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Perception of Contrariety in Jokes

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According to the cognitive approach to humor, the comprehension of humorous texts implies recognizing an incongruity and resolving it. This article studies whether the cognitive process involved in the recognition of incongruity is affected by the conditions that make contrariety evident or only analytically recognizable in the perceptual domain. In study 1, participants were asked to choose (condition 1) or rank (condition 2) the best humorous text among three variations of the same jokes in which the critical incongruity was a global, additive, or intermediate contrariety. In studies 2 and 3, they were asked to recognize the critical property on which these three versions of the jokes played. The findings confirmed that the perception of humor and recognition of the critical element was easier when the elements involved in the jokes were opposite in terms of global contrariety (which is the type of contrariety that is perceptually more evident and more easily perceivable).

INTRODUCTION

Getting a joke or understanding a humorous text means having detected and resolved an incongruity. In this article we studied whether what we know about the psychological rules underlying the perception of contrariety in a nonhumor-
ous context can contribute to the understanding of the process of discovery of incongruities that is implied in humor processing. Before presenting the experimental work done to test this we (1) briefly point out the many approaches to humor that have indicated the recognition of an incongruity as a central aspect of humor processing and (2) show that the application of principles of perceptual organization to the understanding of the psychological processes of humor is not new in the literature. We then present the three types of contrariety that have emerged from perceptual research and whose application to the detection of incongruity in humorous texts was tested in the studies presented in this article.

Detection of an Incongruity as a Key Element in Humor Understanding

A recognized result in literature is that appreciating a joke presupposes the detection of an incongruity. This has been addressed from various points of view—psychological, linguistic, and neurological—on the basis of theoretical and empirical evidence (for an overview, see Forabosco, 1992, 2008; Martin, 2007).

Since its early formalizations in 1960s and 1970s, incongruity has been defined in several ways. For example, in Koestler’s (1964) bisociation theory, incongruity was referred to as a disconnection between two narrative storylines evoked by a humorous text, each of which has its own structure and logic. The replacement of the original storyline with a second one, delivered by the punch line, produces the humorous effect. In the two-stage model presented by Suls (1972), when readers are faced with a joke, they build up a coherent interpretation of the text, until the punch line presents an incongruous meaning. The reader is then puzzled and forced to discover a new interpretation, called the “cognitive rule,” which solves the incongruity. Shultz (1976) pointed out that the processing of incongruity can stand alone in nonsense, whereas it comes before the processing of resolution with more standard humorous stimuli. Also, according to the schema-based psychological theories of humor, such as the frame bisociation theory developed by Norrick (1986) or the comprehension-elaboration theory of elicitation of humor by Wyer and Collins (1992), when the punch line occurs the schema or frame of information initially activated by the humorous text happens to be insufficient, and this stimulates the search for a new adequate schema that is normally incongruent, and sometimes contradictory, to the initial one. In Raskin’s Semantic Script Theory of Humor (1985), which was later reformulated into the General Theory of Verbal Humor (Attardo, 2001; Attardo & Raskin, 1991), the concept of incongruity corresponds to that of “script1 opposition” (Attardo, 1997, pp. 403, 413–414). Two scripts can be

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1A script can be defined as a net of semantic and pragmatic meanings to which a verbal text refers from the macro- and micro-point of view (a whole text recalls a script as does a single word).
opposed either by a direct negation or by antonymy or by local antonymy (defined as an opposition valid only within the context and discourse of a specific text). The opposition of scripts was later reformulated (Attardo, 1997, 2001; Pickering et al., 2009) in terms of opposition between a marked and an unmarked message, as defined by the graded salience hypothesis (Giora, 1988, 1991, 1997, 1999, 2003; Giora, Federman, Kehat, Fein, & Sabah, 2005; Giora & Fein, 2007; Peleg, Giora, & Fein, 2008). According to this hypothesis, what happens in irony and jokes is that an initially activated salient meaning (prototypical, highly accessible, familiar, frequent, predictable, and informative) is substituted, when the punch line occurs, with a less salient marked meaning, belonging to the same discourse topic (Giora, 1997, 1999). In this framework, a well-formed joke must “end with a markedly informative, i.e., almost inaccessible constituent”: this closing constituent is marked either because it is a marginal message in the given set or because it is the unmarked message of a different set (Giora, 1991, p. 471). In both cases, it is hardly accessible and therefore surprising and is informative, because it leads to the new meaning (Giora, 2003, pp. 13–18).

This long list of references was used to show that, although in different ways, all these various theories have considered the cognitive elaboration of an incongruity as a central step in humor processing. Moreover, they have often referred to incongruity in terms of perception of incongruity, without analyzing further what this means. In this article, we aim to contribute to the understanding of this process of recognition of incongruities starting from what we know from the psychology of perception regarding the conditions that make contrariety immediately evident.

