Walking Blues Changes Undersea: Imaginative Narrative in Interactive Poetry Generation with the GRIOT System

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Abstract

Emotionally stirring imaginative narratives help us to make sense of the human condition, including elements of life such as the nature of tragedy, joy, and compassion. Such issues, including happiness and beauty, are seldom interpreted as having much to do with computation. This paper presents an approach to computational narrative that emphasizes meaning and imagination. This approach is based upon research at the UCSD Meaning and Computation Lab that draws upon theories of metaphor, conceptual blending, and narrative imagining from cognitive linguistics, algebraic semiotics, and art practices. With these theoretical underpinnings, I implemented the ALLOY algorithm for conceptual blending, and the GRIOT system for implementing computational narratives. This paper presents new results and analyses, focusing upon my recent interactive generative narrative poetry work entitled *Walking Blues Changes Undersea*. Additionally, the GRIOT system and different levels of its use are described, an updated automaton for structuring narrative events is presented, and new poetic output is presented and analyzed. This work represents initial experiments toward a larger multimedia project entitled "Loss, Undersea."

1 Introduction

I imagine: the poignant pathos of a civilization slipping into the sea, a transforming being losing more and more of herself or himself, mindless traveling through life as if on a moving platform. Such visions capture for me a sense of dissolution of joy, daily struggle for happiness, and the contrast between the rich mental lives of all individuals and narrow social prejudices that constrain people to discrete boxes. My recent artistic work is an attempt to create stories that evoke the themes above. Such stories are intended to blend with the real "lived in" stories of individuals encountering the work (Turner 2003). This allows others to make sense of my personal metaphors and to find sympathy between their own lives, the lives of others, and the issues of the human condition that I attempt to conjure.

In the theory of interactive media there is a line of thought that asserts that enacted, participatory media experiences are potentially more salient than passively observed media: "whatever the power of images, interactive media is more" (Penny 2004), "...with interactivity you have a better chance of making that 'Aha!' experience happen to your audience because they can test their webwork of ideas against yours" (Crawford 2005). While I hesitate to privilege the experience of participatory interactive computational media over other media, I am interested in exploiting possibilities enabled uniquely by computational media, such as user guided content generation and user agency in fictional worlds, in service of artistic goals such as those described in the paragraph above.

With the GRIOT system the goal of implementing computational narratives is not automated narrative generation, but rather to allow authors to create narratives where user interaction drives a wide range of guided and structured, but not scripted, eventualities (Harrell 2005B, Goguen and Harrell 2006). This work bridges accounts of human conceptual blending, metaphor, and narrative imagining with artistic production by providing formalizations for manipulable semantic content for computational narratives. In a general sense the core mathematics underlying this work, universal algebra, is an attempt to formalize the arbitrary combination of symbols (Peacock 1830). This aspect of the approach centers upon systematic examination of how humans compose sign systems with particular attention to regularities such as hierarchies, preservation between mappings, information lost or gained, changes of classification of symbols (type casting), and other similar structural features. Computational methods are very good for these purposes. At the same time, this research approach pays close heed to the ways that humans encode knowledge that is not amenable to computational analysis or manipulation, and explicitly requires human input and judgment in authoring processes. This approach is a combination of formal

methods, awareness of their limitations, and strategies to get around them.

Section 2 below provides a brief account of key foundations of this theoretical framework. Incorporated into GRIOT is the ALLOY algorithm for conceptual blending (Goguen and Harrell 2006), which provides a computational model of several central aspects of blending theory. The GRIOT system architecture and its uses are discussed in Section 3. Section 4 describes previous work in computational poetry, and presents recent work implemented with GRIOT and an analysis of that work. Sections 5 concludes this paper with a discussion of recent insights and future directions. The Appendix includes additional examples of recent output.

