware') in order to take advantage of the capabilities of grid architecture (McKnight (Ed.), 2012)
Emergence	what parts of a system do together that they would not do themselves; collective behavior; what a system does by virtue of its relationship to its environment that it would not do by itself (Pearce & Artemesia, 2009 citing Bar-Yam, 2003) sense of systems altering their character through use (Lin & Cornford, 2000)

Emergent learning	refers to the relatively unplanned learning which occurs spontaneously in order to cope with emergent issues (Deng, 2010)
Emotions	"Emotions are an integral component of all human activities, including human-computer interactions." (Lopatovska & Arapakis, 2011)
Grid	a collection of distributed resources that are shared among a group of users.. It schedules and coordinates resources to offer a diverse collection of services over a network of connected devices. It defines methods to define, create, discover, and manage distributed services (McKnight, 2012:21)
Grid architecture	a network architecture that enables resource discovery and sharing through the formation of virtual wireless grids (McKnight (Ed.), 2012:20)
Gridlet™	WeJay social radio is an example of an Edgeware application or Gridlet
Gridnet	may become as prevalent in the future as the Internet is now. Gridnet would allow for a new conception of resource sharing based on wireless grid connectivity of the vast array of personal devices (Manvi & Birje, 2010)
Gridstream	Enterprise version of the WeJay product
Information and Communications Technology (ICT)	a diverse set of technological tools and resources used to transmit, store, create, share or exchange information" which "... include computers, the Internet (websites, blogs and emails), live broadcasting technologies (radio, television and webcasting), recorded broadcasting technologies (podcasting, audio and video players, and storage devices) and telephony (fixed or mobile, satellite, visio/video-conferencing, etc.) (UNESCO, 2009)
Innovation	transformation of a new idea into a new product or service, or an improvement in organization or process (Heye, 2006)
Mobile ad hoc networks (MANETs)	infrastructureless dynamically self-configuring networks. Other ad hoc networks include wireless sensor networks (WSNs), wireless mesh networks (WMNs), and vehicular ad hoc networks (VANETs). "Ad hoc networks consist of wireless hosts that communicate with each other in the absence of a fixed infrastructure; each host acts as a relay that forwards messages toward their destination." (Katsaros, Dimokas, & Tassiulas, 2010:23)
Peer-to-Peer (P2P) networks	these are properly called overlay networks to emphasize that they run over the existing institutionally owned and managed infrastructure (McKnight (Ed.), 2012:22)

Transformative	evidence that the product breaks away from the *constraints* of the situation as typically conceived (Amabile, 1996)
WiGlet	ad hoc overlay network applications, a generic form of Gridlet™ (McKnight, 2011)
Wireless grids	refer to an emerging form of network for sharing resources, creating resources, facilitating connections across devices (smartphones, sensors, etc.) and enabling ad hoc interactions (McKnight et al., 2004); A human centric open access gateway to shared resources for mobile and wireless electronic devices interconnecting at least one device to at least one other device or resource. A device can establish a grid and become a member of one or more wireless grids (McKnight (Ed.), 2012:20)
Wireless Grids Innovation Testbed (WiGiT)	The WiGiT lab at the School of Information Studies, Syracuse University is researching issues associated with nomadic ad-hoc resource sharing, which is an effort to bind together developments in Grid, P2P Computing and Web services along with ad-hoc and wireless networking. The ultimate vision of the grid is that of an adaptive network offering secure, inexpensive, and coordinated real-time access to dynamic, heterogeneous resources, potentially traversing geographic, political and cultural boundaries but still able to maintain the desirable characteristics of a simple distributed system, such as stability, transparency, scalability and flexibility (WiGiT website, 2011)

APPENDICES

Appendix A: Focus Group Protocol

Name: _____ Date: _____

Moderator's Guide

Introductions

The moderator will begin the session by initiating introductions in preparation for the sharing and exchange of information and for group discussion and interaction. The moderator will speak briefly about the focus group format and explain that participants will be asked to respond to questions regarding their experience of the WeJay beta trial/demo, providing their opinion, impressions, and suggestions.

Statement of Purpose and Confidentiality

The purpose of this research is to contribute to scientific and professional knowledge regarding the new domain of study around wireless grids. Specifically, this study investigates the launch and beta trial of WeJay, a Wireless Grids Innovation Testbed (WiGiT) social radio application. Wireless grids refer to an emerging form of network for sharing resources, facilitating connections across devices (smartphones, sensors, etc.) and enabling ad hoc interactions.

This set of broad and open-ended questions is intended to guide the focus group process, allowing the participants to speak at length and take the conversation in other directions. The process is intended to elicit what is new and what is unexpected, and whether this wireless grid enabled WeJay social radio application really spurs as much innovation and creativity as was initially theorized.

All participants' names will be held confidential. Quotations will be credited to pseudonyms or generic individuals (e.g., female participant). Quotations will not be used that you believe will misrepresent your actual perceptions and attitudes. During the course of the research and before final publication of my thesis, I will validate my observations and interpretations with you. All research information will be password-protected and stored at the School of Information Studies at Syracuse University. Only the Principal investigator, Dr. Marilyn Arnone, the researcher, Patricia McKenna, and doctoral committee members will be allowed access to focus group data. Once all the analyses have been completed and reports and publications that summarize the data have been distributed, all recordings will be destroyed.

Focus Group Protocol, Part A: Participant Experience (for beta trial users)

Questions	Probes/Measures	Constructs
1. What were you able to do with WeJay? (*interactions, discovery, possibilities*)	Uses employed Uses envisioned	Q2:Innovation P3:Creativity
2. What does WeJay mean to you? (*understanding, interpretation*)	Meaning Interpretation	Q2:Innovation
3. Did you go beyond the basics and use WeJay as something other than a social radio tool? (*stimulates new ideas for interaction, cooperation, sharing*)	New outcomes & Transformative Novel unexpected uses Fosters creativity	Q/2:Innovation P2:Innovation P1/3: Creativity
4. What did you like **most** about WeJay?	Experience Social; Awareness	Q1:Innovation P4:Context Awareness
5. What did you like **least** about WeJay?	Experience Social; Awareness	Q1:Innovation P4:Context Awareness
6. Comment on the awareness capabilities of WeJay (*presence, location, resource-aware*)	Location, resource, situation	P4:Context Awareness
7. Comment on the smartness capabilities of WeJay (*resource, contact-suggestions; wireless grid self-correcting and organizing on the fly features to avoid breakdowns*)	Location, resource, situation	P4:Context Awareness
8. Comment on the ambient intelligent aspects of WeJay. (*Embedded knowing, aligned & interactive with user needs, interests, context, situation*)	Awareness Emergent aspects	Q:Innovation P4:Context Awareness
9. What barriers did you encounter when using WeJay (*features, affordances*)	Readiness; Social attitudes, context	Q1:Innovation P4:Context Awareness
10. What, if any, impact did WeJay have for you? (Effect *on activities, interactions, how time spent*)	New outcomes, transformative	Q:Innovation P4:Context Awareness
11. Did anything surprise you about WeJay?	Emergent aspects	Q1:Innovation

12. Did you feel creative during the WeJay experience?	Fosters creativity	P3:Creativity
13. Did you begin thinking of new ways of doing things during the WeJay experience?	Fosters innovation	P2:Innovation
14. What did not work or behave the way you expected? elaborate	Readiness of app	Q1:Innovation
15. What is missing in WeJay preventing you from doing what you want to do? Elaborate	Fosters creativity Readiness of app	P3:Creativity Q1:Innovation
16. Did the WeJay experience make you think of the transformative potential here?	New outcomes & Transformative Emergent aspects	Q:Innovation F4:Context Awareness
17. Were novel ideas generated during your WeJay use experience (by you or someone else)?	CAT Assessment	P2:Innovation P1/3: Creativity
18. Do you want to continue using WeJay? If yes, why? If no, why not?	Emergent aspects	Q1: Innovation
19. Do people need to know about WeJay and other wireless grid enabled applications? Elaborate.	Emergent aspects	Q1:Innovation P4:Context Awareness
20. Does WeJay remind you of other social radio or social media applications? (e.g., iTunes/Ping, Pandora, Spotify, SoundCloud). (*Prior experience, expectations, comparisons*)	Emergent aspects	Q1:Innovation P3:Creativity P4:Context Awareness
21. Generally then, describe your WeJay experience in terms of sharing, collaboration, and interactivity. (*Probe about social, trust, privacy*)	Readiness of app Social attitudes Context Awareness	Q1:Innovation P4:Context Awareness

Focus Group Protocol, Part B: Participant Recommendations

Questions	Probes/Measures	Constructs
1. What changes would you like to see in WeJay?	Improve WeJay Ideas for WeJay Awareness	P2:Innovation P3:Creativity P4:Context Awareness
2. Where do you see WeJay and other wireless grid enabled applications going?	Outcomes - New & transformative Interpretations Awareness	Q:Innovation Q2:Innovation P4:Context Awareness
3. Based on your WeJay experience do you have suggestions for future trials?	Readiness of app Social attitudes ContextAwareness	Q1:Innovation P4:Context Awareness
4. What other recommendations would like to make about WeJay and wireless grid enabled applications?	Uses, meaning Novel, unexpected Awareness	Q2:Innovation P1:Creativity P4:Context Awareness

Focus Group Protocol, Part A: Participant Experience (for demo viewers)

Questions	Probes/Measures	Constructs
1. What were you able to think about doing with WeJay? (*interactions, discovery, possibilities*)	Uses envisioned	Q2:Innovation
2. What does WeJay mean to you? (*understanding, interpretation*)	Meaning Interpretation	Q2:Innovation
3. Did you think about going beyond the basics and using WeJay as something other than a social radio tool? (*stimulates new ideas for interaction, cooperation, sharing*)	Uses envisioned Fosters innovation Fosters creativity Novel unexpected uses	Q2:Innovation P2:Innovation P3:Creativity P1:Creativity
4. What did you like **most** about WeJay?	Experience Social; Awareness	Q1:Innovation P4:Context Awareness
5. What did you like **least** about WeJay?	Experience Social; Awareness	Q1:Innovation P4:Context Awareness
6. Comment on the awareness capabilities of WeJay *(presence, location, resource-aware*)	Location, resource, situation	P4:Context Awareness
7. Comment on the smartness capabilities of WeJay (*resource, contact-suggestions; wireless grid self-correcting and organizing on the fly features to avoid breakdown*)	Location, resource, situation	P4:Context Awareness
8. Comment on the ambient intelligent aspects of WeJay. (*Embedded knowing, aligned & interactive with user needs, interests, context, situation*)	Awareness Emergent aspects	Q:Innovation P4:Context Awareness
9. Did you notice things that might be barriers to what you would want to do with WeJay? (*features, affordances*)	Readiness; Social attitudes, context	Q1:Innovation P4:ContextAwareness
10. What, if any, impact did WeJay have for you? (Effect *on activities, interactions, how time spent*)	New outcomes, transformative	Q:Innovation P4:Context Awareness
11. Did anything surprise you about	Emergent aspects	Q1:Innovation

WeJay?		
12. Did you feel creative during the WeJay experience?	Fosters creativity	P3:Creativity
13. Did you begin thinking of new ways of doing things during the WeJay experience?	Fosters innovation	P2:Innovation
14. What, if anything, did not seem to behave the way you would have expected? Elaborate	Readiness of app	Q1:Innovation
15. What would you say is missing in WeJay preventing you from doing what you want to do? Elaborate	Fosters creativity Readiness of app	P3:Creativity Q1:Innovation
16. Did the WeJay experience make you think of the transformative potential here?	New outcomes & Transformative Emergent aspects	Q:Innovation F4:Context Awareness
17. Were novel ideas generated during your WeJay use experience (by you or someone else)?	CAT Assessment	P2:Innovation P1/3: Creativity
18. Do you want to spend more time with WeJay? If yes, why? If no, why not?	Emergent aspects	Q1: Innovation
19. Do others need to know about WeJay and other wireless grid enabled applications? Elaborate.	Emergent aspects	Q1:Innovation P4:Context Awareness
20. Does WeJay remind you of other social radio or social media applications? (e.g., iTunes/Ping, Pandora, Spotify, SoundCloud). (*Prior experience, expectations, comparisons*)	Emergent aspects	Q1:Innovation P3:Creativity P4:Context Awareness
21. Generally then, describe your WeJay demo experience in terms of sharing, collaboration, and interactivity. (*Probe about social, trust, privacy*)	Readiness of app Social attitudes Social context Awareness	Q1:Innovation P4:Context Awareness

Focus Group Protocol, Part B: Participant Recommendations

Questions	Probes/Measures	Constructs
1. What changes would you like to see in WeJay?	Improve WeJay Ideas for WeJay Awareness	P2:Innovation P3:Creativity P4:Context Awareness
2. Where do you see WeJay and other wireless grid enabled applications going?	Outcomes - New & transformative Interpretations Awareness	Q:Innovation Q2:Innovation P4:Context Awareness
3. Based on your WeJay experience do you have suggestions for future trials?	Readiness of app Social attitudes ContextAwareness	Q1:Innovation P4:Context Awareness
4. What other recommendations would like to make about WeJay and wireless grid enabled applications?	Uses, meaning Novel, unexpected Awareness	Q2:Innovation P1:Creativity P4:Context Awareness

Appendix B: Interview Protocol

Name: _____ Date: _____

This set of broad and open-ended questions is intended to guide the interview process, allowing the respondent to speak at length and take the conversation in other directions. The process is intended to elicit what is new and what is unexpected, and whether this application really spurs as much innovation and creativity as was initially theorized.

Analysis of the data collected in this way will facilitate the identification of patterns, connections, influences, solutions, interpretations and other elements contributing to an understanding and appreciation of wireless grids technologies.

