Memes and Humor: A Linguistic Analysis

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Abstract

In recent years the internet has come to be one of the most powerful social media tools. By utilizing web services like Facebook, Twitter, Reddit, or hundreds of other websites designed for streamlined information sharing, ideas can spread to thousands of people in a matter of minutes. One of the most popular forms of humor on the internet is memes. Humor is associated with memory formation and is an important part of social behavior, widely cited as one of the defining characteristics of being human. This paper seeks to explore several topics, including a possible cognitive model of humor, the linguistic features of a specific meme paradigm, and an integration between the cognitive models of humor and the study of meme humor.

1. Introduction

In recent decades, humor has only rarely been dealt with in the field of cognitive linguistics. Because cognitive linguistics is a relatively new branch of linguistics, the tools and methods for studying and understanding the cognitive models of language are not as well-developed as those in other fields of linguistics, and as such, the topic of humor has only begun to undergo inspection. Linguistics as a whole has, however, dealt extensively with other creative language use like metaphor, story-telling, lying, and sarcasm, though where these creative uses of language cross over into humor, there has not been much research. Within the past few years, however, several researchers have put forth various models for thinking about humor in a cognitive linguistic context, in addition to the recent availability of brain-imaging research dealing with humor appreciation. The most popular theory among these is the incongruity-resolution (IR) model.

The IR model of humor is widely used, but not well-defined; various researchers will define it in different ways. Widely cited is Raskin (1985), who quotes Beattie (1776, p. 155), a Scottish poet, in his definition of incongruity: “Laughter arises from the view of two or more inconsistent, unsuitable, or incongruous parts or circumstances, considered as united in one complex object or assemblage, or as acquiring a sort of mutual relation from the peculiar manner in which the mind takes notice of them.” Suls (1972) defines it somewhat differently for the purpose of his two-stage model of humor: “Incongruity of the joke’s ending refers to how much the punchline violates the recipient’s expectations” (92), quoted in Ritchie (1999). Raskin's (1985) Semantic Script Theory of Humor (SSTH) posited that a text that could be interpreted in multiple ways was represented by various “scripts,” and when two or more of these scripts interact in a specific manner, the text is humorous. Originally, it was not intended as an IR model

(Ritchie, 2009), but was later extended by the General Theory of Verbal Humor (GTVH) (Attardo & Raskin, 1991), which contained more IR-related elements. Ritchie (1999) provides disambiguation for some terms associated with IR models, including "incongruity" itself, and what an "interpretation" (or "script" as Raskin (1985) might have it) is. Also heavily stressed in cognitive models of humor is Suls' (1972) two-stage model (**Figure 1**) of humor appreciation.

