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The iSquare protocol: combining research, art, and pedagogy through the draw-and-write technique

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Abstract

This article introduces the *iSquare protocol*, a novel application of the draw-and-write technique. The protocol was developed in the field of information science to explore the visual dimension of *information* and as an alternative and complement to written definitions of information that dominate the literature. In addition to generating a new visual perspective on information, the approach has proven fruitful for artistic and pedagogical purposes. Here, the protocol is presented in detail for scholars within information science and those beyond who may adapt it to their own research questions. The article begins with an overview of the draw-and-write technique, followed

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by a history of its use in the iSquare Research Program. Then, the distinguishing features of the iSquare protocol, its artistic potentials and teaching applications are outlined. Links are provided to an instructional script and research instrument template, enabling turnkey implementation of the method.

Keywords
arts-informed paradigm, creative methods, draw-and-write technique, information theory, iSquare protocol, visual methods

Introduction: the draw-and-write technique

The *draw-and-write technique* is an arts-informed, empirical, visual research method in which informants are prompted to draw the subject of the investigation (*information*, in the case of the iSquare Research Program) as well as take part in a writing exercise, interview, or focus group (Pridmore and Bendelow, 1995). Typically, the draw-and-write technique is administered to children by teachers and/or researchers in the classroom, though variations of the technique have also been done with adults – the limited focus of this article.

The draw-and-write technique came to prominence in the UK during the 1980s in a series of studies of children's health (Williams et al., 1989), and its popularity is increasing. A multidisciplinary systematic review of research that involves the production of drawings identified 80 studies done in the 1986–2010 period, with a substantial rise after 2006 (Umoquit et al., 2011). The technique is more common to the field of education, though it has also been applied by researchers in healthcare, engineering, environmental science, geography, industrial design, and psychology.

Many different research designs are possible with the draw-and-write technique; the drawing and writing activity may be used independently, or combined with other data gathering methods. Epistemologically, it can enact the traditional tenets of social science, and closely resemble a survey, with the difference being that the response takes the form of a drawing. Alternatively, the draw-and-write technique can express creative research methods (Kara, 2015; Mannay, 2016) that are emergent, participatory (O'Neill 2012) and transformative.

A fundamental ontological question that underlies the draw-and-write technique is, what *are* these drawings? As a mode of communication for adults, drawing often takes the form of graphic ideation, that is, the process of creating sketches to increase self-understanding (McKim, 1980). Kazmierczak (2000/2001) differentiates images from diagrams: the former is a tool of art-making while the latter is a tool of information design. Varga-Atkins and O-Brien (2009) have argued that in studies using visual graphic methods participants may generate diagrams, drawings, or cartoons. These three types differ in important ways and each is best suited to a particular kind of research question, though it may be difficult for the researcher to control the participant's response and the outcomes. For a deeper discussion of epistemological and ontological issues associated with drawing, see McGuirk (2012a, 2012b).

The breadth of studies using the draw-and-write technique demonstrate its range and main features. In the field of education, Sandra Weber and Claudia Mitchell (1995) used

drawings to better understand conceptions of teachers. They collected more than 600 drawings of teachers by teachers from around the world. At a workshop setting, informants were invited to 'draw a teacher (any teacher)' (Weber and Mitchell, 1995: 17) and then given paper and colour pencils. Later, participants were interviewed about their drawings. Weber and Mitchell interpreted the images through the lens of critical feminist pedagogy, using a semiotic and dialectical style of analysis. The findings illuminated the stereotypes and contradictions that exist in teaching practice, such as classroom actions that are simultaneously nurturing and controlling.

Australian health researcher Marilys Guillemin (2004) employed drawing to explore women's experiences of disease. Guillemin believes that drawing is best used as an adjunct to other social research methods, so after conducting a survey and/or an interview, she asked women to draw their understanding of menopause or heart disease, and analyzed the combined data of the interviews and the drawings for themes. Guillemin is an advocate for the sensitive and ethical use of the draw-and-write technique, since health topics can be upsetting to participants.

According to communications scholar David Gauntlett (2005), visual methods are the appropriate medium for communications research because most of mass media exists on a visual plane. In his 'Drawing Celebrity' project, Gauntlett explored how young people think about celebrities. One hundred teenage students were asked to draw a star, celebrity or famous person who they would like to be and were reassured that their drawing skills were of no concern; then the youths completed a single-page questionnaire. Gauntlett's findings were quite revealing, especially the thoughtful, emotionally reflective responses from male teenagers suggested to Gauntlett that young masculinities are changing.

'Drawing energy: exploring perceptions of the invisible' (Bowden et al., 2015) examined how citizens in the UK relate to energy. Within a wide-ranging inquiry that also included ethnographic interviews, drawings of energy were collected from 180 people in a workshop setting. The participants were asked to respond to the question, 'what does energy look like?' using pens, pencils, chalk pastels, ink and/or brushes. The visual data set was analyzed for the subject matter that appeared as well as those that did not appear. Given the aim to make an invisible and ubiquitous phenomenon – energy – more visible through drawing, this study is a close precedent to the iSquare Research Program.

The advocates of the draw-and-write technique, reviewed above, assert that it can be used to investigate a variety of research interests; assists in discovering connections among other forms of data; is a relatively easy form of data collection; and is often enjoyable for the participants, among other benefits. Above all, the draw-and-write technique generates an unusually rich and unique visual data set, as drawings 'offer a different kind of glimpse into human sense-making than written or spoken texts do, because they can express that which is not easily put into words: the ineffable, the elusive, the not-yet-thought-through' (Weber and Mitchell, 1995: 34).