2 Brief Theoretical Framework

2.1 Metaphor and Conceptual Blending Theories

Metaphor theorists propose that the understanding of many basic abstract concepts relies upon metaphorical thinking and analogy, and that metaphorical thinking arises from a basis in embodied human experience of the world (Varela, Thompson, and Rosch 1991, Lakoff and Johnson 1999). George Lakoff, Mark Johnson, Mark Turner, and others have studied metaphor as mappings from one conceptual space to another (Lakoff and Johnson 1980, Lakoff and Turner 1989), and have shown that there are many basic, entrenched metaphors that people use to express everyday concepts. These concepts are often structured by image schemas, "skeletal patterns" that recur in our motor-sensory experiences such as "Motion Along a Path," or "More is Up" as expressed respectively by metaphors such as "Life is a Journey," or "Good is Up."

Conceptual blending theory builds upon Gilles Fauconnier's mental spaces theory (Fauconnier 1985) and elaborates insights from metaphor theory (Fauconnier 2006). Gilles Fauconnier and Mark Turner's conceptual blending theory describes the means by which concepts are integrated (Fauconnier and Turner 2002), guided by "uniform structural and dynamic principles" both unconsciously in everyday thought and in more complex abstract thought such as in literary arts or rhetoric. Metaphoric blends are those that are asymmetric in the sense that one space, the "target" of the metaphor, is understood in terms of the other "source" space (Grady, Oakley, and Coulson 1999). Conceptual integration networks are composed of conceptual spaces and conceptual mappings used in blending the component spaces for situations that are more complex than a single metaphor. The basic elements of a conceptual integration network are (Grady, Oakley, and Coulson 1999):

1) Input Spaces (the conceptual spaces to be combined)
2) Cross-space mappings (links between analogous elements in different input spaces)
3) The Generic Space (a conceptual space mapped to both of the input spaces that describes shared structure between the input spaces)
4) The Blended Space (the space in which elements from the input spaces are integrated)

Fauconnier and Turner assert that the process of blending is structured by sets of "constitutive" and "governing" principles that exert pressure to produce optimal blends. The constitutive principles describe the structure of conceptual integration networks and the process of blending, while the governing principles optimize emergent structure in the blends all "other things being equal" (Fauconnier and Turner 2002). An expanded account of the foundational role cognitive linguistics plays for GRIOT can be found in (Goguen and Harrell 2006, Harrell 2005B).

2.2 Narrative Imagining

Narrative imagining combines a host of cognitive operations (including sequence recognition and construction, categorization of objects and events, projection of image schemas, and more) and the metaphor and conceptual blend generation and interpretation discussed above play a central role (Turner 1995). Turner describes stories as "complex dynamic integrations of objects, events, and actors." Under this view, stories can be described using conceptual blending theory. Blends that integrate input spaces from different, even clashing, organizing frames are considered "double-scope blends (Fauconnier and Turner 2002). When these input spaces represent stories the blended results are "double-scope stories" (Turner 2003).

In (Turner 2003) there are examples of several double-scope stories featuring an astounding succession of blending operations in which characters magically, metaphorically transform from one entity to another. One of his examples is the song "O, Magali" from Frederic Mistral's *Mireille*, which contains a sequence where a suitor pursues the object of his affection only to have her transform into a different entity to escape him. He transforms to capture her, she transforms to escape again, and so on in a spiraling competitive conversation:

–If you become a fish, I will become a fisherman.
–Well then I will become a bird and fly away.
–Then I will become a hunter and hunt you.
–Then I will become a flowering herb in the wild.
–Then I will become water and sprinkle you.
–Then I will become a cloud and float away to America.
–Then I will become the sea breeze to carry you.
…

Turner's account of "O, Magali" and similar stories is especially useful here for two reasons: 1) the works are structured by the pattern of an abstract story: the rhetorical structure of a narrated competitive conversation between two people, and 2) it provides a theoretical model to

describe blending processes in stories involving transforming characters (Turner 2004). The most recent interactive narrative poetry created using GRIOT (presented in Section 4.2 and the Appendix) parallel these two aspects of Turner's analysis (discussed below in Section 4.3). Finally, Turner's account also considers how such work can possibly achieve meaningful impact upon users as they project these metaphorical narratives onto "the stories we live in," our real life experiences.