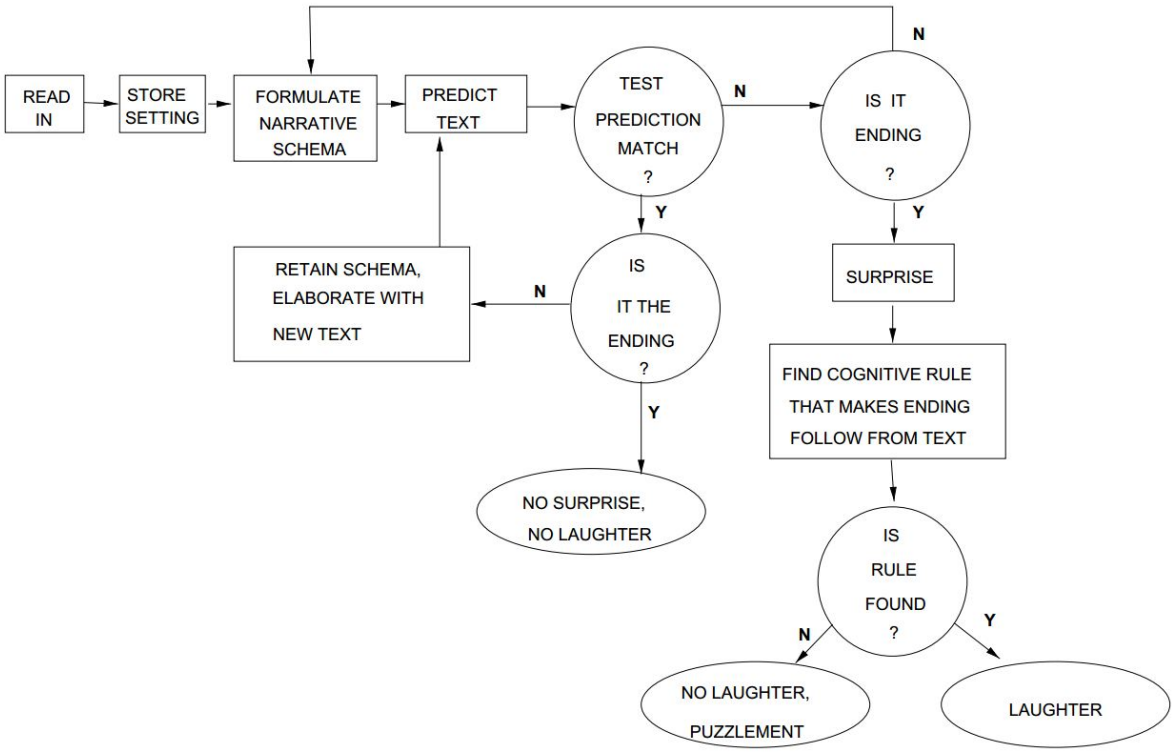


Figure 1 (provided by Ritchie, 1999)

The two steps in this model include "surprise," in which the audience reaches a point in the joke that does not obviously follow from previous parts of the joke (the IR equivalent to incongruity), and "coherence," which is the resolution of the incongruity. Suls' two-stage model applies specifically to cartoons and other related humor and assumes a punchline, rather than a set-up, that causes incongruity which is consistent with meme humor and is thus apt for analyzing the humor associated with memes. The two-stage model also assumes a loosely

defined “cognitive rule” which is used to make sense of the punchline in the context of the set-up. Suls' two-stage model, in combination with a general definition of IR, will be used to evaluate the humor of memes in the current research. More important, however, is a model which is not entirely theoretical, and a discussion of the current research on the neural correlates of humor is warranted.

2. Cognitive Research in Humor

Coulson & Kutas (2001) make an attempt at measuring the cognitive processes related to coherence after surprise by recording event-related potentials in adult subjects. They assume a “frame shifting” mechanism, meaning that subjects are required to shift between two interpretations of a set-up during the coherence phase of joke comprehension. This may be equivalent to Raskin's (1985) “scripts,” in that they represent various interpretations of a text; the important difference is that scripts are semantic interpretations, while frames are cognitive mechanisms representing spaces in memory that allow the audience to make sense of a joke.

(1) I let my accountant do my taxes because it saves time: last spring, it saved me 10 years.[1]

A SSTH analysis would provide two scripts for (1): one in which *time* refers to time in general; and one in which *time* refers to jail time. A two-stage approach identifies the surprise as instead coming from *years* in the punchline, with the two cognitive frames eventually being resolved by some cognitive rule. The first frame provides what seems to be the most obvious interpretation before the punchline; namely, that the interpretation of *time* should be equivalent to the first SSTH script provided above. Once the punchline is delivered, another frame is called upon in which the audience understands that one can do taxes incorrectly, break the law, and subsequently serve a jail sentence. When the surprise of the punchline has been dispelled and the frame switch has occurred, this is the point at which humor is appreciated in this model.

[1] Quoted in Coulson & Kutas (2001).