Perceptual Processes in Humor Processing: Past and Present Suggestions

The idea mentioned above of considering how basic perceptual mechanisms are implied in the cognitive mechanisms underlying humor comprehension is not new in the literature on humor (Maier, 1932; Metz-Göckel, 1989, 2008; Russell, 1996; Smith, 1996; Veale, 2008). In 1776, Beattie had already modeled the detection of incongruities in humor including visual incompatibilities: “If then, it be asked, what is that quality in things, which makes them provoke that pleasing emotion or sentiment whereof laughter is the external sign? I answer, it is an uncommon mixture of relation and contrariety, exhibited, or supposed to be united, in the same assemblage” (p. 454). As examples of perceptual based ludicrous incongruities (pp. 346–349), he referred to the contrast of physical characteristics between Don Quixote and Sancho Pança, a contrast further amplified by the differences in their morals. The studies we conducted address the question of whether there is a typical structure of this “contrast of
qualities” (or of this “perceptual-based incongruity,” to use Beattie’s expression) that facilitates the recognition of incongruities in short verbal humorous texts. In doing these examinations, we refer to a series of studies developed in a neogestaltic perspective (summarized in Bianchi & Savardi, 2008a). Various works in the past that have hypothesized a strong relationship between perceptual processes and humor processing have referred more or less explicitly to the gestaltic approach. First, Maier (1932) was the former scholar who explained humor processing in jokes as well as humorous experiences at large, according to the basic law of gestalt perception: the elements of a configuration depend on the whole to which they belong. In humorous texts or situations the presence of an element perceived as incongruous to the whole to which it belongs stimulates a reconfiguration of the elements into a new whole (the humorous interpretation of the text).

Second, in more recent years, the perceptual laws of visual grouping formalized within the gestaltic framework were applied to humor processing. Metz-Göckel (1989, 2008) not only pointed out the importance of the relationship between the parts and the whole but also reformulated the concept of resolution referring to the two gestalt laws of closure and Prägnanz. In his perspective, incongruity provokes a break in the configuration, which does not appear closed or complete anymore. The humorous resolution works as the principle of closure in perception, allowing us to see the “interrupted whole” again as a closed (harmonic) form. Smith (1996) referred to a whole set of basic gestalt laws of visual organization—namely, to similarity, proximity, continuation, closure, and common fate in addition to figure-ground and the concept of isomorphism—as essential laws to identify the incongruity of a visual humorous stimulus and to find its resolution.

Third, the law of figure-ground organization and in particular Rubin’s classic vase-profiles figure, has been explicitly advocated by Hempelmann and Attardo (2011), for example, when defending the idea of a logical mechanism involved in the resolution of humorous incongruities, and by Viana (2010), who distinguished a background script, processed first, and a foreground script, emerging only at the end of the reading of the text. The explicit reference to perception is clear: “the second (script) takes prominence over the first, in terms of perception and meaning” (Viana, 2010, p. 507). The figure-ground organization phenomenon has also been advocated as a basic mechanism to define ambiguity based humor by Russell (1996) and by Veale (2008), who emphasized that figure-ground organization helps to see a situation in a new perspective and thus favors a humorous interpretation of a stimulus.

Finally, the perception of a gestaltic sequence is the premise for the perception of an incongruity in Nerhardt’s experimental studies (1970), as discussed by Forabosco (1992). Nerhardt asked participants to lift a series of weights; they did not know that only the last weight was much heavier (or much lighter) than
the previous ones. Upon lifting it the participants laughed. Nerhardt (1970, 1976) emphasized that this happened because a great discrepancy had occurred between the participants’ cognitive expectations (built on the basis of the previously perceived weights) and what they were actually perceiving when lifting the last weight. As Forabosco (1992, p. 56) put it, lifting the series of weights gave rise to the perception of a gestaltic sequence, which was disregarded by the final incongruous weight.

In conclusion, there are three aspects which we have highlighted so far. First, the idea of a link between perceptual processes and cognitive processes involved in humor understanding, which is the focus of this article, has distinguished precedents: some central constructs developed in the research on perception (from figure-ground reversal to other principles like closure, Prägnanz, similarity, proximity, good continuation etc. that have been discovered by Gestalt psychologists) have been acknowledged as relevant aspects of humor processing. Second, there is a broad consensus that the perception of an incongruity is a central step in humor processing. Third, a strong relationship between the perception of an incongruity and its conceptualization in humor theories has been somehow anticipated although not experimentally analyzed, except for Nerhardt’s study (1970).

Within this framework, this article aims to verify whether a further point of convergence between psychological mechanisms of perceptual organization and psychological mechanisms of humor processing might concern the structure of incongruity. In other words, we wondered whether a contribution to the understanding of the processes involved in the recognition of incongruities in humor might derive from studies focused on the discovery of the perceptual rules underlying the recognition of two facts (visual configurations, gestures, and melodies) as opposites.

THREE TYPES OF CONTRARIETY

Various studies in the psychology of perception have proved that perceivers deal with similarity, difference, and contrariety as three different kinds of relationship directly recognized between visual or auditory configurations (Bianchi & Savardi, 2006, 2008a, 2008b). Contrariety, in particular, can be perceived on three levels. The three types of contrariety discussed below describe these three levels and their potential application to operationalize the process involved in the recognition of incongruity in humor.

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2For an overview of reconceptualizations of Nerhardt’s weight judgment paradigm, see Martin (2007, p. 88).
Global Contrariety

This is the relationship that emerges when two facts (objects, gestures, or properties) are immediately recognized by an observer as being contraries. The abovementioned experimental studies by Bianchi and Savardi (which analyzed two- and three-dimensional configurations) demonstrated that when two facts are globally recognized as contraries the difference between them concerns only one property or at most two, whereas all the others remain identical (invariant) between them. This was found in both production tasks (where the participants were asked to show the opposite of a gesture or draw the opposite of a figure) and recognition tasks (where the participants were asked to choose two opposite figures or gestures from a set or to classify them or to rate them in terms of degree of contrariety, diversity, or similarity). The results proved that when the two facts differ in many aspects they are not perceived as contraries (but are rather perceived as different) because they are not invariant enough.

