Wayfinding: annotative strategies in the digital and real

by Ray Baldwin, Sunil Garg, Ann Swearingen
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Abstract

The wayfinding behavior of a group of university students having varying degrees of familiarity with the city of Amsterdam, the Netherlands, and the city of Brussels was observed along three axes: 1) whether or not the behavior took place in the "real" world, where the students' physical selves were navigating physical environments, or in the "digital" world (here confined almost exclusively to Internet use); 2) whether the behavior was annotative (making notes made that persist over time, either in the real or the digital) or was not; and 3) whether the behavior was coerced in some way (work required for class, responses to interview questions, and so on) or was not. Additionally, evaluation and analysis of behavior as well as interviews helped locate each subject on a continuum between "newcomer," or someone less familiar with an environment, and "native," or someone who is comfortable enough in an environment that he or she can navigate it easily, and may be able to teach others those skills.

Fig. 1: Matrix of digital/environmental newcomers vs. natives

Background

Wayfinding, or "selecting paths from a network" (Golledge, 1999a, p.7), has had a long history of interest by a variety of disciplines and with a variety of subjects. As one small example, biologists have been interested in both human wayfinding and the wayfinding abilities of bees. However, this research on digital and environmental newcomers and natives is specifically interested in human wayfinding, and so will focus exclusively on wayfinding literature about human beings.

When Myke Gluck wrote *Making sense of human wayfinding: Review of cognitive and linguistic knowledge for personal navigation with a new research direction* in 1991, he performed a multi-disciplinary review of wayfinding literature at the time. While he did not cover every single discipline that has shown interest in the field, he looked at what he terms *competence literature*, which discusses "cognitive models of human wayfinding," and *performance literature*, which discusses "the ability of humans to find their way" (Gluck, 1991, p.118).

In the competence literature, Gluck examined literature in the fields of cognitive science, artificial intelligence, geography, and urban planning. For Gluck, cognitive science and urban planning also have roles in the performance literature, as do psychophysics, psychometrics, and human factors. Cartography, geography, human-computer interaction, information science, and other disciplines are not specifically mentioned, but it can be inferred that those disciplines could fall into these two categories of discourse.

While Gluck's two literature categories are less useful to understanding where the wayfinding literature stands today, he does identify an area that has been neglected in the wayfinding literature: information needs. His suggestion to "systematically explore the information needs and not the products of wayfinding" (Gluck, 1991, p.128) gives a structure to an information behavior-centered research approach. His three questions are a valuable investigative framework: What is the range of situations that elicit wayfinding behaviors? What are the affective and logistical information needs for wayfinding in different situations? How are these needs resolved? (Gluck, 1991, p.128)

Outside of Gluck's overview, though, the scope of the available literature is still immense. Alan MacEachern, a geographer, in *How Maps Work*, spent ten years on his "general framework for the study of maps" (MacEachern, 1995, preface), which examines improving map design, understanding how meaning is derived from maps, how maps have meanings attached to them, and how maps are used. The overlap of (for example) semiotics with studying maps is one of many examples of an ever-widening scope of literature that relates to wayfinding.

Most of the wayfinding literature, if not specifically about the production of wayfinding aids, touches on what Reginald Golledge defines as *cognitive mapping*. In his preface (1999), Golledge, who is also a geographer, surveys a wide range of literature from developmental psychology to urban planning in addition to his own field. While multiple terms have been used for essentially the same idea, Golledge collects those terms into this definition: "The term *cognitive map* is used throughout this book to refer to the internal spatial representation of environmental information. Its use varies between the metaphorical ("as if" the information was stored in map-like format) and a hypothetical construct" (1999). Cognitive maps are explicitly

explored in *Changing Visions,* a book written by an historian, a neuropsychologist/systems theorist, an ethologist, and a professor of philosophy.

These spatial representations are also investigated in *Human Spatial Memory*, edited by Gary Allen. Both he and the contributors to this volume are in the field of psychology, and so explore the cognitive and behavioral processes that inform how "the spatial structure of the environment [is] represented in memory" and how "remembered actions are used to guide action in space" (McNamara, 2004, p.3).

