Humor understanding and knowledge

Carla Canestrari, Alberto Dionigi and Andrzej Zuczkowski
Department of Education, Cultural Heritage and Tourism,
University of Macerata, Italy

According to the cognitive approach to humour, understanding of humorous texts implies a moment of surprise, even confusion of thought, produced by the recognition of an incongruity, defined as an incoherent piece of the text. The problem solving activity involved in humor understanding aims at resolving the incongruity. Our goal is to contribute to better define the surprise experience by describing its epistemic and evidential aspects. The tested hypothesis, verified through "thinking aloud method" and the descriptive tools provided by the Known-Unknown-Believed theory, is that this phase of humor understanding is linked to the worlds of knowledge of unknown and believed, referred to by means of consistent linguistic markers. The hypothesis resulted to be confirmed both for jokes and cartoons.

Keywords: surprise, incongruity, resolution, certainty, uncertainty, knowing/unknowing/believing stance, epistemicity, evidentiality

1. Introduction

A humorous event, such as a joke, can be appreciated and if it is appreciated it must have been understood (Hay 2001). Given its preparatory feature, humor understanding has taken a significant role in the literature on humor and it has been defined as a kind of problem solving activity (Fagen 1981; Suls 1972, 1983; Pepiciello 1989) whose problem is represented by an incongruity asking for a resolution. Before the process of understanding succeeds, the incongruity elicitates surprise (Suls, 1972), defined as "a confusion of thought" (Maier 1932, 70) or puzzlement (Schiller 1938; Berlyne 1972, 56) or embarrassment (Schiller 1938).

Compared to the acknowledgment that something surprising, unexpected, even confusing and puzzling should be experienced during humor processing, the concepts of incongruity and resolution have been studied at great length from several points of view, in particular they have become a matter for cognitive

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psychologists since the 1970's. Recognizing an incongruity has been largely analyzed and studied, usually in connection with its resolution, more generally from a cognitive point of view (e.g. Suls 1972, 1983; Shultz and Pilon 1973; Shultz 1974, 1976; Shultz and Horibe 1974; Rothbart and Pien 1977; McGhee 1979; McGhee, Apter 1982; Ruch and Hehl 1990; Forabosco 1992; Ruch 1992; Hillson and Martin 1994; Hempelmann and Ruch 2005; Samson et al. 2008; Samson and Hempelmann 2011) and specifically from a perceptual point of view (e.g. Maier 1932; Schiller 1938; Nerhardt 1970, 1976; Deckers 1993; Smith 1996; Russell 1996; Metz- Göckel 2008; Veale 2008; Canestrari and Bianchi 2009, 2012, 2013; Viana 2010; Hempelmann and Attardo 2011).

On the contrary, the psychological impact of the recognition of an incongruity, in terms of experiencing surprise, puzzlement, embarassemnt, even confusion, has not been better defined or formalized *per se*, though it is essential to the understanding of a humorous stimulus (Schiller 1938; Suls 1972, 1983).

The aim of this paper is to better define such an important cognitive phase, according to an evidential and epistemic viewpoint, which has not been investigated yet. The cognitive aspect of the psychological experience of surprise, puzzlement, embarrassment and confusion of thought, typical of humor processing, can be rooted in epistemicity and evidentiality, as defined by the Known-Unknown-Believed theory (Bongelli and Zuczkowski 2008; Zuczkowski et al. 2011; Bongelli et al. 2012; Philip et al. 2013). The experimental study of this paper is based on the fact that, when the breaking down of the meaning expectations provoked by the incongruity of a humorous text occurs, the listener/reader experiences surprise, puzzlement, embarrassment and confusion, because the resolution is not yet achieved (Maier 1932; Schiller 1938; Berlyne 1972; Suls 1972). The feeling of surprise and the cognitive experience of confusion and puzzlement are particularly present when the listener/reader does not get the humorous text. In this case s/he should be able to communicate this experience of surprise, puzzlement, embarrassment, and confusion by using linguistic expressions of uncertainty or even lack of knowledge related to the resolution of the incongruity. Complementary, it can be hypothesised that when a humorous stimulus is understood, i.e. the incongruity resolved, the listener/reader activates questionless pieces of knowledge, which are related to the resolution and in general to the content of the humorous text, and are expressed with certainty. The analysis of the epistemic and evidential aspect is conducted on the pieces of communication, referred to the humor process in general and to the surprising moment in particular, produced by people asked to think aloud. The "thinking aloud method", famous within the field of Gestalt psychology, was used to gain access to the problem solving activity (Claparède 1933; Duncker 1935; Van Someren et a. 1994). Participants were given problems to solve, and they were asked to think aloud, namely to verbalize their mental

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activity: they were "emphatically warned to not leave unspoken even the most fleeting and foolish idea" (Duncker 1935 [1972, 2]). According to this procedure, a strict link between thought and language is assumed and the second is considered to be a path toward the first. This method was used to analyse the epistemic and evidential aspects implied in the surprise moment through its communication.

