International Journal of Computer Applications (0975 - 8887)
Volume 182 - No.27, November 2018

Generating Timed Artificial Dream Action(TADA) as the Inverse Process of Freud's Interpretation of Dreams

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ABSTRACT

Apart from being an audacious attempt and a masterpiece, Freud's Interpretation of Dreams has provoked controversy since its publication. After the neurological linkage between Rapid Eye Movement(REM) sleep and dreams, many hypotheses are proposed focusing on REM or its accompanied dreams. This paper reviews recent discoveries regarding the neuro-cognitive aspects of sleep, dreaming, and emotions as a dream ingredient. This paper assumes that a dream content is decomposable into a sequence of Timed Artificial Dream Actions (TADAs) and that dream interpretation resembles the ability of an expert system explaining HOW and WHY questions. Freud tried to answer WHY each dream ingredient is being incorporated. The inverse of this process is to answer HOW a TADA is formed, and it is the concern of this paper. Based on dream-contents, an operational model for dream ingredients is proposed. The proposed TADA generator, nicknamed Oneiros, is decomposed into three modules Morpheus, Phantasos and Phobetor. Morpheus is responsible for the lexical processing of memory contents, in order to perform tasks such as extracting objects, emotions and alterations. Phobetor is responsible for all phobetic-specific aspects. Phantasos is responsible for the actual generation of a TADA.

General Terms

Artificial Cognition, Rapid Eye Movement

Keywords

Rapid Eye Movement(REM) sleep, Dream Action, NGram

1. INTRODUCTION

Dreams have been bewildering humanity, initiating endless hypotheses about their source, meaning and function ([1]).
Apart from being a masterpiece, [2] has provoked controversy since its publication, oppugning literal usage of theories advanced within. In this audacious attempt, Freud argued that a dream, as a wish-fulfilment, has a symbolic meaning. Freud's analysis of a dream of his own, a "Dream of July 23-24, 1895", exemplifies his method of interpretation on many dreams. The dream starts with "A great hall - a number of guests, whom we are receiving - among them Irma...", and henceforth it shall be referred to as the "Dream about Irma". In his analysis of this aforementioned dream, Freud decompose it into clauses.

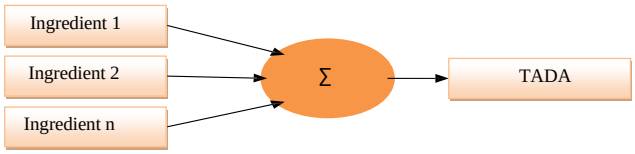

Fig. 1. TADA

This paper is based on a couple assumptions. The first of these core assumptions, is that a dream is decomposable into a sequence of Timed Artificial Dream Actions (TADAs). The basic unit of a dream is a dream action, such as seeing oneself flying, or seeing someone dying. Dream actions are to a dream as clauses are to story. Freud himself decompose his dream in order to analyze it, as in the aforementioned dream about Irma. Timing and artificiality are two aspects of a dream action that need to be insisted here. A dream action is timed, in the sense that it has sequence ID as a scene in a movie reel. It is artificial, in the sense that the dreamer, once is awake, can distinguish it from awake actions.
The second of core assumptions, is that dream interpretation resembles the explanation facility in an expert system (ES). Explanation, a.k.a. justification, denotes the ability of an ES to explain its behavior ([3]). The declarative reading of an ES as a logic program enables the explanation of HOW or WHY questions ([4]), by working backwards or forwards respectively. In one hand, to answer HOW a conclusion is reached, work backwards. In the other hand, to answer WHY a computation is being performed, the ES works forwards to its current goal. Following this analogy, we can assume that certain memory ingredients contribute to the formation of a TADA, as shown in Figure 1, in which the TADA is formed due of ingredients $1, 2, \ldots n$. To answer HOW a TADA is formed, work backwards. To answer WHY an ingredient is being recalled from memory, work forwards to the current TADA. Contemplating Freud's attempt, it turns out that he tried to answer WHY each ingredient is being fetched from memory. The inverse of this process is to answer HOW a TADA is formed, and it is the concern of this paper.
The rest of the paper is organized as follows. Section 2 is a background that reviews literature on sleep in subsection 2.1, dreaming in subsection 2.2, and emotions as a dream ingredient in subsection 2.3.

Section 3 presents the proposed system for generating Timed Artificial Dream Action(TADA).
Sections 4 and 5 are for conclusion and future work, respectively.

