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Incongruity Humor in Language and Beyond: From Bergson to Digitally Enhanced Worlds

1 Introduction

Humour research is often about verbal humour. Language allows us to play with words and with its syntactic, semantic and pragmatic aspects. It provides us with building blocks that can be composed in unusual ways, introducing ambiguities, confusion, inappropriate language use, and incongruities. This allows the design of humour, whether it is word play, verbal jokes, or humorous remarks triggered by conversational interaction. Design and analysis of verbal humor has become part of computational humor studies [1,2].

Language is not the only tool that can be used to design and construct humor. In our daily life we often encounter situations that make us laugh and that we consider to be humorous. We may even help to provide conditions that lead or hopefully lead to humorous situations. Being able to control a physical environment and the way its inhabitants can interact with the environment has now become possible due to advances in sensor and actuator technology. Increasingly we see sensors embedded in our environments that monitor and interpret our behaviour. They include cameras and microphones, position, proximity, and wearable physiological sensors, they gather knowledge about our activities, interpret them in real-time, and anticipate future activities and behavior. Based on such perceptions and interpretations actuators make changes to the environment, its appearance and its interaction and display facilities, including augmented and virtual reality display and interaction possibilities.

Until now, computational humor research has been concerned with modelling verbal humor. But many observations on more general forms of humour [3] can have a computational implementation as well. Or, at least, humour creation by human inhabitants of such environments can be facilitated by humor intelligence embedded in these environments. In particular this intelligence knows about incongruity humor theories. This knowledge allows the environment to introduce incongruities and it allows inhabitants of the environment to use such incongruities to create and exploit humorous situations [4,5] while interacting with the environment and other inhabitants. Unlike the single-modal incongruities that can appear in language, in the physical world we can have cross-modal incongruities, where our senses reach a conclusion, based on partly incomplete and partly conflicting information, that later has to be revised based on newly received information. We have been tricked. Or, in the words of Douglas Hofstadter: "Pulling the wool over the human perceptual system." [6]. Various categories of incongruities have been introduced [3]. Attention need to be given to incongruities that follow from the introduction of new technology as has been visualized in Chaplin's Modern Times or Tati's Mon Oncle and PlayTime. A more recent view has been taken by Stone [7,8], who identified our social media and internet behavior as an attempt to be a 'life node' in our networks, displaying scanning behavior and doing multitasking, and therefore always being in a state of 'continuous partial attention', leading to mental mismatches and unintended juxtapositions of events, leading to incongruous and humorous situations.

2 On Humor Research

Humor has become a well-established research area [9,10]. There is a journal devoted to Humor research; papers on humor research appear in journals on psychology, sociology, linguistics, artificial intelligence, and human-computer interaction. There are also regular conferences, for example organized by the International Society of Humor Studies, workshops and special sessions devoted to humor research during conferences. Moreover, there are many books on humor studies. Computer Science is interested in humor studies. In particular in the research area of human-computer interaction it is understood that understanding human-human interaction is a prerequisite for understanding what is going on in smart and ambient intelligence environments when multiple persons inhabit such environments and are involved in joint activities and interactions. But knowledge about human-human interaction is as well important when we hope to build computers that can offer more natural interaction modalities to their users than are available from monitor, mouse and keyboard. Such an offering is not useful for all computer applications, but in daily life and entertainment applications, in situations where we interact with a social robot or a human-like screen character, in educational and training situations, being able to understand and generate human-like communication behavior is useful. Being able to deal with computational aspects of humorous behaviour is a necessity to algorithmically model understanding of human behavior and to have a computer (a social robot, an embodied agent, a game avatar) engage in an equivalent humorous way with a human conversational partner.

Conventional humor theories, at least those that address possible computational aspects of humor, mainly address humor in language. That is, linguistic theories of literal versus non-literal language usage, theories of irony and theories of sarcasm. Incongruity theory or incongruity resolution theory is in the kernel of computational approaches to humor. It does not mean that other theories cannot contribute to computational theories of humorous multi-party interaction, human-human interaction, or human-computer interaction. We spend a few words to each of the main approaches to humor modelling. The main concepts are simple and easily understood.

