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When the City Meets the Citizen 2

Connect: Citizens, City, Environment
Sensory Research for App Development

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Abstract

The city scape offers a unique place to use mobile media to foster pro-environmental behavior through connecting citizens, to city, to their urban environment. The studies presented here are the start to a series of research studies that will guide the development of a mobile application aiming to foster dialog and action through the presentation of technical data, lived experiences, and community connections within urban nature. Social network theory is used in the presented studies to conceptualize the connections and influences among people and nature. The first study identifies the components of four mobile applications assisting in connecting and influencing citizen behavior toward their environment and each other. The second study identifies citizen's lived, sensory experiences in urban nature and ways a mobile app could support the sharing of these experiences and spur pro-environmental action. As of this printing, these studies are still in progress. The author will present recommendations for app development based on duel interpretations of the studies at the *When the City Meets the Citizen* workshop.

Introduction

The Spanish non-profit DARA recently published the Climate Vulnerability Report (2012) that states if we do not start changing our actions, more than 100 million people will die from disease and economic collapse due to climate change by 2030. Cities and their citizens play a large role in environmental distruction, as they are producers of vast quantities of pollutants and consumers of many resources from outside their boarders (Lifset, 2007).

Because of the major role cities and their citizens play in environmental degradation, practitioners and scholars within the environmental community have been trying to figure out ways to engage both urban individuals and communities in pro-environmental behaviors. The standard approach is to deliver technical proof of the environmental problem and behaviors people should preform to remediate the problem. This communication typically occurs through brochures, websites, and informative presentations or displays at community events. This one-way communication approach has done little to change behavior and has led to the use of environmental public participation (EPP). EPP is used to connect government agencies with citizen networks to engage citizens in decision making processes. This approach is touted as a collaborative, community based, participatory resource management process that calls citizens to assist in the formation and implementation of environmental policies (Akbulut & Soylu, 2012; Jordan, Wurzel, & Zito, 2003; Kasemir, 2003).

Although EPP is offered as an archetypal way to connect to citizen networks, its construction and implementation can constrain the connection with a majority of citizens. EPP typically manifests as in-person events, held at a specific time and location, which are not conducive for a diverse attendance of workers, parents, or people with transportation concerns. The type of discourse used is usually technical, using numerical data from people deemed as technical experts. Creative discourse, most often offered by citizens, is usually deemed less credible at these events as it comes from lived experiences instead of technical equipment (Peterson, 1997). Of course, both types of discourse are important as they provide unique ways of understanding and addressing urban environmental problems.

Additionally, most of the people that attend EPP events are unique, carrying very strong beliefs as to the topics or extremely detailed knowledge of environmental issues beyond that of the average citizen. Putnam (2000) identified this trend in his research across all civic engagement, finding a steady decline of moderate Americans in civic life, leaving most public discussions to citizens who are either very liberal or conservative. Hypothesis for why this occurs is that of time and money constraints brought about by increases in families with non-traditional roles (i.e. single parents and families where both parents work); suburbanization, commuting, and sprawl; and electronic entertainment, specifically television (Putnam, 2000). These trends in combination with the location of EPP events typically leave the physical environment com-

pletely out of the picture, with discussions of how it should be maintained, improved, or controlled occurring in a building or location far removed from nature. While these trends literally move people further away from creating networks with each other and nature, advancements in technology offer a way to create new networks, digitally.

Due to the technological advancements available in smartphones and dramatic increases in their uses, digital mobile devices, such as smartphones and tablets, offer the means to connect citizens and government in their urban environment. Mobile apps have the possibility to offer not only technical information, but to create a dialog with citizens in which they can learn and share their experiences of nature, in nature. Mobile apps offer a plethora of options for connecting, such as games, forums, badges, social networking, etc., but which of these features is best at fostering dialog? Or sharing both technical and sensory information? In what ways do they stimulate emotions and how can they call people to action? These questions along with many others that come with creating an effective and popular application are the foundation for the two studies presented here, and for a series of future studies.

