

Why boys like motorcycles: using emotion theory to find structure in humorous stories.

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Introduction

This paper is modest in scope. We discuss novel ideas for the representation of humor using an emotion architecture. Our goal is to present the seeds of an idea our lab has long held to have potential, for the purpose of generating discussion. Development of these ideas is in the early stages, but by the time of the workshop we hope to have some preliminary results to show.

This paper does not draw much on existing theories of humor. Rather, it is an exploration into humor based on those aspects of emotion for which we have already established a computational platform. The goal of this research, then, is to allow us to specify a small, *computable*, form of humor suitable for use in a believable agent environment.

Our thesis is as follows: Using the Affective Reasoner (hereafter AR) we have demonstrated that it is possible to capture certain important elements of stories by representing the underlying human emotions that are present in the stories (See *Story-morphing in the Affective Reasoning paradigm: Generating stories semi-automatically for use with "emotionally intelligent" multimedia agents*, Elliott, et al., Autonomous Agents 1998) Some stories are also funny stories. Certain kinds of funny stories share similarities in their emotion representation. By extracting this emotion representation, and using story-morphing techniques explored in earlier work, we should be able to generate new stories, or at least new forms of existing stories, that are also funny. Additionally, we should also be able to answer some preliminary questions about the nature of certain structural components of humor by varying this structure under computational control.

The motivation for this work is that interaction with human-like agents can be made more pleasurable if the agents are able to sometimes amuse us with humorous invention. This may be particularly important for agent-helpers such as those in automated tutoring systems: In documenting the persona effect, [James Lester, et al., *The Persona Effect: Affective Impact of Animated Pedagogical Agents*, Proceedings of CHI '97, Conference on Human Factors and Computer Systems] Lester and his group have shown that engagement has been an important component in developing quality interaction between users and tutoring systems. The strategic use of humor is one clear way that agents can be more engaging.

To illustrate how our emotion classification techniques apply we will examine several humorous stories, break them down into a coarse emotion representation as stories --- independent of the fact that they are humorous, compare the similarities in emotion representation between them, and suggest ways in which non-humorous stories can be morphed into humorous ones using the emotion theory.

It is important to note that for the purposes of humor generation, and construction of emotion fabric underlying funny stories, it is not necessary that this be *the* correct interpretation. Any correct interpretation will do as long as new stories generated from the delineated structural components are sound.

Constraints

Much humor is based on elements over which we make no claim here. Timing-based humor, inventive humor, "zany" humor, plays on abstract associations, and verbal humor are all beyond our capabilities. However, some stories seem funny because

they represent funny situations for people to be in. They do not depend on the timing of the telling, nor very much on the sequence of the delivery. That is, if the events in such stories are told in a careless manner with the sequence of events being changed, or with different words used in the telling, such stories might be diminished somewhat, but do not really lose their essential humorous qualities. It is exclusively this sort of humor -- funny stories which are based on the perceived feelings of the characters in them -- on which we will focus in this paper.

In keeping with our work on the emotion fabric of stories we will use only stories believed to be true.

Background

What we refer to as "emotions" in this paper arise naturally in many human social situations as a byproduct of goal-driven and principled (or unprincipled) behavior, simple preferences, and relationships with other agents. This includes many situations not normally thought of as emotional (e.g., becoming annoyed at someone, a mild form of anger in our theory), but explicitly excludes representation of any physical, experiential, properties of emotions. See the emotion table below for details of the emotion representation we use, based on the seminal work of Ortony, Clore, and Collins (*The Cognitive Structure of Emotions* , 1998).

Our approach to story representation uses several points of leverage. This leverage is based on the ideas that human emotion can be faithfully represented at a descriptive level suitable for story representation; that the communication of human emotion is often indirect, and inaccurate; and that humans have a natural tendency to project plausible interpretations onto social interactions and observed emotion expressions. Following are the most salient points of this leverage on which we hope to capitalize.

First, the underlying descriptive emotion theory that we have used in the Affective Reasoning project, based largely on the Ortony, Clore, and Collins model, has been exercised, and extended, over the years in ways useful for describing human emotion narratives. That is, where the theory has not been sufficient to describe some scenario it has had to be extended; where it has had a component that has not been necessary in describing scenarios it has been reduced. In this ongoing process we have described portions of about six hundred different scenarios. Through this transcription process we have developed a somewhat canonical form for the representation of the human emotion component of stories.

