

# Under/standing cartoons: The suppression hypothesis revisited

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## Abstract

In 5 experiments, including 329 participants, we tested the hypothesis that, as predicted for linguistic jokes (e.g., Gernsbacher and Robertson, 1999; Giora, 1991, 2003; Vaid et al., 2003), interpreting pictorial jokes will involve suppressing the salient but inappropriate meanings of the pictorial ambiguity. Materials included nonverbal comic and equivalent non-comic cartoons. Following each of these primes, an identical probe word was displayed, related to the salient meaning of the ambiguous percept which should have been disambiguated following the joke's final, punchline percept, but not following the equivalent non-joke cartoon's final percept. In all, findings from lexical decisions do not support the suppression hypothesis. In Experiment 1, participants were slightly *faster* in responding to a probe word related to the salient meaning following a joke than following a non-joke cartoon. In Experiments 2–3, we used only comic cartoons, but tested the probe just before or just after the punchline picture. Results attested to significantly *speedier* response-times to probes related to the salient meaning of the ambiguous percept following the punchline than following the previous percept. In Experiment 4, participants' response time to related probes was significantly *faster* than to controls. Even when allowed 2500 ms processing time following the presentation of the last punchline percept, the inappropriate meanings were still somewhat *faster* than controls, albeit marginally so (Experiment 5). In all, the suppression hypothesis did not gain support. Instead, the salient, contextually inappropriate meanings of the pictorial jokes were retained (to varying degrees).

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## 1. Introduction

Most studies of joke comprehension focus on one type of jokes—linguistic jokes—involving double entendre, which should be disambiguated at the jokes' punchline. They support the suppression hypothesis according to which interpreting a joke involves a sequential process whereupon an initially activated (salient) meaning of a stimulus is revisited at the punchline position or later on. At this late stage, this meaning may interfere with comprehension. Hence, it is discarded from the mental representation (on the suppression/retention hypothesis, see Giora, 2003).

According to Giora (1991, 2003, and see also Gernsbacher and Robertson, 1999), processing a verbal joke involves initial activation of a salient (coded, prominent, and hence, highly accessible) response to a stimulus (e.g., a word) only to be discarded at the punchline position in favor of an appropriate yet less-salient and less accessible alternative.<sup>1</sup> Similarly,

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<sup>1</sup> Note that in Giora (1991) "suppression" is termed "cancellation"; on how salience is defined in terms of familiarity, frequency, conventionality or prototypicality, see Giora, 2003, Chapter 2).

according to (Attardo, 1994, 1996a,b, 2001; Attardo et al., 1994), processing a joke involves an initial activation of one sense of a stimulus to be reinterpreted and adjusted to contextual information at the joke's punchline position. According to Coulson (2001) and Coulson and Kutas (1998), it is script-shifting that is involved in joke comprehension, resulting in jokes' endings being costly processing-wise because of the need to switch from one script to another. Indeed, Coulson and Kutas (1998) show that jokes, involving high-salience meanings, took longer to process compared to non-jokes and jokes involving low-salience meanings. They further argue that suppressing initial disruptive interpretations facilitates joke comprehension (Coulson and Kutas, 2001). Vaid et al. (2003) also adduce evidence supporting the initial activation of salient meaning (Experiment 1) and the later, selective activation of the less-salient alternative (Experiment 2). The models reviewed so far, then, assume deactivation of or an attention shift from the initially activated sense of the verbal stimulus and its replacement with an alternative.

In contrast, Curcú (1995, 1996a,b, 1998) assumes a different processing model, in which suppression is not included. Instead, a weakly manifest assumption (the meaning activated initially) is retained for contrastive purposes so as to prompt joke comprehension at the punchline position.

The suppression hypothesis may, indeed, account for most of the findings regarding verbal joke comprehension (see also Giora, 2003, Chapter 6). However, will it also account for pictorial jokes comprehension? Five experiments were designed to test the suppression hypothesis in this context.

