

Teaching the design of narrative visualization: Using metaphor for financial literacy and decision making

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Abstract:

The authors provide a scholarly definition for metaphor-rich, story-driven 'narrative visualization'. They argue that metaphors create a rich and emotionally resonant set of associations that frame the narrative and effectively support 'System 1' (or intuition-based) thinking and decision-making that Kahneman and others have identified as the primary drivers of financial behaviour. The authors then apply these observations to a case study in which they analyze student work on a financial literacy design project. They discuss best practices for teaching narrative visualization and argue for its relevance in a contemporary design education - especially its capacity to represent and reflectively explore complex financial and other concepts.

Keywords:

design education, narrative visualization, metaphor, visual metaphor, behavioural finance, financial literacy

Introduction

In this paper we assert the importance of narrative visualization methodologies as part of a contemporary design education, and argue that narrative visualization is especially important in any context in which design can both facilitate understanding and potentially influence behaviour (e.g., public health, financial management). Recent research in behavioural economics suggests that such narratively-driven approaches to information design (in particular, their reliance on metaphor), engage ‘System 1’, or intuition-based, thinking (Kahneman 2011), and thus have a strong impact on decision-making. Narrative visualizations are therefore a crucial tool in the growing field of financial literacy. The 2008 recession prompted governments and non-profit organizations in the U.S. and other countries to step up their efforts to improve financial literacy among the public (cf. the Financial Literacy Research Consortium, <http://www.ssa.gov/pressoffice/pr/flrc-pr.htm>). As with public health and other areas of public importance, one of the key research and funding priorities has been to develop more effective communication strategies and educational resources. Existing financial literacy materials—however thoroughly planned and assessed—often lack consistent design methodologies. (n.b. for policy-makers, the word ‘design’ usually connotes only the design of research instruments such as surveys or studies.) This lack of methodologies presents a significant opportunity for design educators and designers in the twenty-first century. In the design classroom, financial literacy provides an excellent context for students’ exploration of narrative visualization; financial literacy also provides opportunities for students to broaden their skills in information design to include a wider range of visualization strategies. This article is in two parts. In Part 1 the authors define ‘narrative visualization’ and discuss its reliance on visual metaphor. We relate the emotional and cognitive impact of narrative visualizations to recent research in behavioural economics regarding individuals’ interpretation of information and financial decision-making. In Part 2 we apply these insights to a case study in which design educators and financial educators collaborated to approach financial literacy as a ‘design problem.’ Design students were matched with students in a financial literacy-training program to identify issues of critical importance to the future counsellors’ clients (e.g. dealing with poor credit scores); the design students were then tasked with creating short time-based animations that could serve as financial literacy instructional materials. To analyze the finished products, we develop a conceptual framework that identifies crucial factors of an effective narrative visualization, and use the framework to analyze an example of student work. Finally, we suggest that this framework could be extended to development of assessment tools.

Part I: Narrative visualization and behavioural economics

Defining ‘narrative visualization’

The authors define narrative visualization as illustrations, animations, storyboards and graphic novels that engage the viewer with metaphor and story-telling. This is very different from data-driven use of the same term by researchers such as Segel and Heer (Segel & Heer 2010) from

the computer-and graphics-oriented Stanford VIS group (<http://vis.stanford.edu/>): they emphasize the story-telling aspects in visualizations of complex data sets and other schematics.

In contrast, the authors' ('Parsons') definition of 'narrative visualization' refers to the kinds of illustrations that are frequently used to explain financial concepts and elements in financial journalism and financial education materials (see Figure 1). Largely hand-drawn and pictorial—combining simple imagery with graphic elements—these visualizations use metaphors and implied relationships to imbue complex financial concepts with emotional or conceptual context. These narrative visualizations often depict emotional cues (pain, fear, joy) overtly through a character's body language and facial expression when referencing issues that have emotional resonance for the viewer. This resonance allows viewers to engage with the concepts on an intuitive basis: one that relates to heuristic-based 'System 1' thinking (Kahneman 2011). As we discuss in the section 'Two systems thinking' below, the intuitive engagement that narrative visualizations engender may have a significant impact on financial decision-making and behaviour.