Second, in previous work we have given many examples illustrating that humans can have multiple, even conflicting, emotions stemming from the same emotion-eliciting events (e.g., see Elliott, *The Affective Reasoner*, 1992) For example, suppose that one unexpectedly comes by desperately needed money, but it is inherited because a much admired, and loved, favorite uncle dies. News of the uncle's death might simultaneously lead to distress over the loss of a loved one, joy over newly-inherited wealth, relief over escaping from creditors, anger that death came to the family, guilt over feeling happy about the benefits derived from the uncle's death, remorse over not having spent more time with the uncle recently, etc. What this means for story-morphing is that, with respect to interpretations of emotion eliciting situations, we are not so burdened with the "foolish consistency" that is the hobgoblin of plot structures.

Third, humans seem inclined to project not only anthropomorphic qualities to most everything, but also social qualities to anything that has agent-like attributes and interacts in ways perceivable as supporting a community. Given a set of agents engaged in dialog, or characters interacting in a script, people naturally attribute human-like *motivations* to the agents/characters for their actions. We humorously refer to scripted presentations of our personality-rich agents as a multimedia Rorschach test -- but there is a strong element of truth in this line of thinking.

Fourth, facial expressions, music, and inflections in spoken text seem to trigger explanatory mechanisms --- that there is some sort of cognitive dissonance that is quelled only when observers abductively attribute narrative qualities to sequenced expressions, and other social cues, on which they can hang the complex fabric of the interaction.

EMOTION CATEGORIES

Clark Elliott, 1998
after Ortony, et al., 1988

GROUP	SPECIFICATION	CATEGORY LABEL AND EMOTION TYPE
Well-Being	appraisal of a situation as an <i>event</i>	joy : pleased about an <i>event</i> distress : displeased about an <i>event</i>
Fortunes-of- Others	presumed value of a situation as an <i>event</i> affecting another	happy-for : pleased about an <i>event</i> desirable for another gloating : pleased about an <i>event</i> undesirable for another resentment : displeased about an <i>event</i> desirable for another jealousy* : <i>resentment</i> over a desired mutually exclusive goal envy* : <i>resentment</i> over a desired non-exclusive goal sorry-for : displeased about an <i>event</i> undesirable for another
Prospect-based	appraisal of a situation as a prospective <i>event</i>	hope : pleased about a prospective desirable <i>event</i> fear : displeased about a prospective undesirable <i>event</i>
Confirmation	appraisal of a situation as confirming or disconfirming an expectation	satisfaction : pleased about a confirmed desirable <i>event</i> relief : pleased about a disconfirmed undesirable <i>event</i> fears-confirmed : displeased about a confirmed undesirable <i>event</i> disappointment : displeased about a disconfirmed desirable <i>event</i>
Attribution	appraisal of a situation as an accountable <i>act</i> of some agent	pride : approving of one's own <i>act</i> admiration : approving of another's <i>act</i> shame : disapproving of one's own <i>act</i> reproach : disapproving of another's <i>act</i>
Attraction	appraisal of a situation as containing an attractive or unattractive <i>object</i>	liking : finding an <i>object</i> appealing disliking : finding an <i>object</i> unappealing
Well-being/ Attribution	compound emotions	gratitude : admiration+joy anger : reproach+distress gratification : pride+joy remorse : shame+distress
Attraction/ Attribution	compound emotion extensions	love :admiration+liking hate :reproach+disliking

*Non-symmetric additions necessary for some stories.

Two stories with situational humor

In our first example we will look at two vignettes illustrating humor that has been loosely categorized as like "pulling a chair out from under a dignitary," but which we will further refine as the "Citizen's arrest!" form of humor wherein Gomer, from the *Andy Griffith Show*, gets back at Deputy Sheriff Barney Fife for giving him a traffic ticket.

Syntax note: In general we will use parentheses, (), for function arguments, and square braces, [], for parenthetical comments.