2. Surprise, puzzlement, embarrassment, and confusion of thought in humor understanding

Surprise has been often listed among the necessary conditions for a humorous experience to occur. A humorous experience has been linked to something surprising and unexpected since Aristotle's analysis of humor: "the speaker says something unexpected, the truth of which is recognized" (*Rhetoric*, III, 11 1412b, quoted in Attardo 1994, 20). Later, Kant (1724–1804) highlighted the importance of breaking the expected for laughing to occur: "Laughter is an affection arising from sudden transformation of a strained expectation into nothing" (*Critique of Judgment* 1790, 177, quoted in Morreal 1987, 47). In more recent years, the question has been address to from the psychological point of view. For instance, Maier refers to a humorous stimulus as a configuration, which is perceived by someone:

> Not only a configuration be formed in a humorous experience, but in every case it must appear suddenly, the listener or reader having been unprepared for it. Because the reader is unprepared for the final configuration, it appears very suddenly and unexpectedly: the moment he sees the point of a story he is experiencing the final configuration and its resultant meanings. Since he has been prepared for something else, the unexpected configuration is a surprise: for a moment there is confusion of thought, then suddenly the entire configuration is clarified. (Maier 1932, 70)

Similarly, Berlyne (1969, 1972) describes the moment of confusion as a necessary phase for a humorous stimulus to be pleasant. Within the framework of arousal theories, Berlyne (1969, 1972) included surprise, beside incongruity and others, among the "collative variables" that make a stimulus (not only a humorous one, but also a work of art, for example) esthetically pleasant. In particular, the "collative variables" make an increase of arousal, which is released when the punch line of joke is resolved and understood:

> There are plenty of jokes that fit the arousal-jag paradigm. There is a phase of discomfiture, puzzlement, "tension", even fright, and later stimulus material alleviates the confusion due to what come earlier, for example, by explaining it or indicating how it should be interpreted. (Berlyne 1972, 56–57)

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A switch from an unpleasant physiological and psychological arousal, due to what can be called today an incongruity, to a positive one, resulting from what is known as its resolution, is the key element for humor appreciation. What is surprising and unexpected in a humorous experience has been linked to the concept of "incongruity" in an explicit manner by Shultz (1976) and Suls (1972, 1983), who provided the most acknowledged formalization of incongruity from a cognitive-psychological perspective. Following Koestler's (1964) early formalisation, incongruity has been defined in several ways and according to different approaches, some of which are more rooted in linguistics, others in psychology and still others in between the two fields. As a result of this, the technical definitions of incongruity that have been put forward thus far differ slightly or sometimes quite significantly from one another (for an overview, see Keith-Spiegel 1972; Attardo 1994; Ritchie 1999, 2004; Martin 2007; Forabosco 2008). The formalization of incongruity referred to here is rooted in psychology, particularly in Shultz (1972) perspective and Suls' model (1972, 1983).

Given that a joke has a set-up (Sherzer 1985), also called a build up (Hockett 1977), which has the main function of introducing the characters and the setting and time in which the story takes place, and a punch line, generally defined as the closing element of a joke, Shultz (1976) pointed out that the incongruity takes place when the punch line is encountered. In fact, this part of the text is incompatible with the set-up; therefore the listener/reader is forced to backtrack the text in order to find a hidden meaning of the set-up that fits in the punch line. Suls (1972, 1983) developed this idea and formalized a two-stage model capable of describing the understanding process of a joke or a cartoon as a problem solving activity, in line with the configurational approach to humour (Schiller 1938). According to the model, the listener/reader of a joke or a cartoon keeps on figuring out the plausible meaning of the set-up of such a stimulus, therefore s/he makes predictions (i.e. expectations) about its most likely conclusion. When the punch line occurs, being by definition not consistent with the set-up, the predictions fall down and the listener/reader becomes surprised (first stage). In other words, an incongruity is perceived and a problem asking for a resolution arises. The second stage is aimed to discover a cognitive rule capable of removing and resolving the incongruity. When the humorous stimulus is based on an ambiguity (Pepiciello 1989) the resolution phase consists in reinterpreting the set-up, according to another viewpoint or "mental space" (Ritchie 2006).

For example, the following joke can be analyzed according to the two-stage model:

(1) I am opposed to sex before marriage: they arrive late at the ceremony
(Woody Allen http://www.scribd.com/doc/34076872/Woody-Allen-Quotes)

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The first sentence of the joke (the set-up) is interpreted within the field of ethics and probably religion. The reader builds a configuration of meanings in his mind, related to the personal choices and behaviors of the speaker of the first sentence. This configuration works as the basis of expectations about the end of the text, which is then supposed to have a coherent interpretation of the same topic. The second sentence, the punch line, is totally incongruous with the set-up and, according to the incongruity-resolution approach, such incongruity provokes puzzlement, confusion, and surprise (first phase). The second sentence is perceived as not coherent with the first one, that is why the reader is forced to find a way to fix the whole text. In this case, the reader backtracks and re-reads the first sentence in order to find a new and hidden interpretation. In this case, the new meaning is triggered by the word "before", which *per se* refers to a temporal continuum ranging from a long to a short time. In the first sentence "before" is understood as referring to a long period, whereas after the punch line, thanks also to the word "ceremony" which refers to a punctual event, "before" must be restructured as referring to a very short period of time, that is the one immediately preceding the wedding. Then the first sentence is restructured on the light of a sexual and transgressive interpretation. Once the double reference is discovered, the resolution is achieved and the stimulus understood (second phase).

