

AFFECT PROCESSING FOR NARRATIVES ¹

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ABSTRACT

This paper presents a theory of AFFECT processing in the context of BORIS [Dyer, 1982] [Dyer, 1981a], a computer program designed to read and answer questions about complex narratives. Here, "complex" entails the coordination, application and search of many distinct sources of knowledge during both comprehension and question answering. This paper concentrates only on those structures and processes which interact with affect situations. The affect component in BORIS is not a separate module, but rather a series of structures and processes which arise as various lexical items are encountered during narrative comprehension and question answering [Dyer, 1981b].

1. Introduction

Descriptions of characters' emotional reactions to encountered situations occur with frequency in narratives of any complexity. Why is this the case? What effect does this have on the way readers process narrative text? Examples in this paper will be taken from portions of a narrative read by BORIS [Lehnert, Dyer, et al., 1982]. Affective segments are highlighted in boldface:

DIVORCE-1

Richard hadn't heard from his... roommate Paul for years... When a letter finally arrived... Richard was **anxious** to find out how Paul was.

Unfortunately, the news was not good. Paul's wife Sarah wanted a divorce. She also wanted the car, the house, the children, and alimony. Paul ... didn't want to see Sarah walk off with everything... he was **hoping** for a favor from the only lawyer he knew. Paul gave his home phone number in case Richard... could help.

Richard **eagerly** picked up the phone... After a brief conversation, Paul agreed to have lunch with him... He sounded extremely **relieved** and **grateful**.

...as Richard was driving to the restaurant he barely avoided hitting an old man on the street. He felt **extremely upset**... and had three drinks at the restaurant. When Paul arrived Richard was fairly drunk. After the food came, Richard spilled... coffee on Paul. Paul seemed **very annoyed** by this so

Richard offered to drive him home for a change of clothes.

When Paul walked into the bedroom and found Sarah with another man he **nearly had a heart attack**. Then he realized what a blessing it was. With Richard there as a witness, Sarah's divorce case was shot. Richard **congratulated** Paul and suggested that they **celebrate** at dinner. Paul was **eager** to comply.

DIVORCE-1 requires, minimally, the following abstract constructs to represent its conceptual content: object primitives [Lehnert and Burstein, 1979], physical states, scripts, plans, goals [Schank and Abelson, 1977], interpersonal relationships, settings [Dyer and Lehnert, 1982], abstract themes [Dyer, 1981c], and in addition, a theory of affect.

2. Representing Emotions

In BORIS, emotional reactions are represented by a knowledge construct called an AFFECT. It is used to trace the emotional states of narrative characters at the moment that emotional reactions are encountered. Each AFFECT is constructed out of six basic components:

1. STATE -- This component holds a primitive state of emotional arousal which is either positive (POS) or negative (NEG). In general, a NEG emotion signals a goal failure while a POS emotion indicates goal success.

2. CHAR -- Indicates which character in the narrative is feeling the primitive emotion.

3. G-SITU -- Refers to the goal situation which gave rise to the primitive emotional state. The major information an AFFECT carries is a goal situation which describes the success, failure, or activation of a goal, along with other information, such as agency and expectations. These are discussed below.

4. TOWARD (optional) -- Primitive emotions can be directed at another character. For example, "anger" and "guilt" can arise from goal situations involving other characters.

5. SCALE (optional) -- Characters can feel an emotion at various levels of intensity. In BORIS, affect intensity indicates the importance of a goal to the character involved.

