Interactive Narrative Poetry Generation with the Griot System: Walking Blues Changes Undersea

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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, or compassion. Such issues, including happiness and beauty, are seldom interpreted as having much to do with computation. This paper presents techniques for computational narrative that emphasize meaning and imagination. This research approach, developed in joint work at the UCSD Meaning and Computation Lab, is based upon theories of metaphor, conceptual blending, and narrative imagining from cognitive linguistics, algebraic semiotics, which combines algebraic specification with insights from semiotics, and art practices that privilege rich metaphor, social identity and experience, and experimental narrative structure. The Alloy algorithm for conceptual blending, and the Griot system platform for implementing computational narrative are the primary results of this research initiative. This paper presents new results and analyses, focusing upon recent interactive narrative poetry output entitled "Walking Blues Changes Undersea." In particular, the different levels of use of the Griot system are described, the new Griot output is evaluated in light of the concept of double-scope stories from conceptual blending theory, and an updated narrative automaton is introduced. 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, 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" (Turner 2003) stories of individuals encountering the work. 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 developing technology to exploit possibilities enabled uniquely by computational media, such as user guided content generation and user agency in virtual worlds, in service of artistic goals such as described in the paragraph above. This line of thought also relates to the question of another possible facility of computational media: the use of machines that "understand and affect our perceptions of beauty and happiness" to "touch people's lives." While I dispute the ability of machines to "understand" anything, unquestionably machines affect our lives aesthetically and emotionally in profound ways. I believe that it is possible to represent semantic content in manners amenable to computational processing and that such techniques can form the basis for powerful expressive work.

With the GRIOT system for implementing computational narratives the goal 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 2005). This work bridges accounts of human conceptual blending, metaphor, and narrative imagining with related concerns in 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 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, which provides a computational model of several central aspects of blending theory. Together these systems can be used to implement models for concept generation within computational narratives. GRIOT and its uses are discussed in Section 3. A recent development in the GRIOT system is the probabilistic bounded transition stack machine, developed with Joseph Goguen, which allows for more nuanced structuring of narrative events than was previously possible in GRIOT. Section 4 describes recent work implemented with GRIOT. Sections 4 and 5 conclude this paper with a discussion of recent insights and future directions.

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 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" (a basic metaphor), "consciousness raising," "up is good," or even combined in the phrase "movin' on up."

Conceptual blending theory builds upon insights from metaphor theory and Gilles Fauconnier's mental spaces theory (Fauconnier 1994). 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 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" (the structure and process described above) and "governing" principles that exert pressure to produce optimal blends. These governing principles optimize emergent structure in the blends all "other things being equal." An expanded account of the foundational role cognitive linguistics plays for GRIOT can be found in (Harrell 2005, Goguen and Harrell 2004).

2.2 Narrative Imagining

Narrative imagining is combination of 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). Mark 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 inputs spaces from different, even clashing, organizing frames from are considered "double-scope blends (Fauconnier and Turner 2002), when these input spaces represent stories likewise the blended results are double-scope stories (Turner 2003).

As examples of double-scope stories, in (Turner 2003) there are descriptions of several stories featuring an astounding succession of blending operations as 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 (to be expanded upon later in Section 4), 1) it is 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 interactive narrative poetry that I have implemented using GRIOT is conversational in nature, like interactive fiction, chat-bots, and a variety of other turn-based expressive computational works. These interactive poems accepts user input and generates responses to that input. The most recent interactive narrative poetry created using GRIOT (presented in Section 4) also depicts a tale of repeated transformations, hence methods for analyzing double-scope stories in text can also provide a method to analyze these interactive tales, as well as offering possible suggestions for implementation strategies (given an appropriate formalization such as that presented in Section 2.3). 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. The modest claim made here is that precise notation can aid in empirical testing and clarity of discussion about these theories, and in implementing 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 described using sign systems and semiotic morphisms. A sign system 'S' consists of (Goguen 1998):

1) A set of sorts for signs, not necessarily disjoint;

2) A partial ordering on S, called the subsort relation and denoted <=:;

3) A set V of data sorts, for information about signs, such as colors, locations, and truth values;

4) A partial ordering of sorts by level, such that data sorts are lower than sign sorts, and such that there is a unique sort of maximal level, called top sort;

5) A set C_n of level n constructors used to build level n signs from signs at level n or less, and written r: $s_1 \ldots s_k d_1 \rightarrow s$, indicating that its ith argument must have sort s_i, its jth parameter data sort dj, and its result sort is s; constants c: → s are also allowed;

6) A priority (partial) ordering on each C_n;

7) Some relations and functions on signs; and

8) A set of sentences (in the sense of logic), called axioms, that constrain the possible signs.