Similarly, the cartoon of Figure 1 requires two stages to be understood:

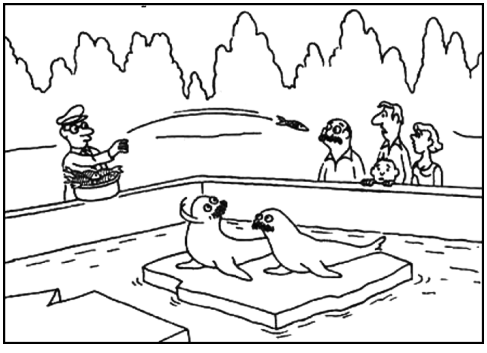


Figure 1. Cartoon taken from the web (www.specialissimo.it). This cartoon was used in the study and it is referred to as "sea lions".

The incongruity of the cartoon in Figure 1 is created by the fact that a zoo operator is feeding a tourist rather than the sea lions (first phase). The resulting experience of surprise, confusion, embarrassment, and puzzlement is overcome throughout the resolution. The resolution of this incongruity results from the comparison of the tourist's face to the sea lions' snouts: their mustaches and bulging eyes explain the misunderstanding (second phase). When a cartoon is taken into account, it is clear that the perceptual laws of visual organization play a significant role, as

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pointed out by Smith (1996).[1] In fact, the resolution of the cartoon of Figure 1 is based on the law of similarity: two elements are perceived as belonging to the same configuration because of their similarity. The tourist and the sea lions are perceived as belonging to the same category, i.e. beings to be fed, because of their visual similarity. In this stimulus, the law of similarity works as the key to resolve the incongruity, or in Watts' words (1989), to fill in missing information.

When a piece of information is missing, an incongruity is perceived and a confusion of thought (Maier 1932, 70) and embarrassment (Schiller 1938) and surprise (Suls 1972, 1983) and puzzlement (Schiller 1938; Berlyne 1969, 1972) are experienced. The problem solving activity involved in humor understanding lies in filling in the gap of knowledge (Watts 1989) throughout a resolution, namely a "logical mechanism" (Attardo and Raskin 1991; Attardo 1997, 2001; Hempelmann and Attardo 2011).

Since the surprise and confusion experience within humor processing is a matter of lack or weakness of knowledge, the study of its epistemic aspect seems a promising one. In the next section what perspective on epistemicity and evidentially has been chosen for the purpose of this paper will be presented.

3. Evidentially and epistemicity in communication: The KUB theory

The Theory of the Known, the Unknown, and the Believed (KUB) is located within the broader field of investigations into evidentiality, epistemicity, and their relationship (Bongelli and Zuczkowski 2008; Zuczkowski et al. 2011; Bongelli et al. 2012; Philip et al. 2013).

According to KUB Theory, the numerous and different (lexical and morpho-syntactic) evidential and epistemic markers available to speakers can all ultimately be reduced to three macro-markers. Two of them have two faces, one evidential and the other epistemic: I know/I am certain, I do not know, I do not know whether (= I believe)/I am uncertain. These correspond to the three basic evidential and epistemic "territories of information" (after Kamio 1994, 1997) of the Known/Certain, the Unknown, and the Believed/Uncertain (see Table 1).

This means that when a piece of information is communicated as certain (epistemicity) by a speaker, at the same time it is also communicated as known (evidentiality) to her/him (and vice versa). On the contrary, when a piece of information is communicated as uncertain (epistemicity), at the same time it is also

1. The laws that organize human visual perception have been considered to explain some aspects of humor processing also for verbal humorous stimuli (e.g. Maier 1932; Schiller 1938; Russell 1996; Metz-Göckel 2008; Canestrari and Bianchi 2009, 2012, 2013).

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communicated as believed (evidentiality) by her/him (and vice versa). Finally, information conveyed as unknown is neither certain nor uncertain: the unknown is marked by absence of information and as a result cannot communicate either certainty or uncertainty, both of which require information to be present.

The known/certain, at the communicative level, is all that a speaker says s/he perceives, remembers, and knows, in a broad sense. The unknown, in contrast, is the information that s/he says they do not know at all. The believed/uncertain includes not only beliefs but also opinions, impressions, suppositions, assumptions, conjectures etc.

It is important to note the difference between not knowing whether (believed) and not knowing (unknown): information that is communicated as unknown involves absence of knowledge (I don't know at all, I have no idea, I don't have the faintest idea) rather than beliefs or suppositions that are unconfirmed or uncertain.

According to KUB Theory, dialogic communication involves an exchange of information; this information originates in one of the three evidential and epistemic territories and is directed at another.

Table 1. Summary of evidential and epistemic markers of known, unknown and believed, taken from Philip et al. (2013).