Problems with the draw-and-write technique have also been registered (Backett-Milburn and McKie, 1999). One critique pertains to *validity*, meaning the degree to which the activity measures what it means to measure. Subjects may draw what is easy to depict rather than what they might initially imagine, or subjects may be affected by the proximity of others and desire to please the researcher. There is evidence, too, that the drawing exercise is unpleasant for a minority of subjects (Barker and Weller, 2003;

Mannay, 2016; Richardson 2015). The most pressing objection to the draw-and-write technique concerns the analysis and interpretation of the resulting visual data. Mair and Kierans (2007) assert that studies thus far have taken naive positivist approaches that hold the drawings to be direct and unproblematic expressions of the research subjects' thoughts and beliefs. Finally, there are open questions about ethical protocols related to consent, privacy, and the use of the images during and after the study (Wiles et al., 2011).

Studying 'information' through the iSquare Research Program

In the field of information science, information is the central concept and yet its nature remains highly contested (Bates, 2010). Most definitions of information are narrowly conceived, generated through a philosophical-analytic approach, and challenging to scholars and students alike. With this as inspiration, in 2011 Hartel sought an alternative and complement in an arts-informed, empirical, visual mode and launched the iSquare Research Program to answer three questions: 1.) How do people visualize the concept of information?, 2.) How do visual conceptions of information differ among various populations? And, 3.) How do these images relate to conceptions of information made of words?

The research design of the iSquare Research Program hinges upon a novel formulation of the draw-and-write technique. In a classroom setting, research subjects are given a 4.25-by-4.25-inch square of white art paper and a black pen, and on the blank, front side are asked to respond to the question, 'what is information?' in the form of a drawing, as shown in Figure 1. On the reverse side of the same piece of paper, the informants provide a written response to the prompt, 'Please say a few words about your drawing…' and they also register a few basic demographics. The activity occurs during 10 minutes of class time and produces a compact piece of visual data coined an information square, or *iSquare* for short.

As mentioned prior, the draw-and-write technique can reflect any number of research paradigms. The formulation at hand fits within an arts-informed methodology (Knowles and Cole, 2008) which enacts tenets of both the social sciences and the arts. From the social science tradition of inquiry, it is an empirical process that collects data in a structured and consistent manner from research subjects; and the data set is analyzed and represented by the research team. At the same time, in the tradition of the arts, the iSquare protocol marshals drawing to enable a different and broader range of expression than what is possible with words alone. The data set is likewise seen as a corpus of artworks to be appreciated for its aesthetic qualities and displayed in formats native to the arts, such as exhibitions. The epistemologically hybrid, arts-informed approach is not without its tensions, which will be revisited in the context of the iSquare protocol, shortly.

In the initial stage of the iSquare Research Program, drawings of information were gathered from 308 graduate students enrolled in a Master of Information degree at the University of Toronto. A sample of the corpus can be seen at: www.iSquares.info. Though iSquares contain both drawings and textual statements on information (on the reverse side), thus far analytical attention has focused on the images rather than the text and multiple visual analysis techniques have been applied.

Figure 1. A student participates in the iSquare Research Program by responding to the question 'What is information?' in the form of a drawing, and on the reverse side of the same piece of paper completing the phrase 'Information is…'

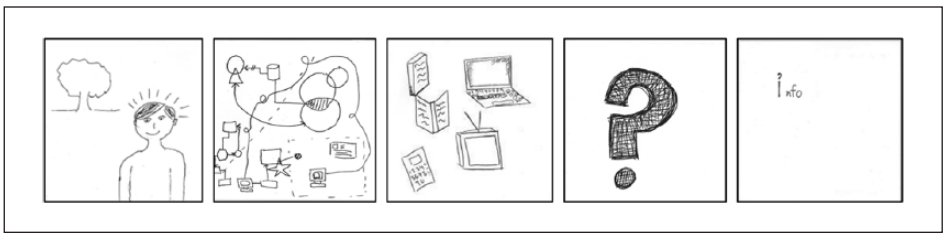

Figure 2. In the first iSquare study (Hartel, 2014a) several types of drawings of information were identified (from left to right): pictures, link diagrams, grouping diagrams, symbols, and text.

First, *compositional interpretation* (Rose, 2011), a humanistic approach grounded in art history and criticism, revealed *how* students drew information as major types of graphic representations (Engelhardt, 2002), that is, as: pictures, link diagrams, grouping diagrams, symbols, and drawn text as displayed, respectively, in Figure 2 (Hartel, 2014a). A subsequent *thematic analysis* (Guest, 2012) determined that 43 percent of the iSquares displayed human beings as a component of information, which was conveyed visually as hands, the brain, a person thinking, an individual in a context, a twosome in information exchange and an information-rich social world (Hartel, 2014b). A *pictorial metaphor analysis* (Forceville, 2009) revealed that students commonly invoked source domains (Lakoff and Johnson, 1980) of earth, web, tree, light bulb, box, cloud, and fishing/mining (Hartel and Savolainen, 2016). The consecutive interpretations of the iSquare corpus was a learning adventure for the team that revealed the selective focusing power of analytic lenses and their ability to generate myriad discoveries within a singular visual data set (Hartel, 2017).

In addition to publications in peer-reviewed journals, iSquare results were presented at conferences of information science (Hartel et al., 2012; Hartel et al., 2013a; 2013b)

and the audience response was polarized. Supporters found the project to be an exciting breakthrough that made the theoretical conversation about information accessible, creative, and inspiring for the first time. Detractors argued that an ontological question about information (for instance, 'what is information?') was out-dated from a social constructionist stance. These detractors also criticized the methodology of the draw-and-write technique, suggesting that it biased informants towards material manifestations of information which are easy to draw (such as books and technologies), and therefore neglected other expressions or dimensions of the nature of information—a result that has been reported in other draw-and-write studies (Mannay 2010; Damon 2000) and remains a limitation of the technique.