A semiotic morphism is a mapping between sign systems. It maps sorts, constructors, predicates and functions of one sign system to sorts, constructors, predicates and functions of another sign system respectively. Precisely, a semiotic morphism 'M: $S_1 \rightarrow$ S2', from sign system 'S_1' to sign system 'S_2' is defined as the following partial functions (Goguen 1998):

1) Sorts of $S_1 \rightarrow$ sorts of S_2

2) Constructors of $S_1 \rightarrow$ constructors of S_2

3) Predicates and functions of $S_1 \rightarrow$ predicates and functions of S_2 such that:

1) if s <= s' the M(s) <=M(s')

2) if c: $s_1 \ldots s_k$ is a constructor (or function) of S_1, then (if defined) M(c): $M(s_1) \ldots M(s_2) \rightarrow M(s)$ is a constructor (or function) of S_2

3) if p: $s_1 \ldots s_k$ is a predicate of S_1, then (if defined) M(p): $M(s_1) \ldots M(s_2) \rightarrow M(s)$ is a predicate of S_2

4) M is the identity on all sorts and operations for data in S_1

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 several semiotic morphisms. Typically it is useful to consider a most basic type of blend that involves a generic space and two input spaces that each get mapped to a target, or blend space. More detail on algebraic semiotics is available in (Goguen 1998). 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.

3 The GRIOT System

GRIOT is a computer program developed to implement systems that output interactive computational narratives (Harrell 2006, Harrell 2005, Goguen and Harrell 2004). The first systems built in GRIOT enable improvisational 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 very condensed description of how GRIOT functions follows, details are available in (Harrell 2005), **Figure 1** depicts 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 are in the form 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 templates are selected and configured, but in the meaning being expressed by the blended concepts. The templates 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 from the grammar morphism. These templates are selected according to an automaton called an "**Event Structure Machine**" (or "**Narrative Structure Machine**") described below in Section 3.2. The Event Structure Machine is the core component of GRIOT responsible for reconfiguring the structure of the narrative and user interaction.

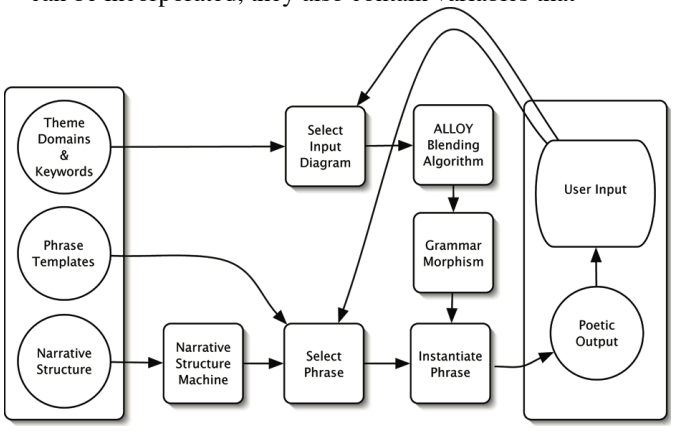

Figure 1: The GRIOT System Architecture

3.2 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 different 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 polypoem. For example, reasonable changes a programmer will 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 the 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, though a user may take a role in the construction of a particular poem, the user is not consider 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 a hard line 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 plasma screen in front of him (Harrell and Goguen 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.

3.3 Event Structure Machine

The initial implementation of an automation 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, Linde 1993). 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 Level 2 system author to specify. This automaton simply indicated for each clause type the possible clause types that could follow it. If more than one clause type was possible the subsequent clause could be chosen either randomly or by consulting a history to avoid duplication. Subsequent projects have necessitated the development of a more powerful machine to structure clauses, in particular hierarchically organized and nested narrative structures. This opened up the possibility to introduce more nuanced control over the structuring of clauses (or more generally events) and for us to provide a more general format to account for discourse/event structures that are not necessarily narrative. Joseph Goguen and I developed the "Event Structure Machine," technically we call it a probabilistic bounded transition stack machine, which I subsequently implemented within Griot, and added provisions for incorporating user-input. The Event Structure Machine has the following format (in a modified BNF notation, with italics denoting descriptions of atomic elements):

<Event Structure Machine> ::= "(structure" <clauses> ")"
<clauses> ::= <clause> {<clauses>}
<clause> ::= "(" <name> <number> <subclause> <exit-to-clause> <read-flag> ")"
<name> ::= *an atomic clause name*
<number> ::= "(" <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 processed as follows:

1) The number of times the clause will be repeated is determined. The first of the pair of numbers indicates the minimum number of repetitions and the second number represents the maximum, hence the automaton is "bounded." A number, called the "repeat number," between the minimum and maximum is chosen at with some user-defined probability (the default is equal probability for each integer in the interval), hence the automaton is "probabilistic."
2) If the read-flag is on (i.e. it is the atom "read") a prompt is given and user input is accepted.
3) A template of the type indicated by the clause name is selected and output.
4) If the subclause is not the empty list then the clause with the same name as the subclause name is processed.
5) If the exit-to clause is not the empty list then the clause with the same name as the exit-to clause name is processed.
6) If the current clause has not been processed a number of times equal to the repeat number then the clause is processed again.