The point at which Coulson & Kutas (2001) posit this frame shifting to occur is during a sustained negative ERP, 500-900 ms after final word onset, as opposed to other joke-related ERPs that occurred at various other times. Jokes also elicited a positive ERP over the frontal areas bilaterally, generally associated with working memory (Goldman-Rakic & Friedman, 1991; Salmon et al., 1996; MacLeod, Buckner, Miezin, Petersen, & Raichle, 1998;Visser, Jefferies, & Ralph, 2010). Pivotal to the study of jokes is ambiguity resolution, which has been shown to occur in several areas in the brain. Namely, they are the pars triangularis, ventral and dorsal pars opercularis, and pars orbitalis (all generally associated with Broca's area) for semantic ambiguity, and additionally the planum temporale (superior posterior temporal gyrus, or Wernicke's area) for syntactic ambiguity (Price 2010). Additional studies have shown the right homologue to Wernicke's area is key in the resolution of semantic ambiguity as well (Harpaz, Levkovitz, & Lavidor, 2009), and it follows that damage to the right hemisphere, and especially in pre-motor areas associated with working memory and the Wernicke's area homologue, would contribute to difficulty in humor appreciation, a phenomenon which has been corroborated by multiple lesion studies; *viz.* Zaidel, Kasher, Soroker, & Batori (2002), Shammi & Stuss (1999), Bryan (1988), and Marinkovic et al. (2011). Various problems associated with right frontal lobe lesions suggest that humor is not simply a linguistic phenomenon. Subjects that have experienced detriments to their social functions like emotion recognition also show problems in understanding jokes. Thus, a cognitive model of humor must go beyond the scope of linguistics to account for behavioral differences, emotional recognition, self-awareness, and other related complex facets of human behavior and psychology.

Additionally, some lesions cause patients to exhibit an inability to recognize the incongruity in jokes, while others can recognize, but not resolve, the incongruity. Bihrle,

Brownell, & Powelson (1986) find in a left-hemisphere lesion study, only recognition of incongruity is affected, while resolution may still take place unaffected in the right hemisphere, suggesting that humor is a multi-stage process in which humor appreciation is not dependent on a conscious understanding of the incongruity associated with jokes. Moran et al. (2004) further investigate the neural correlates of incongruity detection and resolution using fMRI on subjects watching *Seinfeld* and *The Simpsons*. This study is different from the others in that it uses data gathered from subjects being exposed to verbal humor over a period of time which is not encapsulated in a single image or traditional set-up-and-punchline joke. In spite of the unique format of the study they find that incongruity detection occurs (as might be expected from previous data) in Wernicke's and Broca's areas, exhibiting left-lateralization, while the resolution and subsequent appreciation activate similar areas bilaterally (areas consistent with the aforementioned studies). Interestingly, the authors also find that insular cortex (usually cited as the neural basis for strong emotions [Fiol, Leppik, Mireles, & Maxwell, 1988; Phillips et al., 1997]) is broadly activated during the appreciation stage. These findings are corroborated in a 2012 study by Chan, et al., in which the authors find three separate significant stages of neural activity; incongruity detection, resolution, and emotional response. In other words, (verbal) humor is made up of at least two separate facets: linguistic incongruity-resolution; and an affective element. This affective element (see Moran et al., 2004) is a term used to account for the degree to which individuals find jokes funny in the context of past experiences, personal knowledge, and other related factors. Due to the cognitive complexity of humor, it is arguably necessary that a very general term exist for extraneous processes involved in humor which are not readily categorized. It is, however, important to understand how these affective elements interact with humor on a cognitive level for several reasons.

Human memory seems to have several distinct neural substrates which function both independently and together, depending on the type of memory being formed or recalled (phonetic, spatial, working, motor, long-term, short-term memory, etc.) (Schmidt, 2002; Zurowski, et al., 2002). Emotion, and subsequently humor, have been known to positively affect one's ability to recall information (Lippman & Dunn 2000; Schmidt 2002; Summerfelt, Lippman, & Hyman, 2010). Two of these neural substrates – the amygdala and hippocampal complex – function together when emotional pathways are utilized simultaneously with memory formation (Phelps, 2004). This is perhaps the reason why humor, which elicits an emotional response, aids in memory formation. Understanding this interaction between humor and memory has several possible implications for education, or for understanding the complex relationship between human cognition and language.