	Known	**Unknown**	**Believed**
Lexical markers	Evidential verbs (I remember…) Epistemic verbal expressions (I have no doubt …) Epistemic adverbials (surely…)	Negative form of the evidential verbs of the Known (I don't remember…) Adjectives (unknown…)	Epistemic verbs (I suppose…) Verbal epistemic expressions (it is possible…) Epistemic adjectives and adverbials likely, perhaps… Modal verbs
Morphosyntactic markers	Clauses in the present, past and future indicative with no lexical evidential or epistemic marker	"Literal" interrogatives (i.e. excluding rhetorical questions, question tags, etc.)	Modal verbs in conditional and subjunctive moods If clauses Epistemic future

4. Study

In order to verify whether the psychological experience of surprise, confusion, and puzzlement elicitated by the incongruity of a humorous text is anchored to

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the epistemic and evidential experience of uncertainty and unknown, an explorative study was conducted. The pieces of communication produced by the readers asked to describe aloud their own humor processing when they were faced with humorous stimuli were recorded. Then, the communication related to the surprise moment was analyzed according to the operative tools provided by the KUB theory (Bongelli and Zuczkowski 2008; Zuczkowski et al. 2011; Bongelli et al. 2012; Philip et al. 2013): the epistemic and evidential linguistic markers of known (i.e. certainty), unknown, believed (i.e. uncertainty) were detected and depending on their quantity it can be ascertained to which world of knowledge out of the three a piece of communication referred to a surprise moment belongs.

Given a humorous stimulus, a beholder experiences surprise or confusion or puzzlement when s/he encounters the incongruity. Up to this moment, which matches the first phase of the incongruity-resolution model *á la* Suls, the beholder's humor processing is supposed to be anchored to the believed or unknown worlds of knowledge. Therefore, in the corresponding communication there should be plenty of uncertainty and unknown markers. If the beholder succeeds in overcoming and resolving the incongruity, the world of knowledge to which s/he refers to should be that of known. Consistently, the corresponding communication is supposed to contain more certainty markers and less uncertainty and unknown markers than those used in relation to the first phase.

Moreover, these hypotheses were tested on two kinds of humor, namely jokes and cartoons. This is to verify further possible differences in the quality and quantity of markers depending on the type of humor involved.

Finally, a correlation analysis has been carried out, in order to verify the relationships among perceived amusement, difficulty in humor understanding, and annoying and the world of knowledge activated in the surprise moment. A stimulus is supposed to be a good example of humor if it is recognized as such. Since a humorous stimulus must be firstly recognized as an attempt of humor, secondly understood, and then eventually appreciated (Hay 2001), it derives that if a humorous stimulus is appreciated, it has been also recognized and understood. Therefore, the level of amusement is an indirect proof of humor recognition, which is essential to verify the hypotheses.

4.1 Method

4.1.1 *Participants*

14 Italian native speakers (6 males and 8 females; $M = 34.43$; $DS = 4.54$) participated voluntarily and anonymously to the study. Participants did not have previous specialized knowledge or competence on humor and "thinking aloud" method. This feature guarantees genuine and unsophisticated data.

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4.1.2 *Materials*

Five Italian written jokes taken from the internet and five cartoons drawn from the internet and from the weekly magazine *La settimana enigmistica* were chosen on the basis of the following characteristics: 1- they can be analyzed according to the incongruity-resolution model, linked to the assumption that the humorous dimension plays on an incongruity that needs to be solved; 2- the incongruity is anchored to an ambiguity: the element (a word or a pictorial sign) that at the beginning is understood according to the most plausible meaning of the text turns out in a further meaning after its re-interpretation (Pepiciello 1989); the switch to the second meaning results from the resolution phase and it is necessary to understand the humorous aspect of the text.

4.1.3 *Procedure*

A booklet containing the 5 chosen jokes followed by the 5 chosen cartoons, one page for each stimulus, was used. Each participant was asked to read aloud or watch the stimuli. The "thinking aloud" method (Duncker 1935 [1972]; Claparède 1933; Van Someren et al. 1994) was used: participants were asked to verbally communicate all the thoughts and mental images that came into their minds during the reading of a stimulus.

Moreover, participants were asked to express the levels of amusement, difficulty, and annoying they experienced for each stimulus, rating them on a ten-point scale from 1 (not at all) to 10 (extremely).

Participants were interviewed individually: the interviews were recorded and then transcribed. The interviewers were the three authors of this paper. As a warm up session the three of them participated to the interviews of two out of the eight female participants. The aim was to consolidate and validate the following general guidelines: carry out semi- structured interviews, play a not directive role so that interviewer can facilitate the participants in doing the task. The role of the interviewer consisted in facilitating the communication of the humor processing, during the task, and in helping participants in the recall the thoughts and mental images, just after they were produced. The remaining eleven interviews were carried out by one out of the three authors according to the above-mentioned guidelines.

4.2 Results

140 interviews were recorded, with no missing case. The 10 chosen stimuli were generally rated as not annoying ($M = 1.23$; $DS = 0.29$) and in the 50% of responses they were rated as not annoying at all. The average difficulty of the stimuli was low ($M = 2.58$; $DS = 0.83$) and in the 71,4% of the cases stimuli were found to be not difficult at all or a bit difficult. The overall amusement rate ($M = 4.59$ $DS = 0.96$)

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shows an intermediate level of enjoyment. Amusement rating has been utilized as an indicator of proper choice of the stimuli due to the assumption that a stimulus, to be humorous, must be perceived as funny by participants. Perceived amusement can be linked to perception of being enjoyable, hence to the recognition of the humorous aspect, along with the lack of annoying rate.

Results show that jokes resulted to be amusing (ranging from 3.79 to 6.07), poorly difficult to understand, and not annoying (see Table 2). The levels of amusement, difficulty, and annoyance do not vary significantly depending on the stimuli. No correlations were found about total amusement, annoyance and disturbing rate (all $p > 0.05$).

