DEPARTMENT: ART ON GRAPHICS

Six Years of Pursuing Value in Art-Science Collaborations

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In the spirit of this fortieth anniversary of the first issue of Computer Graphics and Applications, we attempt to assess the value of the first six years of the Art on Graphics department – and its regular column which seeks to share promising art-science work processes and results to enlighten and perhaps inspire CG&A readers.

Six years ago this month, our first *Art on Graphics* article offered a perspective on pursuing value, highlighted some work to visually engage potential authors, and committed to pursue value in order to help readers expand their thinking on value and how value can come from art-science collaborations [1]. In doing so, we encountered collaborators working with different processes, producing content via varied sensory media, who offered to share the results of their work along with feedback received from those who experienced their work.

We suggested we would start by mapping the work we highlighted into a 3-D information space with axes comprising three continuums: 1) the intent of the work from art to science, 2) the breadth of the data involved from narrow to broad, and 3) the sensory result from physical to virtual. Our hypothesis was we'd provide more value by populating the volume fully. In this article, we present an updated interactive infographic of our subjective placement of the work covered since that January 2015 article. But before sharing and discussing that, we offer some perspective we gained through working with the authors of submitted papers, interviewees, and invited authors we targeted.

An Articles Review

The ATLAS installation that Ruth West shared with us represented what we considered to be a familiar form of art-science collaboration. She presented the process by which trained artists collaborated with trained scientists to share a process that resulted in an ethereal and dreamlike immersive 3D environment wherein an audience can explore life-size rendering of the Global Ocean Survey (Jan-Feb 2015). The work fits into a broad category of work that both enables awareness of, and motivates investigation into, climate change.

Figure 1 – Wordle word cloud from first six years of Art on Graphics articles. The words art, artists, science, and scientists appear of significant size. The words together and collaboration appear smaller as a result of less use.

Karin von Ompteda and Kevin Walker's work on translating the quantum world to human scale provided another example of how artists and scientists can come together to create art-inspired experiences to make hard-to-grasp scientific concepts approachable for audiences (May-Jun 2015).

Victoria Vesna's work on *Noise Aquarium* and *Bird Song Diamond* offered evidence that an alternative art-science process can enable awareness of where and how science is progressing on climate assessment. In her case, collaborations grow over long periods of building trust with collaborators and those relationships then evolve into engaging audience experiences (July-Aug 2019).

David Goodsell's work painting images of the inside of cells, as well as other molecular scale objects, provided evidence that long-term art-science relationships can bear both eye-pleasing art while contributing to the scientific process by facilitating insight and suggesting possible hypotheses worth exploring (Nov-Dec 2016).

Sally Weber's work on *Lightscape*, *Focal Point*, and *inFLUX* demonstrated the value an artist can provide in collaborations with scientists by staying focused on a particular perspective of seeing for a long time (May-Jun 2018).

Andrea Polli went as far as to coin the term *slow vis* in sharing her *Particle Falls*, *E-Oculus*, and *Skylight* climate-related work with collaborations that she

suggests benefits greatly from slowing down the work generation process (Nov-Dec 2015).

Nathalie Miebach (Jan-Feb 2015) and Dennis Hylinsky (Jul-Aug 2015) demonstrated how one can follow one's own personal, long-tailed passions for visualizing phenomena that could provide insight on climate change, but which require follow-up discussions with scientists to help frame the questions that emerge from their process. Spending adequate time with the products of their artistic work initiated questions, and a shared frame of reference, we could then pursue to satisfy our desire to understand.

Dietmar Offenhuber inspires us with his well-thought out arguments regarding physical data, obtained in the pursuit of understanding climate, as valuable traces that can have long-tail relevance to a wider user base. His work makes us question the data acquisition and publishing process from start to finish (Sep-Oct 2020).