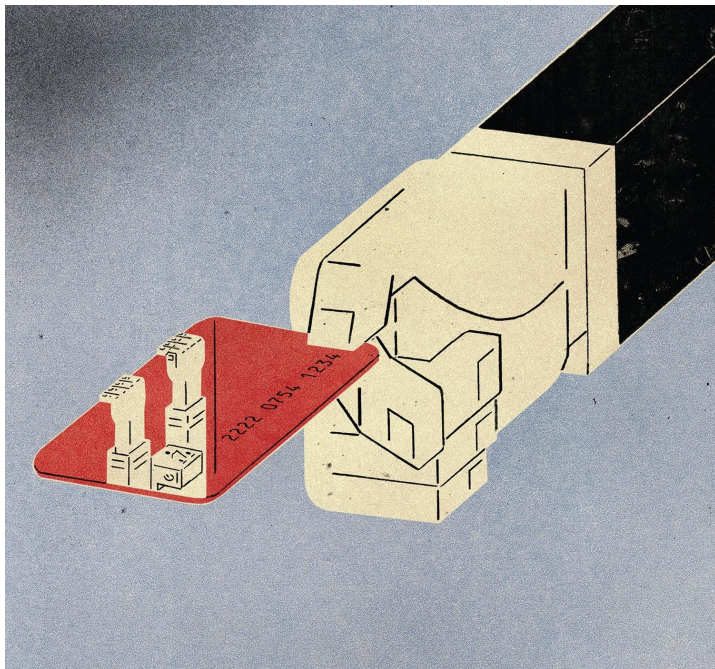


Figure 1: 'Avoiding the Debit Card Trap', David Plunkett, *Business Week*, 13 February 2006

Comparison of these two examples highlights some differences between data-based and narrative-based visualizations. The visualization in Figure 2 lies somewhere along a continuum ranging from 'pure' information/data-driven to 'pure' pictorial/narrative, and integrates elements of both. Figure 2 illustrates the ways in which metaphors can be embedded deeply and implicitly in a visualization that would otherwise seem primarily schematic. This flow chart plots the evolution of the 2008 financial crisis through two narratives that develop over time. The narratives are composed of sequences of events that overlap chronologically; one fuels a

speculative frenzy while the other results in financial crisis. Both sequences of events are framed by two overarching metaphorical associations: green = proceed/safe; red = stop/danger.



Figure 2: ‘A Visual Guide to the Financial Crisis’, *Mint.com*, 13 November 2008.

As the sequence of events and actions accelerates, the background shifts from neutral (or possibly clear) blue sky to green, and then from blue sky to red. Analysis of this image hints at the underlying tension between factual information (or data) and the subjectivity of the metaphorical frame through which it is encoded and communicated. Because the viewer reads this graphic top to bottom, the crisis is identified with a descent or downward orientation. The frame emerges as a form of master narrative that directs the complexity of the data in deterministic and, data purists may claim, reductive ways. ‘Hybrid’ visualizations of this kind point to the fact that maps of any kind are metaphorical: the question is not whether metaphors are present, but how apparent they are to the reader.

Figure 1, in contrast, is rich in explicit metaphorical content. Illustrating a man hanging onto

the edge of a credit card by his fingertips, it is a dramatic representation of the feeling of financial ‘abyss’ that many experience in their relationships to credit and to the credit industry. As in Figure 2, the red colour signifies danger. The card/abyss is proffered by a disembodied hand, which represents the financial system as an impersonal, oppressive and rigid machine. Rigidity and impersonality are further signaled by the geometric, mechanical rendering of the line that outlines the shapes and by the contrasting scale between the big man/big hand and small man/small hand. The article accompanying the illustration explains how banks arrange the order of debit card transactions at the end of the day to maximize the number of times that the customer can be charged overdraft fees.

The narrative suggested in Figure 1 does not lie in the depiction of a linear sequence of events; rather, it appeals in a visceral and emotionally-laden way to the viewer’s anxieties surrounding excessive debt, bank practices and financial insecurity. Its explicit use of metaphor is crucial to understanding how this image functions, because the associations arising from the metaphor frame the financial content in ways that affect the viewer’s interpretation of the image and the way credit is subsequently viewed.

Besides asserting that the depiction of emotional content *is* information visualization (of a different kind from data visualization), the authors contend that the role of metaphor in conveying emotional—and other—content, in these narrative visualizations has been insufficiently studied. Like the discipline of rhetoric more generally, (Engbers this volume), metaphorical devices have historically been associated with language, and only in the last few decades has interest in their visual representations been examined in any systematic fashion in the design context. Recent studies include the role of metaphor in advertising (Forceville 1996), corporate branding (Koller 2009, Engbers this volume), and editorial cartoons of political issues (El Refaie 2003, 2009) and the 2009 financial crises (Bounegru & Forceville 2011). Because images are frequently embedded in-complex texts, formal analyses have expanded to include multimodal forms (Forceville 2008, O’Halloran 1999).