The same might happen when changing only one property if the effect of this single change is to modify the global identity of the figure too much. For instance, the single transformation of the outline of a triangle from angular to curved was not associated to perception of contrariety: it was described as being too serious a violation of the identity of the initial figure. On the other hand, the transformation of the size of the triangle, from small to large, was not enough: the figure remained overall too invariant (the participants described the two figures as similar rather than contrary). But when changing the orientation of the figure, turning the triangle pointing up into one pointing down, this was perceived as evident contrariety: the transformation showed a global opposition and at the same time a clear invariance.

Additive Contrariety

This is the type of contrariety that is recognized only when an analytical process of comparison between the properties of the two facts is activated. This analytical comparison reveals that the two facts (movements, objects, or even properties) differ because many aspects are in effect contrary in one stimulus with respect to the other. For example, starting from the same triangle pointing up that we used above to describe the global contrariety, if we change many of its features into the opposite (for example, it is small, we make it big; it is white, we make it black; it is regular, we make it irregular; it is angular, we make it round; it is still, we make it move; it is flat, we make it three-dimensional; it points up, we make it point down; etc.), we can say that the two figures are analytically contrary because most of their features are in effect contrary. However, these contrarieties concern local information regarding the structure of the stimuli.
(they refer to parts or single aspects that are discovered through an analytical processing) and are not recognized at a global level.\textsuperscript{3} When this is the case the two figures are not perceived as contrary to each other but as different figures.

Intermediate Contrariety

This type of contrariety is present when two facts are recognized as differing in a single aspect (and this satisfies the requisite of invariance described above), but the transformation stops at states that are perceived as only intermediate and does not arrive at the opposite. This happens, for instance, when we change something that is small into something medium sized: the transformation is certainly toward the opposite (big) but does not reach a state or gradation that phenomenally appears as opposite to the initial state (something which is perceived as medium sized is not yet big). The invariance characterizing the two events is too high and the contrast between them is not strong enough to make the two events appear opposite to each other: they are usually perceived as similar.

Application to Humor Processing

Are these three types of contrariety useful to operationalize the extent to which the perception of contrariety plays a role in the recognition of incongruity in jokes? What might applying these three types of contrariety to the key incongruity of a joke mean?

For global contrariety, when the humorous incongruity concerns a single aspect that is evidently opposite in the two incongruous elements (e.g., small—big), the perception of contrariety might be facilitated. If this facility affects the humorous effect of the joke, the jokes playing on this type of contrariety might be recognized as mostly humorous. Consider for example the following joke:

Yesterday at school we celebrated my classmate Marcellina’s birthday so I gave her a cherry and she kissed me to say thank you. Today I gave her a watermelon... But she didn’t get it!

Traditionally, the analysis of this joke would emphasize that to get it means to attribute two incongruous interpretations to the text: a nonsexual and a sexual interpretation. The punch line, placed at the end of the joke, allows us to switch

\textsuperscript{3}We are using the terms “local” and “global” here in the meanings that are widely accepted in the vocabulary of the psychology of perception to refer to different hierarchical levels of processing of visual information/structure. This is not to be confused with the meaning of “local” in Raskin’s definition of local antonymy referring to oppositions that are valid only within the context/discourse of a specific text.
from an innocent and childish situation to a sexual meaning. The joke does not overtly refer to “sex,” but the allusion to this second interpretation, whose discovery makes the text enjoyable, implies it.

Now, let us consider on which key elements the allusion is grounded: a cherry on the one hand and a watermelon on the other. The point is this: if a small gift (a cherry) stimulates a kiss, a big gift (a watermelon) should stimulate much more! The two objects (cherry and watermelon) are clearly opposite in size. It might be noted that they also have other opposite characteristics: for example, a cherry is light, a watermelon is heavy; a cherry contains one round stone, whereas a watermelon contains several flat seeds; a watermelon is red inside, whereas a cherry is red outside. However, what makes size the critical feature of the joke is the fact that it is the only quality needed to resolve the incongruity of the joke and therefore to understand the humorous interpretation. Neither the weight nor the number of seeds nor the color of the fruit can do it better. The two fruits are involved in the joke because of their size. And here is how our question arises: what is the best “big gift” to make the message clear? According to the perceptual rules of contrariety, for the contrariety to be evident the new object needs to be invariant in almost all other characteristics and opposite only in respect to the critical feature. According to these rules, the watermelon has all the requisites for being recognized as evidently opposite to the cherry: it is a fruit like the cherry, it is round like the cherry, and it is red like the cherry, but it is also big (… it’s precisely the biggest fruit we are familiar with) in contrast with the cherry, which certainly belongs to the family of smallest fruits with which we are familiar. In this sense the two elements (cherry and watermelon) are good representatives of opposite sizes (small vs. big) and the critical incongruity is an evident global contrariety.

