NOT ME: COLLABORATION AND CO-PRODUCTION WITH LANGUAGE PROCESSING SYSTEMS

Robert Twomey
Visual Arts Department, University of California, San Diego
9500 Gilman Drive 0037
La Jolla, CA 92093
202-997-3952
rtwomey@ucsd.edu

ABSTRACT

This paper explores the use of language processing technologies for interactive artwork and studio art production. I consider text in multiple roles: as data, as index, and as a medium for interaction. After describing initial efforts with a dysfunctional chatbot, I discuss my recent work with language processing in the creation of studio art objects, and speculate about the extension of those techniques to address the large corpora of personal media we accumulate online.

Categories and Subject Descriptors

I.2.7 [**Artificial Intelligence**]: Natural Language Processing– *language generation, language parsing and understanding, text analysis.*

General Terms

Algorithms, Experimentation, Human Factors.

Keywords

language aware computing, personal data, natural language processing, information retrieval.

1. INTRODUCTION

The goal of this work is to develop software capable of rich, meaningful interaction, both in the gallery and in the studio. Towards this end, I have focused on text-based interaction with systems driven by personal data.

I have chosen text-based interaction for a number of reasons. As a low-bandwidth medium, text is rich in information while simultaneously very open to interpretation. Text is ubiquitous as a means of describing other media (through naming, tagging, and annotating) and thus an ideal meta-data and index. And finally, given an intermediate role in the creative process, text provides a means of dealing with questions of content separate from questions of surface, appearance, and visual form.

The projects described below all process data in some way. The data that interest me are large, unstructured sets of personal media: photos, video, text, or audio. This is the material we produce every day—with digital cameras, e-mail exchanges, and status updates—and it is the material with which we describe and document ourselves. The essential question for me, as an artist, is how to create engaging experience from this abundance of material. I see this as an information processing task as much as an artistic/creative one, and my approaches utilize tools of text analysis and generation.

My ideal work functions for two audiences simultaneously—for the artist, with their intimate knowledge of a piece's mechanics and construction, and for the viewer approaching from the outside. While these two target audiences seem distinct, I believe that distinction collapses with a certain kind of framing—where the artist and viewer are equals, user/operators relating to a computational other. This paper describes initial efforts I have made and concludes with future directions of development.

2. TEXTUAL INTERACTION

The first project, Megahal Grandmommy, is an an exploration of text-based interaction which touches on the ideas of personal data and meaningful interaction mentioned in the introduction. Megahal Grandmommy is a chatbot trained as a surrogate for a loved one suffering from Alzheimer's disease. It is a conversational chatbot, similar to any number of others (ELIZA, ALICE, and Jabberwacky [19, 18, 7]).

This project developed as a reaction to my grandmother's diagnosis with Alzheimer's disease at a point when I lived far from her. I constructed this program to serve two purposes: to function as a conversational partner (and proxy for my grandmother) in unpacking concerns for her situation, and to draw an analogy between machinic dysfunction and my grandmother's mental decline.

For the initial phase of the project I composed a body of text from the point of view of my grandmother, capturing biographical information and a description of her situation. This material was used as training data to give the chatbot software its initial characterization (building forward and reverse Markov models as described by its creator, Jason Hutchens [6]). I then carried on an a series of conversations with the software, resulting in two products: a transcript of my conversations with the program, and an evolved, enriched artifact the program had become through our interactions. It is this developed artifact which I have subsequently exhibited for viewer interaction.

Where ELIZA and ALICE use hard-coded pattern matching to respond to user input (detailed in [19] and [18]), Megahal relies on statistical models of text to construct its outputs. Internally, the program utilizes two 4-gram Markov models to generate responses to user input [6], a method described by Claude Shannon in 1948. [12]

As opposed to pattern matching templates where responses are hard-coded prior to use, the Megahal program learns from language it encounters in the course of interaction. All input text is added to the developing internal models, and subsequently used as material to build possible responses. When the user types in a question or statement, the program parses the input for key terms, then builds a response from the forward and reverse Markov models (full discussion in [6]), giving responses that are frequently topical but also typically disordered.

Hutchens succinctly describes the effect of interaction with his program: "MegaHAL generates gibberish mostly; but occasionally, by pure coincidence, it will reply appropriately, in context. It is these occasions that stick in the mind..." [6]. This corresponds with my experience with the program: the piece appears to respond—if not like a healthy individual, then possibly like an unwell one. Viewers react to this appearance of lucidity, attending to moments of salience in conversation, and excusing the moments of breakdown as something like the product of disease.