2. BACKGROUND

2.1 Sleep

Many experiments investigate the role and the function of sleep in brain. Sleep notably orchestrates the metabolite clearance([5]), consolidates memory([6], [7]), contributes to learning([8], [9]), and inspires insight([10]).

2.2 Dreaming

For a recent survey for theories on the function of dreaming, you can refer to [11] which groups them into

(1) Psycho-dynamic such as [2], [12], and [13].
(2) Evolutionary such as [14], [15] and [16]
(3) Neuro-cognitive such as [17], [18], [9], [19], [20] and [21].

After the neurological linkage between Rapid Eye Movement(REM) sleep and dreams ([22]), many hypotheses are proposed focusing on REM or accompanied dreams. The major trend is the memory consolidation hypothesis([19], [20], [21]).
Recent studies impugn this trend based on the occurrence of consolidation in non-REM sleep. [1], for instance, proposes the 'proto-conscious hypothesis' in which REM sleep contributes in constituting a state, that helps in developing and maintaining the waking consciousness afterwards. An interesting aspect about this hypothesis, is that it nods to a REM world model based on computer games or virtual reality.
However, [23] argues that this hypothesis is not testable, and proposes that, given enough sleep, REM is used by a brain to enable it in waking-up, hence the name 'wake-up hypothesis'. Based on this view, brain consolidates memories as a by-product of its continual operation in sleep on available information. [23] attempts to make his hypothesis stands out among competing hypotheses, by grounding it upon many supporting facts that he provided. He agrees with [24] who proposed 'life-sustaining hypothesis' that REM is a mechanism that supplies the brain with endogenic simulations to forbid it from being excessively shutdown in Slow-wave sleep (SWS). [23] assails the hypothesis proposed by [18] on the randomness of REM neuronal firing, causing stories, a.k.a dreams, to be generated in order to rationalize any erratic action.

2.3 Emotions

The relation between emotions and cognition is undeniable([25]). From evolutionary perspective ([26]), emotions contribute to survival ([27]). Fear is contributed to amygdala ([28]), isn't it?([29]). [30] attempts to spicily basic emotions, defined as discrete responses to universally shared events ([31]). Contempt, for instance, is proven to be basic ([32]).

3. PROPOSED SYSTEM

Based on dream-contents, let us propose an operational model for dream ingredients as shown in figure 2.
The Emotions set adopts the basic emotions of neutral (abbreviated as n), contempt (abbreviated as c), happy (abbreviated as h), surprise (abbreviated as s), grief (abbreviated as g), disgust (abbreviated as d), fear (abbreviated as f) and anger (abbreviated as a). Note that, here, sadness is called grief just to distinguish it from surprise when abbreviated. In context of emotions as a dream ingredients, it is worth contrasting the two basic emotions of contempt and fear. Unpleasant dreams, a.k.a, nightmares, usually have strong emotional brain responses typically fear, indicating a sense of danger. On contrary, contempt indicates superiority. It is said that familiarity breeds contempt. That is why I feel urged to consider emotionally classified ingredients as contempt to be safe.
The Objects set encompasses the dream-viewer (abbreviated as I), other people (abbreviated as P) and all things both animate and inanimate (abbreviated as T). The dichotomy of objects, other than the dream-viewer, into P and T reflects the difference between them in terms of possible interactions with the viewer.
Safely altered occurrences of the dream-viewer (abbreviated as $I^{\pm}$), of other people (abbreviated as $P^{\pm}$) and of things (abbreviated as $T^{\pm}$).
Phobetics, denoted as χ, are fearful objects, such as Vampire, werewolf, and the like. A recent study scrutinize the conceptualization of Beast-People([33]). In context of emotions as a dream ingredients, I may assume that a phobetic, per se, does not cause fear, unless attached to a fear ingredient. Phobetic occurrences of the dream-viewer (abbreviated as I_{χ}), of other people (abbreviated as P_{χ}) and of things (abbreviated as T_{χ}).
The $freq$ of an ingredient is shown at its upper right corner, signifying the total number of occupance in the dream content based on a rough estimation.
The proposed system, nicknamed Oneiros, is decomposed into three modules Morpheus, Phantasos and Phobetor, based on names from Greek and Roman Mythology ([34]) relating to dream.