Contemporary metaphor theory

Traditionally metaphor relies on the correspondence of ideas and attributes between a symbol (e.g., dove) and thing symbolized (i.e., peace). Contemporary theories of metaphor, however, rely on a broad understanding of metaphor as a mapping of concepts (Lakoff 1992), rather than an artifact of language. Conceptual metaphor theory, as this framework became known, grew out of the seminal work of Lakoff and Johnson, based on early work by Pepper (1942), Reddy (1979) and others. In *Metaphors We Live By* (Lakoff & Johnson 1980), they argue that metaphors structure the way individuals perceive the world, and that many metaphors have their origin in physical experiences. They analyze families of metaphorical associations around idioms such as ‘life is a journey’ and ‘argument is war’ to demonstrate how these metaphorical phrases both shape and are shaped by the way humans conceptualize different aspects of their lives. Of particular relevance to financial visualizations are the ‘orientation’ metaphors that underlie ideas such as ‘up’ is good and ‘down’ is bad. As Lakoff and Johnson suggest, these associations may have arisen because of humans’ physical stance in the world: we tend to

face the world from a vertical position, so lying down is associated with illness or weakness. Regardless of the origin, the association of up-as-good pervades how individuals ‘read’ information, and how they organize their visual schema. Quantities are graphed along a vertical axis in which up is associated with more and down with less; similarly, the phrase ‘GDP is up’ connotes positive change. Conversely, the metaphorical phrase ‘falling into debt’ denotes imminent peril (as reinforced visually by the dangerous position of the protagonist in Figure 1).

While Lakoff and Johnson stressed the universality of conceptual metaphor theory, their focus was primarily on (English) language. More recent studies (cf. Casasanto 2009, 2013), have shown that while specific metaphorical and linguistic details may vary, such conceptual mappings occur in many cultures. Body gestures, too, may reinforce these correlations, such as the association of ‘good’ phrases with gestures by the dominant hand, and ‘bad’ phrases with the less dominant hand (Casasanto 2010).

The metaphors used in narrative visualizations thus do more than provide convenient visual symbols for abstract concepts. They draw upon and reinforce existing conceptual frameworks. This process is similar to ‘genre recognition’, (Trogu this volume), which allows readers to infer broader and richer attributes than those presented at face value. For example, the use of the credit card to represent a potential financial/physical abyss in Figure 1 is made more powerful by the conceptual (and experientially familiar) association of ‘falling’ with ‘danger’ and our likening the feeling of being in debt with that of insecurity. The credit card victim is the protagonist in this metaphorically rich implied narrative. Metaphor in a narrative form encourages the viewer to ‘buy into’ the framing implied by the visualization (‘credit is dangerous’), and this ultimately influences both the way the viewer thinks about personal credit and the way he/she subsequently behaves. This ‘reflection-in-narrative’ (Sosa et al. 2013) is a process of viewer reflection on a story *during* its telling.

As Sosa et al. remark, the value of the design process lies in its ability to ‘deal with situations of uncertainty, instability, uniqueness and conflicted values’ (Schön, cited in Sosa et al. 2013: 3), which are inherent in the ‘ill-structured problems [of the] real world’ (Rittel, cited in Sosa et al. 2013: 3). Researchers have found that when humans grapple with these ill-structured problems, they more-often engage an intuitive rather than rational process to make decisions. Recent research in the field of behavioural economics examines how individuals form judgments and make decisions about financial and other aspects of their lives under these conditions of uncertainty and complexity.

Behavioural economics

Behavioural economics has arisen in recent years to challenge the neoclassical model that individuals always act ‘rationally’. Based on clinical and observational studies documenting people’s attitudes and decision-making around money, behavioural economics encompasses work by economists, psychologists and cognitive scientists. Herbert Simon (1957) observed the limitations of time, information and cognitive ability that individuals face in making complex decisions, and coined the phrase ‘bounded rationality’. (Note similarities with the idea of the

‘four-second window’ (Trogu this volume). Citing clinical and observational studies, Tversky and Kahneman published a series of influential papers (1974, 1979, 1981, 1986), defining a number of systematic biases regarding probability and risk. These biases, which most people share, cause them to rely on a set of simplifying heuristics (or rules of thumb) with varying degrees of accuracy. To account for these observed biases, Tversky and Kahneman developed prospect theory, a modification of the neoclassical notion of utility, and explored its consequences for decision-making.

Framing

One factor that influences the less-rational decision-making process is the way that choices are framed. In ‘The framing of decisions and the psychology of choice, Tversky and Kahneman (1981), assert that reliance on frames to interpret information and to make decisions is both significant and empirically verifiable: when the frame shifts, so do decisions. ‘[B]ecause the value function is steeper for losses than for gains, a difference between options will loom larger when it is framed as a disadvantage of one option rather than as an advantage of the other option’ (Tversky & Kahneman 1981: 211).