## 2. Experiments

### 2.1. Experiment 1

Experiment 1 aimed to test the suppression hypothesis using a lexical decision task immediately following the last, "punchline" picture.

#### 2.1.1. Method

*Participants.* Sixty-three psychology undergraduates (53 women and 8 men) of Tel-Aviv-Yaffo Academic College, between 21 and 25 years old, served as participants. They were all native speakers of Hebrew. They received a course credit for their participation.

*Materials.* Materials were 16 nonverbal pictorial jokes (presented as colored cartoon strips, see left column of Fig. 1). They were selected from a large pool of jokes, taken from cartoon books (Mordillo, 1974, 1975) and internet sites, or were created especially for this study. Each joke (see left column of Fig. 1) consisted of 4 drawings presented sequentially. The first 3 drawings support the salient meaning (here, "dartboard"), while the fourth, "punchline" drawing invokes a less or non-salient concept (here, "snail"). For each joke, a corresponding non-joke cartoon was prepared (see right column of Fig. 1), in which the last panel was replaced with a drawing depicting a coherent, non-surprising ending.

Several pretests were run in order to select comprehensibly funny jokes. Participants in these pretests were asked to rate, on a 7 point scale, the extent to which the jokes were funny. The 16 selected jokes scored higher than 3.5 on this scale; their non-joke equivalents scored lower than 2.3. Another pretest was administered for the purpose of selecting the probe words. Participants were asked to describe each joke and explain why it was funny. Their explanations were recorded and used to pinpoint a word related to the salient meaning of the ambiguous word. In cases where a related word did not feature in all the participants' responses, the word was selected by two judges following a discussion.

Two booklets were prepared, each containing 8 jokes and 8 non-jokes, so that each booklet included only one version of each story (either funny or not funny). In addition to the 16 experimental cartoons (each followed by a probe word), each booklet also contained 3 cartoon stories for demonstration (followed by the "funny or not funny" feedback), 5 stories for training, and 9 filler stories (4 jokes and 5 non-jokes), followed by a nonword.

*Procedure.* Participants were tested individually. They were each seated in front of a computer screen and were instructed by the experimenter. In each cartoon story, each drawing was presented for 5 s and then the second drawing was displayed next to it for 5 s, following which, the third drawing was displayed for 5 s. The fourth and last drawing was displayed for 10 s (see Fig. 2). After the offset of the last drawing, participants were given a lexical decision task, in which they were asked to decide whether a letter string makes up a word (in Hebrew) or not, by pressing the "I" key (marked by a green sticker) for "yes" and the "W" key (marked by a red sticker) for "no" (for left-handed participants, the left key was used for "yes" and the right—for "no"). The latency between the onset of the word–nonword probe and the pressing of the key was measured by the computer and served as response-time (RT). Following their lexical decision, participants were asked to answer the following question: "Was the cartoon funny?" by pressing one of the ("yes" or "no") keys, as before.

#### 2.1.2. Results and discussion

Eight participants were excluded from the analysis due to an a priori criterion of making more than 50% errors in answering the questions. The basic data for the analyses were the mean RT in each condition.