Thus, the research presented in this paper attempts to identify the potential for utilizing mobile applications for connecting nature to individuals, individuals to individuals, and individuals to a networked community to facilitate positive environmental changes throughout a city. The theoretical underpinnings used here is that of social network theory. The first study presented examines the mobile applications of Facebook, Foursquare, Litterati, and We Recycle to identify the components that function to influence individuals' experiences with nature and how they communicate these experiences with their social networks. The second study examines how people experience and sense their urban environment to identify what types of sensorial experiences a mobile application could prompt and if these experiences could lead to pro-environmental behavior. Both of these studies are currently in production, hence the results will be available at the *When the Citizens Meet the City Workshop*, but not in this paper.

Networked Citizens, Networked Nature

Understanding how digital mobile technology can influence the creation, maintenance, and leveraging of social networks is important to also understanding the ways in which devices can be used for fostering environmental and human networks. Thus, it is proposed that utilizing social network theory can help us understand how network links can influence human perceptions, beliefs, and behaviors of environmental issues and social responses.

Borgatti, Mehra, Brass, and Labianca (2009) write that "a fundamental axiom of social network analysis is the concept that structure matters" (p.893). In this sense, people's network can influence what they do and why they do these things based on the relationship they have with others and their position in the network. When a person's thoughts, attitudes, opinions, or actions are affected by members of their network, this is called social influence (Friedkin & Johnsen, 1999). Social influence models predict that the closer two actors are in a network, the more likely one of the actor's behaviors will be changed by the other's actions; this process can occur even when the actors are not trying to influence each other intentionally (Marsden & Friedkin, 1994). This connection has been made evident for human to human interactions, but this connection also holds true for human nature interactions. The closer to nature an individual or network is the more influence the nodes and networks of nature will have. For example, if my lively hood depends on healthy populations of salmon, I will be inherently influenced by changing water temperatures affecting fish reproduction. On the other hand if I purchase salmon at a grocery story as an appetizer to my dinner, I may be less inclined to care about water temperatures, or even the reproductive cycle of the fish.

Therefore, in this paper individual nodes include not only individual humans, but also the nodes of our environment, such as plants, animals and minerals. These nodes interact and influence each other through the senses (e.g. smell, taste, touch, sound) and communication (e.g. dialog, images, weather changes, extinctions). The connections made through these processes have the potential for solidifying a network of citizens connected to each other and the environment; ready to engage in changes at the individual level and in return to be impacted by societal changes. Granovetter (1973) states that through networks "small-scale interaction becomes translated into large-scale patterns, and that these, in turn, feed back into small groups" (p. 1360). Therefore, the best solutions to solving urban environmental problems would be those that incorporate the individual, the environment, and society in ways that allow them to feed and build off of one another.

Before diving into the possibilities mobile digital networks might offer for connecting our sensory experiences of nature and human dialog, it is beneficial to critically examine the current networks and processes already in place. To begin with, people form links with nodes and networks of *nature* informally and formally. Informally in the sense of connecting with nodes and networks of nature through the unstructured interactions of our daily lived experience. For example, we could connect with the nodes of plants through the sound of our feet crushing leaves, weather patterns through the feeling of dampness on our face, and water through the smell of a pungent creek polluted with sewage. Each of the nodes in nature are connected to each other, influencing one another; such that weather patterns influence the life cycle of plants, which influence the health of water ways. As we interact on a daily bases with these nodes and networks we gain a knowledge, emotional connection, and understanding of our environment. Formal networks of nature are those

which we construct to help us understand the flows of influence between our human network/nodes and the network/nodes of nature. Examples include the national park system or a city green way connecting city parks and nature preserves. These formal networks connect us to the nodes and networks of nature through informative tours, kiosks, and hands-on activities that allow offer sensorial and rational approaches to understanding human/nature networks.

There are also formal and informal nodes and networks of *dialog* and sharing *of sensorial experiences* concerning environmental issues. Informal nodes/networks of dialog and sharing are those which occur in daily lived experiences or through informal gatherings. Examples include discussions with neighbors about how to bicycle to work or organizing citizen groups to clean-up an area lake. Formal dialog and sharing nodes/networks include non-profits lobbying for more stringent environmental protection laws and cities pooling their resources to implement green way efforts.

The following two studies aim to examine the interactions between the nodes and networks of individuals, communities, and nature.