2.3 Algebraic Semiotics

In order to be implemented, models of conceptual metaphors, blends, and narratives need to be given a precise notation. Formalizing some notions from cognitive linguistics does not entail believing that formal structure alone can account for imaginative thought, or that a blending algorithm implemented using this formalization is doing anything like what humans actually do when we blend concepts. On the contrary, it is hoped that a precise notation can aid in clear thinking about dynamic and contingent processes. Formal notation can aid in empirical testing and allow for implementation of these ideas for artistic (and other) pursuits. Algebraic semiotics can be used for these purposes (Goguen 1998).

In algebraic semiotics the structure of complex signs, including multimedia signs (e.g., a film with closed captioning), and the blending of such structures are formally described using sign systems and semiotic morphisms. A sign system consists of (Goguen 1998):

> a loose algebraic theory composed of type declarations (called sorts) and operation declarations, usually including axioms and some constants, plus a **level ordering** on sorts (having a maximum element called the **top sort**) and a **priority ordering** on the constituents at each level. Loose sorts classify the parts of signs, while data sorts classify the values of attributes of signs (e.g., color and size). **Signs** of a certain sort are represented by terms of that sort, including but not limited to constants. Among the operations in the signature, some are **constructors**, which build new signs from given sign parts as inputs. Levels express the whole-part hierarchy of complex signs, whereas priorities express the relative importance of constructors and their arguments; social issues play an important role in determining these orderings. Conceptual spaces are the special case where there are no operations except those representing constants and relations, and there is only one sort.

A semiotic morphism is a mapping between sign systems, mapping sorts, constructors, predicates and functions of one sign system to sorts, constructors, predicates and functions of another sign system respectively. An example of a semiotic morphism is a mapping between a data structure and a graphical visualization of that data. Blending maps several conceptual spaces together using multiple semiotic morphisms. One important basic type of blend (used often in ALLOY and GRIOT) involves a generic space and two input spaces that each get mapped to a target, or blend space. For implementing computational narratives it is important to formulate sign systems and morphisms so that they can be manipulated algorithmically. The GRIOT system utilizes the algebraic semiotic formulation of blending in order to enable generation of conceptual content in computational media. Many details regarding algebraic semiotics omitted here can be found in (Goguen 1998).

3 The GRIOT System

GRIOT is a computer program developed to implement systems that output interactive computational narratives. The first systems built in GRIOT enable generation of poetry in response to user input. Joseph Goguen and I have coined the phrase "polymorphic poems" or "polypoems" to describe these works. A polypoem is not the individual output of one execution of GRIOT, but rather the code that generates a variety of poems algorithmically. A condensed description of how GRIOT functions follows, details are available in (Harrell 2005B, Goguen and Harrell 2006).

3.1 The GRIOT Architecture

User input, in the form of **keywords**, is used to select the conceptual space network from a set of ontologies, called "**theme domains**," that each contain sets of axioms about a particular theme. These axioms consist of binary relations between sorted constants. This conceptual space network, called an "input diagram," consists of a generic space, two input spaces, and mappings from the generic space to each of the input spaces. The input diagram is passed as input to the ALLOY conceptual blending algorithm. ALLOY is the core component of GRIOT that is responsible for generating new content. An "output diagram," consisting of a blended conceptual space and morphisms from the input spaces to the blended space, is output by ALLOY. Concepts are combined according to principles that produce "optimal" blends. Typically this optimality results in "common sense" blends, but for particular poetic effects different, "dis-optimal" criteria can be utilized. "**Phrase templates**," granular fragments of poetry organized by narrative clause type, are combined with the output of ALLOY (converted to natural language by mappings called "**grammar morphisms**") to result in poems that differ not only in how the phrases are selected and configured, but in the meaning being expressed by the blended concepts. The phrases are said to be "instantiated" when they are combined with the natural language representations of the blends by replacing "wildcards" in the text. These wildcards are tokens representing where generated output can be incorporated, they also contain variables that specify how they are to be replaced, e.g.

constraining the choice of theme domains, or selecting the lexical form to be mapped to by the grammar morphism. These templates are selected according to an automaton called an "**Event Structure Machine**" (or "**Narrative Structure Machine**"), which also structures the reading of user input, described below in Section 3.2.