Interview Protocol (for beta trial users)

Questions	Probes/Measures	Constructs
1. What were you able to do with WeJay? (*interactions, discovery, possibilities*)	Uses employed Uses envisioned	Q2:Innovation P3:Creativity
2. What does WeJay mean to you? (*understanding, interpretation*)	Meaning Interpretation	Q2:Innovation
3. Did you go beyond the basics and use WeJay as something other than a social radio tool? (*stimulates new ideas for interaction, cooperation, sharing*)	New outcomes & Transformative Novel unexpected uses Fosters creativity	Q/2:Innovation P2:Innovation P1/3:Creativity
4. What did you like **most** about WeJay?	Experience Social; Awareness	Q1:Innovation P4:Context Awareness
5. What did you like **least** about WeJay?	Experience Social; Awareness	Q1:Innovation P4:Context Awareness
6. Comment on the awareness capabilities of WeJay (*presence, location, resource-aware*)	Location, resource, situation	P4:Context Awareness
7. Comment on the smartness capabilities of WeJay (*resource, contact-suggestions; wireless grid self-correcting and organizing on the fly features to avoid breakdowns*)	Location, resource, situation	P4:Context Awareness
8. Comment on the ambient intelligent aspects of WeJay. (*Embedded knowing, aligned & interactive with user needs, interests, context, situation*)	Awareness Emergent aspects	Q:Innovation P4:Context Awareness
9. What barriers did you encounter when using WeJay (*features, affordances*)	Readiness; Social attitudes, context	Q1:Innovation P4:Context Awareness
10. What, if any, impact did WeJay have for you? (Effect *on activities, interactions, how time spent*)	New outcomes, transformative	Q:Innovation P4:Context Awareness
11. Did anything surprise you about	Emergent aspects	Q1:Innovation

WeJay?		
12. Did you feel creative during the WeJay experience?	Fosters creativity	P3:Creativity
13. Did you begin thinking of new ways of doing things during the WeJay experience?	Fosters innovation Fosters creativity	P2:Innovation P3: Creativity
14. What did not work or behave the way you expected? Elaborate	Readiness of app	Q1:Innovation
15. What is missing in WeJay preventing you from doing what you want to do? Elaborate	Fosters creativity Readiness of app	P3:Creativity Q1:Innovation
16. Did the WeJay experience make you think of the transformative potential here?	New outcomes & Transformative Emergent aspects	Q:Innovation F4:Context Awareness
17. Were novel ideas generated during your WeJay use experience (by you or someone else)?	CAT Assessment	P2:Innovation P1/3:Creativity
18. Do you want to continue using WeJay? If yes, why? If no, why not?	Emergent aspects	Q1: Innovation
19. Do people need to know about WeJay and other wireless grid enabled applications? Elaborate.	Emergent aspects	Q1:Innovation P4:Context Awareness
20. Does WeJay remind you of other social radio or social media applications? (e.g., iTunes/Ping, Pandora, Spotify, SoundCloud). (*Prior experience, expectations, comparisons*)	Emergent aspects	Q1:Innovation P3:Creativity P4:Context Awareness
21. What changes would you like to see in WeJay? *(improvements)*	Improve WeJay Ideas for WeJay Awareness	P2:Innovation P3:Creativity P4:Context Awareness
22. Where do you see WeJay and other wireless grid enabled applications going?	Outcomes - New & transformative Interpretations Awareness	Q:Innovation Q2:Innovation P4:Context Awareness
23. Based on your WeJay experience do you have suggestions for future trials?	Readiness of app Social attitudes Social context Awareness	Q1:Innovation P4:Context Awareness
24. Generally then, describe your	Readiness of app	Q1:Innovation

WeJay experience in terms of sharing, collaboration, and interactivity. (*Probe about social, trust, privacy*)	Social attitudes Context Awareness	P4:Context Awareness
25. What other comments do you have about WeJay and wireless grid enabled applications? (*Concerns, questions, expectations, observations)*	Experience Interpretations	Q1:Innovation Q2:Innovation

Interview Protocol (for demo viewers)

Questions	Probes/Measures	Constructs
1. What were you able to think about doing with WeJay? (*interactions, discovery, possibilities*)	Uses envisioned	Q2:Innovation
2. What does WeJay mean to you? (*understanding, interpretation*)	Meaning Interpretation	Q2:Innovation
3. Did you think about going beyond the basics and using WeJay as something beyond a social radio tool? (*stimulates new ideas for interaction, cooperation, sharing*)	Uses envisioned Fosters innovation Fosters creativity Novel unexpected uses	Q2:Innovation P2:Innovation P3:Creativity P1:Creativity
4. What did you like **most** about WeJay?	Experience Social; Awareness	Q1:Innovation P4:Context Awareness
5. What did you like **least** about WeJay?	Experience Social; Awareness	Q1:Innovation P4:Context Awareness
6. Comment on the awareness capabilities of WeJay (*presence, location, resource-aware*)	Location, resource, situation	P4:Context Awareness
7. Comment on the smartness capabilities of WeJay (*resource, contact-suggestions; self-correcting and organizing on the fly to avoid breakdowns*)	Location, resource, situation	P4:Context Awareness
8. Comment on the ambient intelligent aspects of WeJay. (*Embedded knowing, aligned & interactive with user needs, interests, context, situation*)	Awareness Emergent aspects	Q:Innovation P4:Context Awareness
9. Did you notice things that might be barriers to what you would want to do with WeJay (*features, affordances*)	Readiness; Social attitudes, context	Q1:Innovation P4:Context Awareness
10. What, if any, impact did WeJay have for you? (Effect *on activities, interactions, how time spent*)	New outcomes, transformative	Q:Innovation P4:Context Awareness
11. Did anything surprise you about	Emergent aspects	Q1:Innovation

WeJay?		
12. Did you feel creative during the WeJay experience?	Fosters creativity	P3:Creativity
13. Did you begin thinking of new ways of doing things during the WeJay experience?	Fosters innovation	P2:Innovation
14. What, if anything, did not seem to behave the way you would have expected? Elaborate.	Fosters innovation	P2:Innovation
15. What would you say is missing in WeJay preventing you from doing what you want to do? Elaborate	Fosters creativity Readiness of app	P3:Creativity Q1:Innovation
16. Did the WeJay experience make you think of the transformative potential here?	New outcomes & Transformative Emergent aspects	Q:Innovation F4:Context Awareness
17. Were novel ideas generated during your WeJay use experience (by you or someone else)?	CAT Assessment	P2:Innovation P1/3:Creativity
18. Do you want to spend more time with WeJay? If yes, why? If no, why not?	Emergent aspects	Q1: Innovation
19. Do people need to know about WeJay and other wireless grid enabled applications? Elaborate.	Emergent aspects	Q1:Innovation P4:Context Awareness
20. Does WeJay remind you of other social radio or social media applications (e.g., iTunes, Spotify, Pandora, SoundCloud? *(Prior experience, expectations, comparisons)*	Improve WeJay Ideas for WeJay Awareness	P2:Innovation P3:Creativity P4:Context Awareness
21. What changes would you like to see in WeJay? *(improvements)*	Improve WeJay Ideas for WeJay Awareness	P2:Innovation P3:Creativity P4:Context Awareness
22. Where do you see WeJay and other wireless grid enabled applications going?	Outcomes - New & transformative Interpretations Awareness	Q:Innovation Q2:Innovation P4:Context Awareness
23. Based on your WeJay demo experience do you have suggestions	Readiness of app Social attitudes	Q1:Innovation

for future trials?	Social context Awareness	P4:Context Awareness
24. Generally then, describe your WeJay demo experience in terms of sharing, collaboration, and interactivity). (*Probe about social, trust, privacy*)	Readiness of app Social attitudes Context Awareness	Q1:Innovation P4:Context Awareness
25. What other comments do you have about WeJay and wireless grid enabled applications? (*Concerns, questions, observations)*	Experience Interpretations	Q1:Innovation Q2:Innovation

Appendix C: WeJay Social Radio Beta Trial Activity Protocol

Name: _____ Date: _____

Activity data and artifact analysis for this study has two components: 1) beta trial registration; and 2) beta trial activity tracking.

Beta Trial Registration

When individuals visit the beta trial registration website and choose to register and download the WeJay beta trial an electronic consent form describing the research study will be presented. Reading and checking the option to participate in the study will enable downloading, registration, and participation. Registration data collected includes:

A unique user ID (will be automatically generated); A registration date (will be automatically generated) A Username will be assigned	Consent; Firstname; Lastname; Username; Organization; School/Faculty; Email; User Type (student, faculty, staff, other (specify)); Gender; Age; Ethnicity; Level of study; Level of teaching; Subject Area

Use of the unique user ID and the assigned Username will support anonymizing of the data while demographic and other detail will contribute to the analysis of use and patterns.

Beta Trial Activity Data

When individuals agree to participate in the study by reading and checking the consent option at the registration and download website, beta trial activity data collection based on beta trial use will begin. Beta trial activity data includes the following data:

unique user ID	Number of logins; Login dates; Duration of login; Photo content; About you content; Number of playlist entries; Playlist artists; Playlist album; Playlist name; Number of shows; Show name; Show description; Delete Shows; Flyer image; Number of advertisements; Advertisement content; Social network sites (SNSs); Friending; Number of friends by SNS; Chat content; Links of show URLs sent to others; Links of show URLs accessed; Help requests for error problems; Help requests for more information; Requests for product beyond the beta trial; Search content; Unfriending; Location; Featured shows; Hosts; Cohosts Other pending functionality may include: refriending; mobile device type; public station usage; video; live interviews; blog links

Analysis of the data collected in this way will facilitate the identification of patterns, connections, influences, solutions, artifacts, interactions and other emergent elements

contributing to an understanding and appreciation of the wireless grid enabled WeJay social radio application.

WeJay Social Radio Beta Trial (Activity Data & Artifact Analysis) Protocol

This protocol is intended to guide the activity data and artifact identification process, allowing the researcher to gain additional evidence about the WeJay deployment and use experience. The researcher may seek to be invite, as in 'friending', to virtually visit radio stations to view artifacts.

Analysis of the data collected in this way will facilitate the identification of patterns, connections, influences, solutions, artifacts, interactions and other elements contributing to an understanding and appreciation of the wireless grid enabled WeJay social radio application experience.

WeJay Social Radio Beta Trial	**Artifact Description**
1. Artifact idea	Description
2. Artifact idea development	
3. Connections (ambient – embedded knowing, aligned & interactive with user needs, interests, context, situation)	
4. Evidence of interactivity	
5. Influences	
6. Patterns	
7. Solutions	
8. Awareness (presence, location, context, resource-aware)	
9. Smartness (resource, contact-suggestions, self-correcting and organizing on the fly to avoid breakdowns)	
10. Other	

Appendix D: Survey Instrument

Name: _____ Date: _____

The survey instrument was pilot tested with another doctoral student prior to use to ensure usability and effectiveness of the tool.

This survey was developed drawing upon insights from research participants during interviews and focus group sessions. Administering the survey to research study participants provided an opportunity to a) elicit more information about the WeJay use experience and to b) assess the survey instrument to further enhance usability and effectiveness.

Using a survey instrument provided an additional method of gathering data from research study participants. Being able to compare and triangulate data from multiple sources (e.g., interviews, focus groups, and surveys) may contribute additional validity to this research study.

WeJay Beta Trial Survey - 2012

Based on your WeJay use or viewing of the WeJay demo videos, please take a few moments to describe your WeJay social radio experience by completing the following questions. Where the symbol * appears a response is required.

1. Overall, how satisfied were you with your WeJay experience? * (option to select one item)

○ Very Satisfied

○ Satisfied
○ Neutral
○ Unsatisfied
○ Very Unsatisfied

2. What made this a satisfying or unsatisfying experience?

_____

3. Think of the features currently available in WeJay. Select the word or phrase that best describes the WeJay social radio environment.* (option to select one item)

○ Feature rich

○ Plenty of features but not fully functional
○ Adequate
○ Somewhat unsatisfactory
○ Nearly featureless

4. Thinking about WeJay in terms of functionality, indicate your level of satisfaction with how well things seem to work? *

	Very Unsatisfied	Unsatisfied	Neutral	Satisfied	Very Satisfied
Installation of WeJay	□	□	□	□	□
The user interface	□	□	□	□	□
Creating a user profile	□	□	□	□	□
Creating and describing a show	□	□	□	□	□
Locating items to add to the playlist	□	□	□	□	□
Adding items to the playlist	□	□	□	□	□
Cohosting	□	□	□	□	□
Finding other beta trial users	□	□	□	□	□
Social settings (e.g., Facebook)	□	□	□	□	□
Chat	□	□	□	□	□
Activity stream	□	□	□	□	□
Search feature	□	□	□	□	□
Integration of WeJay with Weheartradio.com	□	□	□	□	□

5. What would your 'wish list' of features and functionality for WeJay look like? *

	Strongly Disagree	Somewhat Disagree	Neutral	Agree	Strongly Agree
Ability to rearrange items in the playlist	□	□	□	□	□
Ability to delete items in the playlist	□	□	□	□	□
Multiple file types	□	□	□	□	□
A voice over feature allowing for show introductions, fades, transitions, commentary between playlist items	□	□	□	□	□
Ability to schedule a show	□	□	□	□	□
Ability to make a show persistent for listening to anytime	□	□	□	□	□
Ability to add annotations to shows in the playlist	□	□	□	□	□
Display number of: active listeners, listeners by show, etc. (on both WeJay and Weheartradio.com)	□	□	□	□	□
A 'like' feature for shows	□	□	□	□	□
A 'share' feature for shows	□	□	□	□	□
A 'recommend' feature for shows, friends, etc.	□	□	□	□	□
A 'follow' feature for shows, unrelated to friending	□	□	□	□	□
WeJay for my iPhone, iPad, etc. including 'touch'	□	□	□	□	□
Audio recording and editing for content creation	□	□	□	□	□
Multimedia sharing including video	□	□	□	□	□
Faster loading time for dragging items to the playlist	□	□	□	□	□
Smoother play performance without random skipping when a show is broadcasting	□	□	□	□	□
Consistent features and functionality across platforms (e.g., Windows, Mac, etc.)	□	□	□	□	□

6. What other comments would you like to make about WeJay features and functionality?

_____

7. In your view is WeJay a social space (e.g., a space that supports interaction, collaboration, and sharing)? * (option to select one item)

○Yes

○ No
○ Not sure

8. If you responded Yes, or No, to question 7, why or why not in your opinion?

_____

9. What would make WeJay a more context aware, intelligent, and smart space? *

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
Use of profile details to suggest users to each other	□	□	□	□	□
Use of show details to recommend users to each other	□	□	□	□	□
Use of ad feature to enable listeners to locate and purchase content of interest	□	□	□	□	□
Ability to 'like' a broadcast	□	□	□	□	□
Indicator in WeJay and Weheartradio of the number of listeners to each show	□	□	□	□	□

10. What other elements would contribute to the awareness, intelligence, and smartness of WeJay?

_____

11. Through my WeJay experience I now recognize wireless grids tools can enable ambient intelligent (AmI) systems and environments? * (option to select one item)