Eleanor Lutz (Jan-Feb 2019) and Morgan Barnard (Nov-Dec 2018) surprised us when sharing their processes of visualizing large vetted data sets in the public domain, without any engagement with the scientists who discovered and/or documented the data. Although they diverge widely in the media they use, they convince us how motivational and useful their process is to them for investigating their own interest in climate perspectives. The results look and inspire us differently than what we'd expect from scientific training and practice alone.
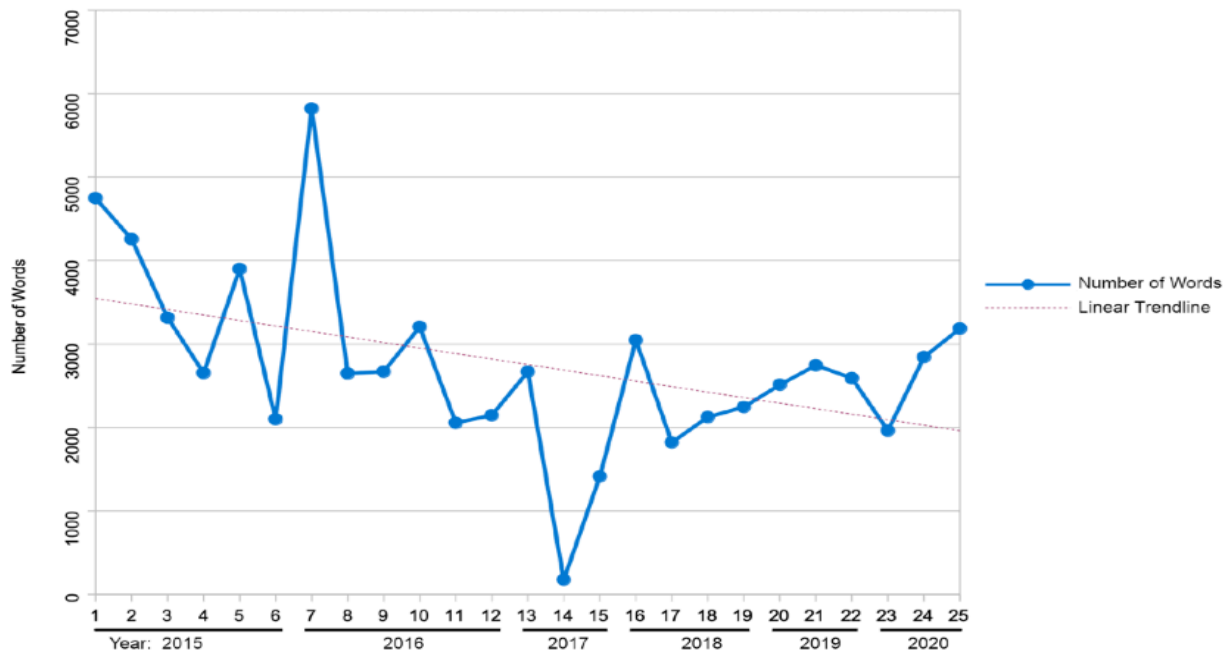

Figure 2 – Word count for Art on Graphics department articles covering January 2015 - December 2020

On the subject of communicating differently, we have come across performance-based presentation techniques from live theater infused with virtual reality and augmented reality (Mar-Apr 2018) to hearing-infused experiences (May-Jun 2019) and comic strip deliverables (May-Jun 2017).

By mixing in a distinguished historian, Tom Chandler and Adam Clulow showed how art-science context can be provided by a virtual reconstruction of lost societies back in a time when climate was different than it is today (May-Jun 2020).

Haru Ji and Graham Wakefield's work on *Fluid Space*, *Time of Doubles*, and *Archipelago* (Jan-Feb 2016), as well as Pedro Cruz and Penousal Machado's work on *A Figurative Approach to Traffic Visualization* (Mar-Apr 2016), highlighted possible value-added methods in taking successful visualization techniques from science sub-domains and applying the techniques to visualize data in a new sub-domain.

Less Words More Images

We examined the frequency of words across all the articles, displaying them in a word cloud generated by Jonathan Feinberg's popular Wordle generator (www.wordle.net). Figure 1 shows the results. The word cloud helps us assess whether the articles fit within the departmental guidelines we post online [2]. Data and visualization appear large, not surprisingly, and the words work, design, see, art, artists, science, time, different, process do indeed align with the intent for creating the department. We hoped the readership would consider different processes that emerge from trained and experienced artists and scientists collaborating together over time.