Richard Thaler, who extended this work to individuals’ behaviour with regard to savings (1980, 1990), describes this theory in the context of consumer behaviour using the following example:

...credit card companies banned their affiliated stores from charging higher prices to credit card users. A bill to outlaw such agreements was presented to Congress. When it appeared likely that some kind of bill would pass, the credit card lobby turned its attention to form rather than substance. Specifically, it preferred that any difference between cash and credit card customers take the form of a cash discount rather than a credit card surcharge. This preference makes sense if consumers would view the cash discount as an opportunity cost of using the credit card but the surcharge as an out-of-pocket cost. (Thaler 1980: 45)

Individuals’ reliance on the ‘frame’ to make decisions is analogous to reliance on visual perspective to make judgments about relative size and position when navigating physical space. As Tversky and Kahneman note, ‘changes of perspective often reverse the relative apparent size of objects and the relative desirability of options’ (1981: 457). Changes in the visual framing of situations can reverse an individual’s thinking about the relative merits of two positions.

This influence of framing is also inherent in the understanding of visual images. O’Toole (1973) constructed a semiotic framework of art analysis by adapting Halliday’s (1985) systemic-functional linguistics to images. As O’Toole noted, when viewers of artworks lack sufficient knowledge or training to appreciate details of representation or composition they tend to interact with and interpret the image through the ‘modal function’ that incorporates issues of ‘gaze’, (the viewer’s) perspective, modality (irony, authenticity, omissions, explicit symbolism, etc.) and framing.

Metaphors also create frames and encourage changes in perspective, articulating what Schön and Rein refer to as ‘cognitive frames’ (Schön & Rein 1994). Consider the two narrative visualizations in Figures 3 and 4. These illustrations have a common subject—that of US taxpayers’ ‘rescue’ of the federal mortgage associations, Fannie Mae and Freddie Mac—but the framing of each is quite different.



Figure 3: ‘Bailout’, Joel Barbee, 7 September 2008.



Figure 4: Bailout cartoon, Heng Kim Song, 2009.

In Figure 3, Fannie and Freddie are depicted as the arms of a drowning man needing to be

saved (‘thrown a lifeline’) by taxpayers. In this illustration, the taxpayer is rescuing the insolvent Freddie Mac and Fannie Mae. The text in the first, ‘we need a bigger boat,’ aligns with the neoclassical model of logical decision-making in that it makes an essentially rational appeal for more capitalization. In contrast, Figure 4 depicts the taxpayer not as empowered rescuer, but as hapless victim. The taxpayer, (shown as a boat), is imminently threatened by Fannie Mae (overweight individual), while Freddie Mac, equally overweight, passively waits to be rescued from the roof of one of many ‘underwater’ houses.

The significant frame shift between the two images is in the ways these agencies are understood. In the first illustration the reference point for Freddie Mac and Fannie Mae is represented by hands of a vulnerable man in urgent need of rescue; in the second Freddie and Fannie are seen as perhaps equally in need of rescue, but undeserving of it, putting their own survival selfishly and recklessly ahead of that of both the underwater homeowners and the U.S. taxpayer. Put another way, in Figure 3 Fannie and Freddie are most at risk; in Figure 4 the U.S. taxpayers are most threatened.

Illustration’s historical importance as a medium for political persuasion is something of a testament to its capacity to shift frames (reference points, perspectives and points of view) through extensive use of visual metaphor.

Two systems thinking

The ‘two systems’ approach to understanding cognition can be seen as a modern version of Aristotle’s logos and pathos (Engbers this volume), or reason and intuition. In its modern form, it is a ‘dual-process’ theory (one that divides cognitive operations into two categories). The terms ‘System 1’ and ‘System 2’ were first used by psychologists Stanovich and West (2000), and subsequently elaborated on by others (cf. Kahneman & Frederick 2002, De Neys 2006). In *Thinking, Fast and Slow*, Kahneman (2011) outlines the differences between System 1 and System 2 thinking with the following table:

System 1	System 2
<p>Intuitive fast automatic effortless <i>without voluntary control</i></p>	<p>Analytical slow careful effortful <i>requires high degree of voluntary control</i></p>
<p>System 1 is particularly good at comparing, averaging, identifying surprises from normal expectations, gauging intensity levels of attributes, and representing sets (of data) as prototypes and norms.</p>	<p>System 2 is particularly good at computational tasks: sums, correlations and statistical tasks. It catches inconsistencies and anomalies in System 1 thinking, but will only be deployed when System 1 thinking encounters a problem it thinks it can't solve.</p>

Table 1: Definitions of System 1 and System 2, Daniel Kahneman, *Thinking, Fast and Slow*, 2011.