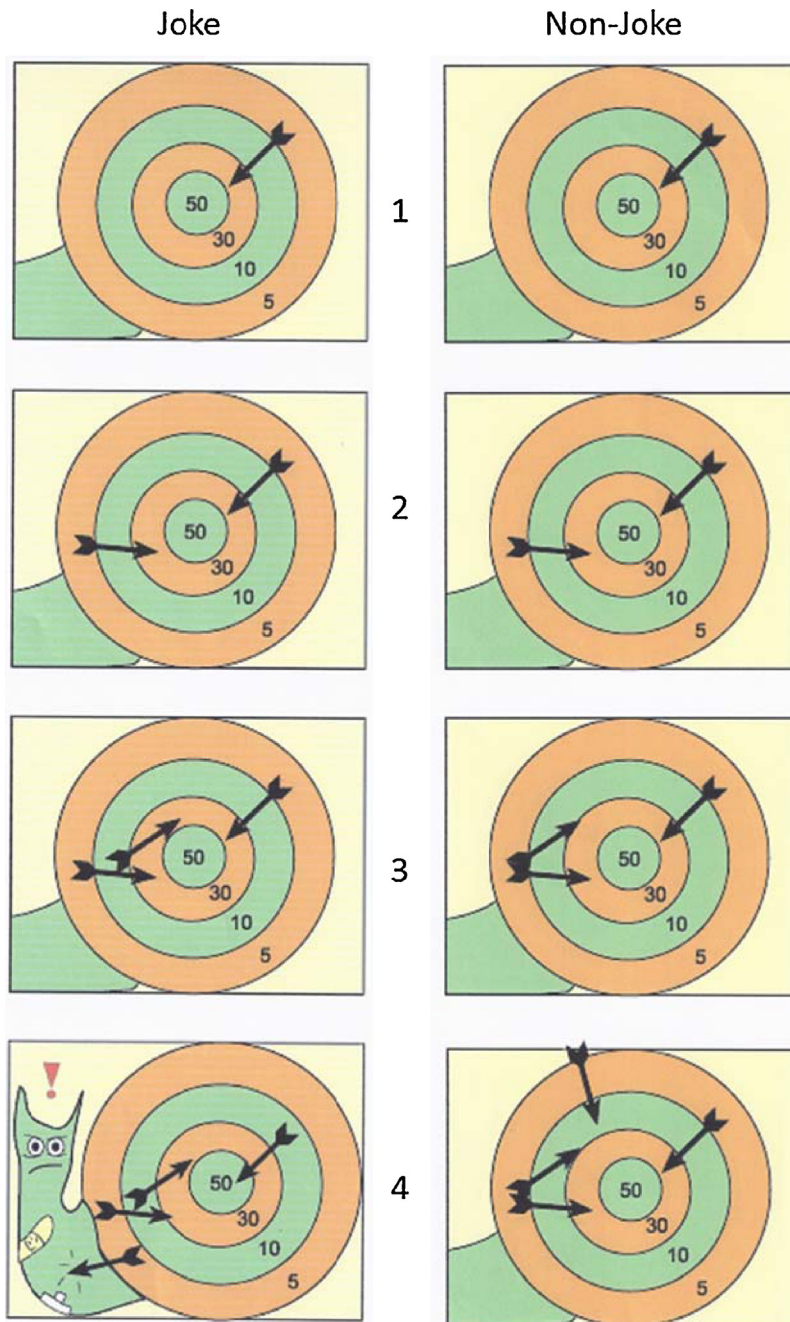


Fig. 1. A sample cartoon presented in Experiment 1. The left column displays the joke version; the right column displays the non-joke alternative.

Results show that participants were slightly *faster* in responding to a probe related to the salient meaning following a joke (1467 ms,  $SD = 430$ ) than following a non-joke cartoon (1523 ms,  $SD = 490$ ),  $t(52) = 1.54$ ,  $p = .06$ . Although the results were only marginally significant, they undermine the suppression hypothesis; they show that the salient meaning was not suppressed but rather retained.

A possible problem in our procedure was testing the accessibility of the salient meaning only after the last fourth percept, in both the joke and non-joke cartoons. Given that the fourth picture was displayed for quite a long time (10 s), it might be argued that the salient meaning was suppressed, only it was suppressed to a higher degree in the non-joke cartoons. Therefore, we devised a way to test the accessibility of the salient meaning just before or just after the fourth punchline picture of the comic cartoons.