○ Yes

○ No
○ I have no idea

12. If you responded Yes, or No, to question 11, why or why not in your opinion?

_____

13. To describe how you felt during your WeJay experience please indicate your level of agreement with the following terms. *

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
Adventurous	□	□	□	□	□
Enjoyment	□	□	□	□	□
Enthusiastic	□	□	□	□	□
Impressed	□	□	□	□	□
Surprised	□	□	□	□	□
Bored	□	□	□	□	□
Confused	□	□	□	□	□
Frustrated	□	□	□	□	□
Impatient	□	□	□	□	□

14. What other terms would describe how you felt during your WeJay experience?

_____

15. Please indicate your level of agreement with the following statements: *

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
When I was using or thinking about how I would like to use WeJay, I felt Creative	□	□	□	□	□
When I was using or thinking about how I would like to use WeJay, I felt In control	□	□	□	□	□
When I was using or thinking about how I would like to use WeJay, I felt Autonomous	□	□	□	□	□
When I was using or thinking about how I would like to use WeJay, I felt Innovative	□	□	□	□	□

16. In your assessment were new ideas created during your WeJay experience? *

	Yes	No
I created one or more new ideas	□	□
I thought about creating one or more new ideas	□	□
I noticed that other beta trial users created new ideas	□	□
Other people I talked to about WeJay came up with new ideas	□	□

17. What is your assessment of the WeJay social radio concept for current use in educational settings? * (option to select one item)

○ Too new for people to grasp

○ Exactly what is needed now
○ Being eclipsed by other technologies
○ No comment
○ Other _____

18. In your opinion what would move WeJay from beta to use? * (check all that apply)

□ Availability for mobile devices

□ Availability for all platforms (Windows, Mac, Linux, etc)
□ Improved interface incorporating 'touch'
□ Build on user information to support social interaction (e.g., interests, content, etc.)
□ Voice-over feature during broadcasts
□ Audio creation and editing
□ Ability to reorder and delete playlist items
□ Support for more file types
□ Support for more media types (e.g., video, etc.)
□ I have no idea
□ Other _____

19. Rate the concerns you had during your WeJay experience. *

	Very Concerned	Concerned	Neutral	Unconcerned	Not an Issue
Copyright	□	□	□	□	□
Privacy	□	□	□	□	□
Security	□	□	□	□	□

20. Describe any concerns indicated in question 17?

_____

21. What do you think the future holds for WeJay? * (check all that apply)

□ An opportunity to realize the unique potential of the core 'social radio' idea

□ A simple way to implement the wireless grid concept, linking devices anywhere anytime
□ A way to create and share multimedia Open Educational Resources (OERs)
□ I have no idea
□ Other _____

22. Suppose WeJay is implemented on a wireless grid connecting devices anywhere, anytime. Indicate on a scale of 1 to 5 if you think this would be disruptive to existing ways of doing things (e.g., unexpected creation of new markets using different values). *

Not really				Absolutely
1	**2**	**3**	**4**	**5**

23. In your assessment is WeJay social radio an innovative tool? * (option to select one item)

○ Very Innovative

○ Somewhat Innovative
○ Not Innovative
○ Not Sure
○ Other _____

24. Indicate your perception of the beta trial period. *

○ Too short
○ Too long
○ Just right

25. Indicate any concerns you had with this beta trial?

_____

26. What other comments would you like to make about this beta trial that could guide future WeJay trials that may occur?

_____

27. The WeJay experience enabled me to come to a greater understanding of wireless grids and their potential. Rank your response to this statement on a scale of 1 to 5. *

Not really				Absolutely
1	**2**	**3**	**4**	**5**

28. Please describe any additional thoughts you have about wireless grid enabled applications generally or WeJay social radio in particular.

_____

Appendix E: Recruitment Message

Participant information and responses will be anonymized and steps will be taken to ensure confidentiality. During the course of the research and before final publication of my thesis, I will validate my observations and interpretations with you.

Students and faculty [in the School of ...] Syracuse University can now explore use of the first public deployment of a wireless grid enabled edgeware application to emerge from the Wireless Grids Innovation Testbed (WiGiT) Lab at the School of Information Studies.

WeJay is a wireless grid enabled social radio application being launched as a pre-standards beta trial.

Registration for this beta trial is now available at the web address location (to be determined). As a registered beta trial user you are invited to participate in a research study being conducted by iSchool Doctorate of Professional Studies (DPS) student Patricia McKenna under the advising of Dr. Marilyn Arnone, Research Associate Professor and Associate Professor of Practice.

The purpose of this research is to investigate the launch and beta trial of WeJay, a Wireless Grids Innovation Testbed (WiGiT) social radio application while exploring possibly related features of ambient intelligent (AmI) environments. Wireless grids refer to an emerging form of network for sharing resources, creating resources, facilitating connections across devices (smartphones, sensors, etc.) and enabling ad hoc interactions. AmI refers to increasingly invisible technologies which are: a) being embedded and integrated into everyday environments and b) designed to be interactive with and responsive and sensitive to people.

Participants will be asked to respond to questions regarding their experience of the WeJay beta trial. Participants will also be asked to provide their opinion, impressions, and possible suggestions. This research study involves participation in *one or more* of the following ways:

- Registering and downloading of the WeJay beta trial in support of data activity and artifact analysis (may include audio-video recording of artifacts)
- *Focus group* session about your WeJay beta trial/demo experience which will be video-recorded (one to two hours in duration)
- *Informal interview* about your WeJay beta trial/demo experience which will be audio-recorded (one to two hours in duration)
- *Survey* consisting of general questions about your WeJay beta trial/demo experience

Your participation in this research is truly appreciated.

Thank you. And I look forward to working with you.

Appendix F: Alternate Recruitment Communications

For Journalism

I invite you to participate in the WeJay Social Radio beta trial.

With the ongoing emergence of social media tools together with the notion of ambient journalism, the use of WeJay provides an opportunity for you to imagine and experiment with how a social and mobile media space can be used, now and into the future.

Create your own sounds, mix and share your music, collaborate on ideas for radio shows, or share your voice in this emerging and interactive sound space! Your radio station can feature lectures, news broadcasts, interviews, documentaries, music or anything you would like to create.

If you do not have the time to download and engage with the product you can still gain exposure to WeJay through viewing a brief video (under 5 minutes). This would enable you to participate in an 'interview' about WeJay and/or a 'focus group'.

Purpose

The purpose of this research is to provide an opportunity to see and use an early stage 'wireless grid enabled' application – WeJay social radio. The beta trial will allow participation with this tool, to determine if it facilitates innovative and creative ideas and if there is any relationship with ambient intelligence (AmI). Wireless grids refer to an emerging form of network for sharing resources, creating resources, facilitating connections across devices (smartphones, sensors, etc.) and enabling ad hoc interactions. AmI refers to increasingly invisible technologies which are: a) being embedded and integrated into everyday environments and b) designed to be interactive with and responsive and sensitive to people

Benefit

The benefit of your research participation is that you will be assisting us to understand and contribute to general knowledge about ambient intelligence (AmI) in wireless grid enabled environments. You may also be influencing the development and direction of wireless grids and ambient media ecologies. This research may contribute to recommendations for wireless grid enabled applications going forward. Having the opportunity to engage with potentially innovative and transformative applications is of benefit as a type of learning environment and may provide an opportunity to explore one's creative and innovative potential.

Create your own sounds ….

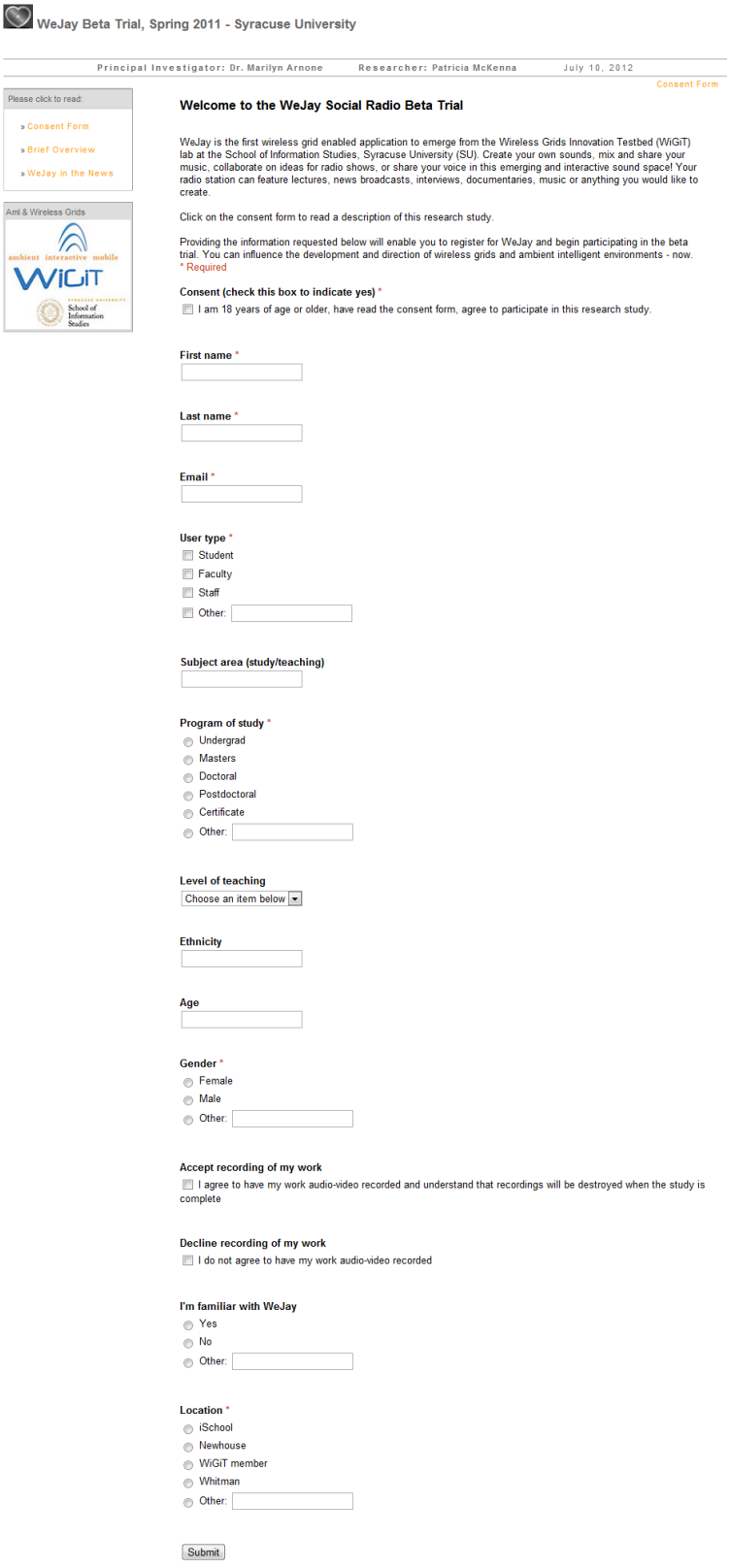
For Business

You are invited to participate in the WeJay Social Radio beta trial, emergent research being conducted through the iSchools's WiGiT Lab.

With the ongoing emergence of social media tools together with the notion of ambient business, the use of WeJay provides an opportunity for you to imagine and experiment with how a social and mobile media space can be used, now and into the future.

Please note that: *Participant information and responses will be anonymized and steps will be taken to ensure confidentiality. During the course of the research and before final publication of my thesis, I will validate my observations and interpretations with beta trial users.*

Appendix G: Recruitment Supports – Registration Page



WeJay Beta Trial, Spring 2011 - Syracuse University

Principal Investigator: Dr. Marilyn Arnone Researcher: Patricia McKenna July 10, 2012

Consent Form

Please click to read:

» Consent Form

» Brief Overview

» WeJay in the News

Ami & Wireless Grids

ambient interactive mobile WiGiT

School of Information Studies

Welcome to the WeJay Social Radio Beta Trial

WeJay is the first wireless grid enabled application to emerge from the Wireless Grids Innovation Testbed (WiGiT) lab at the School of Information Studies, Syracuse University (SU). Create your own sounds, mix and share your music, collaborate on ideas for radio shows, or share your voice in this emerging and interactive sound space! Your radio station can feature lectures, news broadcasts, interviews, documentaries, music or anything you would like to create.

Click on the consent form to read a description of this research study.

Providing the information requested below will enable you to register for WeJay and begin participating in the beta trial. You can influence the development and direction of wireless grids and ambient intelligent environments - now.
* Required

Consent (check this box to indicate yes) *

☐ I am 18 years of age or older, have read the consent form, agree to participate in this research study.