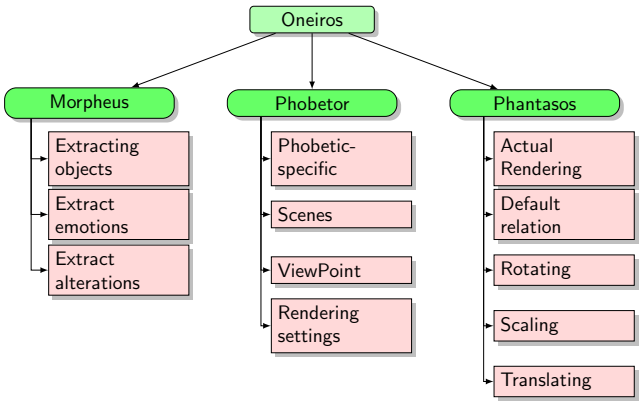

Fig. 3. Oneiros modules

3.1 Morpheus

This module is responsible for the lexical processing of memory contents, in order to perform tasks such as extracting objects, emotions and alterations. To clarify these tasks, let us provide Python code snippets to one of theses tasks. You need to download and install Python. For a matter for computability, please download any version beneath version 2.9, 2.6 is OK. Then obtain and install the following packages :

—PyYAML
—NLTK
—Numpy
—Matplotlib

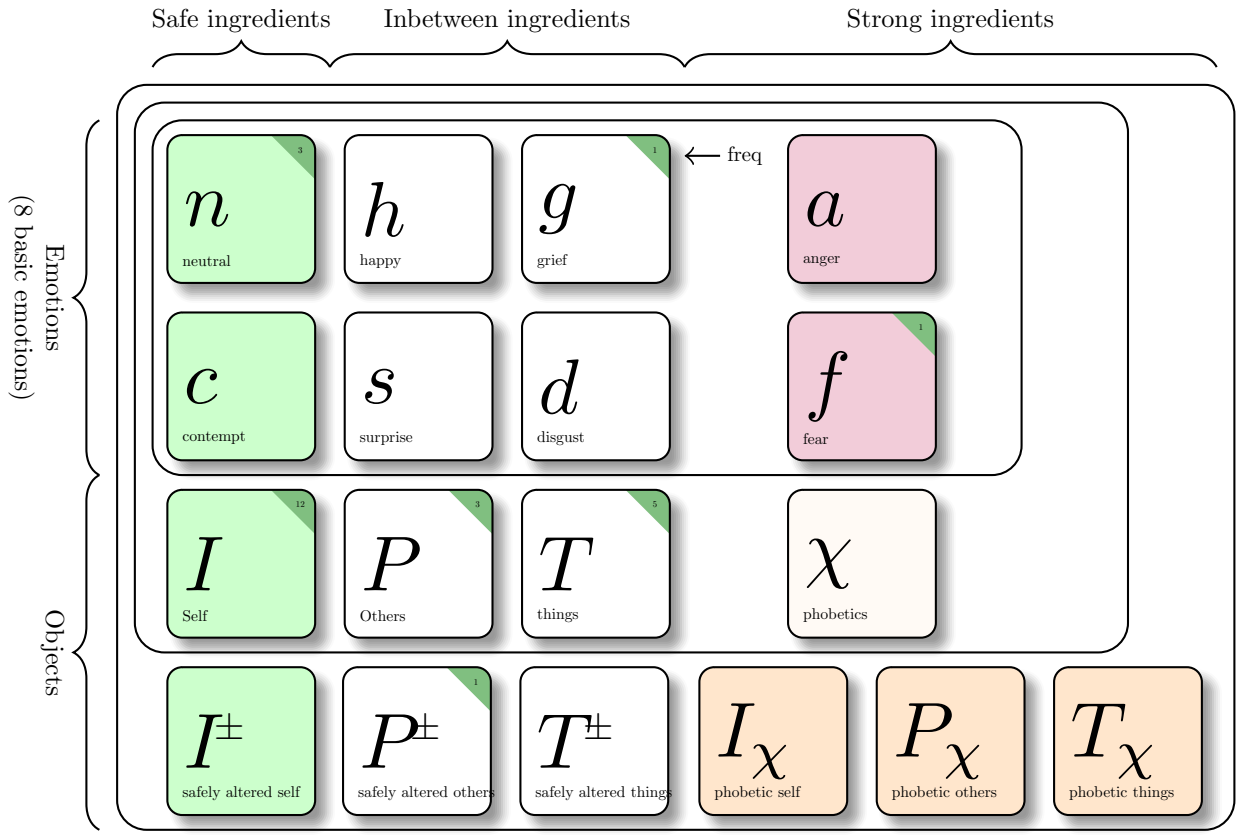

Fig. 2. Operational dream ingredients

Extract the text of any file to denote the memory content till now. For a matter of simplicity, the "Dream about Irma" is fetched and put in a file named 'memoryContent.txt'. Note that this content is a dream for Freud, but for us it is just a memory as we read it. Open the installed Python (IDLE), and write the following code.

```
f = open('C:\\memoryContent.txt')
raw = f.read()
```