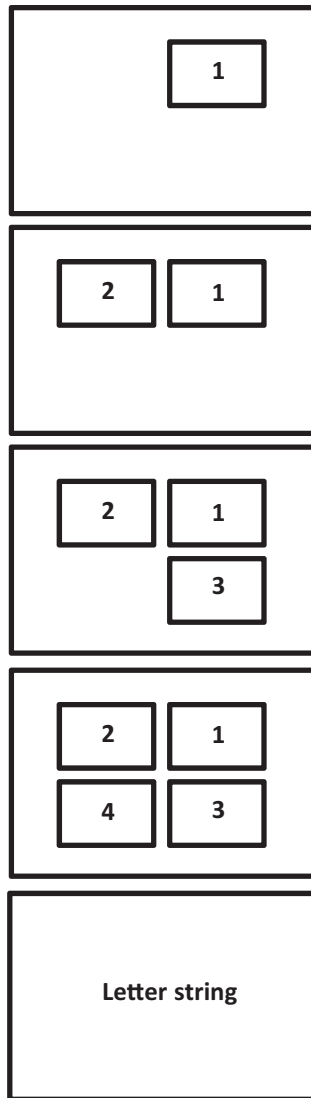


Fig. 2. Sequence of presentation of stimuli in Experiments 1 and 2 (from top to bottom). Since the cartoons were presented to Hebrew speaking participants and Hebrew is written from right to left, the order of presentation was from right to left rather than from left-to-right.

## 2.2. Experiment 2

Experiment 2 aimed to test the suppression hypothesis using a lexical decision task just before or just after the 4th punchline picture. Therefore, we used only the joke cartoons, and presented the probes either right after the 3rd picture (i.e., just before the 4th picture) or right after the 4th picture (see Fig. 1).

### 2.2.1. Method

**Participants.** Seventy-three psychology undergraduates (60 women and 13 men) of Tel-Aviv-Yaffo Academic College, between 22 and 29 years old, served as participants. They were all native speakers of Hebrew. They received a course credit for their participation.

**Materials.** Materials were the same 16 pictorial jokes used in Experiment 1. In one condition (“after punchline”), all 4 pictures were presented; in the other condition (“before punchline”), the first picture contained only the word “wait...”, and the other 3 pictures were the first 3 pictures of the original cartoon (see Fig. 3):