In the **hostility/superiority theory** the focus is on us being superior to the main subject, or rather the victim, of a joke. There is a loser, someone who is becoming ridiculous and we can laugh about his or her misfortune, being

happy that we were not in that situation or being convinced that it would not happen to us. So we laugh about a joke that addresses the intelligence of blondes, we laugh about a situation on stage, in a movie, or in a TV commercial, where we see other's marriage problems, and we laugh when in front of our eyes someone slips over a banana peel.

The **relief theory** provides another point of view. It focusses on our inhibitions rather than our feelings of superiority or hostility. They may be related, but research that has addressed such a question is beyond the topic of this paper. In this relief theory the assumption is that we laugh about situations, whether they come to us in real live or in a told joke, where social, sexual or even intellectual taboos are involved. This can concern a mismatch between what we usually think, say and experience, and a particular situation where our common-sense, emotional and cognitive reasoning do not work, at least not immediately. The situation conflicts with social norms or cognitive reasoning.

In the **incongruity (resolution) theory** the focus is on situations that lead to confusion and misunderstandings. That is, our understanding of a situation is conflicted by new information, requiring a re-interpretation of what we know about a particular situation and how to interpret a particular situation. There is some incongruity involved, and the re-interpretation does not only address a simple misunderstanding, but also a misunderstanding that not just involves a slight re-interpretation but also being forced to take a completely contrasting view on what happened or was described. Without this smile or laughter inducing contrast we just have a misunderstanding of a particular situation.

No viewpoint covers every type of humor. They should be considered as complementary approaches to understanding humor.

3 Henri Bergson on Humor in Comedy and in Real Life

More than other humor researchers, in "Laughter: An Essay on the meaning of the Comic" Henri Bergson [11] focuses on human behavior, actions, and movements that cause laughter. Obviously, such behavior, actions and movements can be described in verbal jokes, but his explanations are mostly done with examples of behavior, actions and events that take place in the real world, rather than in the language world. His essay was first published in 1900, so we don't see him discuss examples of humorous behavior and humorous situations as they were introduced, exaggerating real-life situations, by movie actors and directors later. Think of Charlie Chaplin, Buster Keaton, or Laurel and Hardy. Rather Bergson looked at why we decide that certain human behavior (whether it is physical or mental) will be interpreted as humorous, and how we can have humorous views on the world that follow a 'logic of imagination' rather than a 'logic of reason'. His views also include humorous, anthropomorphic and 'living being' interpretations of actions and events as they occur in nature or society. Bergson's keyword is 'mechanical inelasticity' and it is used to describe movements, behavior and situations that go wrong because there is no flexibility to adapt to something unexpected. That is, like a machine, the body continues with what it is doing, it is unstoppable, until its owner is falling and realizing that rather than gazing at the stars he would have been better off with having noticed the banana peel lying on the street in front of him. This idea is generalized, for example to absent-minded people who continue behaving and acting in their usual way without realizing that the circumstances have been changed. This can lead to funny situations for the spectators and such situations can even be created with the aim to play a practical joke on someone.

This view of "something mechanical is encrusted upon the living" is further illustrated in various ways. For example, why do we find imitations funny? The imitator has recognized certain characteristic patterns in gestures, facial expressions, or body movements and by repeating them in his performance he provides a mechanical look at a person's attitudes, gestures and movements. It is shown how the person can be looked upon as a machine or as a marionette controlled by strings. We can look at nature in a similar way, although we cannot control it by strings or play a practical joke on nature. But we can laugh about a mechanical interpretation of nature. One example of Bergson is taken from the book *Tartarin sur les Alpes* [12], in which the hero of this book, Tartarin, compares Switzerland with an opera performance, where there is machinery, like in the basement of an opera theatre that controls the waterfalls, the rivers and the glaciers with the aim to please the tourists. A second example, also mentioned by other 19th century authors is the remark of a lady who was invited with several others by the astronomer Cassini to watch a moon eclipse in his Paris Observatory. She arrived late, but told her company that since she was a friend of Cassini, he would be happy to start all over again (*"il voudra bien recommencer pour moi."*). There are other examples, for example when a similar astronomical event is not supposed to happen before the king arrives. Bergson also looks at ceremonies and, not surprisingly, emphasizes the formal, mechanical, aspects of such ceremonies and how easy it is, once we distinguish form from content, to laugh about it.