Senior Graduate Student gets taken down

"In graduate school the older Ph.D. students lorded it over us. One day a secretary sent out bulk email to everyone in

Computer Science asking that we each confirm our status on some unimportant matter. A first-year graduate student mistakenly used the "R" form of reply --- which replies to all recipients copied in on the original note, instead of the "r" form --- which only replies to the sender. A senior graduate student then replied to this poor email neophyte, flaming him mercilessly for interrupting everyone's busy academic work by being so technically inept, and blah blah. Of course the senior Ph.D. student mistakenly used the "R" form to reply as well. We all thought this was very funny."

The Dean is late!

"The dean of our school, a rather formal, pontificating, individual, devoted some minutes at the end of a faculty meeting discussing professionalism. We were a typical, frazzled, faculty, with continuous interruptions during our day. Nonetheless he belittled the rest of the faculty members in the school for coming late to meetings, saying that because these were scheduled in advance there really should be no excuse for not arriving on time. When he arrived ten minutes late to the next faculty meeting two days later, much chagrined, we were all greatly pleased at his expense." (Told to the author by faculty from another University.)

The parallel structure of these two stories is relatively obvious, and we offer one analysis here. We can find direct mappings for the following labelings within each of the stories. Step-by-step, using the existing emotion theory underlying the AR, we have the following:

- Agent-A: Authority figure who later becomes an unwilling victim.
- Agent-C: Chorus of observers, who originally are victims but later delight in the downfall of the authority figure, Agent-A.
- Relationship R1: Adversarial from the perspective of the authority figure toward the chorus of observers, with respect to the principle.
- Relationship R2: Adversarial from the perspective of the chorus of observers toward the authority figure, with respect to the principle.

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- Agent-C through an action, Act-1, violates a principle held by the Authority figure, Agent-A leading to emotion instance E1-shame.
 - The authority figure (older grad student / Dean) has an emotion instance, E2-mixed, of mixed emotions, comprised of (a) E2-a-gloating (using the R1 adversarial relationship) over the misfortune of others, and (b) anger, E2-b-anger, over the violation of the stated principle, P, which lead to a thwarting of one of the authority figure's goals, G, (not being disturbed via email / meeting beginning on time).
 - Chorus members are held accountable, through Act-2, by the authority figure, for violating the principle P.
 - The original victims (the new grad student, the faculty) are ashamed, emotion instance E3-shame, but the intensity of this emotion is increased over E1-shame by Act-2 [through emotion intensity variables such as *sense of reality*, and *importance*].
 - An adversarial relationship R2-adversarial, with respect to this principle, from the Chorus members to the authority figure is established at this point, if not already present through the authority figure holding the chorus members accountable for their transgression.
 - The principle held by the authority figure, for which the observers have been earlier held accountable is later violated by the authority figure, through Act-3.
 - An emotion instance, E3-a, of embarrassment (shame) of the authority figure over the violated principle, P.
 - An instance, instance-E3-b, of gloating, of the chorus over authority figure's downfall.

This gives us the emotion fabric:

P is held by Agent-C and Agent-A.

Act-1: Agent-C violates P; E1-a-shame(Agent-C,P); E1-b-mixed-emotions(Agent-A,P,G,R1) [E1-b-i-gloating(Agent-A,P,R1)/E1-b-ii-anger(Agent-A,[at]Agent-C,G,P)]

Act-2: E2-shame(Agent-C,P), intensity is increased by Act-2(Agent-A); relationship [Agent-C -- R2-adversarial -- Agent-A, with respect to P] is established if not already present.

Act-3: Agent-A violates P; E3-a-shame(Agent-A); E3-b-gloating(Agent-C over Agent-A)

Discussion

Not previously well-defined in the Affective Reasoner are (1) authority figure, and (2) adversarial with respect to a specific principle (For example: I have a friend V who has another long-time friend K who will no longer come over to V's house because V has purchased guns, which K is, in principle, opposed to. The two are mutually adversarial with respect to that principle, but are otherwise friends.)