System 2 thinking is analytical: it requires a careful consideration of details, and an aptitude for working through and rationally weighing all the options. System 1 thinking is based on heuristics and on intuitive understanding of situations. System 1 thinking is also lazy; as Kahneman notes, thinking rationally is hard work:

(we) gravitate toward the least demanding course of action (because) in the economy of action, effort is a cost, and the acquisition of skill is driven by the balance of benefits and costs. Laziness is built deep into our nature. (Kahneman 2011: 35)

When faced with new information, System 1 thinking creates a fast holistic picture of the situation, often relying on metaphors (whether verbal, conceptual or visual) to provide a rapid sizing up. It uses metaphorical framing to guide the individual's interpretation of the situation and subsequent actions. Cognitive biases occur when System 1 thinking is substituted for System 2 thinking (usually without the decision-maker being aware of it). The cognitive bias toward less effortful thinking is illustrated by the viewer's response to Figure 3. System 1 thinking encourages the viewer to believe that the cost of bailing out Fannie Mae and Freddie Mac imperils public finances; a System 2 analysis of the same event might have reasoned that the total cost of the bailout was \$187 billion (or 31% of total Federal outflows)¹, that the Fed stands to recoup some or all of the money it spent, and that the situation might be more nuanced than the illustration suggests.

Narrative visualization

The authors assert that visual metaphor is central to the effectiveness of financial communication through narrative visualization for the following three reasons:

i. By being visual, illustrative metaphors engage perceptual intuition. Colour, texture, the angle of a gaze, the tilt of a head, all offer very subtle yet unmistakable cues that are understood at the very instant they are perceived. System 1 thinking is primordial: it will instantly detect a sharp look, a change in the environment or a subtle variation in tone of voice. It does this extremely quickly (often in a fraction of a second), and is therefore a cognitive function whose development is strongly related to survival reflexes.

ii. By being metaphorical, illustrations require little new skill acquisition and investment. Conceptual Metaphor Theory demonstrates that individuals already have an available storehouse of embodied understandings of the world (the learning completed since childhood) and have an equally vast repository of the sociocultural understandings gleaned from thousands of hours of listening to others, playing, interacting socially, watching television, acquiring language and being schooled. By activating associative memory, metaphors allow individuals to access what has already been learned (with considerable effort) and to bring together these elements more effortlessly in new configurations and contexts.

iii. Visual metaphors are effective in helping viewers to change a perspective or point of view. These metaphors have not only the capacity to inform, but to influence; therefore, in combination

¹ As reported by ProPublica: Journalism for the Public Interest, <http://projects.propublica.org/bailout/main/summary>. Accessed 31 August, 2013.

with an increased capacity to process cognitively, they also have the capacity to alter attitudes and behaviours.

Part II: Narrative visualization and design education

Design 4: a case study

Purpose

In the Design 4 course at Parsons, students acquire basic communication design skills for engaging and informing through visual means. A dedicated section of this course in spring 2012 encouraged students to extend their inquiry toward using design and metaphor to influence behaviour.

Context

Parsons the New School for Design offers a broad range of design programs, including an undergraduate management program that awards a Bachelor of Business Administration degree. This program (Strategic Design + Management) teaches design-infused management skills to students interested in the application of design-oriented innovation to the operation of business.

In the first two years of the program, students take courses in economics, social theory, marketing, statistics, art history and written communication, as well as a four-course sequence of design studies. The design studies sequence is intended to help students synthesize design with management as they progress through their program. The final course in the design sequence—Design 4—is a continuation of ‘Design 3: Visual Organization and Information Design’, with an emphasis on the latter. The class is studio-based and draws upon previously acquired design and technology skills.

In Spring 2012, The Visualizing Finance Research Lab offered a topic-specific section of this course, called ‘Design 4: Visualizing Finance’. Although students applied knowledge from their economics and statistics courses, the purpose of this course was to teach design rather than financial concepts. The instructor posed questions such as ‘How can information design be used to make sense of a complex world?’ ‘How can we evaluate data, events, processes and organizational systems visually?’ ‘How can information design provide framing that may promote good (or bad) decisions?’ ‘How can it be used to learn something new, tell stories, and build awareness about ourselves and the world we live in?’

Although the Design 4 course was originally configured to teach information design through the graphical representation of data, the explicit purpose of ‘Design 4: Visualizing Finance’ was to teach ‘narrative visualization’. This was an ambitious goal: first because a course based on conventional information design should ideally precede one based on narrative visualization, and second because narrative visualization demands a variety of complex interpretations and analyses, the totality of which are difficult to accomplish within fifteen three-hour weekly class meetings.

The final and principal project in the course was creation of a brief video or animation

depicting a financial decision-making process and incorporating data and financial concepts. This represented The Visualizing Finance Research Lab's first attempt at implementation of some of the design insights described in this paper, beginning to develop and test a methodology for creating narrative visualizations in both academic and professional contexts.