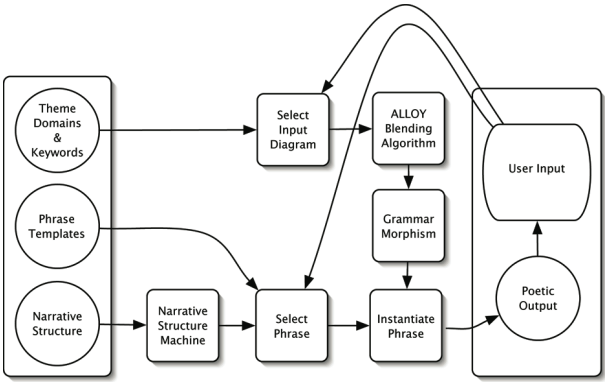

Figure 1: The GRIOT System Architecture

3.2 The Event Structure Machine

The initial implementation of an automaton to structure narrative clauses was relatively simple and was used to instantiate an adapted version of William Labov's empirical model of the narrative structure of personal experience from sociolinguistics (Labov 1972). A formalization of this model is described in (Goguen 2001). The format for specifying the automaton was designed in a way that was easy for a polypoem author to specify.

Subsequent projects have necessitated the development of a more powerful machine to structure clauses, in particular to enable hierarchically organized and nested narrative structures. Toward this end, Joseph Goguen and I developed the "Event Structure Machine," technically we call it a probabilistic bounded transition stack machine, to be described in more detail in the forthcoming (Goguen and Harrell 2006). The Event Structure Machine has the following format (in a modified extended BNF notation in which italicized phrases denote informal descriptions of atomic elements):

<Event Structure Machine> ::= "(structure" <clauses> ")"
<clauses> ::= <clause> {<clauses>}
<clause> ::= "(" <name> <number-pair> <subclause>
  <exit-to-clause> <read-flag> ")"
<name> ::= *an atomic clause name*
<number-pair> ::= "(" <minimum-number>
  <maximum-number> ")"
<subclause> ::= "("*an atomic clause name* ")" | "()"
<exit-to-clause> ::= "(" *an atomic clause name* ")" | "()"
<minimum-number> ::= *a positive integer*
<maximum-number> ::= *a positive integer*
<read-flag> ::= *read* | *n*

The most important structure in this format is the <clause>. The functioning of the event structure machine can be understood by examining the components of these "clauses."

A clause consists of a name, pair of integers, subclause name, exit-to clause name, and a read-flag. A clause is to be interpreted as follows:

1) The <name> is a symbol used for referring to the clause type. This name can be anything and does not necessarily refer to specific clause types from various linguistic or narrative theories
2) The <number-pair> consists of an integer indicating the minimum and maximum numbers of repetitions of the clause.
3) The <subclause> refers to the subsequent nested clause type to be selected.
4) The <exit-to-clause> refers to the subsequent clause type to be selected after all subclauses have been exhausted.
5) The <read-flag> determines whether or not user-input is to first be read and taken into account when instantiating a phrase template of the selected clause type.

For example, the polypoem *The Girl with Skin of Haints and Seraphs*[1] (Harrell 2005A) was reimplemented in the Event Structure Machine format as follows:

```
(structure
  (ori (1 1) () narr read)
  (narr (3 5) eval coda read)
  (eval (0 1) () () n)
  (coda (1 1) () () read))
```

A possible poem output by such an automaton would have the following structure (with clause names standing in for actual clauses):

```
ori
narr,
     eval
narr,
     eval
narr,
     eval
coda
```

In this example the "`eval`" clauses are nested under the "`narr`" clauses, and there are three repeats of "`narr, eval`" pairs. Such structures can easily be elaborated to define more complexly structured output, e.g. simply changing the event structure clause from "`(ori (1 1) () narr read)`" to "`(ori (3 3) narr () read)`" would result in the output consisting of three full repetitions of the output structure in the example above. The following is an example of real generated output, which incorporates blended concepts generated using ALLOY (the LISP parentheses are left in so that clauses may be more easily distinguished):