Each of these cases can be handled, *ad hoc*, without changing the computational framework in the AR. First, that one is an authority figure is in this case really only with respect to the principle under consideration: the senior graduate student is an authority on sending return mail; the Dean is an authority on meetings. Any time a person feels it their job to criticize others for the violation of a principle, for the purposes of this type of humor we can consider them to consider themselves an authority on that principle.

In the case of adversarial relationships being established with respect to certain principles, this is straightforward. In the AR, relationships have been more-or-less arbitrarily established (although dynamically set) anyway. For the purpose of studying humor then, setting the relationships so that an agent is in an adversarial relationship with another agent need not be specific to a certain principle, but can continue to be, instead, global, thus encompassing that principle. From a future-design plausibility standpoint, it would seem that all fortunes-of-others-emotions dependent on that particular principle, and that agent, could simply use whatever setting of the adversarial relationship was desired, ignoring the setting at other times. In this way, should V's guns be stolen, K would gloat, but should V's television be stolen K would feel pity.

Here are some additional intuitions

- E1-b-mixed(Agent-A,P,G,R) does not seem necessary, E1-b-i-gloating(Agent-A,P,R) is sufficient; E1-b-ii-anger(Agent-A,[at]Agent-C,G,P) might work.
- E1-a-shame(Agent-C,P) can be dropped and folded into E2-shame(Agent-C). It is only important that the adversarial relationship, R2, be established, or continued, with Act-2 as the trigger, and that Act-2 either cause, or intensify, E2-Shame(Agent-C,P).
- A (mild) form of E2-Hate(Agent-C,[towards] Agent-A, P2) may be present stemming from disliking of Agent-A by Agent-C, and by the violation of the principle, P2, "Do not point out my faults."
- Agent-C does not necessarily have to hold the same principle, P, but has to be held accountable for it by Agent-A so that if shame is not present, then a new goal G2 sought by Agent-C must take the place of the principle P, such that violating the principle P held by Agent-A will lead to blocking of the goal G2. In other words, if the authority holds a principle to be valid, and a chorus member violates the principle and gets slammed because of it, it may still be funny when the authority later violates that principle.

Here we can also see anger replacing shame, that is, instead of E1-a-shame(Agent-C,P) we have E1-a-anger(Agent-C,P2,G2) where G2 is some goal thwarted by Agent-A as a consequence of Agent-C having violated Agent-A's principle P, and P2 is Agent-C's principle, "Do not thwart my goals on the basis of principles I do not believe in."

For example many non-Christians gloated over the downfall of Jimmy Swaggart, even though they themselves might not have held the principles he was embarrassed to have violated. However, they felt that through the political arena their own goals were being blocked through Swaggart's actions based on their own violation of Swaggart's principles.

- The chorus must identify with the victim's plight just before, or during, the moment that humor emerges. In the AR we use the *cognitive unit* mechanism wherein, in this case, the chorus would identify with the shame of the authority figure, before moving into (or perhaps "simultaneously" with) gloating.
- The principle violated by Agent-A must be the same, or similar to, that recently violated by Agent-C or the situation will not be funny.
- The victim, Agent-A, must feel shame over the action that violates the principle, or it will not be funny. If the senior graduate student, or the Dean, had simply taken the attitude, "Who cares... the rule only applies to peons," it would have simply generated bad feeling, not humor.

Two more complex stories

There are many examples that have a direct parallel to the above situations, and which are funny. We can learn more by looking at funny stories which touch on the gray areas of such representation. To this end we present two more stories, which although they are different on the surface, nonetheless seem to be funny because they share the same underlying emotion structure.

The motorcycles

My friend Richard and I were each going through a somewhat troubled time during hiatuses from college: we both were unfortunate in love, between career decisions, and without particular direction at the time. In short, we were nerds. I hit on the idea of buying motorcycles, which neither of us had ever before ridden, to improve our 'coolness factor.' Being short of funds we managed only to buy a pair of dismantled old Honda 450s most of which came in the form of large greasy boxes with parts in them. Although we did manage to get them re-assembled, and running, they were not reliable. Our 'coolness factor,' and egos, suffered mightily over the next few days as we struggled with, e.g., bikes that failed under us so that we had to walk home across the city in the rain, or worse, had to push one or both of the bikes back up long hills that we had rolled down with the hope of getting them started. (For the uninitiated, pushing a five-hundred pound motorcycle up a long hill is quite different from pushing a bicycle!)