This code reads the contents of the file. Then import the NLTK library ([35]), and tokenize the read data.

```
import nltk
tokens = nltk.word_tokenize(raw)
```

Then let us convert the tokens into a Text data type, which allows for extensive textual operations.

```
memory1 = nltk.Text(tokens)
```

For example, it provide the collocations() function.

```
memory1.collocations()
```

Calling it gives the following result: friend Otto, meaning that these two words co-occur together.
Now its time to extract ingredients,

```
freqDist1=memory1.vocab()
```

This code calculate the frequency distribution of words in memory content into a variable named freqDist1 of FreqDist data type. This data type allows for many useful operations such as $freqDist1.tabulate()$ to tabulate the FreqDist, $freqDist1.max()$ to get the most frequent word, $freqDist1.hapaxes()$ to get the least frequent words that only appear once.
To trace the appearance of key characters in the memory content, we can use Dispersion Plot as shown in Figure 4 for 'I','Irma' and 'Otto' words.

```
memory1.dispersion_plot(['I','Irma', 'Otto'
    ])
```

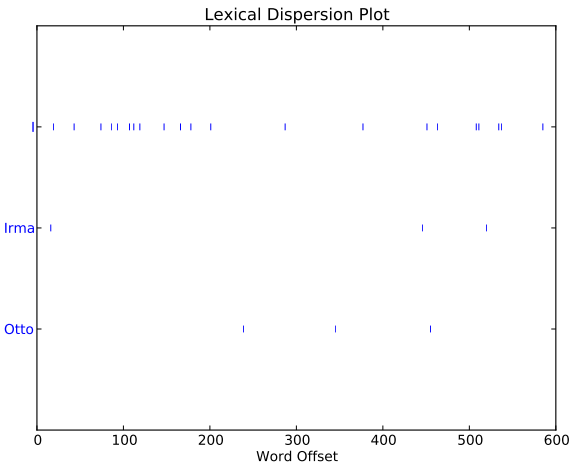

Fig. 4. Dispersion plot for I, Irma and Otto

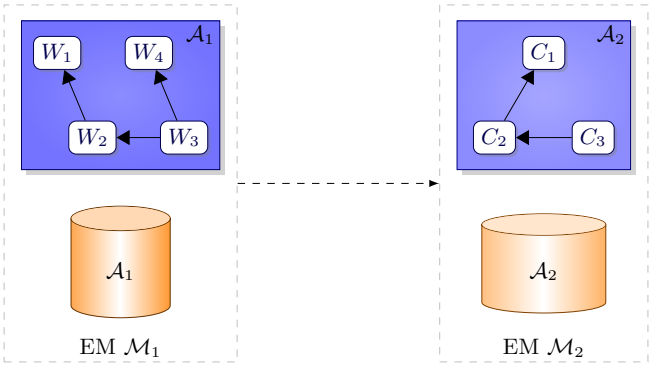

Fig. 5. Generating a TADA using a specific pattern

3.2 Phobetor

The main task of the Phobetor module is being responsible for all phobetic-specific aspects. Minor tasks include determining the parameters for scenes, camera, and rendering settings. However, this version is limited to textual output.

3.3 Phantasos

This module is responsible for the actual generation and rendering of a TADA. In a textual output, the Default relation is assumed. However, in visual output, there could be possible Rotating, Scaling and Translating of objects.
The TADA can be generated using specific patterns, as in ELIZA ([36]) as shown in Figure 5. So the Action A_1 in Episodic Memory M_1 is used as a template in generating the Action A_2 in Episodic Memory M_2. But, I rather prefer generating TADAs using n-gram model ([37]) which is used in text summarization.

```
1 memory1.generate()
```