The brain imaging data applied to the two-stage model, then, gives a clearer, more complete way to understand how cognitive linguistics provides a functional model for humor appreciation. A more concise delineation of the humor appreciation process is as follows, in accordance with Suls' (1972) proposed model (**Fig. 1**).

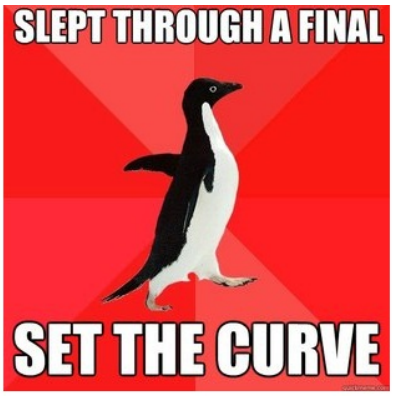
As the set-up is delivered, the audience stores the information in working memory and retrieves relevant long-term memory to develop a "narrative schema," or frame. Within that frame, the audience will predict information which has not yet been given by the joke. If the prediction fails to match the information in the joke, and the joke has ended, the audience experiences surprise at the incongruity. At this point, a cognitive rule (corresponding to the ambiguity-resolution cognitive processes) is looked for, and if one can be found which resolves the incongruity, a frame switch occurs. The frame switch elicits a reinterpretation of the set-up of the joke, and, in the right affective context (not accounted for by Suls in his model), laughter

occurs. If no rule can be found, the joke ends in confusion and non-humor. Subsequently, extending this model further into cognitive processes, the emotions elicited from the joke may interact with the neural substrates responsible for specific types of memory, until these effects have ceased.

3. Memes

Memes set up their own linguistic context (that is, idiosyncratic symbolic systems), which is readily observed in the image rather than in the language included within the meme. Because of this, rather than having a genre of jokes associated with a phrase (ex., "Knock, knock...") or a specific linguistic structure, the meme genre is dependent on the image on which the joke is written. It may be argued that the images are a paralinguistic feature of that genre, or that the image serves as a complete contextual background on which the joke is based. Two main types of memes and a third, hybrid type, are the subject of the current study. Conventionally, a blue background is associated with the “Socially Awkward Penguin” (Awk. P.), a red background is associated instead with the “Socially Awesome Penguin,” (Aws. P.) and the hybrid type uses both red and blue backgrounds (see **Illustration 1**) called the “Socially Awesome Awkward Penguin” (SAAP). All three types include an image of a penguin in the center of a square using the background color schema as part of the set-up and punchline. Notice that in the Awkward paradigm, the penguin is facing left, while it faces right in the Awesome paradigm, and is split in two halves facing different directions in the hybrid type.

Socially Awkward Penguin



Socially Awesome Penguin

Socially Awesome/Awkward Penguin

Illustration 1

An "awkward" scenario is one which demonstrates a situation in which the subject lacks common social knowledge or is in some way acting inappropriately in a social context. An "awesome" scenario, on the other hand, includes some behavior which is potentially rewarding or positive, or in some cases a potentially awkward behavior, but which ends in an unexpectedly positive outcome. However, the background scheme seems more important as a semiotic system than the central image itself. Without the penguin image itself, an identical background scheme may still invoke the same joke paradigm assuming that the reader has background knowledge on the meaning of the original meme structure (**Ill. 2**). Without contextual knowledge, however, the red and blue backgrounds mean nothing. Thus, social media play a key role in the propagation and definition of the proprietary semiotic system in these memes.