Finally, after a week we managed to get the motorcycles running somewhat reliably. We rode them out on a tour of the hills, vainly attempting to be "impressive" in a way that we simply had not been able to capture for all our efforts. Finally, stopping in the gravel parking lot of a woodland area we looked at each other defeated. "It" just had not happened. We were hopeless.

In frustration Richard said, "Watch this!" and attempted to spin a doughnut with his back wheel. Because of the gravel his front wheel slipped as well, the bike went flying out from under him, and he landed face down in the rocky dust. He got up and we inspected the damage. On his bike, the gear shift was crazily twisted around the engine, his brake and clutch grips were curlicued like munchkin shoes from the Wizard of Oz around his handle bars, and his fender was ripped loose. Richard had not fared much better: both palms were bloody and imbedded with small stones from the parking lot, and his face was scraped.

"Wow," I said.

"Now that really WAS cool!" Richard said.

We both burst out laughing. We laughed so hard that we cried, and our stomachs began to hurt. That we could reach such heights of Nerd-dom was really one of the funniest things I have ever encountered.

This vignette is interesting because although on the surface it is different from the two above, from an emotion-humor perspective it might be seen as similar. Here is one analysis suggesting that a common structure with the preceding examples is plausible.

- There is a principle involved, that of being *cool*, or, if you will, the principle of NOT-nerdness. The principle was violated. The victims were embarrassed about this.

Act-1 = Being nerds over the course of a week.

P = Not being nerds.

Agent-C = Richard-and-me [Nerds].

E1-shame(Richard-and-me,P)

- Failing to not be nerds was held over the heads of the two participants as a blameworthy action in the first part of the story. The authority figures making this assessment were the participants themselves.

Act-2 = Inflicting the standard of Not-nerdness

Agent-A = Richard-and-me [Judges of Nerds].

R1 = Adversarial relationships with ourselves -- conflict over wanting to not be nerds, but being nerds. That is, that it is not acceptable [Agent-A] to simply relax and be nerds [Agent-C] indicates that there is motivation, P, for calling us to task for our nerdness.

R2 = Adversarial relationship from Agent-C [nerds] to the part that believes we should not be nerds Agent-A [believing should be not nerd] resulting in the increasing stress from continuing to lose the "not nerd" battle.

- At one point the nerds were exhibiting extreme nerdness by trashing the motorcycle, and were suffering for it. In the next moment, *when the situation became humorous*, the nerds had gained the perspective of a chorus, Agent-C, and could observe the judges [Agent-A authority-figures] brought to the height of embarrassment.

G = Have a moment of Not-nerdness through ripping off a cool doughnut with the motorcycle; thwarted.

E1/2-b-i-gloating(Richard-and-me-Judges,P,R1)

E1/2-b-ii-anger[as frustration](Richard-and-me-Judges,[at]Richard-and-me-Nerds,G,P)

- The chorus, Agent-C [Nerds] could certainly identify with the authority-victims Agent-A [Judges of Nerds] since in this case they *were* also the victims, but yet there was enough cognitive distance from the victims -- at the end -- to enjoy the humor at their expense.

Act-3: Through perspective change, Agent-A [Judges of Nerds] is seen to have violated P. Agent-C [Nerds] can enjoy this at their expense.

- In fact, because the Nerds were able to laugh at the authority-figure component in themselves that had been holding them to the principle of Not-nerdness they escaped that role, and were no longer nerds.

This was a *sad* situation, but if this is all it were, we would not have been frustrated, which is a form of anger in our emotion theory. Had we been sad, we might, at best, have simply experienced relief that our quest to be cool was over, but this does not seem funny.

Additionally, had we not cared about our Nerdness, we might have continued blissfully to be Nerds and the story would not have been funny (except perhaps in a different way -- see the Professor G story below).

Next let us examine a fourth story where the principle, P, at first seems hidden.