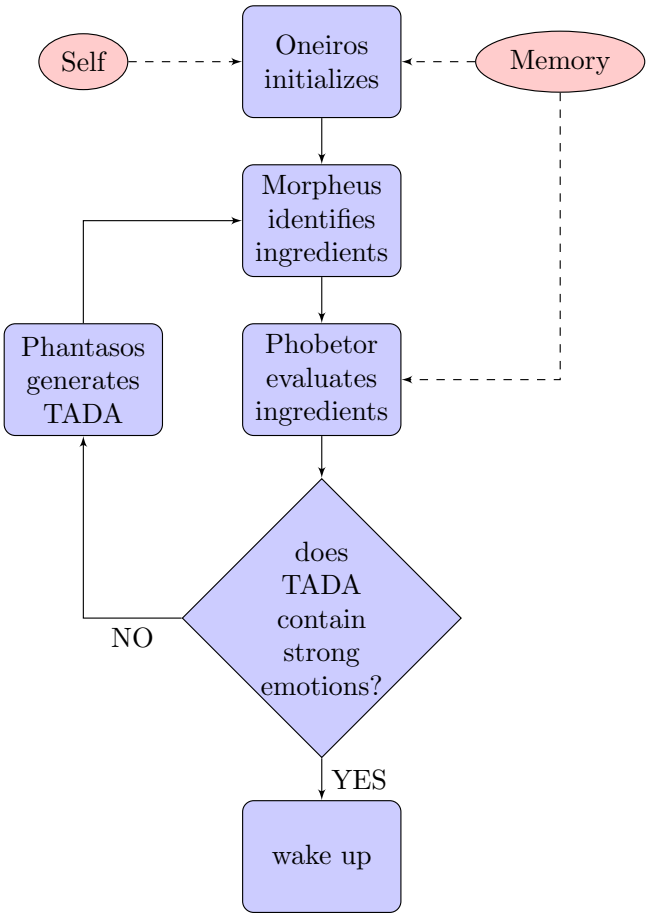

Fig. 6. flowchart

All TADAs generated form “Dream about Irma”, start with the sentence “A great hall - a number of guests,”. The rest of 7 arbitrarily generated textual TADAs are as follows :

—“whom I immediately take aside , as though to answer her letter...”,

—“whom we are receiving - among them Irma , whom I immediately take aside , as though to answer her letter...”

—“whom I immediately take aside , as though to answer her letter...”

—“whom we are receiving - among them Irma , whom I immediately take aside , as though to answer her letter...”

—“whom we are receiving - among them Irma , whom we are receiving - among them Irma , whom I immediately take aside , as though to answer her letter...”

—“whom we are receiving - among them Irma , whom I immediately take aside, as though to answer her letter...”

—“whom I immediately take aside , as though to answer her letter...”

A final note is to consider the interaction between these three modules, as shown in Figure 6 The Self can be operationally approxi-

mated by the profile of the dreamer containing his or her characteristics and mental image. First, Oneiros initializes operation. Morpheus identifies ingredients. Then, Phobetor evaluates them for determining the existence of strong emotions. If the candidate-TADA is safe to be germinated, Phantasos generates it. Otherwise there is a great probability to cause arousal wake-up.

4. CONCLUSION

Freud tried to answer WHY each dream ingredient is being incorporated. The inverse of this process is to answer HOW a TADA is formed, and it is the concern of this paper. Based on dream-contents, an operational model for dream ingredients is proposed. The proposed TADA generator, nicknamed Oneiros, is decomposed into three modules Morpheus, Phantasos and Phobetor. Morpheus is responsible for the lexical processing of memory contents, in order to perform tasks such as extracting objects, emotions and alterations. Phobetor is responsible for all phobetic-specific aspects. Phantasos is responsible for the actual generation of a TADA.
If the N-Gram perfectly approximates the memory consolidation, then we can end up with a couple interesting observations :

—All TADAs generated form "Dream about Irma", start with a sentence from the starting part of the memory content, which corresponds to earliest impressions of childhood.

—some of the arbitrarily generated TADAs contains recursive patterns such as "among them Irma , whom I ... - among them Irma , whom I..."

5. FUTURE WORK

Frequency distribution of ingredients of memory content is based on a rough estimation, Thus, "I" and "me", for instance, and "Irma" and "she" (refereeing to Irma) do not add up. This may require a refinement based on comprehension of the memory content. Also, building the semantic knowledge from memory content can be based on the application of WordNet ([38]) and/or ConceptNet ([39], [40])
One possible direction is implementing visual output in Phobetor module, by determining the parameters for scenes, camera, and rendering settings. This may utilize any a virtual reality or game engines.
Another possible direction is to apply the proposed system in Human-Robot Interaction ([41]), by allowing a robot to dream and tell the generated dream to a human.

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