Study 1: Applications that Connect

The first study was a comparative analysis of both established and new mobile applications that ask the user to engage with the physical environment and to share these interactions with a digital social network. The purpose of the study was to identify the similarities and differences between the various mobile applications in creating social influence networks through the design of the application. The established apps examined included Facebook, specifically the Sierra Club page (https://www.facebook.com/SierraClub) and Foursquare, Great Outdoor Parks in Portland, OR (https://foursquare.com/3rd_horizon/list/great-outdoor-parks-in-portland-or); along with two new apps: Litterati (http://litterati.org/) and We Recycle (https://play.google.com/store/apps/details?id=edu.uga.engr.werecycle&feature=search_result).

This study used Kelman's (1958) framework to understand how specific components of mobile applications could engage social networks of influence, specifically looking at compliance (subjective norms), identification (social identity), and internalization (group norms) (Shen, Cheung, Lee, & Chen, 2011; Dholakia, Bagozzi, & Pearo 2004). The process of *compliance* occurs when a person uses the social cues and feedback of the people around them (in their network) to behave within the groups social norms. One example would be when a person starts to change what they are posting to more accurately reflect the values of the online group (Zhou, 2011; Venkatesh, Morris, Davis, & Davis, 2003). For this study, *Compliance,* as afforded by the application design, was identified by the ability to repost and/or mimic other's behavior in the network. Compliance through content was identified by the amount of reposting and the mimicking of content, such as use of similar words and images.

The process of *identification* occurs when a person starts to feel they are a member of the group, that they contribute and derive value from their network through their interactions. For example, when members of an OSN call the other members of the network their friends and confidants they likely feel a special connection to their group (Zhou, 2011; Tajfel, 1978). For this study, *Identification*, as afforded by the application design, was identified by the ability to promote (share) the application and one's affiliation with the application to other people (in and outside the network). Identification through content was identified by textual cues, such as the words of ownership, such as me, my, and mine, along with images showing the individual's connection to the premise of the application.

Finally, the process of *internalization* occurs when a person adopts the group norms because of their similarity in such things as goals and values with those in the network. For example, after a person is part of a network with specific values, the person within that network starts to claim the group's values as their own (Zhou, 2011; Turner, 1991; Kelman*,* 1958*). Internalization,* as afforded by the application design, was identified by the ability to post personal statements of value alignment with the application and community goals. Internalization through content was identified by the text and images people posted showing how their values and goals aligned with the other application members and the application's goals.

These components provide a useful framework for understanding how people can influence each other within an online social network (OSN), but a key factor we need to consider is how to get people to participate in OSN. Research of OSN has revealed that the number of and connection with friends influences whether a person will join an online social networking group (Anagnostopoulos, Kumar, & Mahdian, 2008; Backstrom, Huttenlocher, Kleinberg, & Lan, 2006). Several studies (Lin & Lu, 2011; Sledgianowski & Kulviwat, 2009) have found that perceived usefulness for obtaining information and the amount of enjoyment one can get from the OSN program greatly influences whether or not the user will engage in online social networking; with enjoyment being the most predictive factor affecting user behavior. Additionally, the number of close ties, such as friends and family, an individual has in their OSN influences how much they enjoy participating in the network, and these ties provide opportunities for connecting with new people (Lin & Lu, 2011; Li & Bernoff, 2008; Tapscott, 2008). These findings point to the importance of examining networks that people are already a part of, such as Facebook or Foursquare, as possible locations for creating an OSN for fostering environmental dialog and sensory information sharing.

Based on the above discussion, established OSN mobile applications - Facebook and Foursquare - were examined to understand the effects of strong human to human networks. While the less established applications of Litterati and We Recycle were examined as they provided stronger links to environmental nodes and networks. Examination of the more established applications provided insight into how various components have successfully brought people back to the application and how participants derive joy from their use. Examination of the less established sites, with more environmental focus, provided greater understanding of what triggers engage people in environmental nodes/networks and sharing their sensory experiences. To identify the most effective networking components connecting individuals, nature, and society, the author looked at the influencing factors of compliance, identification, and internalization.