Since 2011 the project has grown into an entire team of graduate students[1] and a full-scale concatenated exploration. *Concatenated exploration*, in this instance, 'refers at once to a research process and the resulting set of field studies that are linked together, as it were, in a chain leading to cumulative grounded or inductively generated theory' (Stebbins, 2001: 12). While the iSquare protocol, referring to the simple process of producing the black and white line drawings on small white cards, remained essentially the same, more precise research questions about the nature of information were formulated.

Part of this expansion was a more targeted consideration of students and practitioners in the specialty of records and archives management within Australia (Joseph and Hartel, 2015a, 2015b, in press). Another tributary, still underway, is a comparative international study (Hartel, 2015) to investigate whether cultural forces shape visual conceptions of information. Eleven scholars from information studies programs around the world joined the collaboration, representing Australia, Brazil, Croatia, England, Finland, France, Ghana, Iran, Malaysia, Russia, and Taiwan. The contributors were sent a kit of materials including instructions, scripts, blank squares, and pens and were coached to gather drawings of information from their students. Another recently launched angle is an interdisciplinary study, which applies the iSquare protocol to determine whether disciplinary dynamics shape visual conceptions of information. The resulting data set will reveal whether students of music, for example, invoke musical notation in their pictorial expressions of information; and likewise, whether biology students tap motifs such as the DNA double helix, plant forms, or celestial phenomena—familiar visual themes in the natural sciences.

Overall, the iSquare project has helped to bring information science into the visual Information Age, and has created a rich, multimedia genealogy for a contested central concept. As claimed, the iSquare drawings have provided an alternative and complement to conceptions of information made of words. Many viewers of the research outputs have stated a preference for the visual mode. What is more, the drawings suggest facets of information not addressed in verbal counterparts. For example, an affective dimension of information appears in an abundance of smiling or frowning faces. Information's aesthetic aspect is reflected in many drawings that have beauty or charm, qualities not often related to information. Finally, the research revealed the extent to which information is associated with nature, in marked contrast to a literature dominated by manmade artifacts, technologies, or abstractions.

Over the past five years, the iSquare protocol has been honed, and now displays potential for use on other concepts, disciplines, and research questions. For example, at the time of writing, *information, communication* (Ibekwe-SanJuan, 2017), *internet,*

librarian, digital library, happiness, leisure, learning analytics, group work, and *compliance* are being investigated by scholars across the social sciences. To help those who may wish to explore visual conceptions of their own field's major concepts, the essential elements of the iSquare protocol are described next.

The iSquare protocol

The iSquare protocol is informed by exemplar draw-and-write studies, the methodological literature on the draw-and-write technique, an awareness of the ideal constraints to apply to data gathering practices (Varga-Atkins and O'Brien, 2009), and the kind of attention to practical detail that can only be achieved through repetition. The main elements pertain to ethics, the setting and timing, and the materials.

Ethics

The iSquare protocol involves contact with human subjects, hence researchers using it require approval from an Institutional Review Board through a standard application process. Thus far, all iSquare studies have been geared to low-risk (that is, not vulnerable) graduate student populations in classroom or lecture hall settings; therefore, the review has been expedited and unproblematic. Research designs that involve more sensitive research questions, higher risk populations, or less controlled settings may need a more elaborate protocol.

The central ethical concern for the dignity of research subjects is acknowledged through the efficient and upbeat implementation of the drawing and writing tasks. The iSquare protocol's instruction statement[2] that is read or recited from memory at the beginning of the exercise establishes informants' verbal consent and the right to withdraw without any repercussions. Research subjects are informed that the activity is unrelated to the class and will have no impact upon their performance or grade, which ensures that they have not been coerced. The researcher then recites the instructions for completing the drawing and writing in simple language, and repeats them if necessary. Informants are also told how the process is kept confidential, generating data with no personal identifiers, so that their privacy is ensured and thoroughly respected. In a spirit of full disclosure, respondents are alerted that their contribution may be used for publications and presentations both in print and digital formats. Per standard ethical practices, the informants are also told the benefits of the activity, namely that it may be fun and stimulate their imagination.

This protocol can be implemented with or without a modest incentive. In the first year of the iSquare Research Program a granola bar was given to students for motivation and as a gesture of gratitude. However, the research team felt the incentive was an added expense and often viewed with ambivalence by the students. Upon eliminating the incentive, participation rates (99%) and the quality of the outcome remained high.

Setting and timing

The iSquare protocol has been designed for implementation in classrooms of university-level students or a similarly captive audience such as attendees at a conference seminar

or workshop. The data-collecting process is a carefully controlled, 10-minute activity supervised throughout by one or two researchers. After many implementations with student groups of different sizes, the iSquare team has learned that one researcher is adequate for a class of less than 20 students. Two researchers are ideal for a class between 20 and 50 students. Three or more researchers are best for groups with more than 50 students, since it takes some time to distribute and then retrieve the materials, expeditiously, across a large classroom. Appropriately staffing the data gathering outing helps the process run efficiently and demonstrates respect for the instructor and students.