Collaboration

For this project, the Design 4 class partnered with a class called 'Personal and Consumer Finance', at The City University of New York's professional-development evening school for working adults. This CUNY course is designed to train community leaders to work as financial counsellors with individuals in underserved populations.

This partnership encouraged Design 4 students to a more reflective user-centered design process by 'spending time with users/citizens in their own environments, rather than working on a project abstractly in another space' (Manzini, Thackara, Pillonton, cited in Chick 2012), and by recognizing the expertise that resides in those whose interests are affected by the problem and its proposed solution (Chick 2012).

The counsellor-training partnership provided context and content for the design students in several ways. It

- acquainted students with populations different from their own.
- required students to recognize and incorporate cultural and socioeconomic factors outside their own experience.
- gave students live/simulated dynamic representations of financial behaviours and decisions.
- provided a story line based on financial counsellors' experiences with target audiences.

The CUNY class can also be seen as a consumer/client for the completed student work: materials that were intended to be responsive to user needs by being

- culturally relevant to the target populations.
- richer and more emotionally engaging than existing informational materials.
- available to individual; also for use in counselling, education or training sessions.

The partner's expected field usage of these materials can in future provide opportunities for critique from trainers, practitioners, and end users; also opportunities for assessment of the materials' effectiveness.

Background of Partner

The 'Personal and Consumer Finance' course was originated and developed by Joyce Moy, an educator/activist/attorney who has extensive experience developing support structures for underserved populations. Ms. Moy's textbook makes substantial use of practical examples and role-plays drawn from her experiences and financial counsellors'. In several class sessions, her students engage in a role-play that simulates a counselling session on a specific financial topic with related behaviours. Each role-play is a complex and multifaceted encounter, organized in a narrative form to train the counsellors across multiple dimensions, such as

- empathy and interpersonal communication (through body language, tone of voice and linguistic choices for dialog).
- command of information and reference to available resources.
- analysis of data, financial analysis and planning.
- decision-making ability.
- ethical/legal integrity.

The instructor and students, who assess the counsellor's emotional intelligence and command of factual information, as well as the psychological, discuss the simulated session and cultural factors involved in the clients' problems, behaviours and possible solutions.

Methodology

Selected students from the Design 4 class visited the 'Personal and Consumer Finance' class as observers to familiarize themselves with the target populations, financial concepts and the purposes of financial counselling. In a subsequent visit, Design 4 students and instructor videotaped a simulated counselling session.



Figure 5: Video still from financial counseling role-play in 'Fin 180, Personal and Consumer Finance', March 2012.

The role-play scenario concerned a young couple that is consulting the financial counsellor because they want to marry; however, the man's father had accumulated credit card debts in the son's name and the son's credit score was badly compromised. This situation was affecting the couple's decision to marry, and potentially affecting their plans for a family and home.

Back in the Parsons classroom, Design 4 students were provided with a printed script of the role-play and with uploaded versions of the videotape. The students formed groups of two or three to process the information and to draft narrative and visual strategies for interpretation of the material. Instructors from The Visualizing Finance Research Lab briefly explained the financial content and context of the role-play. Students were then asked to present financial concepts and stories directly through explication (text, graphs and dialog) and metaphorically through the creation of characters, settings and story line. Specifically, students were required to create

a narrative, time-based representation of the financial scenario, identifying and incorporating the following content elements and visualization elements:

Content Elements

Financial factors

- Data: information, such as numbers, budgets, facts
- Information
- Concepts: time value of money, negotiation, legal information such as policies, loan terms etc.

Behavioural aspects

- Consequences: financial and emotional
- Decision processes: negotiation skills, strategies and methods
- Ethics: the right/wrong thing to do
- Culture: norms, expectations and understandings within a community
- Emotion: personal and subjective factors such as relationships, loyalties, opinions

Visualization Elements

- Graphs/maps
- Text: on-screen text/data
- Dialogue: monologue, verbal explication (through characters or voiceover)
- Setting: staging, including objects and props
- Character: including archetype(s)/metaphor(s)
- Body language, expressed by character(s)
- Facial expression, expressed by character(s)
- Tone of voice, expressed by voiceover and/or by character(s)

Table 2: Narrative visualization elements.

These elements provided a framework for analyzing student work through the lens of the ideas presented in Part I. The content elements combine standard elements of financial literacy with insights from behavioural economics, and are arranged roughly in descending order from more analytical (or System 2) to more intuitive (or System 1). The visualization elements include crucial narrative factors and are similarly ordered. (This suggests that graphical elements are more aligned with financial concepts, while character and setting lend themselves more naturally to the depiction of behavioural and cultural aspects.) Elements such as genre and composition were omitted because the table is intended to identify only those elements that drive narrative visualization. Aside from the reference under ‘character’, metaphor is not explicitly listed since it operates across the table, creating bridges between content and visualization elements. For example, metaphor can communicate a financial concept in the form of a character, as

seen in Figure 4’s metaphor of a ‘bloated bureaucracy’ (Fannie Mae) as an overweight woman.