[1] This poem is a commentary on racial politics and the limitations of simplistic binary views of social identity. The dynamic nature of social identity is also reflected in the way the program produces different poems with different novel metaphors each time it is run.

```
-> white
(her awareness begins when sunbather scaled-
  being envies melaninated and soul)
-> demon
(she worked raising pain cool children of her
  own)
(death was better)
-> evil
(her ears swam with bedrock dry-skin)
(and her spectre snow-queen feet danced)
-> europe
(her ears swam with guillotine balm)
(she could laugh)
-> angel
(she finally knew that a hate smugness woman
  would never be loved)
```

3.3 Levels of Use

In order to express more clearly how human judgment, subjectivity, and interaction play a role in design and implementation with GRIOT, I have determined four levels of use of GRIOT encountered so far. These are:

Level 0) Coding GRIOT
Level 1) Designing a polypoem
Level 2) Providing input to a polypoem during execution
Level 3) Performing polypoem output

Level 0 refers to programming the platform. It includes originally implementing the GRIOT system and the ALLOY algorithm, but also refers to changes made to GRIOT as it iteratively develops to enable new types of polypoems. For example, reasonable changes a programmer may need to make to the GRIOT system (in LISP) include: introduction of new media morphisms, template variable types, changes to the Event Structure Machine, or updates to ALLOY. In the long term it may be desirable to allow some of these aspects to be changed by a polypoem author, however there is a trade-off as increases in the level of expressiveness for a polypoem author tend to also increase the level of programming expertise required by a polypoem author. This level also includes integrating GRIOT with a graphical user-interface, game, or another software application.

Level 1 denotes content creation using GRIOT. This is akin to authoring using Macromedia's Flash or Adobe's Photoshop. The difference here is that the author attempts to give the user some control over meaning, i.e. how concepts are represented and where user input must be taken into account in generation of new content. The polypoem author must input three components: 1) an ontology consisting of sets of axioms, 2) a template database consisting of text with embedded variable (wildcards), and 3) a particular narrative structure in the format required to instantiate the narrative automaton.

Level 2 denotes using a system, i.e. playing a game or reading a poem. This level complicates the notion of a "reader" since the reader/user may be required to interact with the system, for example entering keywords, selecting icons, or moving a character through a virtual world. Still, although a user may take a role in the construction of a particular poem, the user is not considered to be the "author" of the poem any more than the visitor of a building (who undoubtedly generates a particular experience of the building through her/his navigation of the space) is said to be the architect of the building. The line between user and author is not hard however, and a creative interactive work could blur this distinction. This is generally the most constrained level of participating in a GRIOT system. At the greatest degree of constriction the user is allowed no input and acts merely as a (mechanically) passive reader of a text.

Level 3 exists in the special case of a performance. As output is generated via user interaction with a polypoem a human may be the vehicle for presenting this work. For example, in a polypoem and free jazz performance entitled *The Griot Sings Haibun* Joseph Goguen acted as the level 3 participant by reciting poetry output from a plasma screen in front of him (Goguen and Harrell 2005). This is not a trivial level, a great deal of interpretive nuance arises via a human's ability to adjust to the context of a situation. For example, the human voice afforded Goguen sensitive control for recitation. This level need not refer to vocal performance, however, it refers to any possible way in which a human can use the output of the user's interaction with the system to spur some performative act.

4 Interactive Narrative Poetry

4.1 Previous Work in Computational Poetry

In order to situate the work in interactive, generative poetry developed with GRIOT, it is instructive to look at previous examples. An early relevant work is Raymond Queneau's 1961 "Cent Mille Milliards de Poémes" ("One Hundred Thousand Billion Poems") (Queneau 1961), originally published as a set of ten sonnets with interchangeable lines, but later made available in computer implementations. This work is relevant because of its exploration of writing as a combinatorial exploration of possibilities, which exemplifies the experimental literary group Oulipo's (of which Queneau was a member) often whimsical use of mathematical ideas.