Similarly to jokes, cartoons resulted to be amusing, ($M = 4.20$; $DS = 2.23$ range from 3.64 to 5.57) and not annoying ($M = 1.1$; $DS = 0.49$ range from 1.00 to 1.14) Differently to jokes, cartoons resulted more difficult to understand ($M = 3.03$; $DS = 2.31$ range from 2.14 to 4.64) see Table 3.

Mean scores on the amusement, funniness and annoyance were analyzed as repeated measures. Jokes and cartoons appeared to be significantly different in amusement rate F (4.235,55.054) = 3.34, $p = 0.014$ $n^2p = .83$ [Greenhouse-Geisser correction; $\varepsilon = .47$] and in difficulty F(9,117) = 3.47 $p = 0.001$ $n^2p = .98$) but not in annoyance F (2.429,31.574) = 2.36, $p = 1.01$ $n^2p = .49$ [Greenhouse-Geisser correction; $\varepsilon = .47$]).

A post hoc analysis using LSD's test revealed a significant difference in the level of amusement among cartoons. The "sea lions" cartoon has been rated as funnier than the "witch" cartoon ($p < 0.01$) and that the "snowman" cartoon ($p < 0.05$). The "mole" cartoon has been rated as funnier than the "witch" cartoon ($p < 0.1$). Moreover, the post hoc test showed that the "snowman" stimulus resulted to be significantly more difficult to understand than the "sea lions" and "mole" cartoons ($p < 0.05$).

Two out of 14 participants were not able to communicate their thoughts related to the surprise moment experienced while processing the 10 humorous stimuli. Seven participants were able to communicate their thoughts one time each, two participants did the task correctly twice each, and finally three participants did the task correctly in 5, 4, and 3 times each one. As a result, out of 140 recorded interviews 23 were identified as those where the task has been done correctly, namely the shift from the surprise moment to the understanding was communicated.

The 23 interviews were transcribed and analyzed independently by three experts in order to identify the epistemic and evidential markers used by participants. 18 out of 23 reports (chi-square test significant at $p < .01$) confirmed the hypotheses. The language used by the participants experiencing the surprise moment (those who had not yet understood the humorous stimulus) was richer than the language produced by the same participants after having switched to a

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Table 2. Mean values related to the levels of amusement, difficulty, and annoyance for the five jokes used in the study. The words used in the second column represent each specific joke.

Variables	Jokes	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Amusement	Bus	14	3.79	2.19	.59	2.52	5.05	1	7
	Dust	14	5.43	2.71	.72	3.86	6.99	1	8
	Smart	14	5.50	1.83	.49	4.44	6.56	2	8
	Bear	14	4.14	2.77	.74	2.54	5.74	1	8
	Wedding	14	6.07	2.13	.57	4.84	7.30	1	8
	Total	70	4.99	2.45	.29	4.40	5.57	1	8
Difficulty	Bus	14	1.64	.84	.23	1.16	2.13	1	3
	Dust	14	1.71	1.44	.38	.88	2.54	1	5
	Smart	14	3.43	3.16	.84	1.61	5.25	1	10
	Bear	14	1.93	1.86	.50	.86	3.00	1	8
	Wedding	14	2.00	1.47	.39	1.15	2.85	1	5
	Total	70	2.14	1.97	.24	1.67	2.61	1	10
Annoyance	Bus	14	1.21	.58	.16	.88	1.55	1	3
	Dust	14	1.29	.73	.19	.87	1.71	1	3
	Smart	14	1.29	.83	.22	.81	1.76	1	4
	Bear	14	2.00	1.75	.47	.99	3.01	1	7
	Wedding	14	1.00	.00	.00	1.00	1.00	1	1
	Total	70	1.36	.99	.12	1.12	1.59	1	7

Table 3. Mean values related to the levels of amusement, difficulty, and annoyance for the five cartoons used in the study. The labels used in the second column represent each specific cartoon.

Variables	Cartoons	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Amusement	Sea lions	14	5.57	1.90	.53	4.42	6.72	2	8
	Direction	14	4.00	2.04	.55	2.82	5.18	1	7
	Witch	14	2.93	1.73	.46	1.93	3.93	1	5
	Mole	14	4.86	2.51	.67	3.41	6.30	1	9
	Snowman	14	3.64	2.10	.56	2.43	4.85	1	6
	Total	70	4.20	2.23	.27	3.67	4.73	1	9
Difficulty	Sea lions	14	2.14	1.56	.42	1.24	3.04	1	6
	Direction	14	3.57	2.74	.73	1.99	5.15	1	8
	Witch	14	2.57	1.91	.51	1.47	3.67	1	8
	Mole	14	2.21	1.63	.43	1.28	3.15	1	5
	Snowman	14	4.64	2.71	.72	3.08	6.21	1	10
	Total	70	3.03	2.32	.28	2.48	3.58	1	10
Annoyance	Sea lions	14	1.00	.00	.00	1.00	1.00	1	1
	Direction	14	1.00	.00	.00	1.00	1.00	1	1
	Witch	14	1.36	.93	.25	.82	1.89	1	4
	Mole	14	1.00	.00	.00	1.00	1.00	1	1
	Snowman	14	1.14	.54	.14	.83	1.45	1	3
	Total	70	1.10	.49	.06	.98	1.22	1	4

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complete understanding of the same stimulus. In particular, the communication referred to the moment of surprise was richer of: 1) linguistic expressions of uncertainty: for example, conditional moods, adverbs such as "perhaps", "likely" and so on, verbs like "it seems to me" ecc.; 2) linguistic expressions of unknown such as "I don't know", "I don't get it", and so on. Complementary, markers of certainty (e.g. declarative sentences, expressions like "I get it", "I know") are more frequent after the surprise moment is overcome.