The effect of this system is dependent on sustaining a framing narrative: the dysfunctional Artificial Intelligence as surrogate for a disordered mind. It is this framing that exploits the viewer's predisposition to attach significance to the program's utterances. These effects function equally as well for me, as the artist (having built, trained, and tinkered with the piece), as for the audience.

3. TEXT AS INDEX

My current work with text processing grows from a concern with the creative studio process. A frequent note-taker and brainstormer, fixated on processes of creative thought, I was looking for a way to represent a broad range of diverse materials in a common format: including ideas, images, and physical materials. Having created this uniform representation, it would be possible to analyze my interests and ideas, looking for consistency, and create generative models which draw on these materials.

I arrived at the idea of textual indices as a solution: similar to the tags, names, and annotations we give to personal media—and including the sort of information we casually record in sketchbooks, exchange in online chats, send in e-mails, or post on blogs. For example, here are the top listings from my index of unassigned materials—materials with potential which I have not yet utilized in sculpture:

unassigned materials

railroad ties.
tar paper.
red charcoal grill.
plaster.
paint.
charcoal dress suit, shoes, belt, ties.
spring rocking horse.
paper bags
… [16]

Clearly, these items are specific objects which can be acquired in the world, and deployed in an art work. Other lists include annotated video clips, labelled photos, lists of people, places, and things.

Together these lists are a collection of potential, inspiration, points of interest in the world, and possible art ideas. Have assembled these indices, I could then commence with later phases of data analysis, an oblique approach to self-knowledge: assuming that you are not able to draw accurate conclusions about yourself, gather data which describes you, and analyze it. The next section summarizes approaches to analyzing this textual data.

4. ANALYSIS

One way to query a large textual dataset is in terms of part of speech features. Given a collection of text, we can extract action terms (verb phrases), and objects, people, places, characters, and locations (noun phrases). In NLP literature this is accomplished through Part of Speech (POS) tagging of the raw text, and subsequent pattern matching of tagged terms.

Taking the various texts I have assembled (described in the previous section), I used the Penn Treebank Tagger implemented in the Natural Language Toolkit (NLTK [9]) to extract noun and verb phrases, as detailed below. Finally, I briefly discuss an alternate method of summarizing a dataset in terms of sub-groupings of related words.

4.1 Verb Phrases

Richard Serra laid out such a space of action for himself in 1967-8, with his "Verb List Compilation: Actions to Relate to Oneself" [11]. Rather than composing a list, we can extract one my preexisting body of text: bi-gram verb phrases of the form "to VERB". Sorted by frequency, here are the top 10 and bottom 10 terms extracted from my dataset (with frequency of occurrence):

to be 26
to do 10
to make 10
to get 9
to have 9
to go 9
to move 6
to develop 5
to come 5
to figure 5
…
to philosophize 1
to lead 1
to die 1
to eat 1
to incorporate 1
to fill 1
to use 1
to medicine 1
to find 1
to implement 1

These extracted terms function as evocative language, suggesting actions and physical manipulations. They are also a representation of the source text as a collection of actions. In Serra's case, the verb phrases were used as operations when he then enacted on physical materials, and subsequently documented. The phrases "to catch", "to fold", "to splash" become a short film of a hand grabbing a falling bar, a sheet of lead formed into a sculpture, or molten lead flung at the wall. These brief textual statements were interpreted by the artist as actions, producing sculptures which foreshadowed material strategies he continued to explore in later work.

Distilling a text to a set of actions is an interesting gesture, and suggests a physical operations. Having done this with my textual database, I am exploring possibilities for enacting my own terms.

4.2 Noun Phrases

We commonly encounter noun-phrase extraction in the Amazon web store. For full-text books, Amazon displays two sets of noun features as a kind of document summary: Statistically Improbable Phrases (SIPs) and Capitalized Phrases (CAPs)[2][1]. Statistically Improbable Phrases are calculated against the distribution of phrases across the entire corpus of Amazon full-text books, and Capitalized Phrases are identified through their (rather obvious) surface traits, capitalized first letters of words.