In contrast to such (at least originally) paper based poetry, William Chamberlain and Thomas Etter's dialogue based program Racter, and Racter's (Chamberlain's) book, *The Policeman's Beard is Half Constructed* ("Racter" 1984), used syntactic text manipulation to support conversation with users via text input and generation of poetic output. Text generation programs like Racter have been oriented toward automation and Turing test competence. The goal with GRIOT is quite different: it is designed to provide a technical framework for humans to author polymorphic content and the polypoems created with GRIOT, as

opposed to merely individual instances of output, are considered to be the primary cultural products. Charles Hartman's work in automated poetry generation was presented as literary experimentation, but Hartman realized that it is better not to ask "whether a poet or a computer writes the poem, but what kinds of collaboration might be interesting" (Hartman 1996). Hartman's work emphasizes how a computer can introduce "randomness, arbitrariness, and contingency" into poetry composition (Hartman 1996). This is another significant difference from GRIOT, which uses structured principles of meaning and narrative to guide poetry generation as opposed to random selection.

4.2 Walking Blues Changes Undersea

Walking Blues Changes Undersea is a polypoem that tells the double-scope story of an individual traveling through everyday locations, while performing everyday actions in a dynamic, transitory world of unstable social identity. It evokes an unsteady world increasingly blended with oceanic fantasy as the world sinks beneath the waves (recalling the Atlantis myth). The everyday world initially consists of banal events in everyday locations: waking up in bed, taking a shower, eating at the breakfast table, working, eating lunch, eating again, at home, and back to bed to sleep. The user selects location specific actions such as 'sleep,' 'scrub,' 'munch,' 'procrastinate,' 'watch-tv,' 'exercise,' 'slumber,' and more. Each of these actions is associated (the exact associations are hidden from the user) with a particular emotional disposition such as 'lazy,' 'aggressive,' 'apathetic,' or 'peaceful.' The output generated in response to the user input incorporates blends generated from mental spaces selected from ontologies corresponding to these dispositions and to the locations. Additionally, over the course of the narrative the descriptions of the locations and the protagonist (which can be considered the user's player character) are also blended with spaces selected from ontologies describing undersea themes. Finally, each execution tells a completely different, but similarly themed, tale.

The structure of the "Walking Blues Changes Undersea" polypoems is as follows:

```
(structure
  (orient (1 1) () intro n)
  (intro (1 1) () location-1 n)
  (location-1 (1 1) action-1 location-2 n)
  (action-1 (1 1) transform-response () read)
  (location-2 (1 1) action-2 location-3 n)
  (action-2 (1 1) transform-response () read)
  (location-3 (1 1) action-3 location-4 n)
  (action-3 (1 1) transform-response () read)
  (location-4 (1 1) action-4 location-5 n)
  (action-4 (1 1) transform-response () read)
  (location-5 (1 1) action-5 location-6 n)
  (action-5 (1 1) transform-response () read)
  (location-6 (1 1) action-6 location-7 n)
  (action-6 (1 1) transform-response () read)
  (location-7 (1 1) action-7 sleep n)
  (action-7 (1 1) transform-response () read)
  (sleep (1 1) () coda n)
  (coda (1 2) () () n)
  (transform-response (0 1) () () n)
)
```

Given theme domains, keywords, and phrase templates as described above the polypoem generates output such as[2]:

```
my world was so small and heavy,
rooms for waking, bathing, consuming,
  sweating, sunning, devouring, sleeping, and
  waking
my first movement of the day awaits, I
-> stretch
and encounter fishermen, soft grogginess
a whiff of sea passes through me
reciting a pop song like a mantra while
  washing, I decide to
-> scrub
daily tidepool quiet cleaning
an Atlantean aroma
I need to manufacture energy to confront the
  day, I need vicious and cool, so first I
-> consume
on toward my job
the air shimmers a bit
always imagining resident, fish at my desk, I
  must
-> procrastinate
gulls and feeble working is not bad
it's a water, simple ever-changing days
the day's break is here, I need to
-> eat
full, satisfied, satisfied
colors seem a bit duller today
placating bureaucrats on and on, I must
-> work
the building fills with angler-fish
  compassion as I repeat yesterday's tasks
an Atlantean aroma
after laboring I am in my room to
-> watch-tv
my defeated ineffectual life
```

4.3 Remarks on Aesthetic Analysis of Computational Poetry

Evaluative analysis of artistic work cannot be carried out using methods arising from engineering disciplines based on values such as efficiency, feasibility, generalizability. Since this paper is focused on the aesthetic dimensions of polypoems created with GRIOT, analysis requires a framework suited for subjectively assessing cultural artifacts. One direction in developing an evaluative and interpretive framework is to base analyses in the blending metaphor theory discussed above in Sections 2.1 and 2.2.