Methodology

Because each application situates timelines differently, the 20 most resent post were examined on each application during April 2013. Although this is a brief time frame, digital social networks are always evolving and a snippet of this evolution provides some insight as to how the system works. Additionally, this analysis looked more to identify how the components of images, text, and audio-visual vary across sites and impact the strength of the network, then to understand the overall summary of comments posted.

The data was organized thematically using Glaser and Strauss's (1967) constant comparative method of data analysis. The analysis process followed recommendations by Boeije (2002), which starts with comparison within a single sample where the researcher looks for similar constructs to code and group. The second step was to compare the codes identified in each post to other posts throughout the application, similar codes were combined and code patterns were identified. The third step used of Boeije's (2002) constant comparative analysis process includes comparison of data from different groups; this processes triangulagates the data leading to more reliable results (Kimchi, Polivka, & Stevenson, 1991). This was performed by comparing the codes from the four different applications, which allowed for similarities and differences to be revealed among the applications. Upon completion of analysis, the main themes were selected for inclusion in the *When the City Meets the Citizens* workshop.

Study 2: Sensory Experiences that Connect

The second study involved ethnographies (observation of and engagement with participants) and interviews relating to urban environment experiences and the transferability of these experiences to an app. The equivalent of a 5 block radius was studied at two locations in Raleigh North Carolina: a mixed use urban area and an urban park next to a lake. A networked approach allowed the author to study the field sites and participants as interconnected networks, with various entry points that connected to "different relationships between people and practices," therefore allowing the author to consider the *relationships* "among people, spaces, and objects, as opposed to studying these in isolation" (Boyd, 2008, p. 54). The purpose of this study was twofold: 1) understand the network of experiences and inquiries people have about their urban environment and 2) identify ways these can be plugged into lager social networks to prompt pro-environmental behavior.

To best understand participant experiences, the researcher collected sensory data, which is the use of participants' physical experiences to gather a greater understanding of the social and cultural meanings of their experiences and the spaces in which they occur (Sunderland, Bristed, Gudes, Boddy, & Da Silva, 2012). For example, a chemical smell by creek can triger both a physical feeling of sickness and a social respons of fear and/or anger toward contamination of local water ways. These reactions "shape the way [individuals] feel in, act, and value a particular place" (Sunderland et al., 2012, p. 1057). Sensory ethnography is grounded on the premise that we understand and make sense of the world and our place within it through our body and the senses it affords us (Davis, 1997; Pink, 2008, Sunderland et al., 2012). In turn, the physical spaces we inhabit "shape not only our experiences of those places, but also our personal and social identities that endure across different places and times" (Sunderland et al., 2012, p. 1058).

Using an ethnographic approach allowed the researcher to observe and even experience the ways in which people interact with their environment. Observation of participants is when the researcher follows participants through their routines and observes the way they interact with the world and other people within that world; this method allowed the researcher to synergize these interactions and interpret how they meaningfully interact. Besides observing, the ethnographer also became a part of the participant's sensory experiences by moving, smelling, tasting and seeing the same things the participant did. This form of immersion does not necessarily allow the researcher into the participant's "memories, experiences or imaginations," but it does allow the ethnographer insight into the participants' sensory experiences, which can reveal new perspectives of understanding (Pink, 2009, p. 40). Beneito-Montagut (2011) states that participating in an ethnography offers the researcher a chance to check their interpretations and learning through doing; a process that helps the researcher understand how things work in the situation they are studying.

In addition to ethnography, the study also used interviews that allowed the participants to verbally explain their sensory experiences. The interview process allowed the researcher to learn the ways in which participants concep-

tualized their experiences with their urban environment (Pink, 2009). Harris and Guillemin (2011) state that senses are "portal[s] to experience more broadly, particularly to experience that is otherwise too difficult to articulate, too mundane to recount, or too intangible to otherwise access" (p. 4). Since some experiences can be hard to access through an interview, tapping into participants' senses allows the researcher to elicit more in-depth and complex details relating to the phenomenon understudy (Harris and Guillemin, 2011).