Investigating how human beings understand and retain spatial information plays into how navigational and wayfinding aids are designed as well. Information designers use architectural wayfinding (like Romedi Passini's work) to help newcomers to environments navigate those environments successfully. As Passini puts it, "people need information to make and execute decisions" (1999, p.89). He also notes that "settings with poor wayfinding information lead to more exploratory decisions" (p.89), which can lead information designers to determinations of what information is relevant to explorers of a particular setting. This user-centered method is key to understanding how to build improvements into existing wayfinding tools.

Digital information designers are interested in how people navigate their digital environments as well. In Peter Morville's *Ambient Findability*, he enlists navigational and wayfinding language from the same Romedi Passini (and Passini's book *Wayfinding: People Signs and Architecture*) to make a case for the digital built environment to be thought of in the same way as the urban built environment, and to require the same care and attention to wayfinding (Morville, 2005, pp.26-31). Kim Guenther makes a similar case in *Wayfinding on the Web* (2006).

Certainly, information designers, digital and otherwise, have an interest in studying wayfinding. Linguists do, as do cartographers, geographers, urban planners, and architects. Psychologists, neuroscientists, ethologists, semioticians (Fuller, 2002), literary theorists (Pickles, 2004) and philosophers all have an interest in how wayfinding works. Additionally, Brenda Dervin's work in Sense Making (one example in Dervin, 1999) brings the discipline of information science in, even though it is still as it was in 1991 for Myke Gluck when he suggested those three questions noted above that remain unanswered in the literature.

For this research, each of these disciplines brings something to the investigation of the specific wayfinding behaviors of the subject group. Understanding how wayfinding information is designed, interpreted, processed, and used (or discarded or revised) from a variety of viewpoints is a useful analytic perspective. However, wayfinding studies and methods related specifically to the built environments of the digital and urban worlds (architecture, urban planning, information science, geography, cartography) as well as the interpretations of those environments (semiotics, literary theory, linguistics) have been emphasized.

Research Questions
In any environment, there are different levels of familiarity and competence which support the ability to wayfind. What tools do people use to "annotate," or keep track of their location? Does someone who has more experience use the same resources as someone elsewhere on the spectrum? These questions extend beyond the physical realm to the digital: Do people who are more accustomed to online technology and tools use the same annotative and navigational tools as those who are less so, and are they used in the same way? Is there any overlap or connection between the resources individuals use in the physical world and the digital?

Similarly, do individuals fall back on familiar resources, are there are patterns of use, and is there any change in these methods as their "nativeness" increases? Finally, are there visible patterns of collaboration where more "native" individuals emerge as leaders or instructors?

Context/Relevance

Knowing where to find something or how to get somewhere is supposed to be getting easier as tools are developed to simplify or make known the real and digital environments. Global Positioning Systems (GPS) are getting cheaper all the time, and more accurate. [Google](#) has [mapped most of the Earth](#), and now is [looking to the universe](#). Bookmarking systems like [del.icio.us](#) and [Diigo](#) help people keep track of the digital as well. But have these tools really simplified this process of finding and re-finding? More than one researcher is interested in [Keeping Found Things Found](#). Clearly, a growing mountain of information about the real and digital worlds exists, and it is becoming less manageable by traditional resources.

Understanding whether or not wayfinding techniques in the real world successfully translate to those in the digital can help determine better ways of keeping those found things found. Peter Morville, in *Ambient Findability*, acknowledges that the navigational metaphors used in finding paths through and to Internet resources is inadequate, but useful:

"…our spatial metaphors have limits. We can take them too far. And yet, they have real value and resonance. People do navigate websites. Wayfinding does belong on the Web. But, there are complimentary metaphors such as shape and genre that provide new inspiration for design."

By getting a clearer picture of the intersection of the real and digital, and identifying places where metaphors break or are stretched, as well as identifying the traits that lead to an identity of *nativeness* in a given environment, successful wayfinding skills (and finding skills) can be pinned down and replicated.

The Research

Methods

Data were collected through two methods: interviews and observations. Individual as well as group patterns of tool use related to wayfinding behavior were examined, in addition to the behavior itself. Individual interviews were conducted with the subjects, their group and individual wayfinding behavior was observed in the real world (Amsterdam, Brussels, and other locations in the Netherlands), and their wayfinding behavior was observed in their class blogs, the class wiki pages, and on the class e-mail list.