Automatisms - whether they appear in the mind or the body - going wrong is a recurring pattern in Bergson's observations on humor. But sometimes it is sufficient to consider human behavior, nature or society from the mechanical viewpoint in order to generate laughs. Bergson also looks at the comic element in actions and situations. He prefers to take his examples from the stage, as being a simplified and a magnified view of life. Here again, his viewpoint is that acts and events can become comic when they resemble some mechanical arrangement. Among the issues mentioned here are *repetition* and *inversion* (e.g. role inversion, a child teaching his parents), and also the snowball effect, where one simple and rather innocent action starts an unstoppable series of unplanned events.[1] The word 'incongruity' is not mentioned, but in the context of actions and events

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[1] The Laurel and Hardy movie Big Business (1929) is a nice illustration of this snowball or chain-reaction effect.

Bergson introduces his notion of *reciprocal inference* (l'interférence des series) which he defines as a situation where a series of events can be interpreted in different ways. Since Bergson focuses on comedy on stage, he distinguishes interpretations put forward by the actors who only know part of the story, and the audience, that has been given a more complete view of the events happening on stage and therefore are assumed to have the correct interpretation. So, we have different sequences of events or storylines, but there are overlapping situations, where these storylines meet, and diverge again, until the next overlapping situation. The spectators enjoy the different interpretations of these sequences of events and how these different interpretations are resolved in the overlapping situations. Obviously, there can be one actor that has more knowledge than other actors and for his own benefit tries to knit sequences together whenever there is the chance that the conflict in the storylines is resolved too early. Similarly, the play writer can hide one storyline from the audience during the play and only at the end of the play the hidden storyline emerges when also all other storylines are resolved.

Seeing the actors act in a situation where storylines meet while they are not aware of other than their own storyline leads to humorous situations for the spectators. This will also be the case where a player knows about another storyline or a different interpretation of a storyline but has to patch up a situation where these storylines or interpretations join in order not to give away his interest or secrets. Although not mentioned by Bergson, there should be conflicting interests and contrasting events in these storylines, not really different from what needs to be present in verbal incongruity jokes. The main difference here is that the author of the comedy constantly has to hide the resolution of the incongruity for (some of) his actors and delay it to the end of the play, while the spectators, rather than being challenged to resolve an incongruity in order to understand a verbal joke they are being told, enjoy the ingenuity of the author in having his actors struggle with incongruities, not to resolve them, but giving them a wrong but plausible explanation that makes everyone involved in the play sufficiently happy and motivated to continue his or her own storyline, assuming that it is the main and only storyline, or hoping that his or her storyline can be forced upon others. Clearly, this interplay with storylines, leading to hiding, exposing, resolving and delaying resolution of incongruities can also be found in many (silent) comedy movies or movies that include humorous situations. Sometimes it is the audience that has to resolve incongruities, sometimes the audience is enjoying others (movie or stage actors) struggling with incongruities for which they already know the answers [13].

In the previous observations we looked at sequences of events (storylines) that have overlapping situations at the same time. Instead of such contemporary series of events it is also possible to have inference between a series in the past (being part of your memory, happening in your imagination) and a sequence of events belonging to the present. Bergson also mentions the transposition of a sequence of events from the ancient to the modern, and again, the assumption is that a humorous situation can appear when an overlapping situation appears or is created where past and presence collide. Although not mentioned by Bergson, we can also think of situations where future and presence collide, for example in a situation where science fiction actors have to go back in time and are required to use 21st century or older technology.

The three principles or processes (repetition, inversion, reciprocal interference of series) provide, in Bergson's view, a look upon life as "a repeating mechanism, with reversible action and interchangeable parts". Although Bergson looked at comedy in order to learn about humor in acts and events in general, the transition to humor in real life acts and events is hardly made. However, he remarks that "Actual life is comedy just so far as it produces, in a natural fashion, actions of the same kind …". The three processes that are used by play writers to create comedy can, in Bergson's view, appear in real life, but there they are the product of 'absentmindedness' in characters, rather than being intentionally used by a play writer or stage director to create humorous situations. And, again according to Bergson, this 'absent-mindedness' in events is exceptional. It is not quite clear from Bergson's observations whether his 'absent-mindedness' or 'distraction des événements' has the same meaning as we would give it today. In his view, this absent-mindedness is 'incorrigible'.