[2] User input follows the "->" prompt and, unlike earlier polypoems created with GRIOT, is meant to be read as a part of the text.

Aside from its role as a cognitive theory, Turner and Lakoff have applied metaphor theory to literary criticism (Lakoff and Turner 1989). They assert that despite "an infinitude of potential metaphors," there is a small set of metaphors with special status called "basic metaphors" discovered through systematic analysis of large bodies of linguistic data and claimed to be a part of the common conceptual apparati shared by members of a culture. Analysis can be performed by examining the roles of such metaphors in poetry. Additionally, although the output discussed here is termed "poetry," polypoems are a new cultural form that recalls some structural aspects of narrative prose poetry, omits others, and includes computational characteristics such as polymorphic structure, procedural generation, formal knowledge representation, user feedback loops. The fact that literary criticism based in metaphor theory is based upon cognition, as opposed to examination of structural and rhetorical aspects of traditional poetry also makes it suitable for analysis of polypoems.

Informal analysis of *Walking Blues Changes Undersea* reveals that the tale invokes several basic metaphors. The story of travel through a day is an example of the "Life is a Journey" basic metaphor and is an instance of the "A Lifetime is a Day" basic metaphor. In the sample output from Section 4.2, the first line, "`my world was so small and heavy,`" invokes the "Life is a Burden" metaphor, which among other things maps the notion of "weight" onto life elements. This is illustrated in the different instances of output from Section 4.2 and the Appendix where "`the indolent body atmosphere,`" "`the sleeping-beauty, lazy atmosphere`" and "`the cave heavenly atmosphere`" are all described as "`a little heavy.`" The concept of weight is also invoked in the line "`my head had been rock and my heart black lead`" from output example 2 in the Appendix. The story of a world sinking below the waves is an example of a conceptual blend between the basic "Down is Bad" metaphor and the mundane world the protagonist inhabits. The example of output in Section 4.2 ends with the phrase "`my defeated, ineffectual life,`" which reflects the "Sad is Down" metaphor when interpreted in the context of the sinking world. Similarly, the output instances in the Appendix invoke the "Unconscious is Down" metaphor when interpreted in the context of the sinking world as seen in excerpts such as:

```
a rectangular cushion awaits
I love you, good night
crisp sheets fade to boring warmth
```

and

```
just like before, the day is done
the tale of my every day
good night.
```

Lakoff and Turner describe three general approaches that poets have traditionally taken toward employing basic metaphors:

1) Versifying them in automatic ways resulting in trite verse
2) Deploying them masterfully through combination, extension, and realizing them in striking imagery
3) Deploying them in unusual ways or destabilizing them by revealing their inadequacies for making sense of lived experience in the real world

A preliminary suggestion for deeper aesthetic analysis of this work is to carefully document the invocation of basic metaphors and relating them to the criteria above. Secondarily, the output should be analyzed for creation of expressive and relevant novel metaphors. Thirdly, the output should be analyzed for grammaticality and coherence, taking into account perceived and actual authorial intention and when these issues are to be considered "technical details" as opposed to important aesthetic concerns.

Methods for analyzing double-scope stories in static text can also be applied to polypoems. Following the rhetorical discourse structure of a conversation between a level 2 user and the polypoem that I designed (as a level 1 user), the structure of the output is slightly reminiscent of the structure of "O Magali" discussed in Section 2.2 and it can be analyzed similarly (Turner 2003). There is a succession of blends involving actions (user input), events (transformation of the protagonist and locations), and objects (specific items described in locations). Although the ALLOY algorithm is not considered to capture what humans do when we blend concepts, there is a clear mapping between the Turner inspired account of the conceptual blending that occurs when we participate in the polypoem and the actual output generated when the polypoem is processed and executed using GRIOT. This result is encouraging because it suggests that utilizing the framework of conceptual blending theory is a promising direction for generating interactive double-scope stories with consistently structured output in which user interaction drives the generation of new content for each instance of output.