For example, Amazon's summary of the book Unit Operations by Ian Bogost is as follows:

> SIPs: “simulation fever”, “cybertext theory”, “figure that fascinates”, “complex network theory”, “conditional control transfer”, “gameplay experience”, “game engines”, “game studies”, “unit operations”, “archive fever”, “wandering rocks”, “game design”, “object technology”.
>
> CAPs: “Sim City”. “Father Conmee”, “Hot Date”, “Janet Murray”, “Wind Walker”, “Thousand Plateaus”, “United States”, “Will Wright”. “Human Genome Project”, “Liberty City”. “Paul Starr”, “Stephen Wolfram”, “Chris Crawford”, “Corny Kelleher”, “Gonzalo Frasca”, “Star Wars Galaxies”, “Espen Aarseth”, …

These bi-(and tri-)grams are representative features of the source. The CAPs are proper nouns—people, places, and things, and the SIPs are unique (and probably significant) bi- and tri-grams from the text.

Extracting CAPs or other types of noun phrases or named entities (another common IR problem, Named Entity Recognition) from source texts seems an interesting way to seed creative spaces.

It is easy to imagine employing CAPs (and other proper nouns) in any number of uses: as characters in narrative fiction, props in performance, locations/sites for situated media projects, captions for photographs, or people to interact with. Named entities are points of contact between a text and the outside world.

4.3 Relatedness Measures

A final form of analysis I am currently developing uses relatedness measures on extracted nouns and verbs to accomplish document summarization. Taking a set of nouns or verbs from a text, I calculate the mutual relatedness between every pair of terms using the Resnick relatedness measure [10], based on information content.

Having calculated and normalized these relatedness values, closely related sub-groupings of terms can be identified in the original datasets. I treat these groupings as content fixations expressed by the artist, and in future work would like to use this data to more closely focus the generative algorithms discussed below.

5. GENERATIVE TEMPLATES

Keith Tyson created a system for collaborative studio production in the 1990s with his Artmachine. [5] This project was a generative idea system which randomly populated fields of an art template to produce recipes for objects to fabricate. These objects could be two or three dimensional works of art, in a variety of media and forms.

His structure of an art object, as represented in his Artmachine iteration sheets[17] is:

> Iteration: *Art Machine Iteration (AMCHII) #*
> Title:
> Format: *sculpture, mixed media, painting, framed print, installation, performance...*
> Status: *proposed, fabricated, exhibited*
> Size / Duration: *dimensions, length of time*
> Untitled number: #
> Series & Editions: *unique, edition of #*
> Hanging Specs: *wall, floor, corner floor, on platform against wall...*
> Location/Site: *any, seabed, specific locations...*
> Documentation:
> Date: *when realized*
> Conditions:
> Other Variables:
> Brief Description of Proposed Work / Reproduction of Finished Work:
> Notes:

I would establish my own template something like this:

```
<title> </title>
<subject> </subject>
<dimensions>
    <spatial> ... </spatial>
    <duration> … </duration>
</dimensions>
<medium> </medium>
<material> </material>
```

It is interesting to note the role of the artist's value judgment as the criteria for production. He produced "5,000 equations, 1,000 iteration sheets, published and made maybe 300-400 works... from a pistachio nut to a massive, 50-foot wide video installations.” [5] His system harnessed productive randomness, using the computer to introduce variance beyond the artist's control, but ultimately relied on the iterative, subjective refinement by the artist to produce final art objects.

What is the point of initial randomization if the artist's value judgments become the ultimate criteria for production—isn't this a type of systematic sleight of hand? One could just as well (and perhaps more interestingly...) establish a system that responds to viewer interest to guide the production of work, such as Komar and Melamid have done in works based on the collective critical judgment of the public. [8]

I would argue that the value of a project like Tyson's is not in this release of authorial control, as he describes his process, but rather in advancing an objective and detached exploration of one's creative space. Randomly seeding content for the initial creative concept, the artist's taste becomes the only criteria for inclusion or exclusion of an idea as “worth making”, and iterating this process repeatedly plots points both inside and outside of their subjective space of interest.

I am interested in this type of investigation as an exploration of authorship, but more importantly as a process of self-discovery and conceptual self-experimentation. How does an artist mine their own conceptual space and set of interests? Keith Tyson works actively to stretch his limits of taste in unexpected, and unchosen directions. The challenge of this project requires him to reexamine and reintegrate his understanding of himself and his preferences to incorporate these novel results.