We have dwelt at length on Bergson's explanations of humor. A main reason is that Bergson's starting point when explaining humor is human movements, human behavior and human actions. Only after this has been done he feels ready to discuss humor obtained from words and language and to discuss comic characters. From our point of view, facilitating and creating humor in smart environments, such a starting point is more interesting than a discussion about jokes. A second reason, but it follows from the first one, is that there is a distinction between those that observe a humorous event and those that create, whether this is done voluntarily or involuntarily, a humorous event. Seeing someone slip on a banana peel has a different effect than reading or hearing about someone who slips on a banana peel. Whether or not we consider an event as humorous very much depends on the way we are involved in the event: did we initiate it, maybe with others, are we 'passive' spectators, do we know in advance how sequences of events will interfere, or is the joke played on us? All those involved in a humorous event will have different knowledge of what is happening and therefore will have different interpretations of a particular (potentially) humorous situation and therefore will experience the event in different ways. Again, when we talk about facilitating and creating humor in smart environments, these are important distinctions to consider. Finally, the third reason that we take so much interest in Bergson's humor explanations is the role of 'absent-mindedness'. In a later section we will return to this 'distraction des événements' and will discuss it in the context of our current days' multitasking behavior. That is, mental and physical behavior with our attention distributed over many simultaneously occurring virtual and physical events, a push of information coming from our social media devices, and a pull for information coming from these same social media that we feel obliged to satisfy while doing many other things at the same time [7,8].

Obviously, Bergson's observations were colored by time and culture. Examples are taken from French comedy play writers such as Molière and Labiche or the writer Alphonse Daudet. And, of course, where Freud had his

hydraulic analogies when analyzing humor, Bergson had mechanical analogies. Hence, there is the mechanical viewpoint of "something mechanical is encrusted upon the living", generalized to "the substitution of the artificial for the natural", and even to "the body taking precedence of the soul". All these observations and remarks deal with situations where human intellectual and moral principles are 'reduced' to mechanical viewpoints, and to the 'stupidity' of machines. That is, the human individual is going down in our estimations. So we may wonder how humor was experienced and understood before the mechanization of society, due to the first industrial revolution. Maybe it is not so much the comparison with machines that are not aware of changed conditions that is important in Bergson's observations, but the diminution from generally higher valued human capabilities (morality, rational thinking) to lower valued physical capabilities or even lower valued unconsciously performed mechanical movements and behavior. So maybe there can be references to poorly understood animal behavior. Capabilities and appearance of physically and mentally deformed people can become the butt of jokes too, following the same principle of diminution. Of course, dumb blondes should be mentioned too. And in a similar way we can look at nature and social events. What kind of diminution allows humorous comparisons? Nowadays, instead of making references to a mechanical point of view, we can make references to a computational point of view, and have humorous remarks and events in which humans are reduced to computational devices, rather than to mechanical devices. But clearly, since such a computationally viewpoint is less distant from highly estimated human capabilities such as intelligence, reasoning and moral decision making, it is not that obvious that Bergson's mechanical viewpoint can be replaced by a computational viewpoint.

4 Formalizing Humor in Language, Images, and Moving Images

Can we model humor in such a way that we can algorithmically analyze and generate humor? Or, maybe less ambitious, can we have sensors and actuators in our smart environments that have a modest sense of humor and can decide about changes in the environment that help to implement humorous events? In this section we will look at what has been done in more recent years, compared with Bergson's 19th century's explorations, to understand and model humor. Rather than on understanding humorous situations as they appear on stage or in real life, this 20th and 21th century's research focuses on language, images and moving images. In recent years we also see growing interest in designing humorous products. We will discuss them in a next section since such products, when equipped with sensors and actuators, can help to control the environment and therefore can help to create potentially humorous situations.