1. **Student Interviews:** Students were interviewed individually two separate times while in Amsterdam, once during the first week, and once during the third week. The first week's interviews were focused on understanding where the subjects self-identified on a continuum between native and newcomer for both the digital and the physical realms. Additionally, some tool familiarity (maps, written instructions, bookmarking web services, etc.) was assessed. Subjects were asked to draw (by hand) two maps: one of their home neighborhood in the United States, and one of the city of Amsterdam. The third week's interviews focused on assessing any change in the self-identified place on

the native/newcomer continuum, as well as any tool use or abandonment. Subjects were asked to draw (by hand) a map of their neighborhood here in Amsterdam.

2. **Student Observations – Digital Environment:** Individual and group annotative wayfinding behavior was observed in the class blogs, the class wiki pages, and the class e-mail list only. Personal sites and other non-class-related sites were not examined. Quantitative data, such as a tabulation of every instance of identifiable wayfinding behavior (link-saving, use of social bookmarking tools such as del.icio.us, etc.) was collected. Quantitative data, such as perceptions, challenges, or successes around tools or behaviors described or discussed in those blogs and wikis, was also collected.

3. **Unstructured Individual and Group Observations:** Qualitative data was collected by accompanying participants on trips taken both inside and outside Amsterdam over the course of the first three weeks of the program. Because individuals and groups undertook journeys nearly every day, many opportunities for observing wayfinding behavior existed. The focus was on the following behaviors:

- Was a map used?

- Did someone ask for directions?

- Was a direction/location sign interpreted?

- Did someone draw a map?

- Did someone give directions?

- Did someone create a direction/location sign?

- Did someone get lost, or was unsure of their location?

- Did someone successfully get to where they wanted to go, having never been there before?

  Observations were recorded (through passive observation) either in the field or after we left the field on either paper or laptops. However, if individuals or groups needed wayfinding assistance, a participant-observer model was used and assistance was provided. When those incidences occurred, clear notation in the data separated those instances from non-participative ones.

4. **Structured Group Observations:** Qualitative data was gathered by accompanying participant groups on either their field research trips or social outings during the first three weeks of the program. Scheduling of these joint trips was at the convenience of the participants. For these observations, the questions were the same as in a. above, and the same goal applied.

Affordances and Limitations

Using interviews and observations as methods helps each to balance the limitations of the other. In interviews, subjects are likely to feel pressure to give the "correct" answer, rather than the true one: this is especially true when there may be some shame in revealing actual behavior. In this case, societal pressure exists that prevents individuals from admitting to being lost or confused,

as it may be seen as being "stupid" or "weak." Also, the researchers were not strangers to the subjects, and this collegial relationship may have influenced any self-reported behavior. As part of that same interview process subjects were asked to draw maps by hand, an activity that they may or may not have felt comfortable doing, and they may or may not have seen it as a useful way of thinking about where they locate themselves. Like the activities that were required as part of the course, drawing maps is seen by the researchers as an example of *coerced* behavior, or behavior that seems expected or required in a given situation. Finally, the research plan to have all of the subjects use identical sheets of paper in order to have direct comparisons between one subject and another did not come to fruition. Each researcher used available materials which differed significantly, so dimensions of analysis like relative scale, size, and position were not possible to measure and analyze.

By using observations, both in the real and digital realms, the likelihood of observing uncoerced (or spontaneous or "unfiltered") behavior, or behavior without the pressures and influences attached to answering interview questions, increased. This is especially true with many observations over a period of three weeks. Subjects were observed not only in "informal" settings, where the researchers were making note of wayfinding behaviors as part of other activities, but also in "formal" settings, where the researchers scheduled observations.