**Procedure.** Procedure was the same as in Experiment 1, only this time each drawing was presented for 5 s.

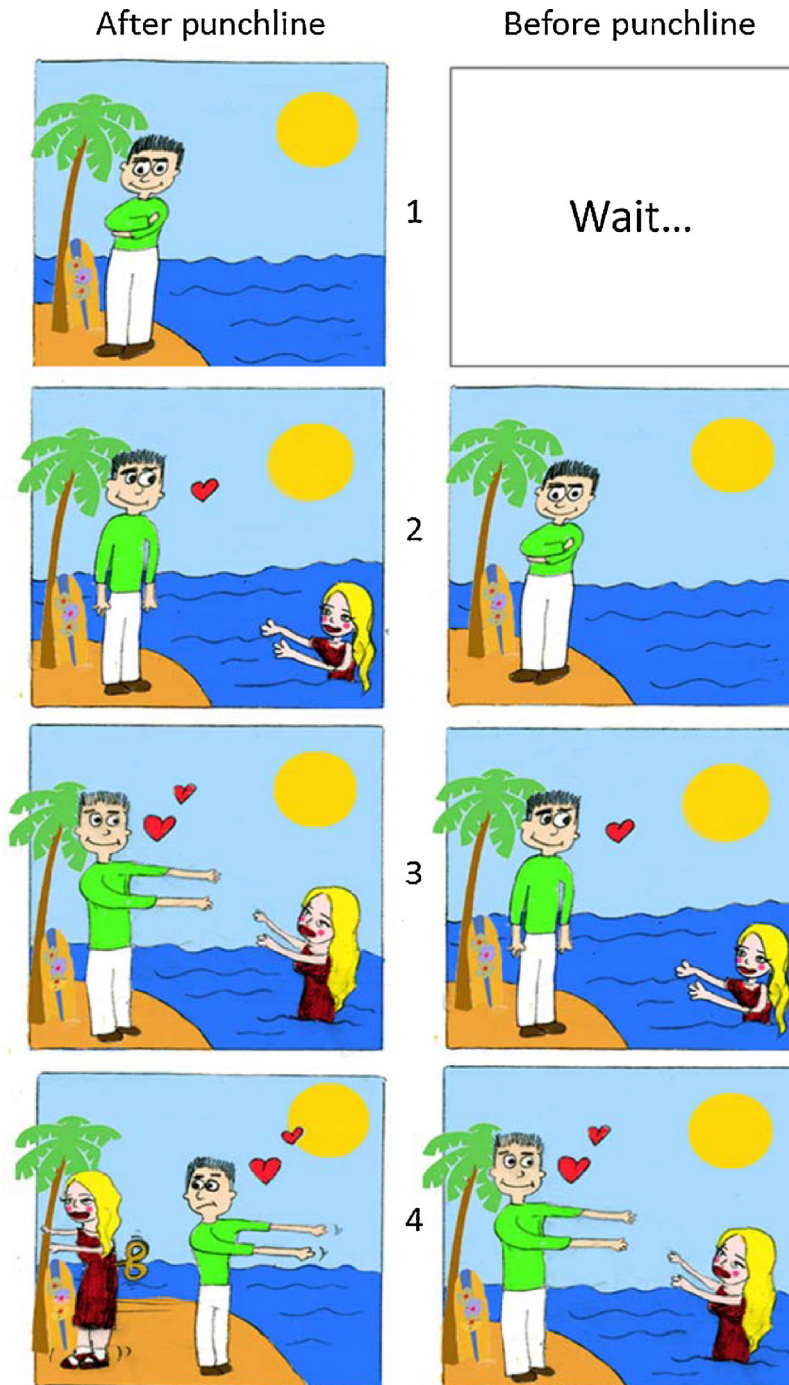


Fig. 3. A sample cartoon presented in Experiment 2. The left column presents the “after punchline” cartoon, while the right column presents the “before punchline” cartoon.

### 2.2.2. Results and discussion

Five participants were excluded from the analysis due to an a priori criterion of making more than 50% errors in answering the questions, and 2—for having a mean RT larger than 3 SDs from the mean of all participants. The basic data for the analyses were the mean RT in each condition.

As in Experiment 1, results attested to significantly *speedier* response-times to probes related to the salient meaning of the ambiguous percept following the punchline (1491 ms,  $SD = 443$ ) than following the previous picture (1559,  $SD = 429$ ),

$t(65) = 1.84, p < .05$ . The new procedure in Experiment 2, then, allows us to conclude that participants retained the salient meaning even after the presentation of the punchline. Such results argue against the suppression hypothesis.

Still, it might be argued that the way we presented the cartoon (see Fig. 2) encourages the retention of the salient meaning, since the first 3 drawings (supporting the salient meaning) remain on the screen when the fourth (punchline) drawing is displayed. Therefore, in the next experiments we changed our presentation scheme.

### 2.3. Experiment 3

Experiment 3 aimed to test the suppression hypothesis using a moving windows technique, whereby the sequentially presented drawings did not accumulate on the screen, but were displayed centrally, one at a time. Advancing the drawings was self-paced, controlled by the participants.

#### 2.3.1. Method

*Participants.* Seventy-six psychology undergraduates (62 women and 14 men) of Tel-Aviv-Yaffo Academic College, between 20 and 29 years old, served as participants. They were all native speakers of Hebrew. They received a course credit for their participation.

*Materials.* Materials were the same as in Experiment 2.

*Procedure.* Procedure was the same as in Experiments 1 and 2, only here the drawings were presented one at a time. Advancing the presentation of the drawings was self-paced, i.e., controlled by the participant. Each drawing was presented centrally and disappeared from the screen when the participant pressed the spacebar. Since it was irrelevant in this procedure, the “wait” drawing, presented in Experiment 2, was omitted in this experiment.

#### 2.3.2. Results and discussion

Twelve participants were excluded from the analysis due to an a priori criterion of making more than 50% errors in answering the questions. The basic data for the analyses were the mean RT in each condition.