Use of metaphor helped students balance narrative aspects (dialog, situation and emotional tenor) with practicalities (financial data and choice options) in their story-telling. Students came to understand that ‘real-world’ financial situations incorporate a complex layering of frames—behavioural/emotional and cultural/familial, as well as the more pragmatic or information-based—and that these situations often arise from decisions that are intuitive rather than analytical/rational.

The Design 4 students had to reduce a 12½-minute role-play into a 3½-minute clip. They prioritized information, condensing some aspects while allowing time to elaborate on others. These students also had to choose the type of story to craft—their characters, settings and props—and the way to activate elements within a narrative arc. They found the development of characters to be a complex process, intertwined with the physical setting of the story.

In the analysis below, the authors use the elements in Table 2 to assess a student project’s success in fulfilling criteria for an effective narrative visualization.

Outcome

This project is a 3:12-minute key-frame partially animated narrative with sound and voiceover. The visual style uses simple vector-based graphics (similar to those used in the television animation South Park) over photographic montages that range from the interior of a church to a collage of credit cards. Some personae are represented metaphorically in memorable ways: Tom as a frightening vampire and Tom's father as a blood-sucking mosquito who drains (transforms) Tom's credit score. Eventually the students’ efforts to resolve Tom’s credit problem lead to a ‘brick wall’, necessitating additional reflection and research.



Figure 6: Still frames from ‘Tom and Jen: A Credit Story’, Brianna Morris and Elizabeth Shupe, May 2012.

This project scored quite high on the ‘visualization elements’ relating to System 1. Behavioural aspects are clearly communicated through the characters (the disappearing groom, the predatory father), their facial expressions and their tones of voice. The visualization engages with financial concepts and behavioural consequences to a limited degree, but is slight to non-existent on imparting financial information and data. The viewer never learns, for example, how a credit score is calculated, what credit-score numbers mean, and what the consequences of having a low credit score are. Stronger aspects in this project were the (metaphorical) personification of Tom’s father as a mosquito, and the ethnically and culturally relevant characterizations and setting. However, the lack of props and other design elements that would indicate more specificity in the setting (further underscoring cultural factors) were a missed opportunity, as was the lack of articulation of the character’s bodies, which limited their expressive ability.

Findings and next steps

Use of the elements in Table 2 has helped to illuminate the relationships among visualization elements, financial factors and behavioural aspects. It also served to highlight current shortcomings in student projects. Future iterations of the Design 4 course will offer opportunities to provide additional support to students in incorporating financial concepts, and to refine both the elements of Table 2 and its use as an assessment tool.

The framework created by Table 2 may also be useful in analyzing published narrative visualizations depicting financial information of the kind discussed in Part A. For example, if we apply it to Figure 1, the primary message involves financial concepts (the nature of credit) as they are manifested in behavioural terms, through emotional factors. These ideas are delivered largely through setting, character, body language, and facial expression.

References

Bounegru, L. and Forceville, C. (2011), 'Metaphors in Editorial Cartoons representing the global financial crisis', *Visual Communication*, 10(2), pp. 209–229.

Cassanto, David (2009), 'When is a Linguistic Metaphor a Conceptual Metaphor', in V. Evans & S. Pourcel (eds.), *New Directions in Cognitive Linguistics*, Amsterdam: John Benjamins, pp.127-145.

Cassanto, David (2010), 'Good and Bad in the Hands of Politicians: Spontaneous gestures during positive and negative speech', *PLoS ONE*, 5(7), e11805.

Cassanto, David (2013), 'Experiential Origins of Mental Metaphors: Language, Culture, and the Body', in M. Landau, M.D. Robinson & B. Meier (eds.), *The Power of Metaphor: Examining its Influence on Social Life*, Washington, DC: American Psychology Association Books.

Chick, Anne, (2012), 'Design for social innovation: emerging principles and approaches', *Iridescent: Icoграда Journal of Design Research*, 2(1), pp. 52-64.

De Neys, Wim, (2006), 'Dual processing in reasoning two systems but one reasoned', *Psychological Science*, 17, pp. 428-433.

El Refaie, E., (2003), 'Understanding Visual Metaphor: The Example of Newspaper Cartoons', *Visual Communication*, 2(1), pp. 75–95.

El Refaie, E., (2009), 'Metaphor in Political Cartoons: Exploring Audience Responses', in C. Forceville & E. Urios-Aparisi (eds.), *Multimodal Metaphor*, Berlin: Mouton de Gruyter, pp.173–96.

Engbers, Susanna Kelly, (2014), 'Branded: the sister arts of rhetoric and design', (this volume).