Even though the subjects had consented from the beginning to being observed in many different situations, there was a marked difference in behavior from the informal to the formal. Formal observations took place after the first interviews, which may have increased the subjects' awareness of the researchers. Most subjects offered up self-reporting while they were being formally observed, pointing out their own wayfinding behaviors and asking researchers to note them. This was also the case for the first few days of informal observations, but eventually the subjects' attention on the researchers dimmed. Nevertheless, the subjects never seemed to forget the researchers entirely, perhaps because so much of the experience of being in an unfamiliar place involved wayfinding. Needing to participate in wayfinding activity nearly every day meant that the interview questions likely stayed fresh in the subjects' minds, even as they performed their own research.

As far as observations of digital behavior, these could identify which tools were or were not being used, and at what point in time, but not much else. Unfortunately, scheduling lab facilities and subjects for real-time digital observations was too complex to organize around the research schedules of the subjects, so no comparison can be made as far as *reported* real-time behavior and their *actual* web wayfinding, unlike the subjects' real world behaviors. The frequency with which the subjects used digital annotation techniques, either coerced or uncoerced was relatively small, which makes drawing any conclusions problematic. Nevertheless, the presence of uncoerced activity in the digital realm proved an integral part of the final analysis.

Finally, the three researchers needed to manage observations and interviews for all of the subjects, so the subject group was split up into sets of research teams. This allowed for consistency in approach, but also maintained an environment that did not allow for different researchers' observation or interview styles to counterbalance each other.

Reflexivity/Process
The research questions were left intentionally open so that a bias towards one behavior or another (or one analysis of that behavior or another) would be minimized. However, open

questions lead to less immediately analyzable data. In other words, discovering the analytical categories that responses to interview questions or observed behaviors fell into was challenging. This was in no small part due to the vast amount of collected data. Each subject drew three maps and answered more than forty questions over the course of two interviews. Each subject was observed formally one time, and informally many times, with each observation making note of eight different wayfinding behaviors. The initial analysis looks at only a fraction of the data that has been collected.

Additionally, responses to the first interview questions and the informal observations led to a modification of the second set of questions. The modification process was smooth, but did constrain the research schedule as the second interviews could not be scheduled until the modifications were approved.

In general, passing through the formal Human Subjects Research process was an significant task with many challenges, and that process inflected each stage of the work. Before the conclusion of the Honors Seminar class in early June, the researchers needed to have all of the recruitment materials and research instruments completed, as well as have fixed the strategies they would use for maintaining confidentiality for their subjects. Once in the field, the researchers had much less flexibility in their methods in comparison to their colleagues. At no point could the research question change significantly, or the Human Subjects research approval process would need to begin again and all data collection would need to cease until the change was approved.

Human Subjects

Recruitment

The potential subject population consisted of the students participating in a university Honors seminar. The class may represent a "coerced" population in that they were required to use the class wikis and blogs, or may have felt pressure from their collegues or instructors to paticipate in the study, so each student was presented with a consent form which detailed what we asked from them for our own research, as well as allowing them to opt out of any or all of our research at any time. This was presented in an environment meant to eliminate any peer pressure to participate.

As members of the class, the researchers had access to the students' email addresses. Participants received an e-mail with a link to the Catalyst survey which remained open for 5 days in order to give them time to consider and respond. The researchers explained the methods and privacy/confidentiality protections in the survey, and made themselves available in person for questions or concerns.

Anonymity and Confidentiality

The participant status of any specific student has not been and will not be revealed outside of our research group. This choice to participate or not to participate has been made clear in the recruitment materials and in the consent forms. Interviews with all potential subjects were held so instructors (and other students) would not have been able to identify which students did or did not participate.

Each participant had an assigned pseudonym (alphanumeric code) that was used for all data collection which acts as a unique identifier. These pseudonyms will be the only published

identities of the subjects. A master code list of the subjects names matched to their codes has been password-protected and located on each of the researchers' laptops, and will not be transmitted in any way. Now that the study is complete, these code lists will be destroyed by September 1, 2008.

No participant has been quoted directly from the blog or wiki entries, as many of those have participants' names attached to them.

The collected data was protected against disclosure by password protected files on the research team's computers. These passwords were not shared with anyone outside the research team. All paper notes are currently in the process of digitization and will be destroyed 3 months after the completion of the study.

Analysis

The initial analysis and interpretation of data focused on three categories: participation in digital annotation, qualities of the hand-drawn maps, and identification of group leaders. These categories were meant to provide a way to locate each subject along the axis from newcomer to native in both the real and digital realms.