Using the aforementioned research as foundation for this study, the author conducted the study with the aim to understand the sensorial experiences of people within an urban setting and how these experiences affected their construction of their urban environment, themselves, and others in it. The author also look to identify the ways new sensorial experiences could be prompted via mobile applications, thus allowing participants to see and feel their urban environment in new ways. Additionally, the study looked at the ways participants' online social networks could be activated to promote pro-environmental behavior within the urban environment. To understand these processes, the author conducted ethnographies and interviews.

Methodology

Both sites, the mixed use and park, were studied in the morning and evening on a week day and weekend day during the month of May. Since the study was aimed at identify the depth of user experience instead of breadth, an extensive amount of time was spent with each participant instead of just a few fleeting moments.

An interpretive thematic analysis, called lines-of-argument (LOA) synthesis method (Noblit & Hare,1988) was used to interpret the data. This process involved first identifying the similarities and differences between each participant's stories and experiences. Then thematically categorizing and combining meaningful aspects of these experiences and stories. And finally, synthesizing this information to create a meta-story that encompassed the relative parts of each participant's stories and experiences in order to tell a "whole" story, which will be explained at the *When the City Meets the Citizens* workshop (Barnett-Page & Thomas, 2009; Sunderland et al., 2012).

Conclusion

The author will present recommendations for app development based on duel interpretations of the studies at the *When the City Meets the Citizen workshop*. Findings from both studies will be presented, then cross referenced and synthesized to offer insight as to which application components are currently working and what needs to be created in order to engage citizen's sensory experiences of urban nature, as well components that can foster a network prompting pro-environmental behavior.

References

Akbulut, B., & Soylu, C. (2012). An inquiry into power and participatory natural resource management. *Cambridge Journal of Economics, 36*(5), 1143-1162. doi: 10.1093/cje/bes034

Anagnostopoulos, A., Kumar, R., & Mahdian, M. (2008, August). Influence and correlation in social networks. In *Proceeding of the 14th ACM SIGKDD international conference on Knowledge discovery and data mining* (pp. 7-15). ACM. doi: 10.1145/1401890.1401897

Backstrom, L., Huttenlocher, D., Kleinberg, J., & Lan, X. (2006, August). Group formation in large social networks: membership, growth, and evolution. In*Proceedings of the 12th ACM SIGKDD international conference on Knowledge discovery and data mining* (pp. 44-54). ACM. doi: 10.1145/1150402.1150412

Barnett-Page, E., Thomas, J., 2009. Methods for the synthesis of qualitative research: a critical review. BMC Medical Research Methodology 9 (59)http:// dx.doi.org/10.1186/1471-2288-9-59.

Beneito-Montagut, R. (2011). Ethnography goes online: Towards a user-centred methodology to research interpersonal communication on the internet. *Qualitative Research* 11(6): 716–735.

Boeije, H. (2002). A Purposeful Approach to the Constant Comparative Method in the Analysis of Qualitative Interviews. *Quality and Quantity, 36*(4), 391-409. doi: 10.1023/a:1020909529486

Borgatti, S. P., Mehra, A., Brass, D. J., & Labianca, G. (2009). Network Analysis in the Social Sciences. *Science, 323*(5916), 892-895. doi: 10.1126/science.1165821

Boyd, D. (2008). Choose your own ethnography. Ch. 2 in *Taken Out of Context American Teen Sociality in Networked Publics*. Dissertation, University of California, Berkeley.

Davis, K., 1997. Embodying theory: beyond modernist and postmodernist readings of the body. In: Davis, K. (Ed.), Embodied Practices: Feminist Perspectives on the Body. Sage, London, UK, pp. 2–26.

DARA and the Climate Vulnerable Forum. (2012). Climate vulnerability monitor 2nd edition: A guide to the cold calculus of a hot planet. *DARA*. Retrieved from http://www.daraint.org/wp-content/uploads/2012/10/CVM2-Low.pdf

Dholakia, U. M., Bagozzi, R. P., & Pearo, L. K. (2004). A social influence model of consumer participation in network- and small-group-based virtual communities. *International Journal of Research in Marketing, 21*(3), 241-263. doi: http://dx.doi.org/10.1016/j.ijresmar.2003.12.004

Friedkin, N. E., & Johnsen, E. C. (1999). Social influence networks and opinion change. *Advances in Group Processes*, *16*(1), 1-29. doi: 10.1080/0022250X.1990.9990069

Glaser, B.G. and A. Strauss (1967) *Discovery of Grounded Theory: Strategies for Qualitative Research*. New York: Aldine.