Illustration 2

As with many other types of humorous media and jokes, these memes include a set-up and a punchline. In the case of the Awk. P., the setup is either neutral or positive with respect to social behavior, but ends in a punchline which is unfavorable or inappropriate (**Ill. 1**). The Aws. P. meme incorporates either favorable, neutral, or unfavorable social behavior with a favorable outcome or punchline. The SAAP begins with a positive situation and ends with an unfavorable reaction. Due to the structure of each meme, a different amount of incongruity arises between the set-ups and punchlines, which may affect the degree to which they are seen as humorous.

There are several rules which memes generally follow, depending on the type of meme as well as the topic of that meme. The penguin meme can be characterized by some nonstandard uses of English which potentially contribute to the humor (perhaps through an incongruity between the expectation of correct grammar and blatant violation of these grammar rules). Namely these errors are simple deletions; deletions of pronouns, overt subjects, and determiners are very common. The most noticeable of these is the lack of pronominal use in the set-up. After collecting the most popular one hundred of each variation of the penguin meme from their respective dedicated websites, only seven of them contained overt subjects in the set-up, three of which were due to a quotation mechanism.

(2) Set-up: “I like your accent, where are you from?” Punch line: Talking to a deaf person.

A total of thirty out of the three-hundred images contained an overt subject in the setup but did not include a determiner.

(3) Teacher displays lost jacket in front of class. Didn't like it anyway.

This rule is less common in the punchline. Out of the three-hundred images, twenty-two punchlines included an overt subject, and ten more had subjects without determiners. As a general rule, however, determiners and overt subjects are not required in either parts of the joke, and it is assumed, unless otherwise specified, that the subject of each part of a given joke is the penguin, which represents some anonymous person or with which the audience may identify. In fact, only one image contained an overt subject that referred to the penguin.

(4) Tissues at front of class. I'll just wipe my nose on my sleeves for 80 minutes.

However, this may simply be considered bad style. (4) may be more appropriately in style if changed to something like (4a):

(4a) Tissues at front of class. Wipe nose on sleeve for 80 minutes.

Because of the limited space available for text in the image, as well as the humor associated with the ungrammaticality and shortness of the meme's linguistic style, overt subjects are considered extraneous. Also evident in (3) and (4) and in a majority of other memes, noun phrases are not required to have determiners where they might otherwise, in prescriptive standard English, require them ((3): ~~*a*~~ *lost jacket, of* ~~*the*~~ *class*; (4): *of* ~~*the*~~ *class*). As such, in meme language, a complete (singular) noun phrase does not require a determiner, and sentences do not require an overtly marked subject at all. The lack of grammatical sentences and abundance of sentence fragments in the penguin meme may be responsible for some of the humor associated with it, due to the aforementioned incongruity ungrammatical sentences may cause which must be resolved by the audience.

4. Experiment

4.1 Introduction

When the incongruity-resolution model is applied to the penguin meme, there are several things that may contribute to the overall humor associated with and within each type. **Table 1** provides the elements present in the current research and associated definitions. Examples are included in **Table 2**, which categorizes the 30 memes used in the present research and notes the number of grammatical deletions present and type of each example. The text of each meme is provided in the **Appendix**.

Elements Affecting Humor	Definition
Type of Joke	
Physical	Involves violence or physical striking, or accidents.
Courtship	Involves courtship behavior (no sexual activity).
Self-deprecating	Involves self-deprecation of the subject or negative emotional reaction.
Inappropriate Behavior	Involves behavior which is uncalled for, accidental, or inappropriate to the situation.
Disability-related	Involves a subject (main or otherwise) with a disability.
Boasting	Involves a subject acting boastfully.
# of Deletions	Includes lack of overt subject, missing copula and aux.verbs, and lack of determiners.
Type of Meme	
Socially Awkward	See **III. 1**
Socially Awesome	See **III. 1**
Socially Awesome/Awkward	See **III. 1**