For additive contrariety, when the incongruity between two elements involves many contrary features, one can of course still analytically recognize them, but we expect the opposition not to pop out. An additive contrariety is in any case a contrariety, and in this sense this condition might anyway comply with the requisite of activating two incongruous interpretations. The question is if the analytical work needed to recognize the critical feature impacts on the humorous effect and how. Just to be clear, we are not formulating a unidirectional hypothesis because, on the one hand, one might expect that this analytical work leading to the recognition of contrariety might weaken the immediate, self-evident process of recognition of an incongruity. On the other hand, one might predict that the analytical process activated and leading to the recognition of many contrarieties might, at the end of the process, strengthen the perception of incongruity. The application of the additive contrariety in the case of the above-mentioned joke would require, for example, to substitute the watermelon with a big polystyrene box, which satisfies the requisite of opposition between something small and something big, but which at the same time also changes
many other properties of the initial object into opposite properties (the cherry is round, the box is square; one is edible, the other inedible; one is juicy, the other dry; one is a natural object, the other a manufactured object; etc.).

For intermediate contrariety, we expect that the incongruity recognized when comparing elements that are only relatively opposite but not perceived as belonging to two opposite states would not be enough to make a text clearly humorous. In the example of the school joke, we expect that substituting a cherry with an apple (which is certainly bigger than a cherry but not really a “big” fruit: it is perceived as having an intermediate size) will not succeed as much as a global contrariety in generating a humorous interpretation. However, because—despite its weakness—this contrariety suggests what the contrasting dimension is, the incongruity triggering the humorous effect can somehow be recognized and a weak humorous effect might be present.

STUDY 1

To test whether the three types of contrariety described in the previous section are useful to operationalize the concept of incongruity, we manipulated the incongruity involved in five jokes (basing it, respectively, on a global, additive, and intermediate contrariety). We then asked participants, in one condition, to complete each joke choosing, of the three, the alternative that produced the funniest effect and in another condition to rank the three versions from the most to the least humorous.

If an immediate recognition of incongruity is the critical factor for the humoristic effect to be produced, the perception of humor should be higher with the version of the joke based on global contrariety rather than with the other two. Conversely, if the activation of an analytic process of discovery of the contrarieties involved in the joke facilitates humor processing, then the additive version or intermediate version should be preferred.

Method

Participants. Seventy-seven undergraduate students (65 women and 12 men; mean age, 20.6) participated in condition 1, and 71 undergraduate students (48 women and 23 men; mean age, 21.3) participated in condition 2. All were Italian speakers participating voluntarily and anonymously to the study.

Materials. Five Italian written jokes were chosen on the basis of the following characteristics: their humorous aspect was based on an incongruity referring to perceptual dimensions such as size (big/small), orientation (up/down), age (old/young), and speed (fast/slow). Three versions of the same jokes, fitting the
requisites of the three types of contrariety discussed and studied in this article, were created (Table 1).

**Procedure.** The participants were given a booklet of five pages in which each referred to a joke (the order of the jokes was randomized between subjects). In condition 1 (choose the funniest of the three), the part of the text that referred to one of the two key elements that make the text funny had been replaced by a blank space. Three alternatives elaborated on the basis of the types of contrariety were offered to complete each joke (the order of the three alternatives was randomized between jokes). The participants were asked to fill in the blank space with the option (of the three) that made the text funniest. In condition 2 (give a rating to the three versions), the participants were asked to read the three versions of each joke and then to rank them from the most (rank 1) to the least (rank 3) funny.

**Results and Discussion**

To study whether significant differences emerged between the jokes playing on the three types of contrariety (global, additive, intermediate) in condition 1, chi-square tests were run on the frequency of choice of the three versions. As shown in Figure 1, where the results of the chi-square tests are reported, a significant difference emerged for four of the five jokes (namely, the jokes on School, Bat, Expert, and Policeman). For these jokes, not only was the global version preferred (adj. residuals > 2) but also both the other versions (the intermediate and the additive) were less frequently chosen than might be expected by chance (adj. residuals < -2). The only exception was the joke about the Blind, where only a tendency toward significance was found (p = .06), with the additive version more frequently preferred (adj. residuals > 2) and the intermediate version less frequently preferred (adj. residual < -2) than expected by chance.

In condition 2, the differences between the mean ranks attributed to the three types of contrariety were studied using Friedman tests. As shown in Figure 2, the difference turned out to be significant for all jokes. In four of the five jokes the global version received significantly lower ratings (i.e., was attributed to the first positions of the ranking) than the other two versions. For only one joke (the Blind joke, and in agreement with what was found in condition 1), the additive version was preferred to the global version.