The excerpt (2) is prototypical of those 18 reports.[2] The stimulus the interlocutors refer to is the cartoon of Figure 2. "P" stands for participant and "I" for interviewer, the dialogical turns are progressively numbered:

(2) 1 P: *Vedo un tipo che entra in una porta con scritto*
1 P: 'I see a guy entering through a door where there's written'
2 P: *direzione: e::: c'è un: s:: una buss-bussola*
2 P: 'direction and::: there's a:: s:: a comp-compass'
3 P: *possiamo chiamarla bussola? Dove segna il*
3 P: 'can we call it compass? It indicates'
4 P: *nord, sud, ovest,est. Non ci sto arrivando subito.*
4 P: 'north, south, west, east. I'm not getting it'
5 P: *c'ho una mia idea in mente::*
5 P: 'I have a personal idea in mind::'
6 I: *qual è?*
6 I: 'which one?'
7 P: è *come se indicasse tutte le direzioni*
7 P: 'it looks as if it indicated all the directions'
8 P: *no? quindi alla fine sono tutti direttori*
8 P: 'doesn't it? so at the end they are all directors'
9 P: *mi dà questa idea qua. Mi è venuta questa idea qua*
9 P: 'it gives me this impression. I got this idea'
10 P: *però non subito* (2.0)
10 P: 'but not immediately' (2.0)
11 I: *chi è questo secondo te?*
11 I: 'who is this one in your opinion?'

2. The fragment was transcribed according to the Jeffersonian model (Jefferson 1984):

? ascending tone;
. descending tone;
(.) brief pause;
:: prolonged sound;
– truncated word;
CAPITAL WORDS emphasis

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12 P: *questo è uno:: c'ha sta cartella (2.0)*
12 P: 'this is one:: he has a folder' (2.0)
13 P: *quindi:: (1.0) boh un tipo. Non lo collego*
13 P: 'hence::(1.0)I don't know a guy.I don't connect it'
14 I: *ok che entra dove?*
14 I: 'ok where is he entering?'
15 P: *mm: dovrebbe essere un ufficio. Direzione*
15 P: 'uhm: that should be an office. Direction'
16 I: *ok.*
16 I: 'ok.'
17 P: *AAAH adesso sì*
17 P: 'AAAH now yes'
18 P: *eh adesso:praticamente te vedi l'ufficio e*
18 P: 'eh now: basically you see the office and'
19 P: *colleghi direzione e ti dai un::*
19 P: 'you connect to direction and you give you an:'
20 P: *comunque entri già nel contesto*
20 P: 'however you are already in the frame'
21 P: *di cosa voglia dire a livello di::*
21 P: 'what it would mean at the level of::'
22 P: *ti sposta il pensiero il contesto*
22 P: 'your way of thinking is moved'
23 P: *di un omino che entra in una porta*
23 P: 'by the little man which enters in a door'
24 P: l*a bussola poi ragionandoci bene*
24 P: 'the compass after a good reasoning'
25 P: *parla di direzione::*
25 P: 'it talks about direction::'
26 P: *cioè::geografica più che manageriale*
26 P: 'that is:: more geographically than managerially'



Figure 2. The cartoon has been taken from the weekly magazine *La settimana enigmistica*", n.4175, 2012, p. 43 (by courtesy of *La settimana enigmistica* copyright reserved).

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In the fragment the participant P communicates what he is processing while looking at Figure 2. The cartoon represents a man entering the office of the person that is in charge of a business company, i.e. the director, referred to by the Italian word "*direzione*" on the door. In front of him there is an object indicating the four main compass points that show geographic directions: north (N), south (S), east (E), west (O). The Italian word "*direzione*" means both direction as spatial orientation and a director's office. The capital letters "N", "E", "O", "S" are the initials of the Italian words for the cardinal points.

The first uncertainty marker is the question in line 3 ("*possiamo chiamarla bussola?*" "Can we call it a compass?"), which is equals to "I do not know whether we can call it compass or not". It is followed by an unknown marker in line 4 "*non ci sto arrivando subito*" ("I'm not getting it") revealing that P is not getting or does not know the link between the left and the right side of the cartoon. P (line 5) explains his hypothesis "*c'ho una mia idea in mente*" ("I have a personal idea in mind") that the compass stands for all the directions, and then it reveals that everyone can act as a director. The hypothesis is introduced by the uncertainty marker in line 7 "*è come se*" ("it looks as if") because it is anchored to the mental world of believed. Although P's effort to find the solution, he has not resolved the incongruity yet. Following I's attempt to help him, P expresses his lack of knowledge in turn 13 through two unknown markers, that are "*bho*" (equals to "I don't know") and "*non lo collego*" ("I can't connect it"). In turn 15 P answers I's question with uncertainty, by using the conditional "*dovrebbe*" ("should"), which stands for "I think that". Finally, the eureka moment occurs in turn 17 revealing that P has just got the resolution of the incongruity, namely that he has understood the humorous aspect of the cartoon.