Emotions and Jackhammers

"For most Ph.D. students, the dissertation defense (exam) is an extremely stressful event. Failing the exam can mean years of additional work, or even outright failure in the program; success can mark the end of years in pursuit of the Doctorate. For days before my own defense I thought through what I believed were all possible situations that could arise. I prepared alternate slide sets, auxiliary arguments in case certain questions were raised, etc. I even carefully choreographed the room to maximize the effectiveness of the presentation.

The faculty judges came in, serious minded, and formidable. I went over all my preparations one last time, and everything

seemed in order. Then, minutes before my defense began, a team of workmen unloaded equipment from a truck in the parking lot right next to our building, started up a diesel compressor, and began to dismantle the sidewalk with jackhammers, eight feet from the window of the defense room. I was mortified. It had taken months to get the committee in one room at one time. It was not going to be possible to reschedule the event. The show had to go on.

Because the talk was on emotion theory I hastily drew up an alternate emotion-scenario diagram that was based on dissertation defenses and bulldozers. When I presented it as one of the first slides in my talk -- pointing out the futility of all my efforts to prepare so carefully -- it was funny. We all laughed about it."

Why is this scenario funny? It is not critical, nor even relevant, to know whether or not I was successful in my defense. On the surface there seems to be only a goal present: wanting a smooth defense. Where is the principle involved? Yet when described this way, as *wanting* to have the defense go smoothly, and having it interfered with, it does not seem funny. Rather it seems, if anything, sad, and does not capture the essence of the story. Alternatively, if the preparation is stressed it would seem either whiney or the ruminations of a braggart. The act of calling attention to the care with which the defense was prepared gives us a clue. Here is an analysis that seems to explain why there was humor in the situation:

1. In preparing so carefully for the exam I was establishing credentials as an authority. The principle was that *I would attend to all details* so that there would be no surprises at the defense. Each detail would be handled. Everything would be prepared. Someone who plans, and executes, this carefully can be seen as an authority for that event. It was *my* show. That there is a principle I was being held to is made clear if we consider the alternative: to not have prepared so carefully, with so much riding on the event, would have been shameful.

Agent-A = Me as authority on being prepared.

Agent-C = Me as preparer of defense.

P = I will handle all situations that arise during the defense through expert preparation.

Act-1: Not handling all contingencies.

E1-shame(Me-preparer, P)

2. By framing the jackhammering in the context of thwarting my hard-sought goals, a cognitive unit was established between the faculty chorus, and myself in the predicament: they could identify with my anxiety since they had all been through defenses themselves.
3. Through my making explicit the extent of my efforts to uphold the principle that "I will attend to all the details," the chorus became focused on my temporary credentials as an expert for this event.
4. By pointing out the futility of my efforts, the chorus became aware of my chagrin at being unable to provide an even remotely suitable environment for the defense.
5. Because the chorus had enough emotional distance from me, they (we) were able to laugh at my expense -- that is at the expense of the event authority who had been insisting on the principle of "attending to all of the details." In this moment, it became funny.

If I had merely pointed out that I had worked so hard to prepare the environment, and was unhappily thwarted in my pursuit of this *goal*, it would have been both in poor taste, and not funny. It is the element of the expert being caught violating his or her own principle that amused us.

Tweaking the funniness

If our thesis is correct then we should be able to make the stories funnier, and less funny (or perhaps NOT funny), by tweaking the emotion content.

One important concept is in looking carefully at how, in our theory, we delineate tragedy from humor. Clearly there is a connection between these two, and a sometimes delicate balance exists between having a situation fall into one category or the other. Much humor involves emotions that can easily turn to sorrow, pity, chagrin, and other negative emotions. What might we say about this here?

First, there are a number of ways to turn the above scenarios into situations that not only are not funny, but are not pleasant either. Or, we can leave them as stories, that are funny for the same reason, but change the degree or character of that funniness. Looking at this can give us clues into constraints that we may have to place on the synthesis of such situations.

Balance

Among the techniques for making stories unfunny are: changing the balance between negative and positive emotions through the tweaking of those variables contributing to the intensity of the underlying emotions and thus affecting the balance in a critical way, adding emotions that were not previously present, removing emotions, changing relationships (e.g., such as removing the *cognitive unit* relationship which seems necessary to appreciate the victim's predicament), and changing the principles that drive the emotions (i.e., so that while a principle is violated by each of the Authority, and the Chorus, the two principles are not the same).