6. E-MODE (optional) -- Refers to the expectations characters have about the likely future outcome of a goal.

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AFFECTs are important is because they implicitly convey information about goals [Wilensky, 1978]. Although AFFECTs do not mention specific goals, they do describe *abstract* goal situations which are currently active. In BORIS "joy" indicates that a character has achieved some goal, while "sad" indicates a goal failure. More complicated goals situations involve the intervention of other characters (as in the case of agency). Hence "grateful" implies that some goal of x has been achieved by means of another character y, while "anger" directed by x toward y implies that y has caused a goal failure for x. In each case, affective descriptors say nothing about specific goal content, but instead serve to reveal abstract goal circumstances. A portion of the BORIS lexicon appears below:

BORIS Affect Lexicon

lexicon	affect info.	goal situation
happy joyous glad	(AFFECT STATE (POS) CHAR x G-SITU (a))	(a) Goal of x achieved
unhappy upset sad	(AFFECT STATE (NEG) CHAR x G-SITU (b))	(b) Goal of x thwarted or suspended or preservation goal active
grateful thankful	(AFFECT STATE (POS) CHAR x G-SITU (c) TOWARD y)	(c) y caused goal situation (a) to occur
annoyed angry furious	(AFFECT STATE (NEG) CHAR x G-SITU (d) TOWARD y)	(d) y caused goal situation (b) to occur
hopeful	(AFFECT STATE (POS) CHAR x G-SITU (e) E-MODE (EXPECTED))	(e) Goal of x is active
fearful worried	(AFFECT STATE (NEG) CHAR x G-SITU (f) E-MODE (EXPECTED))	(f) P-goal (i.e. preservation or maintenance goal) is active
surprised shocked	(AFFECT STATE pos/neg CHAR x G-SITU (g) E-MODE (UNEXPECTED))	(g) A goal is achieved or thwarted
relieved allayed	(AFFECT STATE (POS) CHAR x G-SITU (h))	(h) Situation (f) was active but p-goal failure avoided
disappointed	(AFFECT STATE (NEG) CHAR x G-SITU (i))	(i) Situation (e) was active but goal is now thwarted
proud smug	(AFFECT STATE (POS) CHAR x G-SITU (j) TOWARD y)	(j) goal of y achieved by x
guilty ashamed embarrassed regretful	(AFFECT STATE (NEG) CHAR x G-SITU (k) TOWARD y)	(k) goal of y thwarted by x

More complicated AFFECTs are represented by partial decomposition into more basic AFFECTs. For instance, "gratitude" refers to goal situation (c) in the lexicon, which itself accesses the simpler AFFECT of "joy" (goal situation (a)). So "gratitude" represents an abstract situation in which x feels "joy" due to the fact that y has achieved x's goal.

"Relief" and "disappointment" involve more complex goal situations than "hope" or "fear". In BORIS, "relief" indicates that a narrative character x at one point had an active goal, which x expected would fail. Instead, the goal either did not fail, or was then actually achieved. So "relief" (h) refers to the AFFECT structure described by "worry" (f). Conversely, "disappointment" is represented by an initial expectation that a goal would be achieved (e) which then actually ends up being thwarted (i).

3. AFFECTs in Processing

Affective descriptions influence processing by a) generating expectations, b) triggering inferences, c) aiding parsing, and d) helping construct memories. Consider the first sentence in the third paragraph of DIVORCE-1:

Richard eagerly picked up the phone and dialed.

Subjects infer that Richard will be Paul's lawyer by the time they finish reading this sentence. Yet the same inference would not be made if the story had read:

Richard morosely picked up the phone and dialed.

The expectation that Richard will help Paul is supported by the word "eagerly". But how?

BORIS contains a number of affect interpretation rules and affect response rules. Interpretation rules map certain lexical items into AFFECTs. "Eagerly" is interpreted by the rule:

af1: If x is ACTOR of an ACT
which is modified by "eagerly"
Then interpret as:
"x feel POS affect while x do ACT"

while the response rules relate these AFFECTs to other knowledge structures. Rule ar1 below:

ar1: If x ASK y to serve as agent for x
and y has POS affect
Then y has the goal of being x's agent.

combines Paul's request for a lawyer with the affect arising from "eagerly" to lead BORIS to infer that Richard wants to be Paul's lawyer.

AFFECT information also aids in parsing tasks. Consider again the third paragraph of DIVORCE-1:

Richard eagerly picked up the phone... After a brief conversation, Paul agreed to have lunch with him... He sounded extremely relieved and grateful.