Permission to conduct the research during class time is acquired in advance. Once the research team arrives in the classroom, the process requires a total of 10 minutes: 2 minutes for instruction and the distribution of materials; 7 minutes for the drawing and writing; and 1 minute to express thanks and then retrieve the completed drawings and pens. Originally, the time allotted for drawing was longer but was reduced to 7 minutes after careful observation of the drawers' needs during the pilot stage. The relatively expeditious pace accommodates, with a comfortable cushion, the time needed to reflect, draw, and write; and it does not unduly impact the instructor's lesson plan (hence lowering any barriers to participation in the project). During the exercise, the researchers stay present; the class instructor may leave the room, sit quietly aside, or do the activity. All informants need a chair and desk (or table), and external distractions should be minimized. Ideally, the exercise occurs when the attention of research subjects is fresh, such as the beginning of a class or immediately after a break. Importantly, the activity should not be described in advance, so that responses are uniformly spontaneous and original. Had the activity been mentioned previously, there is a chance that external sources would be consulted to envision the concept of information, which impedes the goal of capturing novel and personal visual perspectives. The constraints and structure applied to the setting and time reveal the epistemological tension that exists between the social science and arts sides of arts-informed research. The former paradigm applies controls to ensure quality and reliability during data collection whereas the latter would endorse a more unfettered creativity throughout.

A negative response to the draw-and-write task has been noted in the literature (Barker and Weller, 2003; Mannay, 2016; Richardson 2015). In our experience, during applications of the iSquare protocol people sometimes opt out of drawing at a rate of <1%. For example, one person left the front side of the paper blank and wrote on the back side, 'Information is everything and nothing. There is no point in giving it a shape.' There are also occasional vocalizations of insecurity about the task, such as, 'But I can't draw!' to which the research team has been trained to respond with a smile and the assurance, 'Please don't worry; this is not a drawing competition. We appreciate your contribution whatever it may be.' These relatively mild and infrequent objections have not spurred any changes to the iSquare protocol.

Materials

The primary data collection instrument for the iSquare protocol is a 4.25-by-4.25-inch piece of white art paper or cardstock. The textured surface of quality drawing paper is porous and best for absorbing black ink quickly without smudging. The paper should be

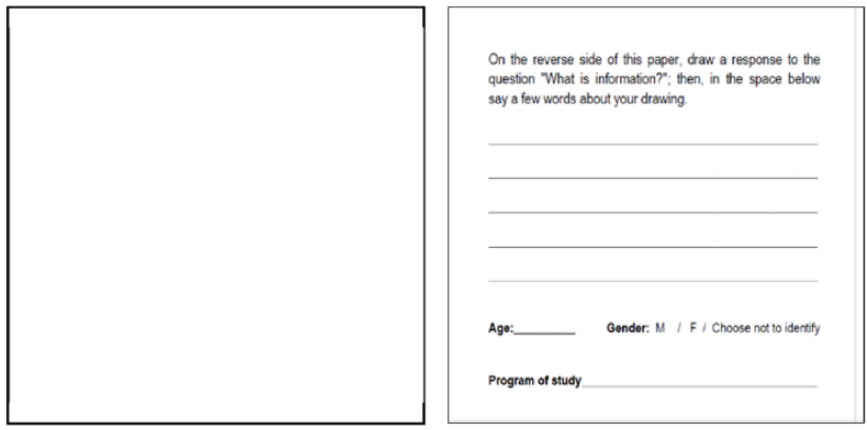

Figure 3. The front and reverse sides of the iSquare data gathering instrument.

heavy enough that markings do not bleed to the other side, but it must also be thin enough to pass through a laser printer or photocopier during the production process. The stiffness that accompanies these finer papers allows it to be handled with minimal tears or bending.

To produce the data collection instrument (a blank iSquare), a template[3] is printed or photocopied onto the drawing paper. Each sheet is then sliced along three light grey lines with a paper cutter. The drawing surface is sized for the most economical use of standard (North American) 8.5 by 11 inch paper, which generates four iSquares and one piece of scrap. Researchers will need one blank iSquare for each participant in their study, and should always bring along a few extras.

In its present formulation, the iSquare protocol embraces materiality through its use of traditional paper and pen. These somewhat old-fashioned technologies inspire beautiful and compelling drawings, perhaps because they return informants to the drawing practices from their youth. These are also the tools that most university-age students who are not in digital art programs are most familiar with using for sketching. However, it may be possible to enact the entire protocol with drawing software in an electronic environment. This mode may be especially amenable to targeting younger populations who have a history of producing digital representations. Electronic drawings may also be easier to collect and manage in large numbers, especially in studies with virtual or geographically diffused populations. This different digital medium is not further elaborated here and is left for others to refine.

At 4.25 by 4.25 inches, the blank iSquare is smaller than what has traditionally been used for the draw-and-write technique. It is also a perfect square, which breaks with the Western art traditional preference of a longer horizontal axis geared to representations of landscapes with linear perspective. Crucially, the dimensions gently guide the participant to a succinct (not sprawling) visual expression and suits a quick drawing activity; a larger piece of paper would demand more effort and class time. Another advantage is that the resulting corpus of hand-sized squares resembles a deck of cards and is

portable and easy to manipulate. One scholar asked, 'Why not *iCircles* instead?' Though an interesting idea, practically speaking, it is time consuming to cut large quantities of perfectly round circles.

During the five-year history of the iSquare Research Program, the text prompt on the reverse side has changed. Initially, the prompt was 'information is…', which generated many answers that had little to do with the drawing on the front side, thereby causing interpretive conundrums during analysis. Beginning in 2014, the back-side prompt was changed to 'Please say a few words about your drawing…', which resulted in statements that were easier to reconcile with the image on the other side. Researchers may try either approach, or another, based upon their situation. The reverse side of the square also contains prompts for a participant's age, gender, and educational program but can be customized to capture other key variables in any study. To maintain confidentiality in the data, no personally identifying information is collected. In contrast to the iSquare protocol's writing exercise, Weber and Mitchell's landmark study of teachers (1995) featured focus groups wherein participants conversed about the drawing. This 'write-and-talk' approach has not been attempted in the iSquare study but may be tested in the future, due to its potential to reveal deeper insights into the nature of information and the drawing experience.