The analysis and comparison of the lines coming before and after the eureka moment show that: markers of uncertainty/believed (e.g., "as if", "should") and unknown (e.g., "I'm not getting it", "I can't connect it", "I don't know") are present before the humorous aspect of the cartoon is understood, whereas they are totally absent in the communication following the understanding, which on the contrary is full of markers of certainty/known (i.e., declarative sentences). This outcome confirms the hypotheses and it was found in 18 out of 23 interviews.

As for the correlation between the levels of difficulty to understand a stimulus and the number of verbalizations of the surprise moment of that stimulus (see Table 4), it resulted that the more a stimulus was difficult to understand the more the interviewers were able to communicate their thoughts. In fact, the correlation between the two variables is positive and very high (0.9, $p < .01$), whereas no significant correlation was found between the number of interviews per stimulus and the relative levels of amusement and annoyance.

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Table 4. Levels of difficulty, amusement, and annoyance for the stimuli on which basis the 23 interviews analyzed were produced.

Stimuli	Type of stimulus	N. of interviews analyzed to verify the hypotheses	Difficulty (Mean rating)	Amusement (Mean rating)	Annoyance (Mean rating)
Snowman	Cartoon	10	4.64	3.64	1.14
Direction	Cartoon	5	3.57	4.00	1.00
Sea lions	Cartoon	2	2.14	5.57	1.00
Witch	Cartoon	2	2.57	2.93	1.36
Smart	Joke	2	3.43	5.50	1.29
Mole	Cartoon	1	2.21	4.86	1.00
Bear	Joke	1	1.93	4.14	2.00
Total		23	2.92	4.37	1.25

5. Discussion

The experience of surprise (Suls 1972, 1983), puzzlement (Schiller 1938; Berlyne 1969, 1972), embarrassment (Schiller 1938), confusion of thought (Maier 1932) connected with the recognition of the incongruity of a humorous stimulus has been poorly defined and has almost been unstudied from the epistemic point of view, although its connection with knowledge has been indicated indirectly. In fact, it has been argued that overcoming the surprise and puzzlement moment due to a detected incoherence in a humorous stimulus produces knowledge, considered as the result of inferences (e.g. Watts 1989) or in terms of "knowledge resources" (Attardo and Raskin 1991). Then, it can be assumed indirectly that a lack or a doubt about the knowledge is experienced by the reader of a humorous stimulus before the psychological experience of surprise is overcome, namely the resolution achieved.

In order to analyze the epistemic feature of this psychological experience, a pilot study was conducted. The link between surprise experience and the epistemic worlds of knowledge of uncertainty and unknown was verified at the communicative level, applying the analytic tools provided by the KUB theory.

As a general result, the chosen stimuli were perceived as being good examples of humorous texts by participants: they resulted in being amusing (and therefore their humorous nature was recognized), not annoying, and not so difficult to understand. This is particularly true for jokes, whereas cartoons were considered as being more difficult to grasp than jokes. This outcome can be explained on the basis of a qualitative analysis of the reported interviews. When participants communicated their difficulty in understanding a cartoon, they often reported difficulties

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in grasping the meaning of a salient element of the drawing. For example, the cardinal points of the "direction" cartoon (Figure 2) were not easily recognized by some participants.

Moreover, the perceived difficulty was found to be an important feature in performing the task. In fact, 10 interviews out of 23 were on the same stimulus, which resulted as being also the most difficult one to get. This outcome can be further verified by considering the interviews where the communication on the surprise moment was absent. In these cases, the level of difficulty should be low.

The general hypothesis of this study was confirmed: the surprise moment experienced when the incongruity of a humorous stimulus is encountered is rooted in the world of knowledge of uncertainty and unknown. This finding is based on the fact that the pieces of communication referred to this peculiar phase showed plenty of markers of uncertainty and unknown, whose quantity was higher when participants referred to the surprise phase more than to the resolution phase. This result is consistent with those coming from artificial intelligence studies (eg., Macedo and Cardoso 2001) based on cognitive models of surprise (e.g., Ortony and Partridge 1987; Meyer et al. 1997). These theoretical models share the assumption that surprise is one of the primary emotions (Izard 1977; Ekman 1992) serving motivational and informational functions (Meyer et al. 1997), and it is elicited by unexpected events (Ortony and Partridge 1987; Meyer et al. 1997). In the field of artificial intelligence systems, surprise is considered an important factor (Macedo and Cardoso 2001), and some systems have been created. Among them S-EUNE is an artificial agent based on an adaptation of the research group from Bielefeld, Germany (e.g., Meyer et al. 1997). It has the goal of exploring and detecting uncertain and unknown environments capable of provoking surprise (Macedo and Cardoso 2001). According to this computational model and to its theoretical background, surprise is based on uncertain and unknown, similarly to the results of this study.