As in Experiment 2, participants made faster response-times to probes related to the salient meaning following the punchline (1417 ms,  $SD = 481$ ) than following the previous picture (1591,  $SD = 544$ ),  $t(63) = 3.21, p < .005$ . Results argue against the suppression hypothesis. They show, instead that participants retained the salient meaning even when the drawings supporting it were not present in front of them.

However, it might still be argued that we do not demonstrate retention until we show that the salient meaning is more accessible than unrelated words. Experiments 4 and 5 were devised to address this critique.

### 2.4. Experiment 4

Experiment 4 aimed to test the suppression hypothesis by comparing response-times to probes related to the salient meaning vs. unrelated probes. Therefore, we implemented only the “after punchline” condition, but tested probes related or unrelated to the salient meaning by using a lexical decision task.

#### 2.4.1. Method

*Participants.* Sixty-four psychology undergraduates (42 women and 22 men) of Tel-Aviv-Yaffo Academic College, between 21 and 23 years old, served as participants. They were all native speakers of Hebrew. They received a course credit for their participation.

*Materials.* Two booklets were prepared, each containing 8 jokes followed by a probe related to the salient meaning and another 8 jokes followed by an unrelated probe (selected on the basis of a pretest, see below). In addition to the 16 experimental cartoons (each followed by a probe word), each booklet also contained 3 cartoon stories for demonstration (followed by a “funny or not funny” feedback), 5 training stories, and 9 filler stories (4 jokes and 5 non-jokes), followed by a nonword.

Two sets of pretests were run in order to allow selecting the unrelated probes. For each of the 16 joke items used earlier, two unrelated words were collected, which matched the probe words related to the salient meaning in terms of number of syllables and word-frequency (Frost and Plaunt, 2005). In the first set of pretests, all the comic cartoons were presented in a booklet, each followed by 3 words (one related, two unrelated), which participants had to rate on a 7 point relevancy scale. This procedure was repeated with different words until we obtained scores higher than 6 for the related words and lower than 2 for the unrelated ones. During this process, two comic cartoons were redrawn. The second set of pretests tested the unrelated words for their degree of accessibility which had to match that of the probes related to the salient meaning. Therefore, an online test was run, in which all the (related and unrelated) probe words were presented following different funny stories (irrelevant to the words tested). Participants were administered a lexical decision task to

assess degree of accessibility. Only the unrelated words that did not differ significantly in terms of response-times from the probes related to the salient meaning of the experimental jokes were selected (all  $p > .20$ ).

*Procedure.* Procedure was the same as in Experiment 3.

#### 2.4.2. Results and discussion

The basic data for the analyses were the mean RT in each condition (related vs. unrelated probes). Results show that participants responded faster to related (1364 ms,  $SD = 450$ ) compared to unrelated probes (1461,  $SD = 492$ ),  $t(63) = 1.90$ ,  $p < .05$ . Such results defy the suppression hypothesis. Instead, they demonstrate that the salient yet irrelevant meaning was retained and was more accessible than unrelated concepts.

In Experiment 5 we test whether this retention persists even later on.

### 2.5. Experiment 5

Experiment 5 intended to test the option that longer processing time would induce suppression of the salient meaning. Therefore, we reran Experiment 4, while allowing another 2500 ms processing time between the offset of the fourth drawing and the onset of the probe.

#### 2.5.1. Method

*Participants.* Seventy-nine psychology undergraduates (68 women and 11 men) of Tel-Aviv-Yaffo Academic College, between 21 and 26 years old, served as participants. They were all native speakers of Hebrew, and received credit for their participation.

*Materials.* Materials were those used in Experiment 4.

*Procedure.* Procedure was the same as in Experiment 4, except for the fact that the probes were not displayed immediately after the participant pressed the spacebar having viewed the last fourth drawing, but rather 2500 ms later. During that time, the participant was presented with the question “Was the cartoon funny?” and was instructed to answer it with by pressing the “yes”/“no” (marked) keys. Regardless of whether the participant responded to the question or not, the probe word was displayed for 2500 ms following offset of the last drawing.