Therefore, in general, the hypothesis that the global contrariety is associated with a funnier effect was confirmed by the results obtained from both tasks. The task used in study 1, which asked participants to chose one of the three alternatives proposed, provided indications about what solution best fitted with the text but did not tell us anything about the suitability of the two excluded
<table>
<thead>
<tr>
<th>Jokes</th>
<th>Versions</th>
<th>Type of Contrariety</th>
<th>Contrary Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blind</td>
<td>On sale a greyhound to a lazy blind man to take a walk.</td>
<td>G</td>
<td>Fast–slow</td>
</tr>
<tr>
<td></td>
<td>On sale a loading rocket to a lazy blind man to take a walk.</td>
<td>A</td>
<td>Fast–slow  Animate–inanimate Natural–manufactured</td>
</tr>
<tr>
<td></td>
<td>On sale a setter to a lazy blind man to take a walk.</td>
<td>I</td>
<td>Fast–medium fast</td>
</tr>
<tr>
<td>School</td>
<td>Yesterday at school we celebrated my classmate Marcellina’s birthday so I gave her a cherry and she kissed me to say thank you. Today I gave her a watermelon… But she didn’t get it!</td>
<td>G</td>
<td>Small–big</td>
</tr>
<tr>
<td></td>
<td>Yesterday at school we celebrated my classmate Marcellina’s birthday so I gave her a big polystyrene box… But she didn’t get it!</td>
<td>A</td>
<td>Small–big Edible–inedible Round–square Natural–manufactured</td>
</tr>
<tr>
<td></td>
<td>Yesterday at school we celebrated my classmate Marcellina’s birthday so I gave her a cherry and she kissed me to say thank you. Today I gave her an apple… But she didn’t get it!</td>
<td>I</td>
<td>Small–medium sized</td>
</tr>
<tr>
<td>Bat</td>
<td>A group of bats is hanging from a branch with their heads down but one of them is standing up. A pair of bats next to him remarks: -Sorry, what’s up with him? -I don’t know, until two minutes ago he was fine then he fainted. A group of bats is hanging from a branch but one of them is leaning against the trunk and his head is dangling. A pair of bats next to him remarks: -Sorry, what’s up with him? -I don’t know, until two minutes ago he was fine then he fainted. A group of bats is hanging from a branch but one of them is lying down. A pair of bats next to him remarks: -Sorry, what’s up with him? -I don’t know, until two minutes ago he was fine then he fainted.</td>
<td>G</td>
<td>Up–down Vertical–horizontal Dangling head–not-dangling head Branch–trunk</td>
</tr>
<tr>
<td></td>
<td>(Continued)</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Continued)</td>
<td>I</td>
<td>Up–lay down</td>
</tr>
<tr>
<td>Jokes</td>
<td>Versions</td>
<td>Type of Contrariety</td>
<td>Contrary Properties</td>
</tr>
<tr>
<td>-------------</td>
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<td>--------------------------------------------</td>
</tr>
<tr>
<td>Expert</td>
<td>“You were the biggest sardine expert, so why are you studying whales?”</td>
<td>G</td>
<td>Small–big</td>
</tr>
<tr>
<td></td>
<td>“Cause of my age, my sight is no longer so good.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“You were the biggest sardine expert, so why are you studying submarines?”</td>
<td>A</td>
<td>Animate–inanimate; Biological–mechanical; Natural–manufactured</td>
</tr>
<tr>
<td></td>
<td>“Cause of my age, my sight is no longer so good.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“You were the biggest sardine expert, so why are you studying cod?”</td>
<td>I</td>
<td>Small–medium</td>
</tr>
<tr>
<td></td>
<td>“Cause of my age, my sight is no longer so good.”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policeman</td>
<td>How can you make an old carabiniere laugh? Tell him a joke when he is young!</td>
<td>G</td>
<td>Old–young</td>
</tr>
<tr>
<td></td>
<td>How can you make an old carabiniere laugh? Tell him a joke when he is a rebellious teenager!</td>
<td>A</td>
<td>Old–young</td>
</tr>
<tr>
<td></td>
<td>How can you make an old carabiniere laugh? Tell him a joke when he is a middle aged man!</td>
<td>I</td>
<td>Old–middle age</td>
</tr>
</tbody>
</table>

The key elements of each version are underlined. The contrary properties involved in the jokes are listed in the last column, where the critical features of each version of the jokes are reported in bold.

*a*The three versions of this joke play on an incongruity having one of the two key elements evoked, namely “German shepherd,” which is not directly accessible. This key element is compared to a greyhound–loading rocket–setter, which are explicit in the texts.

*b*“Carabinieri” are the Italian state police notoriously represented as the butt of dumb jokes in Italy.
alternatives. Condition 2, in addition to confirming that the global contrariety was preferred, also clarified that a clear preference for one of the remaining versions (additive or intermediate) did not emerge: as post hoc tests revealed, for two jokes (Bat and Expert) the mean ranks of these two versions did not differ; for the other two jokes (Blind and Policeman) the additive version was preferred to the intermediate version; in the remaining joke (School) the intermediate version was preferred to the additive version.

STUDY 2

The results of study 1 proved that that in four of the five jokes the version showing global contrariety was more humorous than the versions showing intermediate or additive contrariety. For only one joke, the additive version was preferred. This suggests that adding several contrarieties certainly makes the incongruity bigger in terms of the amount of contrast elements that can be found
between the two texts, but overall this does not produce a more contrastive effect. In other words, changing too much does not usually ensure a better humoristic effect than changing just the critical feature. This finding is in agreement with the perceptual results that global contrariety is immediately perceived (it “pops out” because it is not masked by other variations), whereas additive contrariety is not (Bianchi et al., 2008a, 2008b). We cannot, however, state for sure that the results found in the previous study manifest the fact that participants noticed more easily the critical incongruity in the global versions than in the additive version (where it remained in the background for a sort of masking effect due to the several contrary features characterizing the two incongruous elements) or in the intermediate version (where the evidence of contrariety was too weak).

Study 3 was designed to find out what contrary properties adults identify when asked to match the two elements that were contrasted in the five jokes. Let us remember that the five jokes had been selected based on the criteria that they involved concrete entities (cherries, watermelons, apples, submarines, sardines, bats, policemen, etc.) and that the critical incongruity concerned sensorial aspects (Table 1, last column). Because of these two characteristics, they could easily activate mental images associated to the scenes described and the sensorial
features of the entities compared might therefore be recognized not only at a semantic level but also in terms of mental images activated by the text.\(^4\)

We expect that the contrary features that we know are the critical incongruities in the jokes used in study 1 will emerge easily (and thus be cited more frequently by participants) when matching the two incongruous elements that were involved in the global version, rather than in the intermediate or additive version. For instance, we expected the contrariety *small–big* to be noticed more easily when matching the cherry–watermelon pair rather than the cherry–polystyrene box or cherry–apple pairs.