The writing instrument contributes to the outcome of the drawing and in the iSquare protocol is carefully controlled, in line with social scientific strictures. A black roller ball or gel ink pen is provided to research subjects. Compared to drawings made with pencil, charcoal, chalk, pastel or crayons, those created with a steel pen are especially firm and precise due to a steady ink flow (Taylor, 1957). For this protocol, we do not recommend allowing the use of a pen or pencil that belongs to the informant. For starters, in a digital age, many people do not keep pens on hand. Some pens have potentially damaging effects from inks that smudge, bleed through the paper, or are too faint. Further, we found that the act of giving the student a nice pen helps to make the exercise somewhat special and appealing. While many draw-and-write studies use coloured writing instruments (Weber and Mitchell, 1995; Bowden, Lockton, Gheerawo and Brass, 2015), this option was deemed impractical in terms of material costs; the additional time required to complete a coloured drawing; and the conundrums that colour would raise during the analysis stage, since there is no universal theory to interpret the use of colour in drawings.

Data management and analysis

When the draw-and-write activity is completed, the iSquares are collected by the research team and subject to data management. It is essential to distinguish between different squares, and to chronicle data gathering episodes and their distinct data sets. Seen overall, visual and textual data are managed in both paper and electronic formats through the sequence described next.

First, the incoming squares are photocopied so that the duplicates can be used during analysis and later for exhibitions, thus preserving the physical integrity of the original set. Next, they are digitized (scanned) to enable electronic access, preservation, and future usage in multimedia formats. In accordance with the team's preservation strategy, drawings are scanned in colour at 330 dpi (dots per inch), which is standard print quality, in batches of 6 to 8, depending on the size of the scanner surface.

Though the images are all drawn in black pen, scanning images in colour captures the subtle variations in tone created by the drawer. Using graphic editing software, the squares are cut from the aggregated scan and re-saved as individual image files; some may be colour adjusted to optimize visual clarity using software such as Adobe Photoshop. The digital versions of the drawings serve many functions; they can be used for multimedia exhibition or display, they increase the accessibility of the data set (when working in widely distributed research teams), and they encourage preservation by limiting the handling of originals.

Next, each square is given a unique identification code in the format XXX###-&&&. The three letter alphabetic indicator (XXX) represents something characteristic about the batch. For example, during the international iSquare study, sets of drawings were labelled with their country (such as FRA for France or FIN for Finland). Similarly, in the interdisciplinary study sets of iSquares were marked with their respective discipline (our team used SOC for Sociology or BIO for Biology). The next set of digits (###) assigns each drawing a distinct number within a particular research project. A final part of the identification code [&&&] indicates its place in the corpus overall, given that there might be a series of concatenated studies. For example, an iSquare collected from Iran might be the 62nd item from an international study but the 413th when added to a larger corpus of images; that drawing would be numbered IRN062-413.

Once the identification number has been assigned, it is written in pencil on the front of the original paper square. Writing in pencil allows for removal of the writing if need be, but enables identification when it is laid out on a table for analysis. Each digital file is also named using this system, linking it to its physical counterpart. Then, each set of squares from the data gathering session is registered in a master index that displays the range of numbers assigned to that batch of squares, recording its place within the specific study and the overall corpus.

The textual statements on the reverse side of the squares form another dimension of the project. The prompt to write a few words about their drawing helps decipher ambiguous graphic objects that may appear on the front side. We captured these responses in a spreadsheet that has a row dedicated to each square. An initial column at the far left denotes the identification number; to the right are additional columns to register answers to the reverse side prompts.

All the digital image files and the text spreadsheet can be uploaded to a shared, private, cloud-based storage account, such as Google Drive; thereafter team members in any location can remotely access and use the complete visual and textual data sets.

Increasingly, both researchers and their funding agencies are committed to the long-term, electronic preservation of original data. Indeed, in the future it will be fascinating to revisit the iSquare corpus to reflect anew upon the nature of information. To that end, the iSquare team collaborated with a Digital Initiatives Librarian from the Information Technology Services group at the University of Toronto to create and maintain an iSquare archive in the university's Dataverse system. Dataverse enables a stable environment where sets of drawings can be grouped and described with simple metadata, while access can be controlled by the team through a permissions function—features not available to the same degree in cloud-based systems such as Google Drive.

A final step of data management is for the physical copies of the squares to be placed in archive-quality storage, where they remain available for the data analysis that follows. Many different data analysis techniques can then be applied (Hartel, 2017). For ideas and instructions, we recommend the handbook *Visual Methodologies: An Introduction to Researching with Visual Materials* (Rose, 2011). Though it does not focus on participant generated drawings, Rose's text contains excellent summaries of general analytical techniques for visual data, which can be complemented by other draw-and-write precedents.

Artistic dimensions

Arts-informed research uses art as a catalyst for the exploration of questions, theories, and concepts. It integrates the imaginative qualities of the arts with the rigor of social scientific research practices. It aims to acknowledge physical, emotional, spiritual, social and cultural ways of engaging the world and to make academic research 'accessible, evocative, embodied, empathetic and provocative' (Knowles and Cole, 2008: 60). In keeping with arts-informed research, the iSquare Research Program and protocol entail several creative processes, perspectives, and modes of dissemination.