#### 2.5.2. Results and discussion

The basic data for the analyses were the mean RT in each condition (related vs. unrelated probes). Results show that, while it still took participants less time to respond to related (1014 ms,  $SD = 309$ ) compared to unrelated probes (1072,  $SD = 452$ ), the difference was only marginally significant,  $t(78) = 1.33$ ,  $p = .09$ . Such results might suggest that, at this late point in time, the salient meaning, although still active, is beginning to decay. Alternatively, it is also possible that the salient meaning is only attenuated rather than suppressed, given its relevancy, albeit minor, and hence its visibility (e.g., a dartboard) in the final punchline percept of the pictorial jokes (see Fig. 1 left column above). Pictorial jokes, then, might exemplify the case of shifting the focus of attention away from the salient incompatible meaning to the appropriate one.

## 3. General discussion

According to the suppression/retention hypothesis (Giora, 1991, 2003), contextually incompatible meanings, activated initially on account of their high saliency rather than their contextual fit, will be suppressed if they interfere with the interpretation of the stimulus (e.g., verbal jokes); they will be retained if they are conducive to the interpretation of that stimulus (e.g., metaphors, ironies). Some of the studies looking into the various processes involved in verbal joke comprehension indeed support the suppression hypothesis. They show that interpretations of such jokes resort to suppressing the salient yet contextually incompatible meaning of the key word at the punchline position, especially when compared to non-joke endings (e.g., Coulson and Kutas, 1998, 2001; Vaid et al., 2003; see also Attardo, 1994, 1996a,b, 2001; Attardo et al., 1994). In this study we test the suppression hypothesis with regard to nonverbal pictorial jokes. We aimed to find out whether interpreting such jokes would involve similar suppression processes.

Findings from 5 experiments, involving comic and equivalent non-comic wordless cartoons, answer this question in the negative (see also Curcó (1995, 1996a,b, 1998)). They show that salient meanings of pictorial jokes resist suppression. In Experiment 1, following a nonverbal joke, responding to a probe word related to the salient inappropriate meaning of the joke was faster (albeit marginally so) than following an equivalent non-joke cartoon. Similarly, when only comic cartoons were considered, probing salient meanings just before or just after the final punchline picture suggested a reinforcement of this trend. In fact, in Experiments 2–3, salient yet joke-incompatible meanings were processed significantly faster following the joke’s punchline (which is the point at which suppression is expected to be triggered) than following the prefinal percept (which supports the salient meaning). In Experiment 4, participants’ response-time to probes related to

the salient meaning was significantly faster than to controls. And when allowed lengthy processing time (2500 ms) following the last punchline percept, the inappropriate meanings were still more highly activated compared to controls, although only marginally so (Experiment 5).

One possible explanation might be the fact that the last disambiguating percept of the pictorial jokes is still somewhat related to the salient meaning of the joke, since it also features the object or part of it, related to the salient meaning. Indeed, most of our items feature the object (or part of it), related to the salient meaning (e.g., dartboard), in the jokes' final punchline position (see e.g., in Fig. 1 left column above). This might be one reason why this meaning remains active, although to a limited degree, even when given lengthy processing times.

In sum, results collected from studying 16 nonverbal pictorial jokes and nonjokes question the suppression hypothesis. They show that, unlike verbal jokes, interpreting pictorial jokes does not involve suppressing of the salient, contextually incompatible meaning of the ambiguity following the joke's punchline panel. Instead, the strategy applied is that of retaining the salient meanings (to varying degrees).

Unlike linguistic jokes, pictorial jokes often necessitate the display, at the punchline position, of the joke's object, related to its salient incompatible meaning, even if only partially. To resolve this issue of whether or not suppression of incompatible meanings may be involved in interpreting nonverbal cartoons, experimental stimuli should avoid displaying the object related to the salient meaning in the joke's punchline percept.

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