Digital Annotation

Digital observations of wayfinding behavior were minimal, a condition to be expected as much of this activity fell into the coerced category. Students in the course were expected to use flickr to geo-tag photographic resources as part of their research, to post research updates to the course wiki, and to make one videoblog entry. Personal blog entries were encouraged, but not required. With the exception of a few of the research subjects making personal blog entries, nothing outside of the requirements was performed that was accessible to the researchers. A great deal of activity did take place on social sites like Facebook, as well as through personal e-mail and chat, however the researchers excepted these activities from observation and analysis so that any personal content would be clearly delineated and not examined. Still, the class e-mail list developed into an unexpected additional annotative environment. Subjects posted events and directions, as well as pointers to digital resources.

This behavior was uncoerced, and while not widespread, several subjects participated in annotative wayfinding activity here. It should be noted that as class participants, the researchers participated in this same activity, and may have acted as models for this behavior in some instances. However, no expectation of participation was attached to this activity, and subjects' participation in it seemed to be entirely spontaneous and driven by a desire to share resources. Not surprisingly, subjects who emerged as "leaders," or individuals who could teach or did teach others about wayfinding resources, were participating in this uncoerced activity.

Map-making

Three maps were drawn by each subject in response to the following interview questions:

week one –

- Imagine that I am a friend of yours who has never been to your neighborhood [in the United States], and I am visiting you. Please draw a map for me of your neighborhood on this piece of paper, taking a few minutes to do so.

- Now imagine that I am a friend of yours asking you about your upcoming trip to Amsterdam. Please draw a map for me of Amsterdam on this piece of paper, taking a few minutes to do so.

week three –

- Imagine that I am a friend of yours who has never been to your neighborhood [here in Amsterdam], and I am visiting you. Please draw a map for me of your neighborhood on this piece of paper, taking a few minutes to do so.

By asking for three maps, several comparisons could be made: the well-known environment in the United States with the less-known environment in Amsterdam; the well-known *neighborhood* in the United States with the recently-learned *neighborhood* after three weeks in Amsterdam; and the map of the nearly unknown city of Amsterdam during week one with the better-known neighborhood of Amsterdam in week three.

The hand-drawn maps were rich with analytic possibility, but the researchers focused on three main features:

- the level of detail in a given map, which included the number and type of streets drawn as well as the amount of labeling of resources;

- the landmarks featured, including their presence or absence, their prominence in the drawing, and their location on the drawn map;

- and self-location, or a map-making convention of making a star or an X where the map's author is located, giving a context that may sometimes be at odds with the bird's eye view of conventional maps.

Details and landmarks were measures of individual subject's familiarity with the environment, and were compared against the baseline levels identified in drawing the neighborhood in the United States. At this stage of the research, interpretation and analysis of these levels is rudimentary. Definitions of "level of detail" and "significance or prominence of landmarks" need development in order to make clear statements that allow for comparison between subjects. However, subjects demonstrated a consistent level of detail between comparable maps, in this case the map of the neighborhood in the United Stated and the map of the neighborhood in Amsterdam. While some subjects had not lived in their U.S. neighborhoods for very long and others had for many years, in most instances the two neighborhood maps showed a similar level of detail.

Self-location was inconsistent both inter- and intra-subject. Some subjects always noted their location explicitly, by some sort of "I am here" device like a star or a label like "my house." Some used these explicit conventions as well as implicit ones, like a label of "dorms" or "UvA." Some self-located only on one map, some on two of the three, and some on all three. Interestingly, the mark of self-location was almost never at the center of the map. Some other landmark or other wayfinding device occupied that space, if anything did. In some cases, the subject almost ran out of room for self-location, squeezing it in to one margin or another.

Additionally, maps were examined for possible slight breaks from map-making conventionality. The researchers found "conversational" labels (as opposed to strict street names or landmark names, for example) that may or may not relate to the "imagine I am a friend of yours"

convention from the interview questions, as well as maps that did not resemble more conventional maps (such as street maps or tourist maps).