For example, if the Dean is highly respected, and the principle of *Being on time* is shared by all, then being uncomfortable with the Dean's tardiness would prohibit humor -- unless of course he was able to remove that discomfort by laughing at himself.

The use of traditional comic tension and release is compatible with our approach, and in fact may give us some new insight into its tweaking. We can, for example, increase the tension of this story, building to a greater comic release, if we tell it such that the chorus *gloats* over the authority before the authority discovers that she or he has violated the principle.

To wit: if the Dean is seen to be hurrying across the street, and chugging up the stairs, while the faculty is enjoying themselves at his expense knowing that he will be late, this might increase the humor. If the clock in the meeting room is set back so that the Dean believes he is on time, it may become funnier while we wait for his discovery. If a faculty member leaves the room to purposely arrive even later and is dressed down by the unknowing Dean, we add additional tension. In each case the projected embarrassment is increased, while the real embarrassment has been delayed.

Similarly if the senior graduate student is allowed further pontification without knowing of his own gaff, it becomes funnier.

Suppose we just increased the importance of my Ph.D. defense so that desire was very high. If I did not pass my wife was going to divorce me, I was going to lose my inheritance (hah!), and my advisor was going to retire and leave for the jungles of Borneo on a permanent spiritual quest. In this case the bad break of having jackhammers threaten my ability to pass the exam would be seen only as sad, not funny. Those in the audience might feel badly on my behalf, had they been made aware of the details, but would likely not have found it humorous.

If the victim is not embarrassed it can be funny for a different reason which we might call "oddball humor," best delivered deadpan. This is not something with which our reasoning system, that knows almost nothing about the world other than emotions, would do very well. However, in each of the examples given above this no understanding of how the world works, outside of reasoning about emotions, seems to be required.

If I had not been bothered by the jackhammers, and had given the talk without seeming to even notice them, this might have struck some of the chorus members as *odd*, and hence funny. We can argue however, that the original quality of the humor is lost because one of the essential emotions -- embarrassment in this case -- is missing, and only serendipitously replaced by another form of humor.

Here is a different example. I met a sprightly old AI professor, "Professor G.", when interviewing for graduate schools. He came by while I was sitting on a sofa in the Computer Science office, and we had an animated discussion about various AI topics. Suddenly he jumped up and said, "Here, I have an extra copy of the paper, I'll get it for you." I followed him around the corner where he leaned hard against a door after unlocking it, and managed to open it only about six inches. He reached inside and retrieved a stack of papers from which he gave me my copy. Upon inquiry he told me that, yes, it was his office, no there was nothing wrong with the door -- it was just that it was "a little messy" inside, a stack of boxes had fallen against the door, and as far as he could remember he had not been in his office for about a year.

The professor was not the least bit concerned about this, and the whole thing struck me as very odd, and very funny.

This is an original instance of "oddball humor." Can we morph it into the previous kind of humor we have been discussing? Yes, but only by adding the necessary components. To wit: Professor G. argues at lunch that he does not for a minute buy the

proposition of eccentric professors. As far as he concerned this is just a "lack of professionalism." Later he is "discovered," chagrined, in his attempt to retrieve something from his office. This is funny, but now for the "Citizen's Arrest" reason. As discussed above, with this type of humor we can increase the intensity of the humor by tweaking some of the variables we have associated with emotion intensity: If Professor G. works hard at avoiding discovery, his embarrassment is increased.

When there is no resentment present, or implied resentment because of social status, then the balance between pity for the victim, and gloating (or relief) is altered, and the situation might not be funny. In the case of the Ph.D. defense, if we remove the sense, on the part of the chorus, of the highly principled environment, wherein Ph.D. students have all manner of principles which they are made to uphold, the situation becomes not funny.

The Ph.D. defense does not appear, on the surface, to have the element of resentment on the part of the chorus members. But let us look at this more closely. The chorus, each of them an academic, and former graduate student, has experienced the somewhat stodgy nature of academia, which has a tradition, dating back almost to the dark ages, of holding neophyte scholars up to scrutiny with respect to all manner of principles. By making fun of myself for preparing so carefully for the academic presentation only to be defeated by jackhammers I set myself up for us all to laugh at as the bearer of those principles we have each had to endure. If this seems far-fetched, let us consider this: would an audience of plumbers or high-school coaches have found this to be humorous? Probably not.