Since the project's beginning, Rebecca Noone has served as the artist-in-residence for the iSquare Research Program. Noone has a degree in Museum Studies and her own substantial career as an artist and curator. Utilizing her understanding of art materials and tools, Noone is responsible for the production of blank iSquares to the optimal standards for drawing, considering issues such as the porousness of the paper and the intensity of the black ink. Noone also designed the aforementioned archive of the original completed iSquares so that the paper version of the corpus is kept in ideal conditions for perpetuity.

Noone sees the iSquare protocol as tied to historical antecedents in conceptual art, specifically related to the emergence of the 'open work' (Eco, 1962). In such practices, art production is not the job of a solitary artist but an outcome of process-focused events framed by acts of encounter, chance, co-production, and inter-determinacy. At information science conferences Noone has located the iSquares in artistic traditions such as the Fluxus movement of the 1960s (Higgins, 2002). Fluxus promoted the idea that art was everywhere, not simply cased in the frame of a painting or conceived of in a sculpture. Instead, art was waiting to be discovered in what was already *out there*. As a result, the *art* could take the form of a written or verbal prompt, that would be publicly displayed or privately mailed to people in order to elicit various responses, termed *multiples* (Robinson, 2012). This unconventional framing sanctions the display of many responses, brought together to create a collage of perspectives that can be viewed at once, by an audience. In the case of the iSquare protocol, data gathering generates the collection of responses, that when brought together, form an artwork worthy of exhibition.

The iSquare data set has been mounted as exhibitions at academic conferences, libraries, and university spaces, as shown in Figure 4. These displays have revealed to audiences beyond the research team the visual richness of the drawings and the breadth of the assembled corpus. In a spirit of participation, squares are mounted by impermanent

Figure 4. Two iSquare exhibitions. At left, the drawings are mounted on metal panels using small magnets; at right, the squares are clipped onto a rope like a clothesline.

magnets or hooks that can be removed to examine at closer range and then flipped over to read the reverse side. What is more, viewers have been invited to draw their own iSquare and contribute to the temporary exhibition. At one academic conference, Noone rearranged the displays of data into different thematic formations each morning—constantly remaking the findings to the surprise of observers.

Another outcome made possible with this protocol is the use of drawings to create and share stories. One example from the iSquare study tells a tale of the origin of information. In short, information emerges from chaos at the atomic level, manifests in patterns, plays a vital role in human understanding, and ultimately generates culture as we know it. Taking the style of a children's book, each point in the chronicle is matched with a drawing and makes the best impression when read aloud in a playful manner. The visual data are key to this endeavour, because written definitions do not lend themselves to telling the story of information in the same evocative, accessible, and illustrative way.

Web presence and social media

Soon after the launch of the iSquare study, a website on the Weebly platform was established to display the initial 308 iSquares. In Weebly, hovering over each image with a pointer causes a text caption on the reverse side to appear. The website has additional pages devoted to the different iSquare research projects, a multimedia overview of the protocol, and more. At various stages during a five year history, the work has also been promoted via social media with a Twitter account and blog. Regular postings in these social media channels help to communicate the project's milestones and expand its research community worldwide.

Pedagogical strategies

The iSquare protocol can be used for teaching students, particularly those in information science, about the nature of information and the ways in which scholars of the field define it (Hartel, 2014c). It can be applied, in the same way, to any discipline's central concepts. Drawings can serve as a genial entry to an abstract and elusive topic, accommodate a wide variety of learning styles and intelligences, complement the scholarly literature, lead to lively class discussions, and generate a bespoke collection of images that can be tapped throughout the semester. Two pedagogical strategies, basic and advanced, have been tested in classrooms at the Faculty of Information, University of Toronto and are outlined below.

With a minimum of prep work by the teacher, drawings of any major concept in a discipline can be produced by students using the iSquare protocol. The creation activity is an especially effective ice-breaker and introduction at the start of the school year and is equally productive for students at the undergraduate, masters, and doctoral levels. When used as a classroom-based learning exercise rather than research, ethical clearance is not required. To begin, the instructor states that there have been many efforts to define the concept in question via words and yet it remains highly contested; then the protocol is implemented. Upon completion, the instructor can have students talk about their own drawings and those by peers; they may discuss their favorites; the types and styles of the renderings; and any recurring themes or motifs. The class may also talk about any ways the images relate to conceptions and definitions pre-existing in the literature or popular culture.

For a more ambitious class project, students can be formed as a research team to collaboratively implement a study using the iSquare protocol. This approach fits within a nascent 'student as producer' trend in UK universities (Neary et al., 2014). Since it entails original research with human subjects, an ethical protocol must be written in advance by the instructor, who also coordinates access to research subjects in other classrooms. The research team is first trained to gather drawings and goes on to collect squares in pairs or threesomes. The data sets are then pooled, and a key element of the project is the management and analysis of the shared corpus. Figure 5 shows a class of doctoral students in information studies at the University of Toronto who are together considering their pooled data set for the first time.

Conclusion

For decades the draw-and-write technique has been a visual data gathering method used across the social sciences. This article has outlined the iSquare protocol, a novel formulation of the draw-and-write technique, that is economical and adaptable to the empirical study of almost any concept. When applied, the protocol generates a fresh visual perspective on the word-based, philosophical analytic statements that dominate scholarship. The protocol has been designed to lend itself to artistic practices and outcomes such as interactive exhibitions and storytelling. Its digital end products fit seamlessly into electronic social environments to enlighten new audiences in academe and beyond. The iSquare protocol has found a natural home in the classroom, where it may train and inspire a next generation of visual thinkers.