One explanation for a break from conventionality was the idea that the subjects need to know where the "friend" who was asking them to draw a map *was*, so they could give directions on how to get to their neighborhood. In other words, the only reason someone would ask the subject to draw a map would be to find the subject. This occurred with more frequency for the maps of the subjects' neighborhoods in the United States (roughly half of the subjects), but still occurred with the Amsterdam neighborhood maps (roughly twenty-five percent of the subjects). Some of the labels on the maps reflect this directional idea, but as if the "friend" is being addressed directly.

Finally, most of the hand-drawn maps resembled conventional maps, regardless of the map's subject but especially in the case of the maps drawn of the city of Amsterdam. These hand-drawn maps tended to resemble street or tourist maps. With one exception, Central Station is located at the top of the hand-drawn maps, near the center, and the rest of the map is oriented around that point. The station is a landmark in Amsterdam, as well as a point of orientation for incoming travelers. For many of the subjects, this was their entry point to the city. Still, the resemblance of the hand-drawn maps to street maps may be due to the subjects' familiarity with those maps before arriving in Amsterdam.

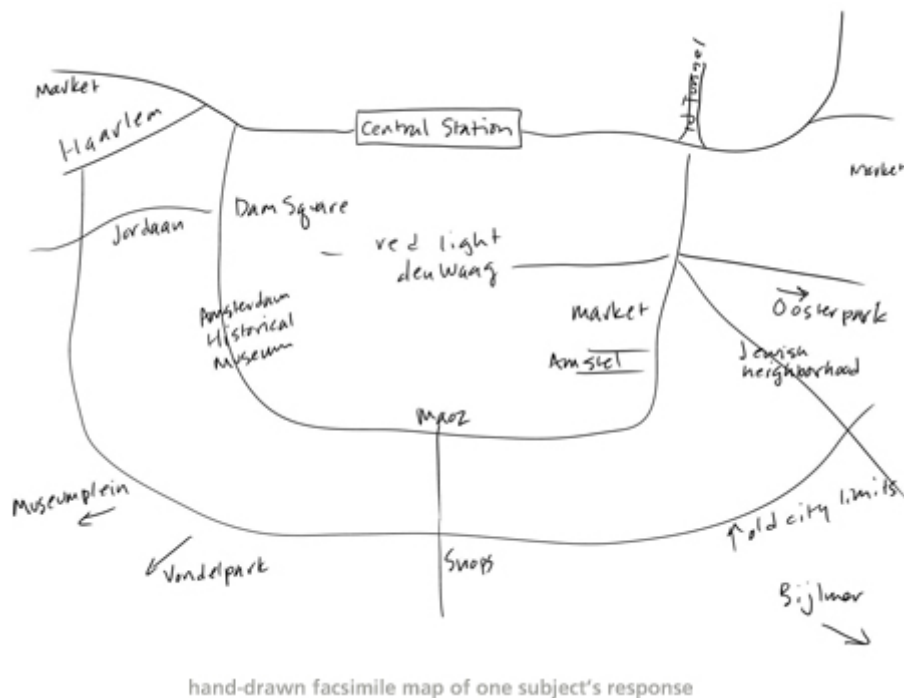hand-drawn facsimile map of one subject's response

 Fig. 3: Comparing commercial maps with hand-drawn maps

Perhaps for similar reasons, the significant landmark of the IJ River is overwhelmingly at the top of the page, with only a very few exceptions. Major streets and notable landmarks are labeled, and those are the only labels outside of place names or directional indicators (arrows, compass directions, etc.). A minority of the subjects drew at least one map with less resemblance to conventional maps, and most of those either had conversational label additions (such as, "you pass this and you're on the right track!") or made clear the subject's unfamiliarity with an area (such as a label of "mysterious void").

Leaders

Over the course of the first interviews and observations, it became clear to the researchers that there were subjects who were acting as wayfinding leaders. This behavior seemed to be the best measure of whether or not subjects had made a transition from *newcomer status* (or navigating only with others leading, not venturing very far from home base, and so on) to *native status* (or leading others, traveling solo, venturing larger distances from home base, and so on). Some subjects showed evidence of leading in the digital world, observable by the researchers as an annotative process. Some showed evidence of leading in the real world, which could incorporate annotation, but was also non-annotative.