Who does "he" refer to? People usually assume that "he" refers to Paul. After all, it is Paul (not Richard) who is in trouble and who has asked Richard for help. So resolving "he" requires knowing: a) the goal circumstances of both Paul and Richard, and b) what "grateful" and "relieved" mean in goal

terms. When BORIS sees "he" is bound to the CHAR slot in an AFFECT, it searches for an active character whose goal situation matches the G-SITU associated with that AFFECT. Consequently, Paul is chosen as the referent.

Norm violations initiate special processing. For example, when BORIS reads:

Paul's salary from the school was very small.

it builds the following structure:

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(OCCUPATION
  ACTOR Paul
  CLASS (TEACHER)
  LOCATION (INSTITUTION
    FUNCTION (EDUCATION))
  SALARY (SCALE IS ( <NORM )))
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As BORIS constructs <NORM, it tries to understand its significance by checking for a current AFFECT associated with the ACTOR in this structure. The following deviation rule is used to infer that Paul has an active P-FINANCES (preserve finances) goal:

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ad1: If x is the ACTOR in a knowledge
      structure which has an attribute (ATTR)
      and ATTR is >NORM or <NORM
      and the current AFFECT of x is NEG
      Then find a preservation goal G enabled by
      ATTR and assume that G is active
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Rule ad1 works in other cases. For instance:

Mary was worried. She was overweight.

Here BORIS will infer that Mary has a P-HEALTH goal active since P-HEALTH is enabled by maintaining normal weight. In contrast, if the sentence had read:

Mary was happy that she was overweight.

then no preservation goal would be inferred.

4. Empathy and Interpersonal Themes

Characters often react emotionally to what other characters have experienced. Such reactions are empathetic, and help preserve relationships between characters.

Consider the following sentence from paragraph 2 of DIVORCE-1: "Unfortunately, the news was not good." How is "unfortunately" to be processed? Here, it is clear that "unfortunately" should mean:

Richard is negatively aroused because of some goal situation affecting Paul.

But what if the passage had read: "Fortunately, the news was not good." Now, the natural effect upon the reader is to assume that Richard does not like Paul. The same result would be achieved by: "Unfortunately, the news was good." but not by: "Fortunately, the news was good." What is going on here?

In each case, Richard is being emotionally influenced by the success (or failure) of Paul's goals. BORIS's ability to make a correct interpretation is based on its knowledge of interpersonal themes (IPTs) as they relate to empathetic reactions. These relationships appear below:

Empathy Table

Y has goal FAILURE	Y has goal SUCCESS	interpersonal theme (IPT)
X feels NEG	X feels POS	IPT-FRIENDS(X,Y) (goal accord)
X feels POS	X feels NEG	IPT-ENEMIES(X,Y) (goal conflict)

Situations of negative empathy arise from the interpersonal theme of IPT-ENEMIES. These situations are signaled by such words as "jealous", "spiteful" and "resentful", and are represented in BORIS by a knowledge construct called an ACE (Affect as a Consequence of Empathy):

	ACE ---	theme ----
commiserate condole	x MTRANS TO y that [goal failure (y) causes: x feel NEG]	(IPT-FRIENDS x y)
felicitate congratulate	x MTRANS TO y that [goal success (y) causes: x feel POS]	(IPT-FRIENDS x y)
envy jealous spiteful	x MTRANS TO y/x that [goal success (y) causes: x feel NEG]	(IPT-ENEMIES x y)
gloat	x MTRANS TO y/x that [goal failure (y) causes: x feel POS]	(IPT-ENEMIES x y)

ACEs are important because they capture empathetic aspects of interpersonal relations. At the end of DIVORCE-1 Richard congratulates Paul. BORIS uses ACE-FELICITATION to interpret this as Richard telling Paul that Richard feels happy because Paul has won his divorce case.

5. AFFECTs and Episodic Memory

Subject protocols indicate that people can not directly access events when given the description of a character's AFFECT. For example, the question: "When did Paul feel angry?" is very difficult for most people to answer. Subjects try to answer this question by chronologically 'scanning' through the story until they encounter an event in which Paul might have become angry.