Tables 1

Type of Meme	Appendix reference number	# of Deletions	Type of Joke
Socially Awkward	3	3	Inappropriate Behavior
	5	0	Self-deprecating
	7	4	Inappropriate Behavior
	10	4	Disability
	13	1	Disability
	15	1	Inappropriate Behavior
	18	2	Inappropriate Behavior
	23	1	Inappropriate Behavior
	25	2	Inappropriate Behavior
	28	0	Inappropriate Behavior
Socially Awesome	1	2	Boasting
	11	1	Inappropriate Behavior
	14	3	Boasting
	16	1	Inappropriate Behavior
	17	3	Inappropriate Behavior
	19	3	Boasting
	26	4	Boasting
	27	3	Boasting
	29	0	Inappropriate Behavior
	30	2	Boasting
Socially Awesome/Awkward	2	4	Courtship
	4	4	Physical
	6	2	Inappropriate Behavior
	8	2	Self-deprecating
	9	1	Physical
	12	2	Self-deprecating
	20	3	Inappropriate Behavior
	21	1	Courtship
	22	2	Self-deprecating
	24	3	Inappropriate Behavior

Table 2

In this experiment is is assumed that different degrees of incongruity exist according to the meme type. Due to the important nature of the background and semiotic system provided therein, each meme provides a different expectation and frame in the set-up and punchline. The Awk. P. provides a neutral or positive set-up and creates the expectation that something will go wrong. By default, the audience should theoretically predict a neutral punchline in all cases; that is, they will predict something that follows logically from the set-up according to common social practice. The background, then, serves to facilitate the frame-shifting process by providing a pragmatic context with which to match the disambiguating cognitive rule. The Aws. P. generally

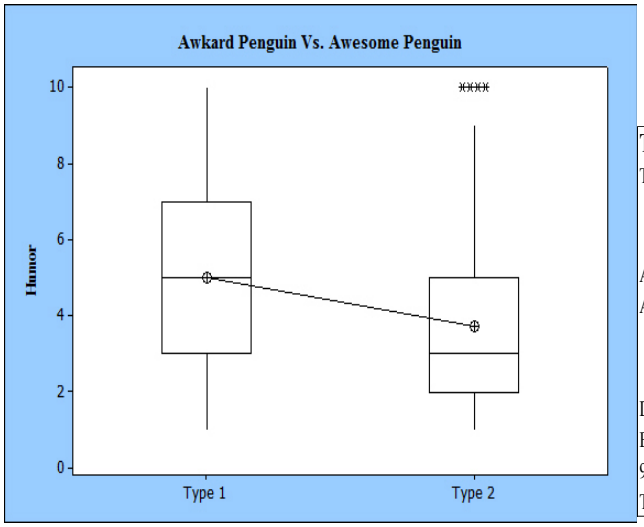
provides an awesome set-up and an awesome punchline. Here, there is less of an incongruity to resolve. There are less inappropriate behaviors that challenge preconceived notions of what an acceptable reaction to the behavior in the set-up might be, and thus, should theoretically be significantly less humorous than the Awk. P. The SAAP, however, should be significantly more humorous than the Awk. P. due to the larger amount of incongruity present. With an awesome set-up, the audience is looking to expect a punchline which is not difficult to understand in the context of the original set-up. When the punchline is delivered and instead is awkward or inappropriate, a greater amount of incongruity is created and a frame-shift is necessary to resolve the incongruity, theoretically making the SAAP more humorous on average. The present study seeks to test whether there is a significant difference between the perceived humorousness of each type of meme as a whole.

4.2 Methods

In this experiment, 10 random images were taken from the top 100 memes of each type under inspection (Awk. P., Aws. P., and SAAP) for 30 total images. The 30 images were presented to two groups ($n_1 = 28$, $n_2 = 27$, $n = 55$) and the order of presentation was randomized for both groups. Subjects were asked to subjectively rate the humor of each image on a scale from 1 to 10 (1 being not humorous, and 10 being extremely humorous). Each image was presented for 15 seconds on a projector. All subjects were college-aged, though gender was not controlled for. The size of each image was also not controlled for; however, the majority of the images were the same size (27 out of 30 presented at 300 x 300 pixels, and 3 out of 30 presented at 200 x 200 and subsequently zoomed to 140% size, effectively 280 x 280 pixels). Images were also controlled for the number of deletions (no statistically significant differences were present between the three types), but not text length.