We examined the number of words across all articles by generating a time series with linear trend line (Figure 2). As it took time for Art on Graphics to become familiar to the CG&A community, we worked initially with paper submissions from other targeted publications that needed a home we could provide. Those papers were more wordy than we intended a column that focused on art to be and we worked as editors to cut down on the number of words to focus on visual expression.
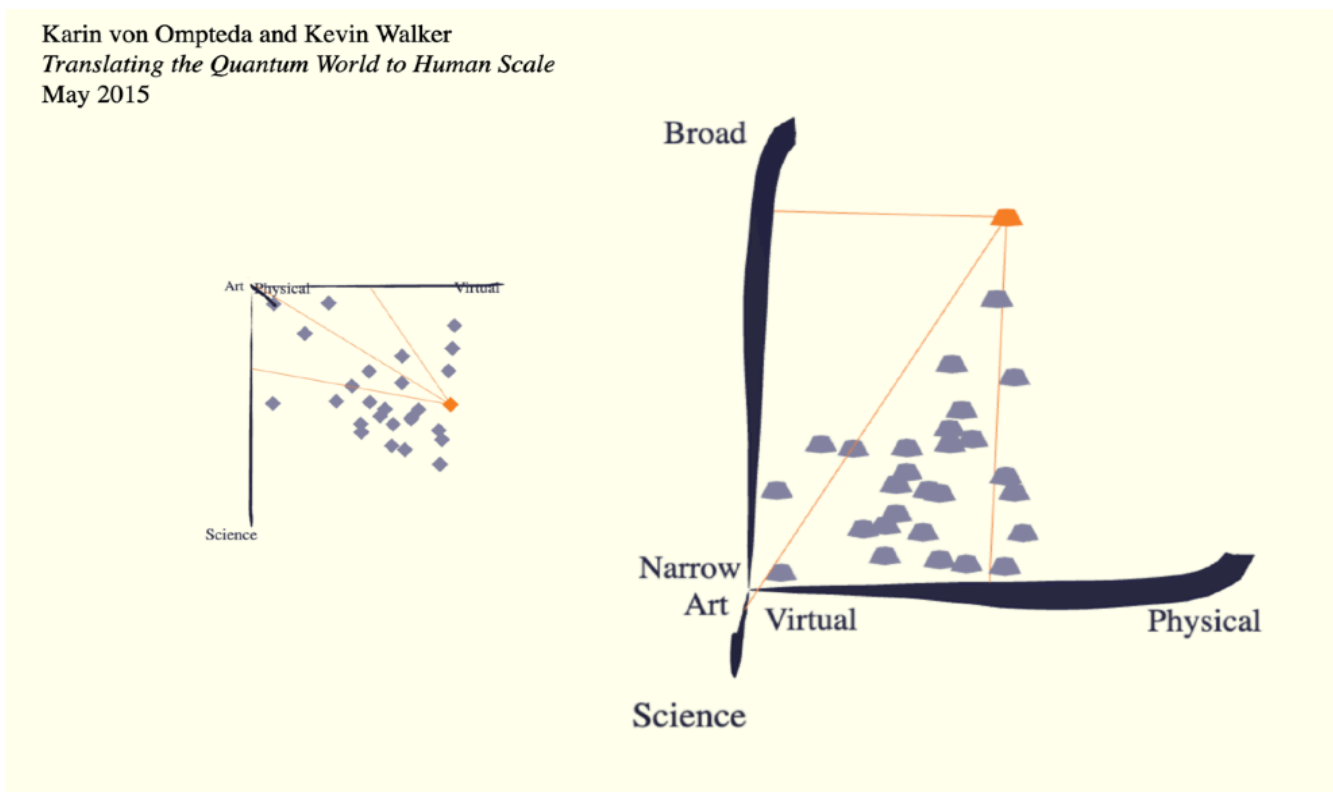

Figure 3 – Placement of Art on Graphics departmental articles referenced work in the 3-D infospace–interactive version at bdcampbell.net/ieee/cga/aog vis.html. The smaller inset on the left shows a top-view of two dimensions, suggesting a slight bias towards art compared to science.

The word count bottomed out on on article on data comics (where words were instead incorporated into the imagery as an innovative demonstration) and has been creeping up slowly since we have found relationships between art and science that require the context words provide. We expect to get better at reducing the number of words as new ideas get expressed over time, as we target less words and more images. In the 25 articles represented in figures 1 and 2, we have printed 68,843 words of body text for an average number of 2753.72 per article. That average seems reasonable as a long-term goal of communicating art-tech-science context through articles, but we aim to inspire experiments in other forms of communicating.

An Interactive Infospace

Following an idea we introduced in 2015, we expanded the 3-D visualization to include all the work from art-tech-science work highlighted in the *Art on Graphics* department through 2020 (see figure 3).

Looking at our subjective placement of glyphs within the three dimensions (the intent of the work from art to science, the breadth of the data involved from narrow to broad, and the sensory result from physical to virtual), we notice our collection spreads out within the volume except in the spaces at the broad end of the narrow-broad dimension and science end of the art-science dimension. We also notice that highlighted work is more art than science, but that's become our intent over time.

The interactive version provides clickable glyphs for better consideration of the placement of work within the volume.