These protocols are in keeping with experimental work by Robinson on autobiographical memory [Robinson, 1976] in which subjects experienced much more difficulty in recall when prompted with affect terms than when prompted with either object or activity terms. Consequently, AFFECTs do not themselves hold memories in BORIS. Instead, they are usually reconstructed from instantiated goal situations and memory structures referring to them. Next to goals and ACEs, the structures most closely related to AFFECTs are Thematic Abstraction Units (TAUs) [Dyer, 1982] [Lehnert, Dyer, et al., 1982] [Dyer, 1981c].

TAUs represent a class of thematic structures, which are often expressed in natural language by adages, such as "a friend in need is a friend in deed", or "caught red-handed". For instance, whenever a character is relying on a plan requiring secrecy to achieve a goal and this plan fails as the result of an

eye-witness, TAU-RED-HANDED is instantiated. BORIS instantiates this TAU in DIVORCE-1 when Paul catches Sarah in bed with another man.

Once memories have been built with the aid of AFFECTs, BORIS is able to answer affect-related questions:

Q1: How did Richard feel when the letter appeared?
RICHARD FELT GLAD BECAUSE PAUL AND HE WERE FRIENDS.

Q2: Why was Paul upset about the divorce?
PAUL AND SARAH WERE FIGHTING OVER
THE FAMILY POSSESSIONS.

Q3: How did Richard feel when the coffee spilled?
RICHARD WAS EMBARRASSED.

Q4: How did Paul feel when he caught his wife
with another man?
PAUL WAS SURPRISED.

Q5: How did Richard feel when Paul won the case?
RICHARD WAS HAPPY ON PAUL'S BEHALF.

Often the answer is reconstructed from a knowledge structure which was built when the situation (referred to in the question) was originally processed. The AFFECTs in the question-answering above are reconstructed from these knowledge structures: Q1 (IPTs), Q2 (GOALs), Q3/Q4 (TAUs), Q5 (ACEs).

When Richard spills coffee, TAU-REGRETTABLE-MISTAKE is built. This structure represents BORIS's knowledge about social blunders and how each role (i.e. SCHLEMIEL and SCHLIMAZEL) will feel about the blunder. The SCHLEMIEL should feel embarrassed while the SCHLIMAZEL is expected to be angry. Unless the characters' reactions violate these expectations there is no reason to instantiate a specific emotional state in episodic memory. To answer Q3, we look for the default AFFECT associated with SCHLEMIEL in TAU-REGRETTABLE-MISTAKE. Likewise, the answer to Q4 is reconstructed from knowledge about TAU-RED-HANDED. Finally, Q5 is reconstructed from ACE-FELICITATION, which was instantiated when Richard congratulated Paul.

6. Comparison With Other Work

The BORIS affect model derives much of its inspiration from a paper by Roseman [Roseman, 1979] in which he developed five dimensions for categorizing emotions -- i.e. desirability (D), outcomes (O), probability (P), agency (A), and legitimacy (L). Using these dimensions, for example, Roseman represented fear as: D(+) O(-) P(-) or D(-) O(+) P(-). Thus, fear involves the chance that what you do not want may occur, or that what you do want may not occur.

Much work on affect deals with the physiological [Izard, 1971] and psychological [Mandler, 1975] [Bower et al., 1981] [Schachter, 1966] complexity of the emotional experience itself. In contrast, BORIS is designed only to understand the conceptual significance of affective reactions on the part of narrative characters. To do so BORIS employs a representational system which relates AFFECTs to one another through decomposition and shared inferences. BORIS is not intended to model emotional states or experiences themselves.

7. Conclusions

The AFFECT model described here represents a first-order approximation of a very complex domain. BORIS affect theory is oriented towards understanding the intentional significance of emotional reactions by inferring their corresponding cognitive structures. Memory structures containing these reactions are exactly those structures which capture events of greatest importance to the characters involved.

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