In the case of the motorcycles the question arises as to whether or not there is (a) shame originally present for the chorus members, and (b) shame present for the victims. In both cases this is easy to mark because *frustration* was clearly present, and within the emotion theory that we are using to represent stories frustration is a form of anger. Anger in turn is not possible without someone being held accountable for the violation of a principle. It is the violation of this principle, that of "not being nerds" which led to shame, or embarrassment. This shame was present during the week preceding the humorous incident, and was also present at the time of dumping the motorcycle in the gravel parking lot.

In the Ph.D. defense, this situation does not appear to have initial shame, but I wonder -- is it funnier because the chorus members have each experienced the highly principled academic atmosphere of which we are making fun? The point is that it was the silliness of my preparations which were funny. This could be made more clear if we consider that had I prepared even more exotically -- that is, tried to beat the system -- say by bringing in some sort of low-volume multimedia examples only to discover that they were useless next to the Jackhammer.

Some general discussion

Note the similarities in the intensity variables created by effort, one of the variables we believe contributes to the intensity of many emotions: the harder the Dean runs, the harder and longer we worked at the motorcycles, the better I had prepared for the defense, each tends to increase the funniness of the story.

That these are instances of situational humor, and not dependent on the timing, and cleverness, of much humor is clear. Even if any four of these stories are told in reverse order, though diminished, they are still funny, and are still stories. This suggests that this type of humor is not dependent much on the sequencing, or on an element of surprise:

"The Dean came late to a faculty meeting and was embarrassed about it. We all thought this was pretty funny because just two days before he had lectured the rest of us about being on time."

"A senior graduate student mistakenly sent mail to all of the people in computer science by using "R" instead of "r". The funny part of this was that in his message he was berating a first-year student for doing exactly the same thing.

"Richard dumped his motorcycle in the parking lot, confirming beyond all hope of redemption that we were hopeless nerds. Thinking about how hard we had worked to be "cool" with these motorcycles, and all the effort we had put into the endeavor, we just burst out laughing at how ridiculous we were.

"At my dissertation defense there were jackhammers and a compressor running right outside of the window. What made this funny was that in my anxiety I had prepared for most every other contingency that could arise."

One reviewer of this paper, who made excellent comments, has suggested that the above reversed stories would not be seen as humorous if we did not include comments like, "what made this funny was..." We'll offer the counter argument that saying it is so would not make it humorous if a story did not have this inherent potential. Situations are funny in a different way if

the victim can laugh as well -- but is not necessary. The victim can even be angry, or sad, and it can still be funny.

Some questions

Is the sequence comprised of components Agent-A, Agent-C,A-1,E-1,etc. enough to plausibly suggest humor? When these features are present in the emotion fabric, is this enough to suggest that humor will also be present?

Conversely, when humor of this "citizen's arrest" type is deemed, ad hoc, to be present, will we *always* find such AR tokens present?

In addition to the emotion theory elements, what other tags do we require? This is important because while our AR agents do a good job at manipulating emotion content, they have greatly impoverished representation of other elements in the world, and NO understanding of what those elements represent. Hence each of these additional elements must simply be treated as labels, without any inference manipulation.

Summary

Our thesis is that certain kinds of situational humor is intertwined with human emotion, and that to understand it, and understand its structure, we must understand human emotion as well. Conversely, if we are looking at funny stories, and know something about the emotion nature of stories, then we might also be able to say something about the emotion structure of funny stories -- in particular what elements in them make them funny. In this paper we analyzed a few emotion scenarios from this perspective.

Here we presented only a minimal sample of the kind of humor that can be represented through emotion theory. A number of additional structures for humorous situations have also been explored.

Importantly, by reducing each human scenario to just Affective Reasoner elements, we able to make a decent case that situational humor which is dependent on the desires and principles of the characters (and explicitly *not* on and understanding of the world) is computable within an already existing framework.