Forceville, Charles, (1996), *Pictorial Metaphor in Advertising*, London: Routledge.

Forceville, Charles, (2008), 'Metaphor in Pictures and Multimodal Representations', in R.W. Gibbs, Jr (ed.), *The Cambridge Handbook of Metaphor and Thought*, Cambridge: Cambridge University Press, pp. 462–82.

Halliday, M.A.K. (1985), 'Systemic Background', J. Benson & W. Greaves (eds.), *Systemic Perspectives on Discourse, Volume 1: Selected Theoretical Papers from the 9th International Systemic Workshop*, Norwood: Ablex.

Kahneman, Daniel and Frederick, Shane, (2002), 'Representativeness Revisited: Attribute Substitution in Intuitive Judgement', in T. Gilovich, D. Griffin & D. Kahneman (eds.), *Heuristics and Biases: The psychology of intuitive thought*, New York: Cambridge University Press, pp. 49-81.

Kahneman, Daniel, (2011), *Thinking, fast and slow*, London: Penguin.

Koller, Veronika, (2009), 'Brand images: Multimodal metaphor in corporate branding messages', in C. Forceville & E. Urios-Aparisi (eds.), *Multimodal Metaphor*, Berlin: Mouton de Gruyter, pp. 45-72.

Lakoff, George, (2008), *The political mind: why you can't understand 21st-century American politics with an 18th-century brain*, New York: Penguin.

Lakoff, George, (2011), 'The contemporary theory of metaphor', in A. Ortony (ed.), *Metaphor and Thought*, 2nd ed., Cambridge: Cambridge University Press, pp. 203–204.

Lakoff, George and Mark Johnson (1980), *Metaphors we live by*, Chicago: University of Chicago Press.

O'Halloran, Kay L (1999), 'Interdependence, Interaction and Metaphor in Multimodal Discourse', *Social Semiotics*, 9(3), pp. 317-354.

O'Toole, Michael (1990), 'A systemic-functional semiotics of art', *Semiotica*, 82-3/4, pp. 185-209.

Pepper, Stephen (1942), *World Hypotheses*, Berkeley: University of California Press.

Reddy, M. J. (1979), 'The conduit metaphor: A case of frame conflict in our language about language', in A. Ortony (ed.), *Metaphor and Thought*. Cambridge: Cambridge University Press, pp. 284–310.

Schön, Donald and Martin Rein (1994), *Frame reflection: toward the resolution of intractable policy controversies*, New York: Basic Books.

Segel, Edward and Jeffrey Heer, (2010), 'Narrative visualization: telling stories with data', *IEEE Transactions on Visualizations and Computer Graphics*, 16(6), pp.1139-1148.

Simon, Herbert (1957), *Models of Man*, New York: Wiley.

Sosa Tzek, Omar, Beck, Jordan E. and Siegel Martin A (2014), 'Building the Narrative Cloud: Reflection and Distributed Cognition in a Design Studio Classroom', *DRS Cumulus Oslo 2013: Proceedings from the 2nd International conference for Design Education*, Oslo: International Association of Universities and Colleges of Art, Design and Media, pp. 2160-2174.

Stanovich, Keith and Richard West (2000), 'Individual differences in reasoning: implications for the rationality debate', *Behavioural and Brain Sciences*, 23, pp. 645-65.

Thaler, Richard (1980), 'Toward a positive theory of consumer choice', *Journal of Economic Behaviour and Organization*, 1, pp. 39-60.

Thaler, Richard (1990), 'Anomalies: Savings, Fungibility, and Mental Accounts', *Journal of Economic Perspectives*, 4(1) (Winter, 1990), pp. 193-205.

Tracey, Monica and Baaki, John (2014), 'Design, Designers and Reflection-in-Action', in B. Hokanson & A. Gibbons (eds.), *Design in educational technology: Design thinking, design process, and the design studio*, New York: Springer Publishing, pp. 1-13.

Trogu, Pino, (2014), 'The four-second window: how the time constraint of working memory and other psychological principles determine the success of a graphic design', (this volume).

Tversky, Amos and Kahneman, Daniel (1974), 'Judgment Under Uncertainty: Heuristics and Biases', *Science*, 185, pp. 1121-1134.

Tversky, Amos and Kahneman, Daniel, (1979), 'Prospect Theory: An Analysis of Decision Under Risk', *Econometrica*, 47(2), pp. 263-292.

Tversky, Amos and Daniel Kahneman (1981), 'The framing of decisions and the psychology of choice', *Science*, 211(30), pp. 451-458.

Tversky, Amos and Daniel Kahneman (1986), 'Rational Choice and the Framing of Decisions', *Journal of Business*, 59, pp. S251-S278.