Figure 5. First-year doctoral students at the Faculty of Information, University of Toronto consider their iSquare data set for the first time.

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Notes

1. In 2013, the team included masters and doctoral students Pavel Danzanov (Research Manager), Stephanie Power (Data Manager), Christie Oh (Education Manager), Bridgette Kelly (Social Media Manager), and Rebecca Noone (Artist-in-Residence).
2. Available at: http://www.isquares.info/isquare-protocol.html.
3. Available at: http://www.isquares.info/isquare-protocol.html.

References

Backett-Milburn K and McKie L (1999) A critical appraisal of the draw-and-write technique. *Health Education Research* 14(3): 387–398.

Barker J and Weller S (2003) Is it fun? Developing child centered research methods. *The International Journal of Sociology and Social Policy* 23(1–2): 33–58.

Bates MJ (2010) Information. In: Bates MJ and Maack MN (eds) *Encyclopedia of Library and Information Science* (third edition). New York: Taylor and Frances, 2347–2360.

Bowden F, Lockton D, Gheerawo R and Brass C (2015) *Drawing Energy: Exploring Perceptions of the Invisible*. London: Royal College of Art.

Damon FH (2000) To restore the events? On the ethnography of Malinowski's photography. *Visual Anthropology Review* 16(1): 71–77.

Eco U (1962) *Opera Aperta: Forma e Indeterminazione Nelle Poetiche Contemporanee*. Milano: Bompiani.

Englehardt Y (2002) *The Language of Graphics: A Framework for the Analysis of Syntax and Meaning in Maps, Charts and Diagrams*. PhD thesis. Institute for Logic, Language and Computation, University of Amsterdam, Netherlands.

Forceville C (2009) Non-verbal and multimodal metaphor in a cognitivist framework: agendas for research. In: Forceville CJ and Urios-Aprarisi E (eds) *Multimodal Metaphor*. The Hague: Mouton De Gruyter, 19–42.

Gauntlett D (2005) *Moving Experiences: Media Effects and Beyond* (second edition). New Barnet, Herts: John Libbey.

Guest G (2012) *Applied Thematic Analysis*. Thousand Oaks, CA: SAGE.

Guillemin M (2004) Understanding illness: using drawings as a research method. *Qualitative Health Research* 14(2): 272–289.

Hartel J (2014a) An arts-informed study of information using the draw-and-write technique. *Journal of the American Society for Information Science and Technology* 65(7): 1349–1367.

Hartel J (2014b) Information behaviour illustrated. In: *Proceedings of the Eighth Information Seeking in Context Conference*. Leeds, UK, 2–5 September 2014. *Information Research* 19(4).

Hartel J (2014c) Drawing information in the classroom. *Journal of Education for Library and Information Science Education* 55(1): 83–85.

Hartel J (2015) Visual analysis through four lenses. *International Visual Methods Conference*. Brighton, UK, 16–18 September 2015

Hartel J (2017) Adventures in visual analysis. *The Visual Methodologies Journal* 5(1): 80–91.

Hartel J, Pollock K and Noone R (2012) A Visual response to the perennial question: what is information? *iConference*. Toronto, Canada, 7–10 February 2012.

Hartel J, Mai JE, McKenzie P and Olsson M (2013a) New views of information. *Conceptions of Library and Information Science Conference* (alternative event). Copenhagen, Denmark, 19–22 August 2013.

Hartel J, Pollock K, Noone R, Mai JE, Latham K and Bates M (2013b) The concept formerly known as information. *Annual Meeting of the American Society for Information Science and Technology (panel)*. Montreal, Canada, 1–5 November 2013.

Hartel J, Carbo T, Noone R, Power S, Danzanov P and Kelly B (2015) Visualizing information worldwide. *78th Annual Meeting of the American Society for Information Science and Technology* (panel). St. Louis, MO, 7–12 November 2015.

Hartel J and Savolainen R (2016) Pictorial metaphors for information. *Journal of Documentation* 72(5): 794–812.

Higgins H (2002) *Fluxus Experience*. Berkeley, CA: University of California Press.

Ibekwe-SanJuan F (2017) The journey of information. How students perceive information in France using the draw and write technique, In: *Proceedings of the Ninth International Conference on Conceptions of Library and Information Science*. Uppsala, Sweden, June 27–29, 2016.

Joseph P and Hartel J (2015a) Visualisation of information. *Australian Society of Archivists Conference: Archives on the Edge*. Hobart, Australia, 18–21 August 2015.

Joseph P and Hartel J (2015b) Dreams (visions) of information in RIM. *InForum 2015*. Melbourne, Australia, 30 August–2 September 2015.

Joseph P and Hartel J (in press) Visualizing information in the records and archives management (RAM) disciplines: using Engelhardt's graphical framework. *Records Management Journal*.

Kara H (2015) *Creative Research Methods in the Social Sciences: A Practical Guide Paperback*. Bristol: Policy Press.

Kazmierczak E (2001/2002) A semiotic perspective on aesthetic preferences, visual literacy, and information design. *Information Design Journal* 10(2): 176–187.

Knowles JG and Cole AL (2008) *Handbook of the Arts in Qualitative Research: Perspectives, Methodologies, Examples, and Issues*. Los Angeles, CA: SAGE.