Because the perceptual approach that we are assuming here as a frame of reference for our analysis (in line with the assumptions of gestalt psychology) deals with contrariety as to a directly perceived relationship, we asked participants to describe the contrasting features that they noticed immediately between the two objects/elements rather than describe the properties of the single objects and then deducing their contrasting dimensions by means of factor analyses—as done, for instance, by Hillson and Martin (1994).

**Method**

**Participants.** Sixty undergraduate students (53 women and 7 men; mean age, 25.65), divided into three groups of 20, participated voluntarily and anonymously to the study. All were Italian speakers. None of the participants had participated in study 1.

**Materials.** Three booklets (one concerning intermediate contrariety, another concerning global contrariety, and a third concerning additive contrariety) with five response sheets were used, each concerning a pair of elements. The instructions, together with an example, were printed on the first page (the example matched the entities: T-shirt/sweater, and three contrary properties were described: light–heavy; cool–warm; short–long sleeved). At the top of each sheet the two words referring to the pairs of entities to be matched were printed. They regarded the pairs German shepherd–setter, cherry–apple, sardine–cod, bat hanging–bat lying down, and old–middle aged man for the intermediate contrariety booklet; the pairs German shepherd–greyhound, cherry–watermelon, sardine–whale, bat hanging–bat standing, and old–young man for the global contrariety booklet; and the pairs German shepherd–loading rocket, cherry–big polystyrene box, sardine–submarine, bat hanging–bat leaning against the trunk with his head dangling, and old carabiniere–rebellious teenager for the additive

\(^4\)According to the dual-coding theory developed by Paivio (1971, 1986), visual and verbal information are processed differently but are interrelated.
Procedure. A booklet was presented to each participant. The participants were asked to imagine the two objects described by the words printed at the top of each response sheet and to focus on the opposite characteristics they had. They were asked to list them, following the order in which these characteristics came to mind. One group of participants was presented with the five pairs of words referring to the entities used as representatives of intermediate contrariety in the five jokes studied in study 1 and 2, another group with the five pairs of words referring to the entities used as representatives of global contrariety, and a third group with the five pairs of words referring to the objects used as representatives of additive contrariety.

Results and Discussion

Participants identified for each pair of elements to be matched from 13 to 25 contrary properties. To identify which were the properties that most participants thought of when comparing the two objects, we calculated an index of intersubject agreement for each property, which expressed the ratio between the number of participants who mentioned that property out of the total number of participants. Given that there were 20 participants per condition, the ratio might have ranged from 0.05 (i.e., 1/20 participants) to 1 (i.e., 20/20 participants). Table 2 provides an example of the properties mentioned when comparing the pair of elements corresponding to the three versions of the School joke, with their respective inter-subject agreement indexes.

We were interested in particular in how many participants noticed the dimension of contrariety that was critical for each joke: the higher the intersubject agreement index, the higher the number of participants who identified the property as contrary. As shown in Table 3, with the exception of the pair involving the policeman, the critical contraries were identified with higher intersubject agreement when the two objects matched were those presented in the global version rather than in the intermediate or additive versions.

Overall, the results of study 2 showed that the entities matched in the five jokes used in study 1, even when extrapolated from the specific jokes, were recognized as opposite with respect to several features. Among these features were the critical properties on which the jokes played. The opposition that was critical for the incongruity on which the joke played was more frequently noticed and described by a large majority of participants when the two objects evoked by the words fitted in with the requisites of global contrariety. When the objects were characterized by the other two types of contrariety, the critical feature was frequently mentioned for some jokes (the School, the Expert, and the Policeman
<table>
<thead>
<tr>
<th>Cherry–Watermelon</th>
<th>Cherry–Big Polystyrene Box</th>
<th>Cherry–Apple</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contrary Properties</td>
<td>Intersubject Agreement</td>
<td>Contrary Properties</td>
</tr>
<tr>
<td>Small–big</td>
<td>1</td>
<td>Small–big</td>
</tr>
<tr>
<td>One stone–several seeds</td>
<td>0.4</td>
<td>Edible–inedible</td>
</tr>
<tr>
<td>Light–heavy</td>
<td>0.3</td>
<td>Colorful–white</td>
</tr>
<tr>
<td>On a tree–on the ground</td>
<td>0.25</td>
<td>Round–square shaped</td>
</tr>
<tr>
<td>Red–green</td>
<td>0.25</td>
<td>Smooth–rough</td>
</tr>
<tr>
<td>Fleshy–watery</td>
<td>0.2</td>
<td>Odorous–odorless</td>
</tr>
<tr>
<td>Dark red–light red</td>
<td>0.2</td>
<td>Natural–manufactured</td>
</tr>
</tbody>
</table>

The properties are listed decreasingly based on the number of participants who mentioned each of them (expressed by the intersubject agreement, which ranges from 0 to 1).
TABLE 3
Indexes of Intersubject Agreement Related to the Critical Features Characterizing the Elements Matched in the Jokes Used in Study 1

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Global version</td>
<td>0.6</td>
<td>1</td>
<td>0.6</td>
<td>1</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td>Additive version</td>
<td>0.4</td>
<td>0.7</td>
<td>0.21</td>
<td>0.65</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Intermediate version</td>
<td>0.1</td>
<td>0.9</td>
<td>0.15</td>
<td>0.74</td>
<td>0.65</td>
<td></td>
</tr>
</tbody>
</table>

The highest values between the three versions of each joke are in bold.