First name *

Last name *

Email *

User type *

☐ Student
☐ Faculty
☐ Staff
☐ Other:

Subject area (study/teaching)

Program of study *

○ Undergrad
○ Masters
○ Doctoral
○ Postdoctoral
○ Certificate
○ Other:

Level of teaching

Choose an item below

Ethnicity

Age

Gender *

○ Female
○ Male
○ Other:

Accept recording of my work

☐ I agree to have my work audio-video recorded and understand that recordings will be destroyed when the study is complete

Decline recording of my work

☐ I do not agree to have my work audio-video recorded

I'm familiar with WeJay

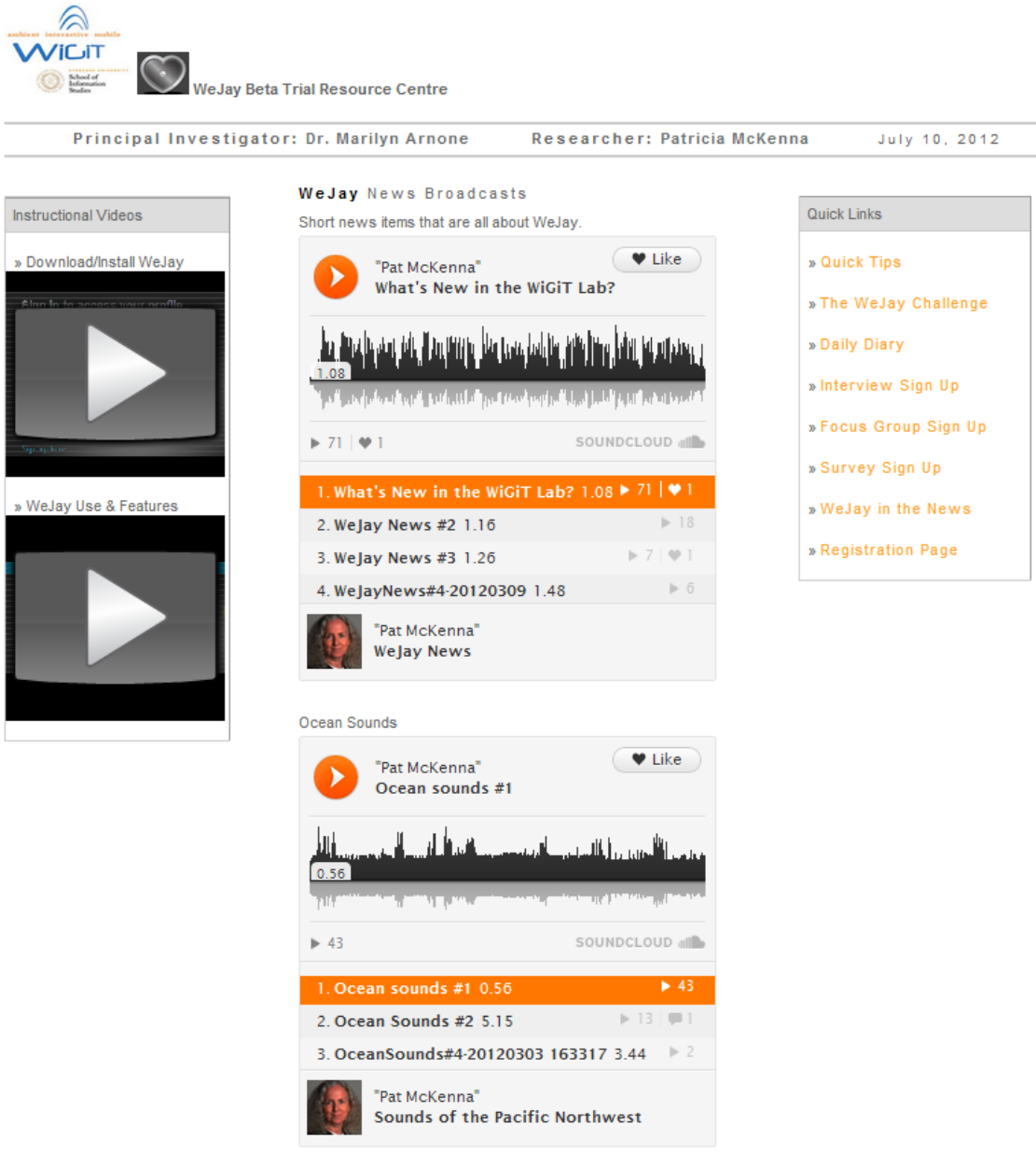
○ Yes
○ No
○ Other:

Location *

○ iSchool
○ Newhouse
○ WiGiT member
○ Whitman
○ Other:

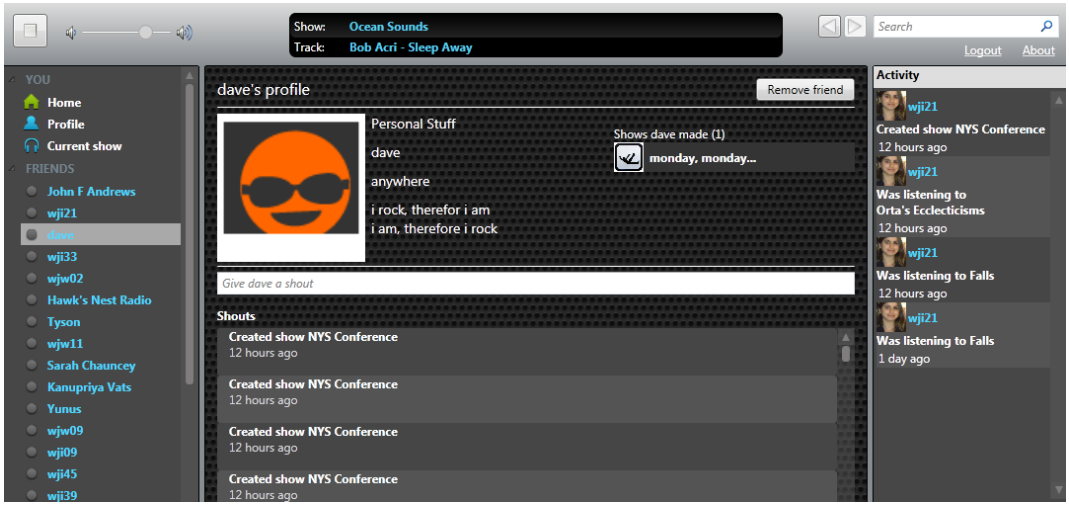
Submit

Appendix H: Materials – WeJay Beta Trial Resource Center



Appendix H: Materials – Weheartradio.com

Appendix H: Materials – WeJay Interface



Appendix I: Supplementary Data (Recruitment, Activity)

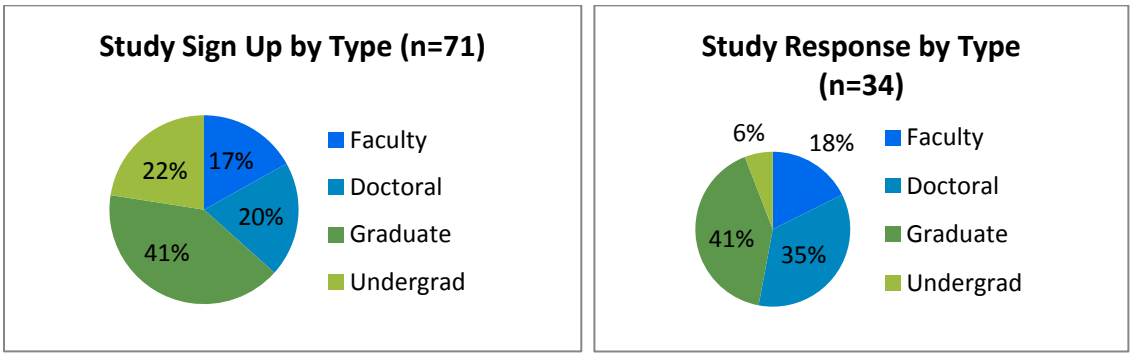


Figure 17: A-1 Research Study Sign Up and Response by Type

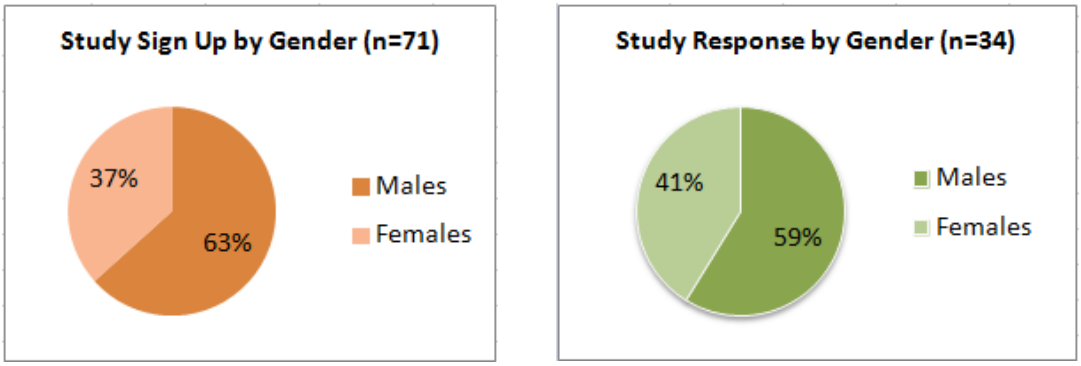


Figure 18: A-2 Research Study Sign Up and Response by Gender

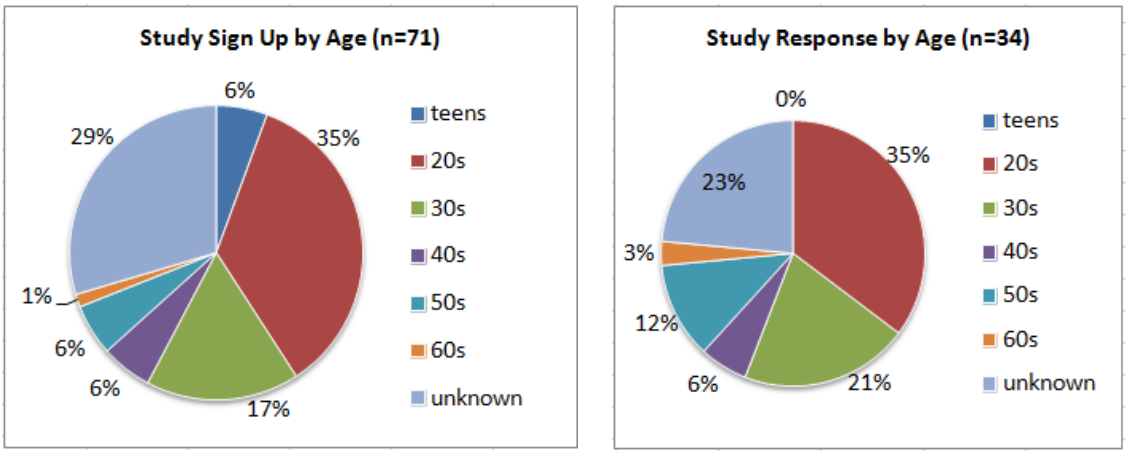


Figure 19: A-3 Research Study Sign Up and Response by Age Range

Table 43: A-1 WeJay Activity: Interview, Focus Group, Survey Respondents

WJ=WeJay; CH=Cohost; FB=Facebook; I=interview; FG=FocusGroup; S=survey; E=email; D=diary

ID	G	Activity Data (WeJay)									I	FG	S	E	D
		WJ	Web	Profile	Name	Photo	Loc	Shows	Co Host	FB					
001	m	y	y	y	y	y	y	y (2)			y		y	y	y
002	f	y		y	y	y	y	y (10)			y			y	
003	m	y	y				y	y (1)			y			y	
004	m	demo									y			y	
005	m	y	y					y (2)		y	y		y	y	
006	m	y			y	y	y	y (1)		y	y		y	y	y
007	m	y		y		y	y	y (2)		y	y			y	
008	m	y	y					y (3)			y		y	y	y
009	f	y	y	y			y	y (3)		y	y		y	y	
010	m	y	y		y	y	y	y (15)	y	y	y		y	y	
011	f	demo	y								y		y	y	
012	f	y	y		y			y (1)			y		y	y	y
013	f	y	y	y	y		y	y (1)			y			y	
014	f	demo									y		y-i	y	
015	f	demo									y			y	
016	m	demo	y								y		y	y	
017	m	demo	y								y			y	
018	f	y	y					y (1)			y			y	
019	m	y	y	y	y	y	y	y (3)		y	y		y	y	
020	m	y	y		y		y	y (1)		y	y		y-i	y	
021	f	y	y	y			y				y			y	y
022	m	login									y			y	
023	f	y	y	y			y			y		y	y		
024	m	y						y (1)	y	y		y		y	
025	m	y	y	y	y	y	y	y (4)				y	y		
026	f	y		y	y		y	y (1)	y			y	y	y	
027	f	y			y	y	y	y (7)	y			y	y		
028	f	y								y		y			
029	m	y		y	y	y	y	y (1)					y		
030	f	login	y										y		
031	m	y	y					y (1)	y				y		
032	m	login											y	y	
033	m	y		y		y	y						y	y	
034	m	y			y		y	y (6)	y				y	y	

- y-i=incomplete surveys
- demo = viewed one or more brief videos in lieu of WeJay access and use
- login = login and viewing of WeJay with no evidence of activity
- web = Weheartradio.com website usage

Total # included for data analysis = 34

Table 44: A-2 WeJay Activity: Interview, Focus Group, Survey Nonrespondents

WJ=WeJay; CH=Cohost; FB=Facebook; I=interview; FG=FocusGroup; S=survey; E=email; D=diary

ID	G	Activity Data (WeJay)									I	FG	S	E	D
		WJ	Web	Profile	Name	Photo	Loc	Shows	Co Host	FB					
035	m	login	y										y-i	y	
036	m												y-u	y	
037	f												y-u	y	
038	m	y	y					y (1)						y	
039	m	y	y		y	y	y							y	
040	m	y		y	y		y								
041	m														
042	m	login	y											y	
043	m	login	y											y	
044	m	y					y								
045	m													y	
046	m	login	y											y	
047	m	y	y											y	
048	f	y	y		y	y	y			y				y	
049	f	login	y											y	
050	m	y	y	y			y							y	
051	f													y	
052	m													y	
053	m	login	y												
054	f														
055	m														
056	m														
057	f	login	y												
058	m	login													
059	m														
060	f	y	y		y		y								
061	f	login													
062	m	login	y												
063	m	login	y												
064	f	login													
065	m	login													
066	m	y	y		y		y								
067	m	login													
068	f	login													
069	f														
070	m														
071	m														

y-i=incomplete
y-u=unreliable due to lack of exposure to WeJay – confirmed by email (2)
login = login and viewing of WeJay with no evidence of activity
web = Weheartradio.com website usage

Total number of non-respondents = 37

Summary data with totals for the 37 non-respondent participants appearing in Table 44 A-2 is as follows:

- inactive=8
- email correspondence=11
- active in WeJay= 7
- web activity=15
- login only=16