In the AI point of view the focus has been on verbal descriptions of situations and sequences of events, in particular in jokes that allow different interpretations because of incomplete and therefore ambiguous descriptions. A typical but simple example of applying syntactic and semantic knowledge and algorithms to humor research can be found in [14]. Here off-the-shelf parsing and reference resolution algorithms are used to generate questions that show some funny misunderstandings of a previously described situation. Other examples, but mainly at the lexical level, are pun riddles [15] or have funny word combinations that fit into an existing, well-known, abbreviation [16].

We can learn from incongruity humor research as it is done for language and when it is focused on the detection of incongruities as they appear in language use, and, in particular 'extreme' language use, such as in wordplay and jokes. We can go from images to moving images and look at humor in movies and TV series. Humor appears in movies and movie directors introduce potentially humorous situations and they direct their actors to engage in humorous activities. They can control their actors and the activities in which they are engaged. In "Theorizing the Moving Image" [13], Noël Carroll discusses how movie directors introduce humorous situations and humor in movies. Carroll's observations can help engineers of future smart environments to introduce tools and agents that can help in creating humorous situations in these environments. in a similar way, short narratives often appear in TV commercials. Humor is an important part of such commercials and since commercial messages will not only reach us through the TV, but probably more often via devices, such as smart phones, tablets and PCs that give us access to our social and professional networks, it is worthwhile to investigate how humor is used in commercial messages [17]. Based on an existing typology of humor techniques [18], in an empirical way categories such as (1) slapstick, (2) clownesque humor, (3) surprise, (4) misunderstanding, (5) irony, (6) satire and (7) parody were identified. Again, humor engineers of future smart environments where audiovisual media play an important role should learn from such a typology.

5 Characterizing Humorous Actions, Events and Situations in Real Life Environments

It is useful to distinguish humor techniques and to cluster them to get a more global view on what generates humor. It helps us (or the smart environment), to choose and combine techniques to achieve certain effects. As mentioned in [17], it is possible that "different types of humor … lead to different types of effects in different types of audiences." Typologies help to get some grip on prevalence and appreciation of humor in certain situations, for certain audiences, and using certain media. Finally, it can help us to design certain humor styles that can be adopted by an environment, its devices and artificial social inhabitants. This is a yet rather speculative view on the use of humor typologies, but it also provides a view on research issues that need to be tackled when we aim at smart environments that employ their smartness not only to offer efficient cooperation, but also, when appropriate, offer elements of play and humor in their interaction with human partners that partner these smart environments.

Real-life activities can be shown and watched, hence, humor typologies that have been introduced and that also take into account non-language humor, are useful for audiovisual media as well. We already mentioned the typology introduced by Berger [18] and its role in analyzing humor in TV commercials. Berger surveyed the use of

humor in various situations, including 'action humor', and distinguished more than forty humor techniques and clustered them, by hand and by intuition, into four categories: (1) Language; The humor is verbal; (2) Logic: The humor is ideational; (3) Identity: The humor is existential; (4). Action: The humor is physical or nonverbal. Morreal [3] also attempts to characterize humorous events that go beyond humorous language exchanges. He distinguishes between incongruity in 'Things' (objects, persons, situations) and incongruity in 'Presentation' (speech and language). We are interested in the former since it focuses more on situations and events that can occur in digitally augmented physical situations and events (see also one of our earlier papers [19]).

Typologies tell us what generates humor, what kind of humor techniques can be distinguished and used. From the point of view of digitally augmented environments (or smart environments) we should mention the 'shortcomings' of these categories. We cannot blame the authors of these typologies since their worlds did not include digital technology (embedded intelligent sensors and actuators) as we know it today and as we can expect it to be more integrated in our daily life activities in the near future. Here we just mention these 'shortcomings' without addressing solutions. We think the following observations are useful:

- Current typologies characterize humorous activity and humorous techniques in worlds where digital technology does not play a role. This is also true for the typology of humor in audiovisual media [17] since it concerns the representation of (non-digitally enhanced) real-life situations in TV commercials. How can we incorporate digital technology in our typologies of humor techniques?

- In current typologies and descriptions of humor techniques there is no or no explicit addressing of the different modalities and their integration in the generation or analysis of multimodal humor, whether it is found or created. In current interaction and multimedia research touch, smell and taste are included. Moreover (neuro-) physiological information is taken into account. So we need multimodal humor analysis and multimedia humor display research.