...jokes), whereas it remained more masked for others (the Bat and the Blind). This result is in agreement with the outcomes that emerged in study 1 and the hypothesis that the global version, which makes the contrariety between the two elements more evident, makes the recognition of the incongruity and the understanding of the humor easier. Study 3 was designed to add a further step in the understanding of this relation between recognition of the critical contrariety and humor understanding.

STUDY 3

Study 1 proved that a specific type of contrariety (global contrariety) is generally preferred in terms of humorous effect to the other types of contrariety. Study 2 confirmed that the dimension that is evidently opposite between the two objects/entities is more easily noticed by participants when this type of contrariety is involved. In study 2, the objects were matched *per se*, independently of the jokes. The results guarantee that, potentially, the critical contrariety on which the incongruity of the joke played was embedded in the elements matched by the joke, but we cannot state for sure that participants identified it as critical for the specific joke. Study 3 was conducted to verify this.

Method

Participants. One hundred thirty-seven undergraduate students (128 women and 9 men; mean age, 21.94) participated voluntarily and anonymously. All were Italian speakers. None of the participants participated in studies 1 and 2.

Materials. The jokes used were the same as study 1 and reported in Table 1, plus a warm-up joke that was not considered in the analysis. The five jokes were divided into three booklets, each pertaining a version (global, intermediate, or
additive) of the five jokes. Each joke was followed by a table where 10 contrary properties extracted from the lists that emerged in study 2 were listed (and among which the critical feature was present). The position of the critical feature in the list was randomized between the jokes and between subjects. A second column, made of empty cells, was used for responses.

Procedure. The participants were divided into three groups. Each group was presented with one of the three booklets (i.e., a group was given the booklet containing the five jokes in the global versions, another group received the booklet containing the five jokes in the intermediate versions, and the remaining group was given the booklet with the analytic versions of the five jokes). The task for all three groups was to indicate the critical features on which the jokes played by putting a mark in the corresponding cell. They were then asked to rate how difficult they found it to identify the property using a 10-point scale ranging from 0 (not difficult at all) to 10 (extremely difficult). A warm-up session was conducted with a joke, different from the five jokes used and unrelated to the critical dimension on which the five test jokes played.

Results and Discussion

The responses were analyzed in terms of number of participants who correctly identified the incongruity on which the joke played and in terms of difficulty of this identification.

**Number of participants who correctly identified the incongruity.** Overall (i.e., independently of the specific joke considered), the frequency of the correct responses turned out to be different in the three versions ($\chi^2 = 3.610; df = 2; p < .001$). As confirmed by Pearson’s adjusted residuals, the correct responses were significantly higher than expected by chance for the global version (74.7% of the total number of responses) and significantly lower for the additive version (48.2%). The percentage of correct responses in the intermediate version was between the two (56.6%).

An analysis of the results for the single jokes (Figure 3) proved the following:

1. When the incongruity consisted of a global contrariety, the participants were able to correctly identify the critical incongruity in four of the five jokes. The percentage of correct responses was particularly high for the Expert joke and low for the Bat joke ($\chi^2 = 4.073; df = 4; p < .001$).
2. When the incongruity consisted of an additive contrariety, the correct incongruity was identified more frequently than incorrect incongruities in only two cases (Expert and School jokes). Similarly to what was found for the global version, it was the Expert and the Bat jokes that
had, respectively, a significantly higher and lower frequency of correct identifications ($\chi^2 = 5.566; df = 4; p < .001$).

3. When the incongruity consisted of an intermediate contrariety, the correct incongruity was more frequently identified than other (incorrect) incongruities for three of the five jokes. The identification of the correct incongruity was particularly hard for the Blind and the Bat jokes, whereas it turned out to be particularly frequent for the School and Expert jokes ($\chi^2 = 3.441; df = 4; p < .001$).

Consistently, these data proved that the critical incongruity was more frequently identified when the joke played on a global contrariety than on an intermediate contrariety and, in turn, an additive contrariety. This suggests that the critical dimension for the humorous effect emerges better when a single contrariety related to the two elements is involved (and better when the single contrariety is evident, not only intermediate) than when the contrast between the two elements involved many contrarieties.

**The difficulty of identification of the critical incongruity.** The conclusion drawn from the frequency data was confirmed when the difficulty ratings were
considered (Figure 4). A mixed-model ANOVA conducted on the difficulty ratings (with jokes and types of response as independent variables) revealed the following:

1. The difficulty rating associated to incorrect responses turned out to be higher than that associated to correct responses (this was revealed by the main effect of type of response; see top left graph of Figure 4).
2. With the Expert joke, the identification of the critical incongruity was easier than with all the other jokes (this was revealed by the main effect of joke; see top right graph of Figure 4; LSD post hoc significant for $p < .001$).
3. The participants who correctly identified the critical incongruity judged this to be easier when the global version rather than an intermediate or additive version was involved (this was revealed by the significant interaction between types of response and versions of the jokes; see bottom graph of Figure 4).