My work with the Wordnet database and semantic transformations expands on Tyson's work, but facilitates a more flexible, fluid relationship between the artists effort and the textual proposal.

6. PROCESSING NAMES

Avoiding this recipe/equation method of art production, for my recent studio projects I have operated in the realm of short, declarative language describing art objects. Utilizing the Wordnet database[20] (as interfaced in the NLTK [9]), I have developed a set of language operations which run on these descriptions, transforming them to explore adjacent semantic spaces.

The Wordnet database is a "large lexical database... Nouns, verbs, adjectives and adverbs are grouped into sets of cognitive synonyms (synsets), each expressing a distinct concept. Synsets are interlinked by means of conceptual-semantic and lexical relations." [20] For any word in english (or in the other languages for which Wordnets have been created [3]), a query will determine it's presence in the database, and if present, will produce a set of related terms defined across a number of different semantic relations. Wordnet contains verbs, nouns, adjectives, and adverbs, and specifies relationships amongst each of these parts of speech.

My name-processing software [14] replaces words in input terms with semantically related words, effecting a "semantic blur" on input descriptions.

For instance, the query phrase:

> this, unfortunately, is a site of concentration

Becomes:

> this, regrettably, is a setting of mellowness
> this, alas, is a digital computer of compactness
> this, alas, is a diamond of viability
> this, unluckily, is a subdivision of size
> this, regrettably, is a railyard of dispersion
> this, alas, is a yard of solvability
> this, regrettably, is a parade ground of concentration
> this, regrettably, is a fort of composition
> this, unluckily, is a polls of convention
> this, regrettably, is a left field of isotropy

Certain stop words and punctuation remain unchanged ("this", "is", "a", and "of", as they are either too common, or are participles, clarifiers, and other functional language) but the remaining terms are swapped out. You could consider this redirecting the reference of an indexical phrase: while originally referring to one target, now it is shifted in reference to some new thing. For words in input phrases identified as nouns and verbs, replacement terms are chosen from sibling terms where:

> sibling is a child of the parent of the query term

In the terminology of the Wordnet, this is the set of words defined as:

> hyponyms ("is a") and instance hyponyms ("is an instance of") of the hypernym of the query term
>
> hyponyms and instance hyponyms of the instance hypernym of the query term

For adverbs + adjectives, which in Wordnet do not have established parent-child hierarchies, replacement terms are defined by the Wordnet relationship of similarity.

Batch processing my indices of ideas and materials with the semantic blur software, I have produced a number of candidate studio objects for manufacture:

> Results. (appealing candidate phrases)
>
> blurry puppy blueprint
> finite feeling simulator
> convolute lawn chair
> super-computer totalizer bleach
> CDC 7600 in purple
> account for myself the slain number cruncher
> eyeballs oppose
> ogle at the trial wave by moonlight
> old maid switch
> creche of cube daughter … [15]

I have manufactured a subset of those phrases as art objects, viewable online [13].

As Jason Hutchens described the megahal program, my algorithm produces "gibberish, mostly", but it sparks moments of interest. The phrases above are a selection of a few of the most evocative results I have gotten from the process. However, I am bothered by the scattershot randomness of the process—while each term in an input phrase is replaced with a related term, the compounding deflections of content radically shift the reference of the phrase.

In further development I hope to target and constrain its output more specifically to certain regions or genres of subject matter. This is where analysis of the sum total idea corpus will be useful, extracting related sub-groupings of subjects and actions used to evaluate generated outputs.

The process shows potential as a speculative linguistic exploration, mapping out new points in a material/object space in a similar manner to Keith Tyson's system described above, but in a manner which is more fluid and evocative rather than narrowly prescriptive. The inputs start as indices of objects, images, and things which do exist, and the results are indices of new things which could exist. A full, interactive implementation of both the language processing software and the complete set of textual indices is available online. [13]

7. CONCLUSIONS

There is a gap between any textual label and the object/image it describes, a gap which has been exploited by artists as a source of dynamic tension and a hook for viewer engagement. When producing things other than text, language-based analysis and interaction is a type of pre-production—involvement at the level of imagination and the formulation of ideas, before images, objects, and other artifacts are produced.