Granovetter, M. S. (1973). The strength of weak ties. *American journal of sociology*, 1360-1380.

Harris, A., & Guillemin, M. (2011). Developing Sensory Awareness in Qualitative Interviewing: A Portal Into the Otherwise Unexplored. *Qualitative Health Research*. December.

Jordan, A., Wurzel, R. K. W., & Zito, A. R. (2003). 'New Instruments of Environmental Governance: Patterns and Pathways of Change. *Environ Polit Environmental Politics, 12*(1), 3-24.

Kasemir, B. (2003). *Public participation in sustainability science : a handbook*. Cambridge, UK; New York, NY: Cambridge University Press.

Kelman, H. C. (1958). Compliance, identification, and internalization: Three processes of attitude change. *Journal of Conflict Resolution, 2*(1), 51–60.

Kimchi, J., Polivka, B. & Stevenson, J. S. (1991). Triangulation. Operational definitions. *Nursing Research* 40: 120–123.

Li, C., & Bernoff, J. (2008). *Groundswell: Winning in a world transformed by social technologies*. Boston, MA: Harvard Business School Press.

Lifset, R. Yale Journal Examines the Global Impact of Cities. *Yale News*. Retrieved from http://news.yale.edu/2007/06/18/yale-journal-examines-global-impact-cities

Lin, K.-Y., & Lu, H.-P. (2011). Why people use social networking sites: An empirical study integrating network externalities and motivation theory. *Computers in Human Behavior, 27*(3), 1152-1161. doi: http://dx.doi.org/10.1016/j.chb.2010.12.009

Marsden, P. (1994). Network studies of social influence. In Stanley Wasserman and Joseph Galaskiewicz (eds). *Advances in Social Network Analysis: Research in the Social and Behavioral Sciences*. Thousand Oaks, CA: Sage. pp. 3-25

Noblit, G.W., Hare, R.D., 1988. Meta-Ethnography: Synthesizing Qualitative Stu- dies. Sage, London.

Peterson, T. (1997). *Sharing the earth: The rhetoric of sustainable development*. Columbia: University of South Carolina Press.

Pink, S. (2009). *Doing sensory ethnography*. London: Sage.

Pink, S., 2008. An urban tour: The sensory sociality of ethnographic place-making. Ethnography 9, 175–196, Retrieved from http://dx.doi.org/10.1177/1466138108089467.

Putnam, Robert E. (2000). Bowling Alone: The Collapse and Revival of American Community. New York: Simon & Schuster.

Shen, A. L., Cheung, C. K., Lee, M. O., & Chen, H. (2011). How social influence affects we-intention to use instant messaging: The moderating effect of usage experience. *Information Systems Frontiers, 13*(2), 157-169. doi: 10.1007/s10796-009-9193-9

Sledgianowski, D., & Kulviwat, S. (2009). Using social network sites: The effects of playfulness, critical mass and trust in a hedonic context. *Journal of Computer Information Systems, 49*, 74–83.

Sunderland, N., Bristed, H., Gudes, O., Boddy, J., & Da Silva, M. (2012). What does it feel like to live here? Exploring sensory ethnography as a collaborative methodology for investigating social determinants of health in place. *Health & Place, 18*(5), 1056-1067. doi: http://dx.doi.org/10.1016/j.healthplace.2012.05.007

Tapscott, D. (2008). *Grown up digital: How the next generation is changing your world*.New York: McGraw-Hill.

Tajfel, H. (1978). Social categorization, social identity, and social comparison. In H. Tajfel (Ed.), *Differentiation between social groups: Studies in the social psychology of intergroup relations*. London: Academic Press

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*, 425–478.

Zhou, T. (2011). Understanding online community user participation: a social influence perspective. *Internet Research*, *21*(1), 67-81. doi: 10.1108/10662241111104884#sthash.kRmVVTYY.dpuf