GENERAL DISCUSSION

In line with the several studies that have acknowledged the relevance of some laws of perception in humor processing (see Introduction), here we focused on whether the rules underlying the perception of contrariety (in particular, the definition of three types of contrariety involving different recognition processes) might shed light on the cognitive factors underlying the detection of incongruity in humor processing. In agreement with previous theoretical analyses (Canestrari & Bianchi, 2009), study 1 showed that, in most cases, when the humorous incongruity of a short verbal text is built on a global contrariety, the humorous effect is better achieved than if an intermediate or an additive contrariety is involved. Studies 2 and 3 aimed at proving if this result could in effect be explained by the fact that participants noticed more immediately the critical contrariety on which the incongruity played. The results showed that in effect both out of context (study 2) and in the joke context (study 3) the critical properties of the key elements of the jokes were better recognized when the two key elements showed a global contrariety than the other two types of contrariety. In the former case the critical property was recognized by most participants.

This result is consistent with the outcomes of perceptual studies on the evidence of contrariety (Bianchi et al., 2008a, 2008b), which have proved that two facts are immediately perceived as globally opposite when they differ extremely in one dimension and share, for the rest, a highly invariant identity. Conversely, when the two elements differ in several different properties, as in the additive contrariety, they are perceived as diverse. When the variation between
the two elements is too weak, as in the intermediate contrariety, the two elements are perceived as being similar rather than contrary. In agreement with this, the incongruity involved in humorous texts emerged well in the jokes where it conformed to global contrariety, whereas it did not emerge and was less easily detected in the version of the jokes where the critical incongruity conformed to additive or intermediate contrariety.

Although our methods differ from others used to measure the distance between two meanings (e.g., Godkewitsch, 1974; Hillson et al., 1994), our results overall are in agreement with the findings that emerged in studies following the domain-interaction approach (Hillson et al., 1994). In fact, the global contrariety structure used in our studies can be considered as a synthesis of, on the one hand, a high between-domain distance (namely an extreme distance in the same

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**FIGURE 4** Mean ratings of difficulty expressed by participants in study 3 (associated to the main effect and the interactions, which turned out to be significant in a mixed model ANOVA). Error bars represent ±1 SE.
dimension, e.g., big–small for the “size” dimension), and on the other hand, a low within-domain distance (namely the presence of invariant properties between the two compared elements). This convergence of results reinforces the strength of the single conclusion.

We are aware that one of the limitations of our work is that the jokes used were short jokes playing on sensorial aspects (this was a constraint related to the hypothesis that we were testing and which required us to start from jokes where the role of perceptual aspects was massive). However, the jokes were not totally homogeneous in terms of structure: the Blind joke, which is more precisely an example of one-liner humor, is a kind of bad taste humor; the School joke shares with the Expert joke the same humorous incongruity (small–big) but differs from the Expert joke as well as from the remaining three stimuli for being a kind of sexual-based humor; the Bat joke is the only one among the texts used that contains an additional incongruity, as it involves animals that talk (Samson & Hempelmann, 2011); the Policeman joke belongs to the category of the dumb jokes, whose butt is an Italian policeman. The fact that the stimuli used are so different do not diminish the strength of the overall result that the global versions is preferred but rather reinforces it, suggesting its generalization.

The fact that the additive version of the Blind joke was preferred to the other versions in study 1 made us think of what might be the weakness of the global version in this case when compared to the additive version. And, in effect, a loading rocket (the key element for the additive version) is actually faster than a greyhound (the key element for the global version). Even though a comparison between a loading rocket and a German shepherd produces many more dimensions of variation than that of a greyhound and a German shepherd, the speed is higher in the first case, and this, which is the critical dimension, emerges (rather than being masked) with the rocket. In other words, a masking effect is not achieved in the additive version of the Blind joke because the velocity of the rocket pops out, and this represents an indirect proof of the importance of noticing the contrariety of one feature with evidence, which is the general principle underlying the hypothesis of a preference for the global contrariety.

Several points remain to be explored and represent potential starting points for future research. For instance, are these conclusions valid for different kinds of humorous texts, involving also nonsensorial key elements and might they also be valid for nonverbal humor? As we have already said, our choice to focus on sensorially based humorous texts derived from the fact that this is a pioneer research on the application of visual rules of contrariety to the field of appreciation of humor and verbal stimuli, instead of visual stimuli. Moreover, verbal texts were used because the concept of incongruity has been studied mostly from the perspectives of verbal language so far (e.g., Attardo, 2001; Attardo et al., 1991; Chiaro, 1992; Chlopicki, 1997; Hay, 2001; Hempelmann,
2004; Hockett, 1971; Norrick, 1993; Norrick & Chiaro, 2009; Raskin, 1985; Ritchie, 2004; Vaid et al., 2003; and many others) rather than visual language, even though some exceptions to this can be found (e.g., Brône & Feyaerts, 2003; Hempelmann & Samson, 2007, 2008; Samson et al., 2011; Smith, 1996). The generalization of our results beyond these limits is a thought-provoking issue. Similarly, it might be interesting to investigate how much individual differences affect the generalization of these conclusions. It has been verified that the preference for specific structures of humorous stimuli can be associated to specific personality traits (Ruch & Hehl, 1998). Starting from Ruch’s (1992) experimental findings suggesting that humor can be thought of as a continuum, ranging from incongruity-resolution structured humor to nonsense structured humor, whose appreciation is affected by peculiar characteristics of personality, one might wonder whether the preference for the global or the additive version (which might appear to be somehow related to Ruch’s distinction) is affected by personal preferences.

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