4.3 Results

Using two-sample t-tests, the average humorousness of each type was evaluated and compared against the other types. In accordance with the hypothesis, the Awk. P. was found to be rated as significantly more humorous than the Aws. P. ($p < .00$) (**Fig. 2**), and the SAAP was found to be rated as significantly more humorous than the Awk. P. ($p = .02$) (**Fig. 3**). There was no significant correlation between average humorousness and the number of deletions present in each image.



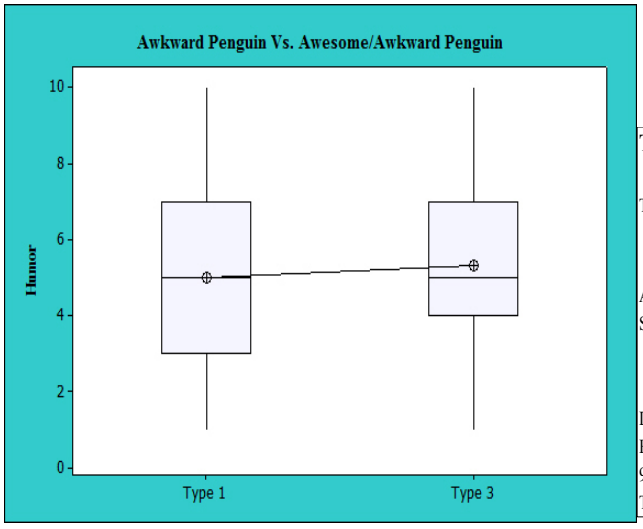
Two-Sample T-Test and CI: Awk. P., Aws. P.

Two-sample T for Awk. P. vs Aws. P.

	N	Mean	StDev	SE Mean
Awk. P.	550	4.99	2.38	0.10
Aws. P.	550	3.73	2.07	0.088

Difference = mu (Awk. P.) - mu (Aws. P.)
Estimate for difference: 1.267
95% CI for difference: (1.003, 1.531)
T-Test of difference = 0 (vs not =): T-Value = 9.43 P-Value = 0.000 DF = 1076

Figure 2



Two-Sample T-Test and CI: Awk. P., SAAP

Two-sample T for Awk. P. vs SAAP

	N	Mean	StDev	SE Mean
Awk. P.	550	4.99	2.38	0.10
SAAP	550	5.32	2.28	0.097

Difference = mu (Awk. P.) - mu (SAAP)
Estimate for difference: -0.327
95% CI for difference: (-0.603, -0.051)
T-Test of difference = 0 (vs not =): T-Value = -2.33 P-Value = 0.020 DF = 1096

Figure 3

4.4 Discussion

The results seem to indicate a significant relationship between the type of meme and the average subjective humor associated with each type. The least humorous type seems to be the Aws. P., followed by the Awk. P., with the SAAP being rated consistently more humorous than the other types. The findings seem to support that hypothesis based on the IR model of humor. However, there are several factors which may have inadvertently affected the results. Gender was not accounted for, and many of the images assume a male subject (see Appendix examples 2, 4, 8, 9, 11, 15, 20, 21, and 29) with only one assuming a female subject (see Appendix example 6), if we are to assume the penguin is heterosexual. Naturally the gender and sexuality of a subject are things to consider when the joke itself is gendered.

Additionally, memes that elicited any laughter may have been rated as higher on average than they would have otherwise, due to the fact that individuals who are alone suppress laughter (Devereux & Ginsburg, 2001). Since humor appreciation is affected by social circumstances, collective laughter may have affected how some subjects rated the humorousness of various images, skewing the data higher for those images which elicited laughter. Joke type was not controlled for (physical, courtship, etc); nor was joke length. The type of humor present in each image and the amount of time required to read the text on each image may have affected the degree to which subjects found them humorous. Further study would benefit from controlling for all the aforementioned categories; subject gender, image text length, joke type, and group vs. individual rating tasks.