By week one, a *courtyard phenomenon* had developed. The subjects and researchers were housed in a set of dormitory buildings which shared a common courtyard, visible from most of

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the rooms. This social space developed into a nexus for wayfinding behavior, including giving directions, leading others to locations, and sharing best practices. Informal observation of courtyard dynamics and behavior led the researchers to add a question to the week three interview that allowed subjects to identify people they believed were wayfinding leaders, and also to self-identify (although not explicitly):

- Is there a person or are there people in our group who always seem to know where he/ she is or where they are? If so, please identify the person or people, and describe the characteristics they have that demonstrate or exemplify this.

The researchers identified seven subjects who demonstrated leading skills. Of those, four were identified by the subjects as a group. Of those four, three identified themselves as leaders and one did not. Of those same four, three drew comparatively detailed maps, and one did not. The subject who did not identify as a leader was not the same person as the subject who did not draw detailed maps.
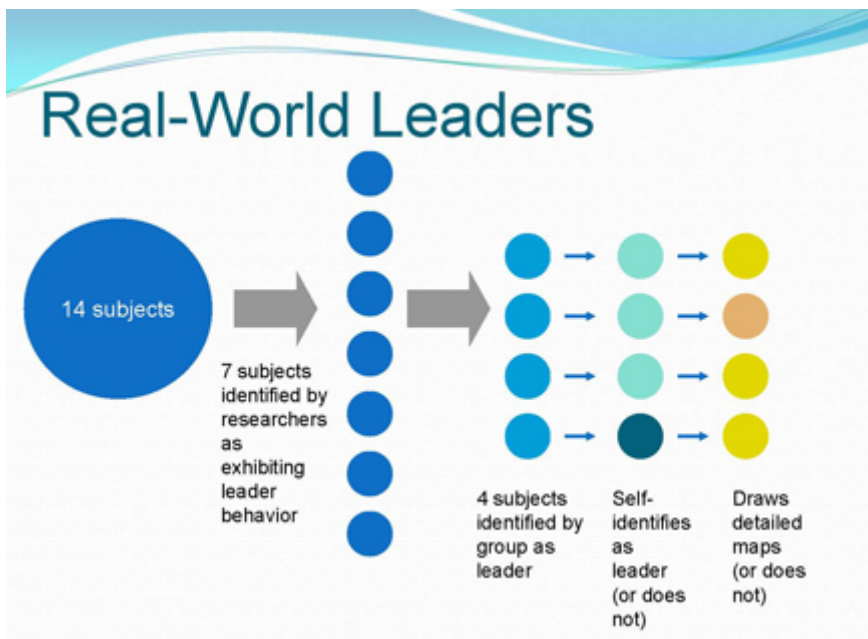
Discussion/Results

Fig. 2: Breakdown of the leadership attributes identified in the *n=14* subjects

Wayfinding leaders frequently demonstrate some or all of the following characteristics: they annotate their environment without being coerced, they are aware of their ability to lead, they have a clear sense of where they are most of the time, and they assist others in wayfinding tasks. A clear understanding of how those leaders develop, and whether or not anyone could develop into a leader over time is key to both unraveling successful navigation techniques in the digital and the real, but also for reconceptualizing the metaphors used for digital navigation.

Clearly, the data collected over the course of this project have not been fully analyzed. There are multiple dimensions of analysis that can be developed in the future, based on this initial

collection, as well as larger-scale projects that can build from this one. Some future paths could include these questions:

- Are people who lead in the digital environment the same as those who lead in the physical environment? If they're not, what does that tell us about the potential for transferring navigation skills from the real to the digital?
- At what point is the "social disruption" (or the transformation of moving rapidly from the well-known to the less-known) of being in a new place overcome? What changes?
- How do real-world collaborative spaces (such as a dormitory courtyard) affect annotative wayfinding practices? Do these spaces replace a need for annotation? Support it? And, if these spaces are more successful at developing or disseminating wayfinding skills can the courtyard exist in the same way in a digital space? In other words, is this non-annotative, simultaneous social space possible in a digital realm? Or is this what makes the navigational metaphor stretch beyond its limits?

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