Survey Data

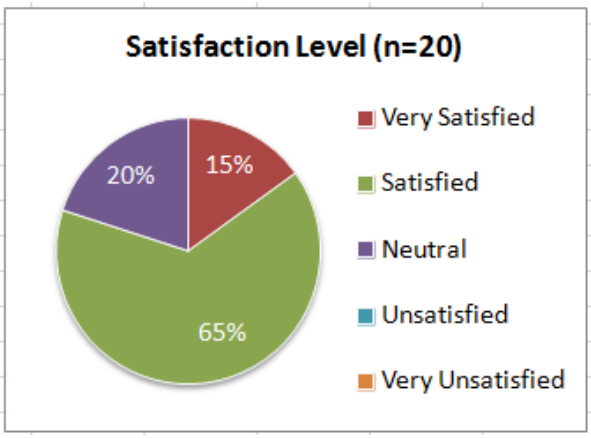


Figure 20: S-1 Q2: Satisfaction with WeJay Experience

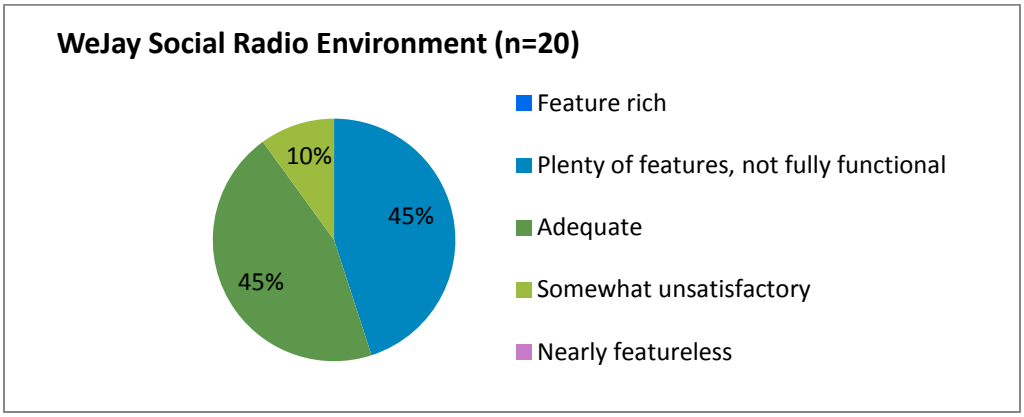


Figure 21: S-2 Q4: Satisfaction with WeJay Features

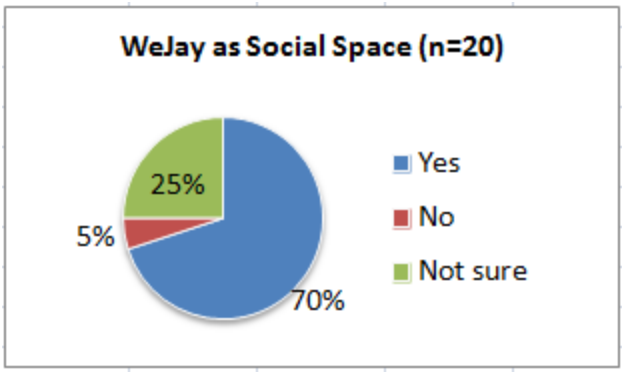


Figure 22: S-3 Q8: Perception of WeJay as a Social Space

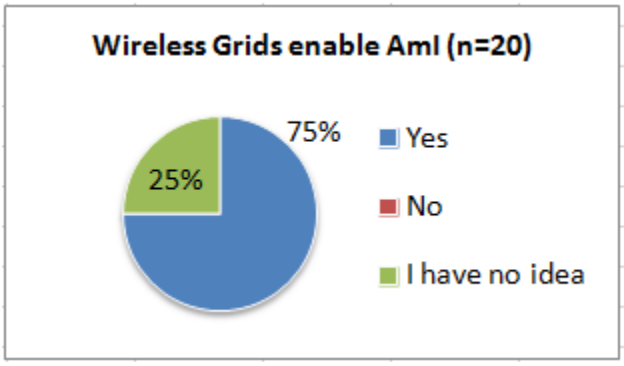


Figure 23: S-4 Q12: Perception of Wireless Grids & AmI Environments

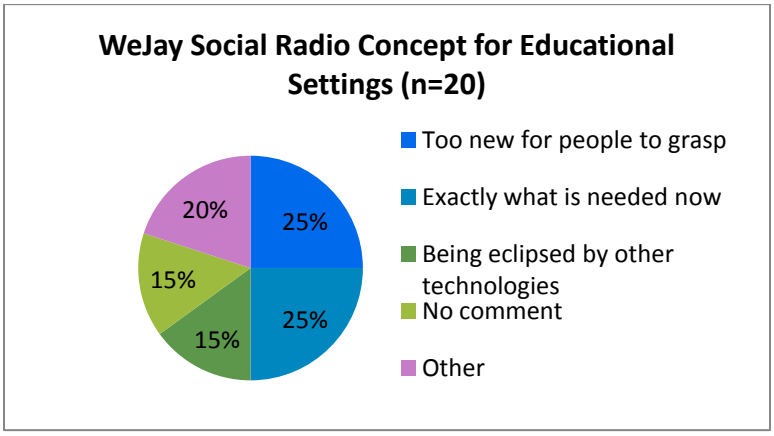


Figure 24: S-5 Q18: Assessment of WeJay for Educational Settings

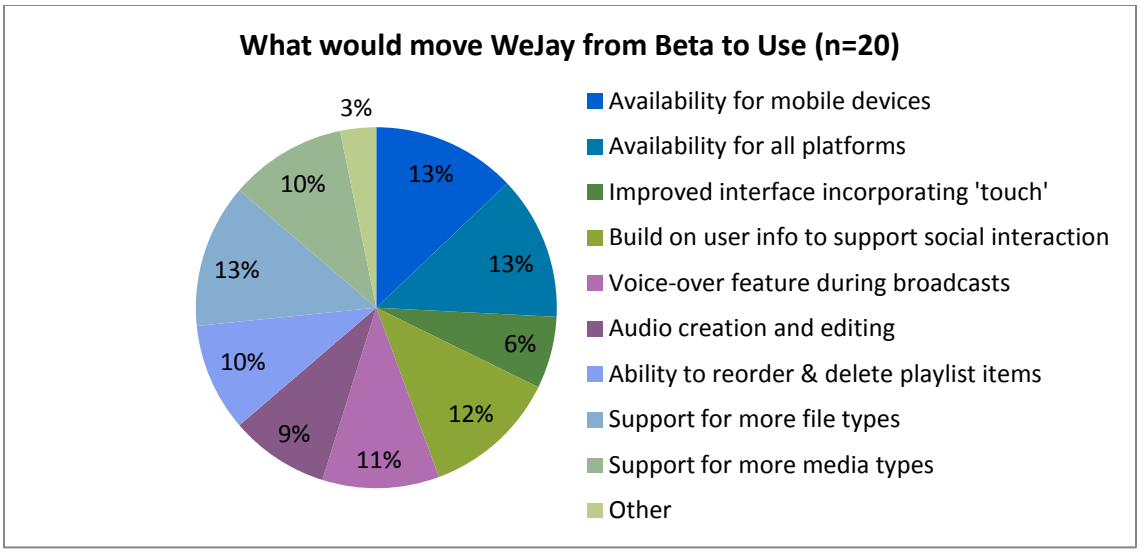


Figure 25: S-6 Q19: Factors Moving WeJay from Beta to Use

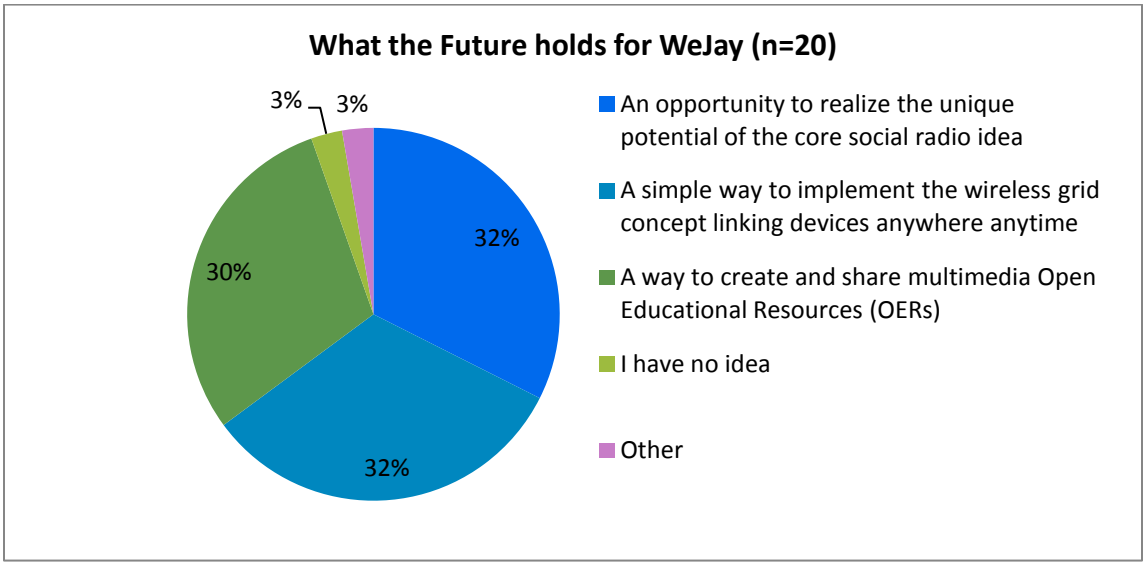


Figure 26: S-7 Q22: Assessment of the Future for WeJay

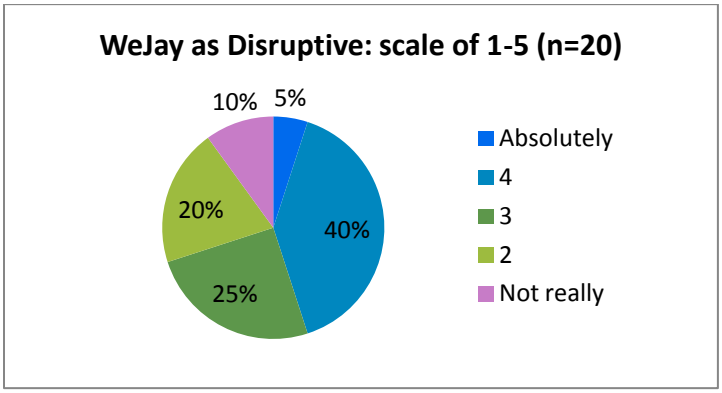


Figure 27: S-8 Q23: Assessment of WeJay as Disruptive

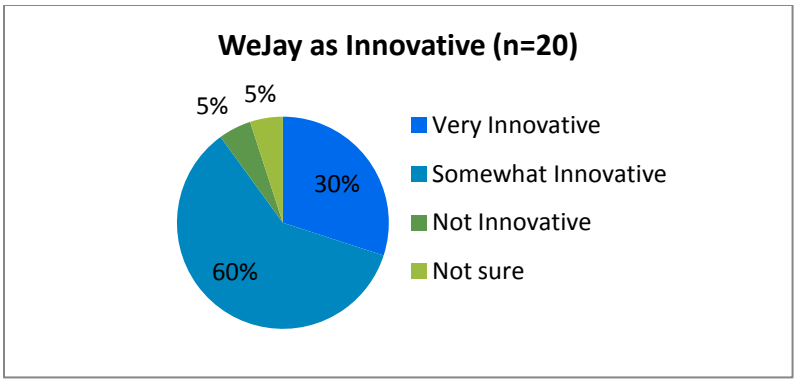


Figure 28: S-9 Q24: Assessment of WeJay as Innovative

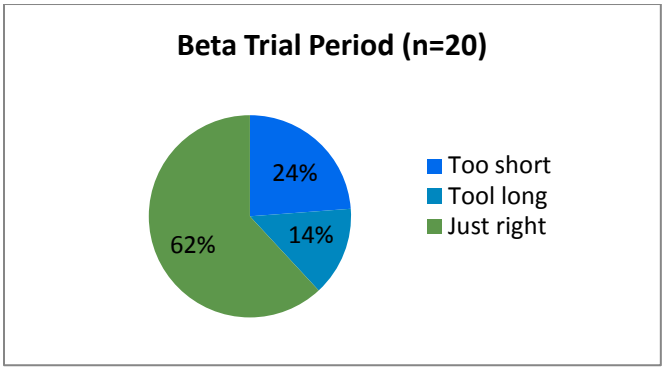


Figure 29: S-10 Q25: Assessment of the WeJay Beta Trial Period

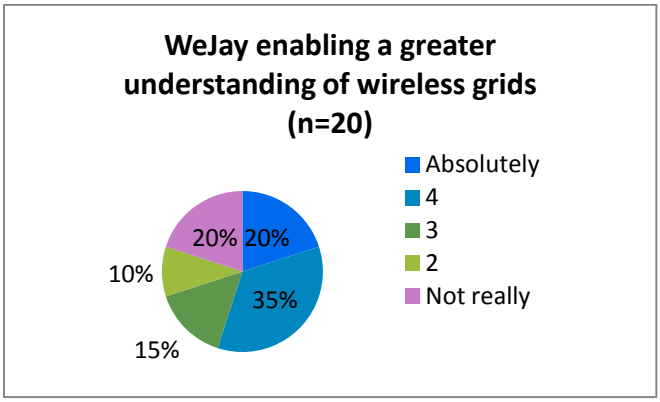


Figure 30: S-11 Q28: WeJay Enabling Greater Understanding of Wireless Grids

Appendix J: Coding Glossary

Category Code	SubCategory Code	Definition	Text Segment Example
Ambient Intelligence (AmI)	Smartness	Embedded knowing aligned and interactive with user needs and interests, preferences, incorporating personalized, adaptive and anticipatory elements.	… it is kind of like recognition software whereas if I'm playing a particular radio show maybe down in the corner or somewhere you could have displays of artists from the 80s or playing a 90s radio type theme, artists from the 90s.
Ambient Intelligence (AmI) - Context Awareness	General	Refers to the embedding and integrating, on a mass scale, of technologies that are sensitive and responsive to humans in everyday environments in increasingly invisible and unobtrusive ways (De Ruyter & Aarts, 2009:1039). AmI technologies are described by five key characteristics: embedded, context-aware, personalized, adaptive, anticipatory (Bick et al., 2007). Context awareness in general includes reference to context.	… certainly being able to connect to people I know on … WeJay is cool. But I would feel as if it was even more social if some of these context awareness things could make connections for me that I couldn't necessarily just make on my own. … song annotations would be really cool … that's what I usually wonder … if a friend posts a song or shares a song, what I want to know is why they did it … if I am curious it's oh, I wonder why you posted that song.
Ambient Intelligence (AmI) - Context Awareness	Recommending	System intelligence and assistance based on user choice to identify interests and needs.	from the ambient perspective, again I didn't get that functionality that they have in Amazon but I could see where that could possibly be added because if I'm broadcasting say for instance all classical I could see where the software would you know maybe recommend a friend who also has a radio show and has a lot of classical.
Ambient Intelligence (AmI) - Context Awareness	Location	System intelligence and assistance based on user choice to identify location.	… if I've got my cell phone on and I happen to be in Oklahoma you know the cellphone towers know that I'm in Oklahoma so therefore it'd be great if there's suddenly a tornado warning that it comes to my phone not because I have an Oklahoma number because I don't but because I happen to be in Oklahoma when that emergency is happening. So that's kind of where I see wireless grids in my mind going but I know it's totally different than the WeJay experience.
Ambient Intelligence (AmI) - Context Awareness	Presence	System intelligence and assistance based on user choice to identify presence.	So it seems at least you know in terms of friends, it found who's there …
Ambient Intelligence (AmI) - Context Awareness	Resources	System intelligence and assistance based on user choice to identify resource/content for sharing.	… in terms of resources, on my computer it did, they are in certain folders that are difficult to find, ah so it linked into iTunes and so if you stick to just the iTunes then it works find but if you have other files … it was a little bit more difficult to place everything.