Six years provides us a first perspective on the body of work of the Art on Graphics department. This department represents the *CG&A* editors' ongoing commitment to sharing interesting art-tech-science innovations infused in work relevant to the magazine's community. We welcome contributors from all art-tech-science teams and individual contributors and hope we will continue to share their work as useful to our readership for many more years to come.

References

[1] Campbell, B. D., Samsel, F. (2015), "Pursuing Value in Art-Science Collaborations", IEEE Computer Graphics and Applications, vol. 35, no. 1, 2015, pp. 6–11.

[2] CG&A Department Guidelines, Art on Graphics, https://www.computer.org/csdl/magazine/cg/write-for-us/15472?title=Department%20Guidelines&periodical=IEEE%20Computer%20Graphics%20and%20Applications

Appendix A

List of all the AoG articles included in the visualization:

Jan-Feb 2015: Pursuing Value in Art-Science Collaborations (4747)
Ruth West, Nathalie Miebach, Julia Buntine

Mar-Apr 2015: Gestalt Principles in Multimodal Data Representation (4256)
Muhammad Hadiz Wan Rosli and Andres Cabrera

May-Jun 2015: Translating the Quantum World to Human Scale: An Art-Science Collaboration (3315)
Karin von Ompteda and Kevin Walker

Jul-Aug 2015: Murmurations: Drawing Together Art, Visualization, and Physical Phenomena (2653)
Dennis Hlynsky

Sep-Oct 2015: Imagining Macondo: Interacting with García Márquez's Literary Landscape (3898)
Angus Graeme Forbes, Andres Burbano, Paul Murray, George Legrady

Nov-Dec 2015: Slow Vis: Extending Opportunities for Insight and Understanding Over Time (2099)
Andrea Polli

Jan-Feb 2016: Endogenous Biologically Inspired Art of Complex Systems (5820)
Haru Ji and Graham Wakefield

Mar-Apr 2016: Pulsing Blood Vessels: A Figurative Approach to Traffic Visualization (2647)
Pedro Cruz and Penousal Machado

May-Jun 2016: Immersive Visualization to Support Scientific Insight Bruce Campbell (2669)

Jul-Aug 2016: Designing for Insight: A Case Study from Tennis Player Analysis (3205)
Kim Albrecht and Burcu Yucesoy

Sep-Oct 2016: Spectral Landscapes: Visualizing Electromagnetic Interactions (2056)
Brett Balogh, Anıl Çamcı, Paul Murray, and Angus G. Forbes

Nov-Dec 2016: Using Art to Visualize Cellular Environments David Goodsell (2146)

Jan/Feb 2017: A Generative Approach to Chinese Shanshui Painting Weili Shi (2668)

May/Jun 2017: The Emerging Genre of Data Comics (176)
Benjamin Bach, Nathalie Riche, Sheelagh Carpendale, Hanspeter Pfister

Sep/Oct 2017: "Coming Into Focus: An Interview with Ellen Jantzen Ellen Jantzen" (1413)

Mar 2018 "Interaction, Narrative and Animation in Live Theatre" (3046)
Andrew Bluff, Andrew Johnson, David Clarkson (Univ. of Technology-Sydney, Stalker Theater)

May 2018 "Sally Weber: Making Art from Light" (1821)
Sally Weber (Resonance Studio)

Jul 2018 "Weather Report: A Site-Specific Artwork Interweaving Human Experiences and Scientific Data Physicalization"
Daniel Keefe and 8 others, (University of Minnesota, MINN_LAB)

Sep 2018 "Data Tectonics: A Framework for Building Physical and Immersive Data Representations"
Carmen Hull, Wesley Willett, (University of Calgary)

May 2019 "Lance Gharavi: Performance Inspired Science + Technology" (2512)
Interview article by Bruce and Francesca (on Lance's work at Arizona State University)

Jul 2019 "Victoria Vesna: Inviting Meaningful Organic Art-Science Collaboration" (2745)
Victoria Vesna (University of California, Los Angeles)

Nov 2019 "Morgan Barnard: Melding our Environment and the Unseen Supplied with Data"
Morgan Barnard (from his Santa Fe, New Mexico, studio)

Jan 2020 "Eleanor Lutz: Making Art From Public Data" (1963)
Eleanor Lutz, University of Washington

May 2020 "Modeling Virtual Angkor: An Evolutionary Approach to a Single Urban Space" (2843)
Tom Chandler, Monash University Adam Clulow, University of Texas-Austin

Sept 2020 "Dietmar Offenhuber: Collaboration Via the Many Traces Our Data Sets Leave Behind" (3185)
Deitmar Offenhuber, Northeastern University

About the Author

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