For example, a haibun (a combination of prose poetry and haiku) poem can be defined with the following structure (for an example of a real poem with this structure please refer to "November Qualia" (Goguen 2004)) :

```
(structure
  (orient (2 2) () (poem) n)
  (poem (3 5) (intro) () n)
  (intro (1 1) (topic1) () n)
  (topic1 (2 2) (eval1) (topic2) n )
  (eval1 (1 1) () () n)
  (topic2 (1 2) (eval2) ()n)
  (eval2 (1 1) () () )  n))
```

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

```
orient
orient
poem,
    intro,
        topic1,
            eval1,
        topic1,
            eval1,
        topic2,
            eval2
poem,
    intro,
        topic1,
            eval1,
        topic1,
            eval1,
        topic2,
            eval2,
        topic2,
            eval2
poem,
    intro,
        topic1,
            eval1,
        topic1,
            eval1,
        topic2,
            eval2
```

For another example that incorporates user input, after introducing the Event Structure Machine to GRIOT, the polypoem "The Girl with Skin of Haints and Seraphs" (well documented in (Harrell 2005)) was reimplemented with a narrative structure as follows:

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

This results in output, which incorporates blended concepts generated using ALLOY, such as the following (the LISP parentheses are left in so that clauses may be more easily distinguished):

```
-> evil
(every night she wakes covered with hate, awe sweat)
-> europe
(imperialist and girl thoughts taunted her as a teen)
(serious times were here)
-> africa
(drum spiked-tail vapor steamed from her pores when
she rode her bicycle)
(in the rain)
-> angel
(when twenty-one she was a homely woman)
(that was nothing lovely)
-> skin
(tears ran relay races between her girl and european
eyes and her ignorance, longing earlobes and back)
(she could laugh)
-> angel
(her dreams were of cupid epidermis)
(life was a sight gag)
-> demon
(so she resolved to find bat-wings and pointed-nose
passion and be happy)
```

I shall leave it as an exercise for the reader to parse the output above according to the narrative structure given.

4 Undersea Interactive Narrative Poetry

"Walking Blues Changes Undersea" is a polypoem that tells the story of an individual traveling through everyday locations, performing everyday actions in a dynamic, transitory world of unstable social identity, an unsteady world increasingly blended with oceanic high fantasy. 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, consume, munch, procrastinate, watch television, 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. In the end, 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 (user input follows the "->" prompt and, unlike earlier polypoems created with GRIOT, is meant to be read as a part of the text):

Walking Blues Changes Undersea

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

The output is a double-scope story integrating the tale of travel through a day with the elements of the ocean. Following the abstract 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). Emphasizing that signs come in systems, the stories being integrated are themselves blends. The story of travel through a day is an example of the "life is a journey" basic metaphor and the story of a world sinking below the waves is an example of a metaphorical blend between the basic "down is bad" metaphor (the inverse of "up is good") and the storyworld the protagonist inhabits (Lakoff and Johnson 1980, Lakoff and Turner 1989). As can be seen, a rich array of conceptual blending that occurs, and though 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. The Appendix of this paper contains several additional examples of out generated by the "Walking Blues Changes Undersea" polypoem.

5 Conclusion and Future Work

"Walking Blues Changes Undersea" is an attempt to capture a coherent style and thematic content in 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 (reader).

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. 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 three samples of "Walking Blues Changes Undersea" output. In each case the user selected keywords all serve to highlight 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) Lazy disposition:#2:
my world was so small and heavy ,
but free, and free made it seem I walked through water, not air
from my bed I
-> sleep
I get up, my mind on sanctuary heavenly
I caterwaul in the shower, then
-> soak
commercially scented for a new day
a lovely day
30 chews for proper mastication, I
-> munch
I feel penny staid
an Atlantean aroma
cool restful surface, chilling, ok, regal I cannot stop thinking on the job, I must
-> delay
feeble parent working is not bad
I notice dugong householder scent coming from me
reenergizing for the crisp-sheet compassionate day after break I
-> chit-chat
back to my mean and weak job
it seeps under the door, through me, from me
it is not a difficult job, I begin to
-> procrastinate
slow-moving contented wages for this
a peaceful satisfied change day
finally home to
-> watch-tv
it slips into living-room weak night
it is humid today
another day past
beginning life beneath the waves

3) 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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