- Obviously, we can learn about humorous situations, we can try to imitate humorous situations, and we can try to use humor techniques as they appear in these typologies in digitally augmented real-life environments. However, how do they translate to design criteria for humorous events in these digitally augmented environments?

- Designing humor requires knowing about the role that we expect or want humor to play in a particular environment for a particular audience. What kind of preferences can be distinguished for different audiences (age, gender …) and in different situations? What kind of humor style should be used, in particular when a virtual agent or social robot produces the humor: affiliative, aggressive, self-defeating, or self-enhancing?

Obviously, when designing (smart) enviroments with a sense of humor we can expect to learn from landscape, town and house architects and from interior designers. They take into account preferences and constraints coming from inhabitants, users and intended use, and, in addition preferences and constraints coming from their clients. This leads to designed environments with different characteristics and personalities. And, in the future, they can be designed with different kinds of senses of humor. Criteria to design environments in such a way are not yet available. However, we can learn from the design of humorous products and clearly, the sense of humor of an environment will be a function of the humor that shows in its products and services. That is, how we perceive them and in particular how we can interact with them.

6 Digital Technologies and Humor: Discussion and Conclusions

Not every banana peel guarantees humor. Not every slip on a banana peel guarantees humor. We can agree that there are more sophisticated kinds of humor that are worth pursuing. On the other hand, as we can learn from Henri Bergson, some principles of humor occurrence can be can be illustrated with this kind of humor and his observations on mechanical versus natural human activity, acts, behavior, and movements.

We recall the line of reasoning we wanted to follow in this paper. Humor appears in language, but also in images, products, movies, interactive 3D worlds (games), and in the real (physical) world. Our question was: Can we control sensors and actuators to configure the real world, just as we can control words (and timing, prosody, gestures ...) to create humor? Can smart devices, interactive products, robots, software agents, and smart environments lead to more situations that can be potentially humorous for human partners or inhabitants? Or can they intentionally introduce humor opportunities that assume active involvement of their human partners (grasping the opportunities that are offered). And then, as a next step, is there a possibility that we have attempts to initiate humorous situations by changes in the smart environment? Can we turn smart cities into playable cities, and not only playable cities, but also cities that have a sense of humor?

Rather than having clear-cut answers to these questions we surveyed literature and research approaches in order to make clear that these are indeed valid questions and that we have developments in humor research that maybe not explicitly, but certainly implicitly help to provide answers to these questions. Although it is not the only viewpoint, incongruity and conditions that make incongruity humorous have been in our mind when exploring the continuum from word-level humor to humorous events in the physical world. This view may be biased because of our desire to find computational aspects of humor understanding and generation. Feelings of superiority and relief may be harder to address from a research point of view than detecting or generating incongruities, whether it is in language, using computational linguistics and artificial intelligence methods, or, at the other extreme, the digitally augmented physical world with its embedded sensors and actuators. Summarizing, we still have the following questions:

- Can we use sensors and actuators to configure the real world, just as we can use words (and timing, prosody, gestures, ..), with the aim to configurate humor?
- Can social robots, virtual agents, smart environments introduce conditions to facilitate humor generation by humans or can such environments and artificial agents generate humorous events themselves?

We think that for answers it is worth looking at humor modelling approaches we see in language, cartoons [20], products [21,22], art [23], stage, movies, and interactive 3D worlds (games) [24], to model (understand and create) humor in real-life situations using smart technology.

References

[1] J. Hulstijn, A. Nijholt (Eds.). Computational Humor: Automatic Interpretation and Generation of Verbal Humor. Proc. Twente Workshop on Language Technology 12, University of Twente, Netherlands, 1996.

[2] O. Stock, C. Strapparava, A. Nijholt (Eds.). The April Fools' Day Workshop on Computational Humour. Proc. Twente Workshops on Language Technology 20 (TWLT 20), ITC-IRST, Trento, Italy, 2002.

[3] J. Morreal. Taking Laughter Seriously, State University of New York Press, 1983.