Ambient Intelligence (AmI) - Context Awareness	Situation	System intelligence and assistance based on user choice to identify situation-related information.	… when I use Skype I like to stay offline … people try to talk to me sometimes and I am in a meeting … they see me online so think I am available and they try to call or talk to me.
Creativity	Tool-fostered	Perception that being creative is fostered by the WeJay tool as in feeling creative during the WeJay experience.	I was able to play all my favorite ... songs …. I really like that creative part …
Creativity	Autonomy - User Control	Being able to pick and choose and customize.	… you can pick and choose the song that you want to broadcast to the radio. Usually you just have to pop in the CD and you let the CD play but with this one it allows you to customize your particular radio show.
Creativity	Motivational aspects	Tool readiness pertaining to engagement, creativity, etc.	… with a low audience you know I maybe had two or three friends listening at once as a maximum number of users that I was aware of and so um the time and attention I would have to spend in picking out songs in particular order, or in a creative way, it just didn't feel worth it with such a low audience.
Creativity - Novel Ideas	Assessment - Negative	"A product or response will be judged as creative to the extent that a) it is both a novel and appropriate, useful, correct or valuable response to the task at hand, and b) the task is heuristic rather than algorithmic." (Amabile, 1996:35). Perception that novel ideas were not generated by self or others.	I don't think so … I don't want to give the impression I didn't enjoy using the software at all but … it didn't make me think that I was doing anything um unusually cool (laughter).
Creativity - Novel Ideas	Assessment - Neutral	Neutral as to whether novel ideas were generated by self or others.	I don't feel like I have enough to really comment on because of the few interactions that were there.
Creativity - Novel Ideas	Assessment - Positive	Perception that novel ideas were generated by self or others.	… these kids come up with such wonderful ways of using it … that are just novel ….
Emergent	Learning	Refers to the relatively unplanned learning which occurs spontaneously in order to cope with emergent issues (Deng, 2010).	That dialogue or collaboration sessions that I had with that individual I thought it was pretty interesting.
Emergent	Patterns	Refers to patterns of use, lack of use, engagement, exposure to the product, etc. Perception of radio as background versus foreground visual and more demanding. Belief patterns around age. Assumption around copyright.	It became just one of those things that was part of my daily routine, you know, along with checking my Twitter, checking my LinkedIn, my Facebook. Then it was, then there was WeJay …
Emergent	Processes	Refer to processes around the use and engagement experience.	Yeah, see that's the great thing about this, it's more than just hosting something out for people to listen to, there is an ambient experience around the whole process of this thing..
Emergent - Attitudes	Social Media - Positive	Perception of this type of social media experience as fun, awesome and possibly contributing to consideration of future possibilities.	I was broadcasting my show, just chatting with the person who was listening, you know as far as myself I don't particularly participate in those types of things so yeah it was definitely an experience for me , a positive one.

Emergent - Attitudes	Social Media - Neutral	Neutral as to social media.	I personally am not a Facebook person. I'm not a big social media type person.
Emergent - Attitudes	Social Media - Negative	Comments regarding social media interactivity, marketing, etc.	I don't like to share control of my radio station.
Emergent - Behavior	Engagement - Positive	Refers to expressions of engaging and imagining engagement.	I could see where you could have a set time, you know, during the week or on the weekend and really have a very robust social type atmosphere …
Emergent - Behavior	Experiment	Refers to emergent curiosity and the desire to explore, experiment, hack.	I just wanted to … experiment … and see how it is … and … I was under the impression that it was an iSchool product so I, I thought it would be really cool to test it.
Emergent - Behavior	Engagement - Constraints	Refers to expressions of not wanting to engage or barriers to engagement. Also encompasses time issues, not having enough time.	I feel uncomfortable making a new friend by using this kind of online social media … Because not many of my friends are … using WeJay at the moment. So when I see many of my friends using WeJay I think in that case I feel like I may want to use WeJay. … I haven't spent much time with it purely through lack of time.
Emergent - Behavior	Modeling	References to other user activity.	Well, being able to, to see what other people were doing was really nice too.
Emergent - Behavior	Conversat-ions	References to conversations with others about WeJay.	… others that I talked to about it … like one of my friends he's actually a DJ with a local radio station here and he was really interested in what WeJay was.
Emergent - Properties	Constraints	Refers to inconsistent functionality, instability of the tool or rigidity, limitations, etc.	Sometimes when I was playing my songs or my show I don't know if it was maybe my laptop but the songs would skip and I didn't know if that was something in the software or something with the iTunes application itself.
Emergent - Properties	Affordances	Refers to perceptions of the tool: cool, ease of use, simplicity, user friendly, having value in some way (e.g., enabling communications etc.)	… it's something that almost everyone's done at at some point of their life … enjoy music with their friends … and … it's a cool way to do it.
Emotions - Negative	Bored	Expression of boredom.	I may use WeJay a couple of times and I may be bored with using WeJay so I think we need to think about how to make people more interested in using WeJay continuously …
Emotions - Negative	Confused	Expression of confusion.	… I was just confused in the video that it said wait for it to copy the file and I [was] confused about where the file was being copied …
Emotions - Negative	Frustrated	Expression of frustration.	I got frustrated and I didn't want to ah, ah to just go and re-download it again and ah go through all of the process again.
Emotions - Negative	Impatient	Expression of impatience.	… that is one other barrier I would say that it kind of, it’s a case of patience, if your Internet speed is not that great and you are trying to play songs through WeJay …

Emotions - Negative	Annoyed	"Emotions are an integral component of all human activities, including human-computer interactions." (Lopatovska & Arapakis, 2011). Indicate the type of emotion expressed in the text. Expression of annoyance.	… that was a minor annoyance … that's the most barrier …
Emotions - Negative	Worried	Expression of worry.	For children it gets a little bit tricky because you have to worry about safety … in any kind of technologies.
Emotions - Negative	Surprised	Expression of negative surprise.	I suppose some of the constraints I mentioned surprised me ... in the sense that I couldn't change songs once they were sort of in the order. … so I guess that's a negative surprise.
Emotions - Negative	Disappoint-ed	Expression of disappointment.	She was demoing it in front of other students and that was a disappointment to me because when a ... child is up in front of her peers basically and demoing something that she's excited about and really wants to show it and … it doesn't work, or features of it don't work, that shouldn't happen.
Emotions - Negative	Unsatisfied	Expression of dissatisfaction.	… but the geolock placed on the radio was a bit uncomforting …
Emotions - Positive	Adventurous	"Emotions are an integral component of all human activities, including human-computer interactions." (Lopatovska & Arapakis, 2011). Indicate the type of emotion expressed in the text.	
Emotions - Positive	Enjoyment	Expression of enjoyment.	Now I'm not that big on social media type applications but I did find this one to be very creative and actually enjoyable
Emotions - Positive	Enthusiastic	Expression of enthusiasm.	I wonder … how it can position itself in today's growing field of software and tools and apps. So its more hopeful enthusiasm.
Emotions - Positive	Impressed	Expression of being impressed.	I was impressed by WeJay [it] like help[s] people to communicate by using radio.
Emotions - Positive	Interested	Expression of interest.	I was actually able to create a radio show with 80s music which I thought was pretty interesting …
Emotions - Positive	Peaceful	Expression of a peacefulness.	Excitement and peaceful mediation.
Emotions - Positive	Surprised	Expression of surprise.	… simply surprised in a lot of the different things I was actually able to hear and again a lot of the different music and things were things that I had never ever been exposed to.
Emotions - Positive	Safe	Expression of safety.	… I felt safe that I was not downloading other people's files ...
Emotions - Positive	Comfortable	Expression of comfort.	… somehow it looks like iTunes and also I think that's why I feel comfortable to use this kind of application because it looks similar to some previous education …
Emotions - Positive	Happy	Expression of happiness.	I was really happy with how easy it was.

Emotions - Positive	Excited	Expression of excitement.	... one of the things that made me so excited about this ... was that I was, in my younger years and in undergrad, ... in college radio for four years and I've never lost my passion for doing that kind of thing. So I was really excited to try out the software here.
Emotions - Positive	Satisfied	Expression of satisfaction.	… it was fun thinking about my own music, in a curatorial way, which is something that I do … but it was easy to do on the service. And that sort of sense of, I mean it's a creative experience and it was very satisfying …
Emotions - Positive	Pleased	Expression of pleasure.	I was like so pleased by what, by the thing itself …
Expectations	Realized	Met expectations	I think that for my expectations … it worked more smoothly than I thought it would even though I had a couple of small glitches.
Expectations	Unrealized	Did not meet expectations	I'm kinda have a higher bar ... I actually, I expected a WeJay product included, produced some more … outputs.
Expectations	Uncertain	Not knowing what to expect	I guess I didn't know what to expect.
Future Trials	Audience	Comments regarding audience.	… maybe getting out to a wider audience.
Future Trials	Functionality	Comments regarding tool functionality, improvements, enhancements.	I'm just using my laptop and being able to do that on the phone.
Future Trials	Participation	Comments regarding participation, time zone considerations, group use, friend use, etc.	… maybe getting more people in the next trial maybe expanding it more and get more people actually using the software.
Future Trials	Support	Availability of assistance in gaining access to the tool, setup, and use. Also includes use case videos (e.g., this my understanding of the tool, this is what I did, this is how I did it, etc.)	I would like somebody available ... to help me to actually participate in it … it would have been really helpful just to have somebody from WiGiT or IT or somebody, I don't know ... say … I'm available if you need help to go through this beta trial period.
Future Trials	Conduct	Structured, controlled, and monitored usage.	… monitor their activity as soon as they install WeJay and how they go about it.
Impact	Potential	Larger social media, explorations, and other implications (e.g., convenience, private networks, etc.)	Well, you know, it got me thinking about you know other aspects of social media and maybe the next frontier of social media.
Impact	Content Promotion	Music purchase.	I was exposed to new music, so I bought new music.
Impact	Music Awareness	Broadened music repertoire, feedback, discovery of shared interests.	I was able to enjoy other people's broadcasts … Plus a lot of music that I had actually never heard before or anything even close to it.
Impact	Opportunit-ies	Job offers, etc.	I think the biggest impact it had on me … was it got noticed by somebody who's currently in radio and they offered me … a half hour or hour long weekly radio show um as long as I produce the content.
Impact	Research	Refers to inclusion in grant proposals, doctoral research, etc.	Well, it's affected many proposals that I've written and, and [am] continuing to write … I want to include it as part of the activities that I'm suggesting in these proposals. .

Impact	Educational Settings	Comments in relation to educational settings	… I was thinking that this would have been an ideal tool for the classroom … giving students a different way of … communicating and interacting with each other …
Impact	Information Sharing	Refers to cultural and many types of information sharing.	Yeah a potential tool for awareness of the world and …
Innovation	Adoption - Laggards	Refers to "an idea, practice, or object that is perceived as new by an individual" (Rogers, 1983). Late adopters(Rogers, 1962 – Diffusion of innovations).	… so I'm more of a laggard, speaking of innovation …
Innovation	Functionality	Refers to functionality in relation to innovation.	... it needs to be successful … it needs to work every time.
Innovation	Transforma-tive	Evidence that the product breaks away from the constraints of the situation as typically conceived (Amabile, 1996 citing Jackson & Messick, 1965). Transformation of a new idea into a new product or service, or an improvement in organization or process (Heye, 2006).	… what's transformative is ... it's no longer going to be something that only a few people can do because they're the only ones that have the capabilities. And you don't have to, it removes ... the ... location barrier because they don't have to be in the same place.
Innovation	Evolutionary	Innovation as continuous rather than disruptive.	I don't think WeJay is groundbreaking in that sense [transformative] but sort of a natural extension. … so in terms of breaking the mould of traditional radio I think that that … has already been in place for a very long time … at least for … maybe a decade.
Innovation – Interpretat-ion	Discovery	Refers to discovery in relation to innovation.	… don't know what a taxonomy of the sounds that you would represent would 'be' but I didn't see ... I guess there ... wasn't, and there may not be at this point, a ... really intuitive way for finding things.
Innovation – Interpretat-ion	Meaning	Product may also be perceived as different.	Well, you know to me it actually means innovation as far as you know applications which allow you to actually play music.
Innovation – Interpretat-ion	Possibilities	Refers to interpretation of possibilities.	I thought at least personally, maybe I could get more into the whole social media, social profile type cultural environments.
Innovation – Interpretat-ion	Uses	Refers to interpretation of uses (e.g., education, entertainment, gaming, military, research, etc.)	It's almost like a platform for ah, ah for sharing and collaboration …
Parallel Trials	Influences	References to other concurrent WeJay beta trials.	I didn't do that myself but I checked out [parallel beta trial] Hawksnest radio which was pretty cool. I was really impressed with what the kids did with that.
Readiness	Beta Trial	Comments regarding conducting of the trial (e.g., instructions, approach, etc.).	… the instructions that you provided were very straight forward.
Readiness	Experience - Positive	One's experience of the readiness of WeJay.	Well if I had to sum up in one word it would probably be awesome.