Lakoff G and Johnson M (1980) *Metaphors We Live By*. Chicago: University of Chicago Press.
McGuirk T (2012a) From disegno to 'epistemic action: drawing as knowledge generation. In: Granville G (ed) *Art Education in Contemporary Culture: Irish Experiences and International Perspectives*. Bristol: Intellect, 11–28.
McGuirk T (2012b) Drawing and intellectualism: contested paradigms of knowledge. In: Niedderer K and Mey K (eds) *Art, Design and Communication in Higher Education Journal* 10(2): 219–233.
McKim RH (1980) *Experiences in Visual Thinking*. PWS Publishing Company: Boston.
Mair M and Kierans C (2007) Descriptions as data: developing techniques to elicit descriptive materials in social research. *Visual Studies* 22(2): 120–136.
Mannay D (2010) Making the familiar strange: can visual research methods render the familiar setting more perceptible? *Qualitative Research* 10(1): 91–111.
Mannay D (2016) *Visual, Narrative and Creative Research Methods: Application, Reflection and Ethics*. Abingdon: Routledge.
Neary M, Saunders G, Hagyard A and Derricott D (2014) *Student as Producer: Research-engaged Teaching and Learning. An Institutional Strategy*. York: Higher Education Academy.
O'Neill M (2012) Ethno-mimesis and participatory arts. In: Pink A (ed.) *Advances in Visual Methodology*. London: SAGE, 153–172.
Pridmore P and Bendelow G (1995) Health images: exploring children's beliefs using the draw-and-write technique. *Health Education Journal* 54(4): 473–488.
Richardson M (2015b) Embodied intergenerational: family position, place and masculinity. *Gender, Place and Culture* 22(2): 157–171.
Robinson JE (2012) Multiple manifestations: nouveau réalisme & fluxus. In Celant G (ed.) *The Small Utopia/Ars Multiplicata*. Venice, IT: Fondazione Prada.
Rose G (2011) *Visual Methodologies: An Introduction to Interpreting Visual Materials* (third edition). London: SAGE.
Stebbins RA (2001) *Exploratory Research in the Social Sciences*. Thousand Oaks, CA: SAGE.
Taylor JC (1957) *Learning to Look: A Handbook for the Visual Arts*. Chicago, IL: Chicago University Press.
Umoquit JJ, Tso P, Burchett H and Dobrow MJ (2011) A multidisciplinary systematic review of the use of diagrams as a means of collecting data from research subjects: application, benefits and recommendations. *BMC Medical Research Methodology* 11(1): 11.
Varga-Atkins T and O' Brien M (2009) From drawings to diagrams: maintaining researcher control during graphic elicitation in qualitative interviews. *International Journal of Research & Methods in Education* 32(1) 53–67.
Weber S and Mitchell CA (1995) *That's Funny You Don't Look Like a Teacher: Interrogating Images and Identity in Popular Culture*. London: Routledge.
Wiles R, Clark A and Prosser J (2011) Visual research ethics at the crossroads. In: Margolis E and Pauwels L (eds) *The SAGE Handbook of Visual Research Methods*. London: SAGE, 685–706.
Williams T, Wetton N and Moon A (1989) *A Picture of Health – What Do You Do that Makes You Healthy and Leeps You Healthy?* London: HEA.

Author biographies

Jenna Hartel received a Doctorate of Philosophy in Information Studies from the Department of Information Studies at the University of California, Los Angeles. Her work aims to be an imaginative, energetic, and committed form of intervention in the field of library and information science (LIS). She believes a different character of LIS is possible, one that moves beyond

pragmatic concerns with information resources and technologies to consider positive and upbeat information phenomena across the entire human experience. She promotes that vision through her ethnographic research into information within leisure, pleasurable, or profound contexts. To the same end, her ideas are expressed and packaged in non-standard forms of presentation that are playful and accessible to all.

Rebecca Noone is a PhD candidate at the University of Toronto's Faculty of Information and a practicing artist. She has been the Artist in Residence for the iSquare Research Program since 2011. She has contributed to publications such as *Visual Methodologies* and *Journal of Education for Library and Information Science*.

Christie Oh is a PhD candidate at the University of Toronto's Faculty of Information. Having joined the iSquare Research Program in 2013, her research interests include visual methodologies, pedagogy, and learning strategies. Her current research focus is on digital humanitarianism, knowledge management, and information behaviour in the disaster context. She has co-authored papers for scholarly journals, such as the Journal of Education for Library and Information Science, and published conference proceedings, including the Proceedings of the International Conference on Software Engineering.

Stephanie Power is recent Master of Information graduate, with a concentration in Library and Information Science. She has been Data Manager for the iSquare Research Program since 2014 and recently collaborated on a series of undergraduate workshops as part of the Jackman Humanities Institute's Scholars-in-Residence Program. Having taught sessions on data management and preservation, her research interests include teaching information literacy, visual methodologies, and the preservation of scholarly communication.

Pavel Danzanov is a General Librarian in Toronto Public Library system. He also works as a Cataloguing Assistant in Ontario Pay Equity Commission. He has recently graduated from the Faculty of Information, the University of Toronto, with a concentration in Library and Information Science. Pavel is a PhD in Sociology, and author of more than ten scholarly publications including four monographs. He became a member of the iSquares research team in 2014, where his responsibilities included data collection and analysis, monitoring and supervising the international part of the project.

Bridgette Kelly is an Education Media Researcher with the Independent Learning Centre, the Province of Ontario's provider of distance education, where she is part of a team that creates online high school course modules. She is a recent Master of Information graduate of the University of Toronto iSchool with a dual concentration in Library and Information Science as well as Archives and Records Management. She has participated in many projects that communicate the value of library services and collections. She recently co-authored an article in OpenShelf, an Ontario Library Association professional publication, that featured her research into reference service provision. She is currently researching intellectual property issues in the broadcasting sector.