5 Conclusion and Future Work

Walking Blues Changes Undersea is an attempt to capture a coherent style and thematic content in a reconfigurable and generative system. Artistically it also is an attempt to capture a certain feeling and an imaginative vision. All of this is intimately tied to the technical means used to produce it. The meaningful content is formally represented and algorithmically manipulated. I conclude here with a few remarks on broader issues relating the expressive and technical aspects of this work.

The Event Structure Machine allows for much greater nuance in structuring the output of systems implemented with GRIOT. It shares the same spirit as the ALLOY algorithm – though it on one hand represents a structuralist

approach to narrative discourse, on the other hand it is very flexible and does not require the use of any one particular type of narrative form. The goal is to produce an expressive, relatively simple, framework that a level 1 user can use to implement her or his intended model of narrative for a specific expressive purpose. When this is integrated with the highly variable output from ALLOY, the result is a high degree of control for the level 1 user (author) and a thematically consistent, yet highly variable experience for the level 2 users (readers).

Future steps involve adding to GRIOT the facility for blending and composing of multimedia elements in addition to text. The polypoem *The Griot Sings Haibun* represents initial steps in this direct since user input is entered via a graphical user interface (GUI). The project *Loss, Undersea* is currently planned to utilize the polypoem *Walking Blues Changes Undersea* also with user input entered via a GUI. Multimedia imagery will also be selected and composed using GRIOT's facilities for concept representation, blending, mapping blends to output in various media, event/narrative structuring, and user interaction. The hope is that this framework will be a sensitive enough tool for implementing a poetic experience where an Atlantean undersea metaphor can evoke the weight of daily life, the dynamic, contingent nature of social identity, tender joys, and continual loss.

Appendix: Sample Output

The following are two samples of "Walking Blues Changes Undersea" output. In each case the user selected keywords all serve to select theme domains highlighting a particular emotional disposition.

1) Lazy disposition:

```
no gills, no webbing between digits,
it wouldn't be a watery grave, but a salt water
  life
the day's initial action : I
-> sleep
and feel like a lazy sleeping-beauty
the indolent body atmosphere is a little heavy
the day cannot begin without being clean, I need
  to
-> soak
I think playful contented thoughts, then of the
  breakfast table
you will recall the importance of hearty
  breakfast cuisine to
-> munch
feeling tubes, staid again
the sleeping-beauty, lazy atmosphere is a little
  heavy
it is not a difficult job, I try to
-> procrastinate
chilling and flimsy, my labor's reward
too-satisfied, anxiety seeps under the door,
  through me, from me
a sandwich, I must
-> chit-chat
another soft lazy-goat lunch
it's becoming a fish loser life
the walk to the restroom is the nicest part of
  the workday again, I need to
-> procrastinate
living my daily hours in this nasty ineffectual
  room
an Atlantean aroma still
at home an occasional television watcher, today I
  shall
-> watch-tv
so goes the ice-hearted and lazy day
ocean in the air, I feel lighter
a rectangular cushion awaits
I love you, good night
crisp sheets fade to boring warmth
```

2) Aggressive disposition:

```
my head had been rock and my heart black lead,
but somehow I would not perish in the watery
  clam, echinoderm world
rousing from slumber to
-> scratch
falling back to my pillow and blank ornery dreams
  a moment
I become doormat fighting
I never shower slowly, I just
-> scrub
I think caring awesome thoughts, then of the
  breakfast table
the air shimmers a bit
in the dim cube for eating I
-> devour
on toward my job
the cave heavenly atmosphere is a little heavy
always imagining swim still at my desk, I must
-> work-hard
a heavenly scary-place, a mean, weak job
colors seem a bit duller today
my lunch order is ready, I
-> consume
uncaring angry, stuffed
a lovely day
work cave trench, whale fierce work, I must
-> network
living my daily hours in this morning-person
  fierce room
it's loser free, ever-changing days
my room after the day where I shall
-> fornicate
soon I'll be drowsy, seashell weaponly thoughts
just like before, the day is done
the tale of my every day
good night
```

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