Readiness	Barriers	Identification of barriers to use associated with features and functionality as well as other barriers including downloading, installation, and access issues (platform compatibility, international geo-locks, etc.)	… the only barrier that I had dealt with the actual songs skipping when I was playing.
Readiness	Continued use	Comments on continued use of WeJay.	You know I will use it … if I don't get frustrated trying to use it …
Readiness	Dislikes	What users disliked about WeJay.	The inability to change my playlists once I uploaded songs.
Readiness	Likes	What users liked about WeJay.	I liked WeJay because a lot of stuff in my collection is not stuff that was on Spotify. So I could more or less be pretty unlimited in terms of what I wanted to play.
Readiness	Improve-ments	Refers to how the product may be improved.	… I'm just using my laptop and being able to do that on the phone.
Readiness	Features	Used with Interview data only. Then preferred Readiness - Features - Functionality.	
Readiness	Learning Curve	Gaining familiarity with the tool.	… once I was able to learn how to actually create the show and use the software it made it very very enjoyable.
Readiness	Synchronous / Asynch-ronous	Discussions of the tool in relation to synchronous or asynchronous use.	Yeah, well I tried to broadcast when I knew people were on …
Readiness	Commerciali zation	References to the commercial aspect of the product	… this commercial side is very exciting ... and I wonder … how it can position itself in today's growing field of software and tools and apps.
Readiness	Stability	References to product stability.	I think it holds promise but it has to work and work seamlessly and with little effort.
Readiness	Instability	References to instability.	… the initial experience was satisfying - the product worked as promised and i was able to create [an] internet-based radio station. But after the first few times (3-4 times), the software kept crashing.
Readiness - Concerns	Copyright	References to copyright.	So I think what it provides us [is] more legality around the sharing of music.
Readiness - Concerns	Privacy / Trust	References to privacy / trust.	… playing music and just chatting with an individual so I wasn't releasing any personal information and I didn't give anybody access to my personal laptop or anything so as far as personal information no I didn't have any concerns.
Readiness - Concerns	Security	References to security, authentication, etc.	… authentication. Like that was really the value added …
Readiness - Content	Access	Refers to the persistence and availability of content.	I would have preferred uploading the songs just once instead of uploading multiple times, each time I played.

Readiness - Content	Creation	Refers to how content gets created for sharing in WeJay.	but what I didn't grasp was like how to do it, how to, do I just plug in my microphone and talk or do I record something and then … play it. Because if I record something then it's not really in the moment and if I'm talking and … able to transmit that while I'm talking like … in real time then that … would be more I guess … interesting to me.
Readiness - Content	Diversificat-ion	Refers to the range and diversity of content.	You know you need to, not just audio files but video files and … a lot, more … different types of file … sharing..
Readiness - Environment	Collaborat-ion	References to WeJay as a collaborative environment.	I didn't co-host a show or have anybody co-host one of my shows …
Readiness - Environment	Interaction - Systems	Refers to the leveraging of multiple tools to enable device, platform, and people interactivity.	It qualifies as a social tool but I don't think it really functions as a social tool as a standalone product. … having it integrate with Facebook is, is helpful because that's an existing social network that then something like WeJay can leverage.
Readiness - Environment	Sharing	References to WeJay as a sharing environment	It's almost like a platform for ah, ah for sharing and collaboration …
Readiness - Environment	Social	Refers to social contexts for learning including the influences of prior activity, play, fantasy, affective states, competition (Amabile, 1996: 229-240). Also includes reference to friends, friending, connecting, social identify, etc.	… so to me it's the personal involvement that makes it social, its not the immediate presence necessarily. You know like you want to make sure you don't lose any of the cool things … if I had been around and people were around and I was able to say hey, I really love this song and we got into a conversation and it possibly changed what they played next and like that could be cool too. … somehow it looks like iTunes and also I think that's why I feel comfortable to use this kind of application because it looks similar to some previous education …
Readiness - Environment	Peer-to-peer	Refers to personalized and small group activity.	… the reason I was interested in it, and this was borne out by my experience even though it was just a small trial, is that, it really was a way to connect with people on a peer-to-peer level, about what kind of music they wanted to share with each other. What kind of music I wanted to share with them instead of it being filtered through a bunch of … either corporate or just professional filters.
Readiness - Environment	Distinctive-ness	Demonstration of how WeJay as a wireless grid enabled application differs from traditional social media applications and social networking infrastructures.	… try to do just a, maybe one really nice ... real world demo. That would kind of grab people .... so basically just tell people that we can built [this] and ... connect a device together. ... link to do something ... different from a traditional ... Internet or traditional networks. Just show the difference to people that ….
Readiness - Environment	Interaction - People	Refers to discussions of interaction and interactivity for people.	… I noticed that, whenever they come online you are able to see that they are online and interacting.

Readiness - Features	Search	Comments regarding search capability.	There was search that I wasn't confident about.
Readiness - Features	Interface	Comments regarding ease or difficulty of use, appearance, design, etc.	It's appearance, it's a beta so it doesn't look that pretty.
Readiness - Features	Functionality	General comments regarding functionality	I kind of thought that was but I wasn't really sure what that functionality was in the beta software. [persistence of content] It seemed like there were some people that were doing that but they were doing it by just basically leaving their computer on and open. ...some of the songs when I dropped them down and they would play they would skip or they would kind of repeat. … And again, I didn't know if it was my laptop or the WeJay software or because I was dragging and dropping from iTunes but other than that everything else just seemed to work fine.
Readiness - Features	File Types	Comments regarding additional file type content (e.g. images, video, etc.)	I was wondering if video could be incorporated into it as well.
Readiness - Features	Website	Refers to Internet dimension of WeJay - Weheartradio	I can listen to some music by others and any kind of radio show by others and actually I can listen to that on the website, both of them.
Readiness - Features	Mobile Applications	Comments regarding WeJay mobile functionality.	I think it might be a good idea to have some kind of WeJay application with any kind of smartphone
Readiness - Features	Communication Options	Expanded communication including voice over, recording, editing, annotating, scheduling or programming to play later, etc.	… if I can also talk at the same time and that it also recorded … during the radio show, that would have been nice. ... I don't how to realize that in technical terms but text-based interaction is fine. And I'm ... suggesting using more communication options ... along with text ...
Readiness - Features	Listeners	Indication of number of listeners and ability for listeners to provide feedback (in WeJay and on the Weheartradio site).	... if it was my music I would want to know what you think about it. … So that would be something that would be very important to me. … I wonder how many people are listening and who it is, if possible.
Readiness - Features	Playlist	Comments about playlist features and functionality.	it did not … allow me to shuffle, to delete a song once I put it in there.
Social Media	Engagement	Used with Interview data only. Then preferred Social Media - Positive	
Social Media - Comparisons	Amazon	Refers to specific social media comparisons with WeJay.	… again I didn't get that functionality that they have in Amazon but I could see where that could possibly be added because if I'm broadcasting say for instance all classical I could see where the software would you know maybe recommend a friend who also has a radio show and has a lot of classical.

Social Media - Comparisons	Pandora	Refers to specific social media comparisons with WeJay.	I have listened to Pandora, again you don't have any control over those types of applications, you pretty much have to listen to something that the system is going to provide for you as far as music to play.
Social Media - Comparisons	- General	Refers to generalized comparisons around social media including the importance of WeJay interactivity with other social media.	I guess to certain extent it does. Ah it's a little bit more of framework than a full, full up implementation.
Social Media - Comparisons	Spotify	Refers to specific social media comparisons with WeJay.	… another place where I think it succeeds where something like Spotify doesn't. I need Spotify, the software, to listen to the playlist that friends make. I can have any sort of web connection to listen to … the Weheart radio stations.
Social Media - Comparisons	iTunes/Ping	Refers to specific social media comparisons with WeJay.	... my roommates ... are not technology people and ... they probably might give [it] a shot and be like why do I need to use something, I'm just going to use iTunes or Spotify or whatever …
Social Media - Comparisons	Turntable	Refers to specific social media comparisons with WeJay.	… if I had never used Turntable.fm it [WeJay] would have blown me away. …
Social Media - Comparisons	SoundCloud	Refers to specific social media comparisons with WeJay.	If it could connect to SoundCloud that would be cool ... then its going to be easier to play other people's music and their [mixes] and all that kind of stuff. So that would ... be neat and that would be ... another opportunity for expanding the social side of things.
Social Media - Comparisons	Last.fm	Refers to specific social media comparisons with WeJay.	… what's the difference between that [WeJay] and … I think its Last.fm.
Wireless Grids	- General	General comments or observations on wireless grids.	I see WeJay as one instance … from the wireless grid project … where the … technical aspects are behind the scene from the user, but from the user experience it's the concept of sharing … choices to create a soundtrack of sorts within a circle of friends.
Wireless Grids	Potential	Reference to the perceived potential of wireless grids.	… if you had like a, let's say a, a WiGiT in a box ... I'm thinking like PGP [Pretty Good Privacy] or ... some kind of privacy ... and access control so that the people ... could just do like a local setup, we're settin' up our own network and we have control and others can't listen in, that would be awesome.
Wireless Grids	Understand-ing	Comments related to one's understanding of wireless grids.	… I really don't fully understand the capacity of the wireless grids … I get it, to a degree …. So I'd really like to get a better understanding of the capabilities and the technology.
Wireless Grids	Comparisons	Refers to comparisons with other wireless grid examples (e.g., Mac AirDrop, WEJYIYE, etc.)	W-E-J-I-Y-E … we join in …. And what they do is, they just kind a created some … peer-to-peer … networks to a wireless connections.

Appendix K: Inter-Coder Analysis

Inter-Coder Analysis - Interviews

7/7/2012

IQ#	INTERVIEW QUESTION	#SEGMENTS	Main Category MATCH	Main Category NO-M	Main Category %MATCH	Sub Category MATCH	Sub Category NO-M	Sub Category %MATCH
1	What were you able to do (or think about doing) with WeJay?	34	30	4	88.24%	29	5	85.29%
2	What does WeJay mean to you?	29	27	2	93.10%	26	3	89.66%
3	Did you go beyond (or think about going beyond) the basics and use WeJay as something other than a social radio tool?	27	25	2	92.59%	25	2	92.59%
4	What did you like most about WeJay?	25	23	2	92.00%	22	3	88.00%
5	What did you like least about WeJay?	25	25		100.00%	24	1	96.00%
6	Comment on the awareness capabilities of WeJay.	38	38		100.00%	38		100.00%
7	Comment on the smartness capabilities of WeJay.	23	21	2	91.30%	20	3	86.96%
8	Comment on the ambient intelligent aspects of WeJay.	36	36		100.00%	36		100.00%
9	What barriers did you encounter when using WeJay? (Did you notice things that might be barriers to what you would want to do with WeJay?)	28	28		100.00%	28		100.00%
10	What, if any, impact did WeJay have for you?	36	32	4	88.89%	32	4	88.89%
11	Did anything surprise you about WeJay?	24	23	1	95.83%	22	2	91.67%
12	Did you feel creative during the WeJay experience?	29	27	2	93.10%	27	2	93.10%
13	Did you begin thinking of new ways of doing things during the WeJay experience?	28	24	4	85.71%	24	4	85.71%
14	What (if anything) did not work or (seem to) behave the way you (would have) expected?	26	25	1	96.15%	25	1	96.15%
15	What (would you say) is missing in WeJay preventing you from doing what you want to do?	29	28	1	96.55%	28	1	96.55%
16	Did the WeJay experience make you think of the transformative potential here?	36	32	4	88.89%	32	4	88.89%
17	Were novel ideas generated during your WeJay use experience (by you or someone else)?	30	25	5	83.33%	24	6	80.00%
18	Do you want to continue using (spend more time with) WeJay? If yes, why? If no,, why not?	23	21	2	91.30%	21	2	91.30%
19	Do people need to know about WeJay and other wireless grid enabled applications? Elaborate.	26	23	3	88.46%	23	3	88.46%
20	Does WeJay remind you of other social radio or social media applications?	24	23	1	95.83%	23	1	95.83%
21	What changes (improvements) would you like to see in WeJay?	31	30	1	96.77%	30	1	96.77%
22	Where do you see WeJay and other wireless grid enabled applications going?	40	34	6	85.00%	33	7	82.50%
23	Based on your WeJay experience do you have suggestions for future trials?	27	26	1	96.30%	26	1	96.30%
24	Generally then, describe your WeJay (demo) experience in terms of sharing, collaboration, and interactiivty. (in relation to copyright, privacy, security, trust)	46	45	1	97.83%	45	1	97.83%
25	What other comments do you have about WeJay and wireless grid enabled applications?	36	33	3	91.67%	33	3	91.67%
	TOTALS:	756	704	52	93.12%	696	60	92.06%

REPORT NOTES:
1. Match Indicates that one or more of the codes assigned to a text segment by the first and second coder resulted in a match.
2. See Report - Main Category _Sub-Category 1st 2nd Coder Matched Assignments
3. See Report - Main Category Sub-Category 1st Coder Assignments
4. See Report - Main Category Sub-Category 2nd Coder Assignments

Inter-Coder Analysis - Focus Groups

7/7/2012

IQ#	FOCUS GROUP QUESTION	#SEGMENTS	Main Category MATCH	Main Category NO-M	Main Category %MATCH	Sub Category MATCH	Sub Category NO-M	Sub Category %MATCH
1	What were you able to do with WeJay?	8	8		100.00%	8		100.00%
2	What does WeJay mean to you?	5	5		100.00%	5		100.00%
3	Did you go beyond the basics and use WeJay as something other than a social radio tool?	8	8		100.00%	8		100.00%
4	What did you like most about WeJay?	5	5		100.00%	5		100.00%
5	What did you like least about WeJay?	4	4		100.00%	4		100.00%
6	Comment on the awareness capabilities of WeJay.	4	4		100.00%	3	1	75.00%
7	Comment on the smartness capabilities of WeJay.	5	5		100.00%	5		100.00%
8	Comment on the ambient intelligent aspects of WeJay?	4	4		100.00%	4		100.00%
9	What barriers did you encounter when using WeJay?	5	5		100.00%	5		100.00%
10	What, if any, impact did WeJay have for you?	4	4		100.00%	4		100.00%
11	Did anything surprise you about WeJay?	3	3		100.00%	3		100.00%
12	Did you feel creative during the WeJay experience?	5	5		100.00%	5		100.00%
13	Did you begin thinking of new ways of doing things during the WeJay experience?	3	3		100.00%	3		100.00%
14	What did not work or behave the way you expected?	4	4		100.00%	4		100.00%
15	What is missing in WeJay preventing you from doing what you want to do?	1	1		100.00%	1		100.00%
16	Did the WeJay experience make you think of the transformative potential here?	3	3		100.00%	3		100.00%
17	Were novel ideas generated during your WeJay use experience (by you or someone else)?	4	4		100.00%	4		100.00%
18	Do you want to continue using WeJay? If yes, why? If no, why not?	1	1		100.00%	1		100.00%
19	Do people need to know about WeJay and other wireless grid enabled applications?	2	2		100.00%	2		100.00%
20	Does WeJay remind you of other social radio or social media applications?	4	4		100.00%	4		100.00%
21	Generally then, describe your WeJay experience in terms of sharing, collaboration, and interactivity. (copyright, privacy/trust, security)	5	5		100.00%	3	2	60.00%
22	What changes would you like to see in WeJay?	7	7		100.00%	6	1	85.71%
23	Where do you see WeJay and other wireless grid enabled applications going?	4	3	1	75.00%	3	1	75.00%
24	Based on your WeJay experience do you have suggestions for future trials?	3	3		100.00%	2	1	66.67%
25	What other recommendations would like to make about WeJay and wireless grid enabled applications?	3	3		100.00%	3		100.00%
	TOTALS:	104	103	1	99.04%	98	6	94.23%