The eventual outcome of a collaboration between producer and system is much more rich when the artist is interacting at this level—they are free to engage their material, visual, sensory imagination in production, and use the linguistic interaction with a language-processing system as kind of higher-level feedback and control. I believe this semantic approach to generative art is a valuable alternative to 3d geometries and numerically-driven representations.

Taken together, the accumulation of personal data online—in public (through Flickr, Facebook, Twitter) and in private (e-mail, cellphone logs, bank accounts, and health records)—comprise a massive resource to be used. Tools for analysis and generation, similar to those I have outlined above, could be incredibly useful in creating personalized interactive experience from these varied materials. With this online accretion of personal material, our contemporary self has become in some sense the aggregate of these digital/material traces, begging for exploitation via database query and generative algorithms to produce new, data-driven experience.

As a collaborator, ultimately, the computer needs to act with some semblance of intentionality, a trait lacking in my recent language processing experiments. I find a useful analogy for what I desire in the field of robotics. From an article in from the New York Times Magazine, describing Cynthia Breazel's robot Kizmet:

> [Kizmet is] programmed to have the same basic motivations as a 6-month old child: the drive for novelty, the drive for social interaction, and the drive for periodic rest. The behaviors to achieve these goals, like the ability to look for brightly colored objects, or recognize faces, were also part of the basic behavior. [4]

I would like to develop a system similarly intentional: motivating generative decisions rather than producing randomly. The method of analyzing my inputs to create a software model that produces ideas similar to my own will provide intentionality to my collaborative studio program. This model will also explore the idea of representing a thinking, feeling human being in a similar manner as my grandmother project.

8. ACKNOWLEDGMENTS

Thanks to the Center for Research in Computing and the Arts (CRCA) at UCSD for their support, the Department of Visual Arts at UCSD, and the Experimental Game Lab (EGL).

9. REFERENCES

[1] Amazon CAPs help http://www.amazon.com/gp/search-inside/capshelp.html

[2] Amazon SIPs help http://www.amazon.com/gp/search-inside/sipshelp.html

[3] Global Wordnet Association, website http://www.globalwordnet.org/

[4] Henig, R M. The Real Transformers. The New York Times Magazine. July 29, 2007 http://www.nytimes.com/2007/07/29/magazine/29robots-t.html?_r=1

[5] Herbert, M. 2001. "Human mind mapper." Art Review 52{i.e.53}: 58-9.

[6] Hutchens, J, Alder, M. Introducing MegaHal. NeMLaP3 / CoNLL98 Workshop of 1998. Human-Computer Conversation, ACL. 271-274.

[7] Jabberwacky interactive chatbot http://www.jabberwacky.com/j2about

[8] Komar, V., Melamid, A., Wypijewski, J. 1999. Painting by numbers: Komar and Melamid's Scientific Guide to Art. Univ. of California Press.

[9] Natural Language Toolkit website http://www.nltk.org/

[10] Resnik P. 1995. Using information content to evaluate semantic similarity. In Proceedings of the 14th International Joint Conference on Artificial Intelligence, pages 448-453. Montreal.

[11] Serra, R. 1967-68. Verb List Compilation: Actions to Relate to Oneself. retrieved from http://www.ubu.com/concept/serra_verb.html

[12] Shannon, C. E. 2001. A mathematical theory of communication. SIGMOBILE Mob. Comput. Commun. Rev. 5, 1 (Jan. 2001), 3-55. DOI= http://doi.acm.org/10.1145/584091.584093

[13] Twomey, R. Natural language sculpture projects http://roberttwomey.com/naturallanguage

[14] Twomey, R. Semantic blur software http://roberttwomey.com/naturallanguage/#query

[15] Twomey, R. Semantic blur software results – candidates for manufacture http://roberttwomey.com/script/results.txt

[16] Twomey, R. Unassigned materials http://roberttwomey.com/script/unassigned%20materials.txt

[17] Tyson, K. 2002. Head to Hand. Thea Westreich & Ethan Wagner.

[18] Wallace, R. 2003. The Elements of AIML Style. Retrieved from A.L.I.C.E. website http://www.alicebot.org

[19] Weizenbaum, J. 1966. ELIZA—a computer program for the study of natural language communication between man and machine. Commun. ACM 9, 1 (Jan. 1966), 36-45. DOI= http://doi.acm.org/10.1145/365153.365168.

[20] Wordnet website http://wordnet.princeton.edu