[4] A. Nijholt. Towards Humor Modelling and Facilitation in Smart Environments. Proceedings of the 5th International Conference on Applied Human Factors and Ergonomics (AHFE 2014), T. Ahram, W. Karwowski, T. Marek (Eds.), Krakow, Poland, 19-23 July 2014, 2014, 2997-3006.

[5] A. Nijholt. Towards Environments that Have a Sense of Humor. Proceedings 6th International Conference on *Intelligent Technologies for Interactive Entertainment (INTETAIN 2014)*, Dennis Reidsma, Insook Choi, Robin Bargar (Ed.), Chicago (IL), USA, Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering (LNICST 136). Springer Verlag, Berlin, July 9-11, 2014, 77-80.

[6] D. Hofstadter. Foreword. In: A. Seckel. Masters of deception. Escher, Dali & the Artists of Optical Illusion. Sterling, New York, London, 2004, 5-8.

[7] M.J. Silber. Digital Humor Theory. M.Sc. Thesis, School of Art and Design, Pratt Institute, New York, 2013.

[8] L. Stone. Attention: The *Real* Aphrodisiac. Talk at the Emerging Technology Conference, San Diego, CA, 2006, http://web.archive.org/web/20130729205453id_/http://itc.conversationsnetwork.org/shows/detail739.html

[9] M.P. Mulder, A. Nijholt. Humour Research: State of the Art. CTIT Technical Report series, No. 02-34, University of Twente, Enschede, the Netherlands, September 2002.

[10] V. Raskin. The Primer of Humor Research. Berlin: Mouton de Gruyter, 2008.

[11] H. Bergson. Laughter. An essay on the meaning of the comic. Translated from Le Rire. Essai sur la signification du comique, 1900. Gutenberg project, 2003.

[12] A. Daudet. Tartarin on the Alps. 1885. Translator: Katharine Prescott Wormeley, University of Adelaide, South Australia. Gutenberg project, 2008.

[13] N. Carroll. Theorizing the Moving Image (Cambridge Studies in Film). Cambridge: Cambridge University Press, 1996.

[14] H.W. Tinholt, A. Nijholt. Computational Humour: Utilizing Cross-Reference Ambiguity for Conversational Jokes. In: 7th *International Workshop on Fuzzy Logic and Applications (WILF 2007)*, LNAI 4578, F. Masulli, S. Mitra & G. Pasi (eds.), Springer-Verlag, Berlin, 477-483.

[15] K. Binsted, G. Ritchie. An implemented model of punning riddles. In Proceedings of the Twelfth National Conference on Artificial Intelligence (AAAI-94), Seattle, USA, 1994, 633-638

[16] O. Stock, C. Strapparava. The act of creating humorous acronyms. Applied Artificial Intelligence, 19(2), 2005, 137–151.

[17] M. Buijzen, P. Valkenburg. Developing a Typology of Humor in Audiovisual Media, Media Psychology, 6:2, 2004, 147-167.

[18] A.A. Berger. An anatomy of humor. New Brunswick, NJ: Transaction Publishers, 1993. First edition appeared in 1976.

[19] A. Nijholt. Towards Humor Modelling and Facilitation in Smart Environments. In: Advances in Affective and Pleasurable Design. Yong Gu Ji and Sooshin Choi (Eds.). Published by AHFE, 260-269.

[20] C.F. Hempelman, A.C. Samson. Cartoons: Drawn jokes. In [10], 2008, 609-640.

[21] G.D.S. Ludden, B.M. Kudrowitz, H.N.J. Schifferstein, P. Hekkert. Surprise and humor in product design. Designing sensory metaphors in multiple modalities. Humor. Volume 25, No. 3, 2012, 285-309.

[22] Y. Yu, T.-J. Nam. Let's Giggle! : Design Principles for Humorous Products. DIS 2014, June 21–25, 2014, Vancouver, BC, Canada, 275-284.

[23] A. Gérin. A second look at laughter: Humor in the visual arts. Humor 26(1), 2013, 155 – 176. DOI 10.1515/humor-2013-0009

[24] C. Dormann. Fools, Tricksters and Jokers: Categorization of Humor in Gameplay. Proceedings INTETAIN 2014, LNICST 136, Springer, 2014, 81-90.