REPORT NOTES:
1. Match Indicates that one or more of the codes assigned to a text segment by the first and second coder resulted in a match.
2. See Report - Main Category _Sub-Category 1st 2nd Coder Matched Assignments
3. See Report - Main Category Sub-Category 1st Coder Assignments
4. See Report - Main Category Sub-Category 2nd Coder Assignments

Inter-Coder Analysis - Survey

7/7/2012

IQ#	FOCUS GROUP QUESTION	#SEGMENTS	Main Category MATCH	Main Category NO-M	Main Category %MATCH	Sub Category MATCH	Sub Category NO-M	Sub Category %MATCH
3	What made this a satisfying or unsatisfying experience?	**17**	16	1	94.12%	16	1	94.12%
7	What other comments would you like to make about WeJay features and functionality.	**8**	8		100.00%	8		100.00%
9	If you responded Yes, or no, to question 8, why or why not in your opinion? [Is WeJay a social space (supports interaction, collaboration, and sharing)]	**11**	10	1	90.91%	10	1	90.91%
11	What other elements would contribute to the awareness, intelligence, and smartness of WeJay?	**7**	6	1	85.71%	6	1	85.71%
13	If you responded Yes, or No, to question 12, why or why not in your opinion? [Through my WeJay experience I now recognize wireless grids tools can enable AmI systems and environments]	**11**	10	1	90.91%	10	1	90.91%
15	What other terms would describe how you felt during your WeJay experience?	**8**	5	3	62.50%	5	3	62.50%
18	What is your assessment of the WeJay social radio concept for current use in educational settings? (other)	**4**	4		100.00%	4		100.00%
19	In your opinion what would move WeJay from beta to use? (other)	**4**	4		100.00%	4		100.00%
21	Describe any concerns indicated in question 20. [copyright, privacy, security]	**3**	2	1	66.67%	2	1	66.67%
22	What do you think the future holds for WeJay?	**1**	1		100.00%	1		100.00%
26	Indicate any concerns you had with this beta trial.	**9**	9		100.00%	9		100.00%
27	What other comments would you like to make about this beta trial that could guide future WeJay trials that occur?	**6**	6		100.00%	6		100.00%
29	Please describe any additional thoughts you have about wireless grid enabled applications generally or WeJay social radio in particular.	**5**	5		100.00%	5		100.00%
	TOTALS:	**94**	**86**	**8**	**91.49%**	**86**	**8**	**91.49%**

REPORT NOTES:
1. Match Indicates that one or more of the codes assigned to a text segment by the first and second coder resulted in a match.
2. See Report - Main Category ,Sub-Category 1st 2nd Coder Matched Assignments
3. See Report - Main Category Sub-Category 1st Coder Assignments
4. See Report - Main Category Sub-Category 2nd Coder Assignments

Inter-Coder Analysis - Email/Diary Correspondence

7/7/2012

IQ#	EMAIL/DIARY TEXT	#SEGMENTS	Main Category MATCH	Main Category NO-M	Main Category %MATCH	Sub Category MATCH	Sub Category NO-M	Sub Category %MATCH
1	Email Comments	**46**	43	3	93.48%	43	3	93.48%
	TOTALS:	**46**	**43**	**3**	**93.48%**	**43**	**3**	**93.48%**

REPORT NOTES:
1. Match Indicates that one or more of the codes assigned to a text segment by the first and second coder resulted in a match.
2. See Report - Main Category ,Sub-Category 1st 2nd Coder Matched Assignments
3. See Report - Main Category Sub-Category 1st Coder Assignments
4. See Report - Main Category Sub-Category 2nd Coder Assignments

Appendix L: Institutional Review Board (IRB) Approval

SYRACUSE UNIVERSITY
Institutional Review Board
MEMORANDUM

TO: Marilyn Arnone
DATE: November 18, 2011
SUBJECT: **Submitted for Expedited Review-Determination of Exemption from Regulations**
IRB #: 11-250
TITLE: *Toward Ambient Intelligence with Wireless Grid Enabled Applications: A Case Study of the Launch and First Use Experience of WeJay Social Radio in Education*

The above referenced application, submitted for expedited review has been determined by the Institutional Review Board (IRB) to be exempt from federal regulations as defined in 45 C.F.R. 46, and has been evaluated for the following:

1. determination that it falls within the one or more of the five exempt categories allowed by the organization;
2. determination that the research meets the organization's ethical standards.

This protocol has been assigned to exempt category **2** and is authorized to remain active for a period of five years from **November 17, 2011** until **November 16, 2016**.

CHANGES TO PROTOCOL: Proposed changes to this protocol during the period for which IRB authorization has already been given, cannot be initiated without additional IRB review. If there is a change in your research, you should notify the IRB immediately to determine whether your research protocol continues to qualify for exemption or if submission of an expedited or full board IRB protocol is required. Information about the University's human participants protection program can be found at: http://orip.syr.edu/human-research/human-research-irb.html. Protocol changes are requested on an amendment application available on the IRB web site; please reference your IRB number and attach any documents that are being amended.

STUDY COMPLETION: The completion of a study must be reported to the IRB within 14 days.

Thank you for your cooperation in our shared efforts to assure that the rights and welfare of people participating in research are protected.

Tracy Cromp, M.S.W.
Director

Note to Faculty Advisor: This notice is only mailed to faculty. If a student is conducting this study, please forward this information to the student researcher.
DEPT: Information Studies, 105 Hinds Hall **STUDENT:** H. Patricia McKenna

Office of Research Integrity and Protections
121 Bowne Hall Syracuse, New York 13244-1200
(Phone) 315.443.3013 ◆ (Fax) 315.443.9889
orip@syr.edu ◆ www.orip.syr.edu

Appendix L: IRB Approval – Amendment #1

SYRACUSE UNIVERSITY
Institutional Review Board
MEMORANDUM

TO:	Marilyn Arnone
DATE:	January 20, 2012
SUBJECT:	**Amendment for Exempt Protocol**
AMENDMENT#:	1 - A) Revised Consent Form(s), B) Change in Protocol Title, C) Other - Revision of Focus Group/ Interview Protocol
IRB #:	11-250
TITLE:	*Ambient Intelligence with Wireless Grid Enabled Applications: A Case Study of the Launch and First Use Experience of WeJay Social Radio in Education*

Your current exempt protocol has been re-evaluated by the Institutional Review Board (IRB) with the inclusion of the above referenced amendment. Based on the information you have provided, this amendment is authorized and continues to be assigned to category **2**. This protocol remains in effect from **November 17, 2011** to **November 16, 2016**.

CHANGES TO PROTOCOL: Proposed changes to this protocol during the period for which IRB authorization has already been given, cannot be initiated without additional IRB review. If there is a change in your research, you should notify the IRB immediately to determine whether your research protocol continues to qualify for exemption or if submission of an expedited or full board IRB protocol is required. Information about the University's human participants protection program can be found at: http://orip.syr.edu/human-research/human-research-irb.html Protocol changes are requested on an amendment application available on the IRB web site; please reference your IRB number and attach any documents that are being amended.

STUDY COMPLETION: The completion of a study must be reported to the IRB within 14 days.

Thank you for your cooperation in our shared efforts to assure that the rights and welfare of people participating in research are protected.

Tracy Cromp, M.S.W.
Director

Note to Faculty Advisor: This notice is only mailed to faculty. If a student is conducting this study, please forward this information to the student researcher.
DEPT: Information Studies, 105 Hinds Hall **STUDENT:** H. Patricia McKenna

Office of Research Integrity and Protections
121 Bowne Hall Syracuse, New York 13244-1200
(Phone) 315.443.3013 ◆ (Fax) 315.443.9889
orip@syr.edu ◆ www.orip.syr.edu

Appendix L: IRB Approval – Amendment #2

SYRACUSE UNIVERSITY
Institutional Review Board
MEMORANDUM

TO:	Marilyn Arnone
DATE:	March 20, 2012
SUBJECT:	**Amendment for Exempt Protocol**
AMENDMENT#:	2 – Change in Recruitment Materials
IRB #:	11-250
TITLE:	*Ambient Intelligence with Wireless Grid Enabled Applications: A Case Study of the Launch and First Use Experience of WeJay Social Radio in Education*

Your current exempt protocol has been re-evaluated by the Institutional Review Board (IRB) with the inclusion of the above referenced amendment. Based on the information you have provided, this amendment is authorized and continues to be assigned to category **2**. This protocol remains in effect from **November 17, 2011** to **November 16, 2016**.

CHANGES TO PROTOCOL: Proposed changes to this protocol during the period for which IRB authorization has already been given, cannot be initiated without additional IRB review. If there is a change in your research, you should notify the IRB immediately to determine whether your research protocol continues to qualify for exemption or if submission of an expedited or full board IRB protocol is required. Information about the University's human participants protection program can be found at: http://orip.syr.edu/human-research/human-research-irb.html Protocol changes are requested on an amendment application available on the IRB web site; please reference your IRB number and attach any documents that are being amended.

STUDY COMPLETION: The completion of a study must be reported to the IRB within 14 days.

Thank you for your cooperation in our shared efforts to assure that the rights and welfare of people participating in research are protected.

Tracy Cromp, M.S.W.
Director

Note to Faculty Advisor: This notice is only mailed to faculty. If a student is conducting this study, please forward this information to the student researcher.
DEPT: Information Studies, 105 Hinds Hall **STUDENT:** Patricia McKenna

Office of Research Integrity and Protections
121 Bowne Hall Syracuse, New York 13244-1200
(Phone) 315.443.3013 ◆ (Fax) 315.443.9889
orip@syr.edu ◆ www.orip.syr.edu

Appendix L: IRB Approval – Amendment #3

SYRACUSE UNIVERSITY
Institutional Review Board
MEMORANDUM

TO:	Marilyn Arnone
DATE:	April 25, 2012
SUBJECT:	**Amendment for Exempt Protocol**
AMENDMENT#:	3 – Other – Appendix D – Survey Protocol
IRB #:	11-250
TITLE:	*Ambient Intelligence with Wireless Grid Enabled Applications: A Case Study of the Launch and First Use Experience of WeJay Social Radio in Education*

Your current exempt protocol has been re-evaluated by the Institutional Review Board (IRB) with the inclusion of the above referenced amendment. Based on the information you have provided, this amendment is authorized and continues to be assigned to category **2**. This protocol remains in effect from **November 17, 2011** to **November 16, 2016**.

CHANGES TO PROTOCOL: Proposed changes to this protocol during the period for which IRB authorization has already been given, cannot be initiated without additional IRB review. If there is a change in your research, you should notify the IRB immediately to determine whether your research protocol continues to qualify for exemption or if submission of an expedited or full board IRB protocol is required. Information about the University's human participants protection program can be found at: http://orip.syr.edu/human-research/human-research-irb.html Protocol changes are requested on an amendment application available on the IRB web site; please reference your IRB number and attach any documents that are being amended.

STUDY COMPLETION: The completion of a study must be reported to the IRB within 14 days.

Thank you for your cooperation in our shared efforts to assure that the rights and welfare of people participating in research are protected.

Tracy Cromp, M.S.W.
Director

Note to Faculty Advisor: This notice is only mailed to faculty. If a student is conducting this study, please forward this information to the student researcher.
DEPT: Information Studies, 105 Hinds Hall **STUDENT:** H. Patricia McKenna

Office of Research Integrity and Protections
121 Bowne Hall Syracuse, New York 13244-1200
(Phone) 315.443.3013 ◆ (Fax) 315.443.9889
orip@syr.edu ◆ www.orip.syr.edu

Appendix L: IRB Approval – Amendment #4

SYRACUSE UNIVERSITY
Institutional Review Board
MEMORANDUM

TO:	Marilyn Arnone
DATE:	May 3, 2012
SUBJECT:	**Amendment for Exempt Protocol**
AMENDMENT#:	4 - Other - Appendix D - Survey Protocol Edits
IRB #:	11-250
TITLE:	*Ambient Intelligence with Wireless Grid Enabled Applications: A Case Study of the Launch and First Use Experience of WeJay Social Radio in Education*

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Office of Research Integrity and Protections
121 Bowne Hall Syracuse, New York 13244-1200
(Phone) 315.443.3013 ◆ (Fax) 315.443.9889
orip@syr.edu ◆ www.orip.syr.edu

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VITA

NAME OF AUTHOR: Helen Patricia McKenna

PLACE OF BIRTH: Summerside, Prince Edward Island, Canada

DATE OF BIRTH: October 19, 1954

GRADUATE AND UNDERGRADUATE SCHOOLS ATTENDED:
University of New Brunswick, Fredericton, New Brunswick, Canada
McGill University, Montreal, Quebec, Canada

DEGREES AWARDED:

Bachelor of Arts in English Literature, 1976, University of New Brunswick
Master of Library Science, 1980, McGill University

PROFESSIONAL EXPERIENCE:

Librarian to Makerere University (Uganda) Library Collection Committee, Association of Universities & Colleges of Canada, Ottawa, Canada, 1981
Serials Conversion Librarian, Canada Institute for Scientific & Technical Information, Ottawa, Canada, 1981-1982
Information Officer, Canadian Council for International Cooperation, Ottawa, Canada, 1983-1990
Cataloguing Librarian & Census Products Indexer, Statistics Canada, Ottawa, Canada, 1990-1992
Book Indexing, International Development Research Centre, Ottawa, Canada, 1994-1995
Information & Systems Consultant, Canadian Centre on Substance Abuse, Ottawa, Canada, 1990-1999, 2002-present
Information Consultant, Canadian International Development Agency, Ottawa, Canada, 1993-1995
University Librarian & Information Consultant, University Canada West, Victoria, British Columbia, Canada, 2005-2007
President & Founder, PHM Information Consultants Inc., Ottawa/Victoria, Canada, 1995 – present