Complementary to what is communicated when the surprise occurs, the communication referred to the resolution-phase, characterized by the solution of the incongruity and the overcome of the experience of surprise, puzzlement, embarrassment, confusion of thought, is more richer of markers linked to the territory of known than those referred to the surprise moment. This result suggests that in order to be understood a humorous stimulus must activate unquestionable pieces of information related to the most explicit and implicit meanings (e.g. a manager's office and four cardinal points in the cartoon of Figure 2) and their link (e.g. the double meaning of the word "*direzione*"), as far as ambiguity is concerned. Generally speaking, in Raskin's words (1985), the unquestionable pieces of information activated are related to two opposed scripts and their logical mechanism. The informational contents of the scripts and their humorous connection emerge

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as certain, clear, evident information. If this is not the case, we can conclude that the humorous aspect of a stimulus has not been grasped. This is confirmed by the massive presence of markers of unknown and uncertainty used by participants when they did not get the point. The fact that a humorous attempt succeeds if the beholder already knows the informational content on which the humorous stimulus plays is not new in the literature. For example, according to Norrick's pragmatic analysis (1993), humorous interactions can serve to discover at what extent an interlocutor knows about a specific field, depending on the failure or success of the understanding of a humorous stimulus playing around that field. Obviously, if a salient piece of information is missing in the interlocutor's world of knowledge, the humorous attempt fails. The results of the study presented here specify further this shared knowledge. In fact they give evidence that a humorous stimulus may not be understood also when the specific informational contents on which a humorous text plays are not activated in the beholder's mind, even though they are present within his/her world of knowledge. An interesting point, deserved to the future, is to investigate if a humorous text can be understood as having more than a humorous interpretation. If this is the case different connections should be found between the initial most obvious meaning of a humorous text and more than one final less obvious one.

One of the limits of this study is the difficulty in performing the task by participants. In fact, out of 140 interviews, only 23 could be analyzed to verify the general hypothesis because they were those where a communication on the experience of surprise, puzzlement, and confusion of thought was present. This limit was assumed on the basis of Claparède's (1933) analysis of the method: when people are not trained to think aloud, they can have difficulties in thinking and at the same time talking continuously, moreover sometimes thought is so quick and discontinuous that words do not come easily and fluently. This limit can be overcome by reproducing the study with people trained to think aloud while processing humorous stimuli. However, this method allowed us to gain access to thought through an intersubjective tool, namely language, and, as a pilot study, data coming from the 23 interviews furnished useful information to point out some important results. It is plausible that one of the reasons why in many cases participants were not able to think aloud in reference to the surprise moment is that this phase was overcome very quickly. If this is the case, those interviews where such type of communication is absent should result to be associated with a low level of perceived difficulty of the humorous stimulus they referred to. Individual psychological features can be assumed as another reason why the task was not done correctly in many cases. The results suggest that 3 out of 14 participants were the most apt to apply the "thinking aloud" method. This method is likely to succeed when it is applied by people with high levels of self-awareness and analyticity. These three factors,

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namely training in thinking aloud, a perceived difficulty in understanding the humorous stimuli, and specific personal characteristics, should be taken into account for future studies on humor processing to be carried out with the thinking aloud method. As Claparède (1933) suggested, people trained to think aloud while solving a problem, in this case a humorous problem, are more likely able to verbalize their mental activity.

The next step is to reproduce the study using controlled difficulty stimuli with people trained to think aloud while processing humorous stimuli.

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Authors' addresses

Carla Canestrari
Department of Education
Cultural Heritage and Tourism
University of Macerata
p.le L. Bertelli 1
62100 Macerata
Italy
Tel.: +39 0733 258 5828

carla.canestrari@unimc.it
http://docenti.unimc.it/docenti/carla-canestrari

Alberto Dionigi
Department of Education
Cultural Heritage and Tourism
University of Macerata
p.le L. Bertelli 1
62100 Macerata
Italy
Tel.: +39 328 3894312

alberto.dionigi@unimc.it
http://unimc.academia.edu/AlbertoDionigi

Andrzej Zuczkowski
Department of Education
Cultural Heritage and Tourism
piazzale L.Bertelli 1
contrada Vallebona
62100 Macerata (Italy)
Tel.: +39 0733 258 5941

zuko@unimc.it
http://docenti.unimc.it/docenti/andrzej-zuczkowski

About the authors

Carla Canestrari, Ph.D., is researcher in General Psychology at the University of Macerata (Italy), Department of Education, Cultural Heritage and Tourism and she is a member of the ISHS (International Society for Humor Studies). Her main research topics concern qualitative analysis of spoken and written communication, and on the cognitive processes involved in the understanding of humorous texts. She wrote international publications specially on humour in journals and books.

Alberto Dionigi, Ph.D., is a cognitive-behavioural psychotherapist. He received his Ph.D. in Psychology of Communication and Cognitive Processes at the University of Macerata (Italy). He is a member of the ISHS (International Society for Humor Studies) and his main research interest concerns the psychology of humor. He has delivered talks internationally at academic conferences and published scientific articles on the subject.

Andrzej Zuczkowski is Full Professor of General Psychology at the University of Macerata (Italy), where he is director of the Research Center for Psychology of Communication and of the PhD course Psychology of Communication and Cognitive Processes. His main interests are the relationships between linguistic communication and mental processes. In particular, in the last years he has been studying the epistemic and evidential aspects in written and spoken corpora.

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