5. Conclusion

Humor remains one of the more enigmatic topics in psychology and linguistics. Due to the recent surge in brain-imaging studies, however, the elucidation of the neural pathways and

cognitive mechanisms associated with humor is now becoming a possibility. As more data becomes available, previous theories of humor, such as the two-stage model posited by Suls (1972) and the GTVH by Attardo & Raskin (1991) can be integrated into our current understanding of these processes and edited accordingly for applicability purposes. Despite being a relatively new field of study, cognitive linguistics remains a powerful tool for functionally analyzing language, and further study of humor within the framework of cognitive linguistics may provide an invaluable approach to integrating the cognitive processes associated with language to other facets of human behavior.

Appendix

Text of memes used in the study:

	Set-up	Punch line
1	SLEPT THROUGH A FINAL	SET THE CURVE
2	HITS ON CUTE CASHIER GIRL	CREDIT CARD DECLINED
3	PROFESSOR ASKS RHETORICAL QUESTION	RAISES HAND
4	CUTE GIRL AT CONCERT GESTURES FOR A HIGH FIVE AFTER AWESOME SONG	AIMS INCORRECTLY AND SMACKS HER IN THE FACE
5	"COME TO THE FRONT OF THE AUDITORIUM TO GET YOUR AWARD"	OH GOD NO
6	CUTE GUY HOLDS THE DOOR FOR YOU	PANIC AND OPEN THE OTHER DOOR
7	WAITER REACHES FOR MENU AFTER ORDERING	SHAKES HAND
8	GETTING MARRIED	CAN'T COME UP WITH 4 GROOMSMEN
9	CATCH A CUTE GIR'S EYE	WITH YOUR ELBOW
10	CAME OUT OF HANDICAP STALL	GUY IN WHEELCHAIR WAS WAITING
11	FORGET TO ZIP UP YOUR PANTS	ON PURPOSE
12	NEVER FORGETS A FACE	NEVER REMEMBERS A NAME
13	I LIKE YOUR ACCENT, WHERE ARE YOU FROM?	TALKING TO A DEAF PERSON
14	FRIEND ZONE	NEVER HEARD OF IT
15	CUTE GIRL ASKS HOW OLD I AM	"LEVEL 23"
16	CALLED THE POLICE	TO JOIN MY PARTY
17	FART IN CLASS	PROLL INTO MOST EPIC BEATBOX OF ALL TIME
18	TRIES TO HOLD BACK A SNEEZE IN CLASS	FARTS
19	FINISH TEST FIRST	WALK OUT LIKE YOU OWN THE PLACE
20	HOLDS DOOR FOR GIRL	TO MENS ROOM
21	COMPLIMENT A GIRL ON HER FRECKLES	ACNE
22	DRESSES UP FANCY FOR A CHRISTMAS PARTY	WINS UGLY SWEATER CONTEST
23	HOMELESS GUY TELLS ME TO GET HOME SAFE	"THANKS, YOU TOO!"
24	GIVES LOST STRANGER DIRECTIONS	REALIZES LATER THAT THEY WERE WRONG
25	TRIES TO TAKE JUST SWEATSHIRT OFF IN CLASS	NOPE, EVERYTHING
26	CELL PHONE GOES OFF WHILE WALKING INTO A ROOM	THEME MUSIC
27	FORGETS ENDING TO JOKE	COMES UP WITH A BETTER ONE
28	"OK CLASS, FIND A PARTNER"	OH GOD NO
29	YOU HAVE A BOYFRIEND?	WHAT ABOUT A "MAN"FRIEND?
30	MEET THE MOST INTERESTING MAN IN THE WORLD	GET BORED

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