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Sonja Heintz *School of Psychology*

Giovannantonio Forabosco

Alberto Dionigi

Filippo Cioni

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Humour comprehension and appreciation: An analysis of Italian jokes

Sonja Heintz^{1,2}, Giovannantonio Forabosco³, Alberto Dionigi⁴, & Filippo Cioni⁵

Author notes

¹ School of Psychology, University of Plymouth, United Kingdom

² Department of Psychology, University of Zurich, Switzerland

³ Centro Ricerca Umoreismo, CRU, Italy

⁴ Psi.Co. Studio di Psicoterapia Cognitiva, Cattolica, Italy

⁵ MENSA Italia, Italy

Address for correspondence: Dr Sonja Heintz, School of Psychology, Faculty of Health: Medicine, Dentistry and Human Sciences, University of Plymouth, Drake Circus, Plymouth, PL4 8AA, United Kingdom, sonja.heintz@plymouth.ac.uk

Authors' Biographies

Sonja Heintz

Lecturer in Psychology at the University of Plymouth. Her main research interests are personality and measurement, humour (individual differences and measurement) and positive psychology (character strengths and well-being). She is a member of the Advisory Board of the International Humour Summer School.

Giovannantonio Forabosco

Psychologist and psychotherapist. He directs the Humor Research Center (CRU). Associate to the International Society for Humor Studies. RISU Book Review Editor. He has published several articles and essays on humor, including "Il settimo senso" / "The seventh sense. Psychology of the sense of humor" (Muzzio 1994; Tarka 2020).

Alberto Dionigi

Cognitive-Behavioural psychotherapist and clown doctor. His main research interests are about humor psychology, the use of humor in psychotherapy and healthcare clowning. He is Co-Editor-in-Chief of RISU – Rivista Italiana di Studi sull'Umoreismo.

Filippo Cioni

Graduated in Political Economy of Financial Intermediaries, he works as an analyst and financial consultant. He held the position of National Secretary of Mensa Italia and is now Secretary of the local Mensa group Emilia-Romagna.

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Abstract

Humour comprehension and appreciation are two basic domains of humour research and central stages in humour processing. In the present study, 238 Italian adults rated 20 jokes to investigate how a humour comprehension task influences subsequent funniness ratings. Additionally, the relationships between humour comprehension and funniness were investigated for the total set of jokes, for individual jokes, and for jokes with different contents (neutral or tendentious) and difficulty (elementary or advanced). Comparing participants who performed only the funniness ratings with participants who first performed a humour comprehension task showed that funniness scores were reduced in the humour comprehension condition. Humour comprehension and funniness were positively related at the level of individual jokes, while these effects were less pronounced in the analyses across jokes. Overall, advanced-neutral jokes showed the most pronounced differences. The study thus showed that the level of analysis (individual jokes vs. aggregating across jokes), content and difficulty of jokes should be taken into account when relating humour comprehension and appreciation. Additionally, it should be considered that humour comprehension tasks can bias humour appreciation ratings. Hence, the measurement and interplay between these humour domains deserves more attention in research.

Key words: Humour appreciation, humour comprehension, jokes, humour processing, measurement

1 Introduction

Psychological humour comprises three large domains: Humour comprehension, appreciation, and production (Ruch 2012). While standardised measures exist for both humour appreciation (e.g., the *3 Witz-Dimensionen test of humour appreciation* by Ruch 1992, and the *Escala de Apreciación del Humor* by Carretero Dios et al. 2010) and production (the *Cartoon Punch Line Production Test* by Koehler and Ruch 1992; see Ruch and Heintz 2019), humour comprehension has been less well understood from a measurement perspective. Additionally, the interplay between the three domains, comprehension, appreciation, and production, is still underdeveloped. The present study aims to partly fill these two gaps by (a) investigating the effects of a humour comprehension task on subsequent humour appreciation and (b) by relating humour comprehension and appreciation in a set of 20 jokes.

1.1 Humour appreciation

Humour appreciation is the best studied of the three humour domains. A large host of theories and models (for overviews, see Ferguson and Ford 2014; Heintz 2019; Martin and Ford 2018; Raskin et al. 2009) have been proposed to explain individual differences and the processes underlying humour appreciation. Overall, they emphasise the importance of different structures in humorous stimuli, which can range from simple and solvable (incongruity-resolution) to more complex and impossible (nonsense). In incongruity-resolution, the appreciation is drawn from comprehending the punchline and making sense of the humorous stimulus, while in nonsense, enjoyment derives more from the play with possible solutions and interpretations of the humorous stimulus (see Ruch 1992; Ruch and Hehl 2007). In addition to the structure, humour can differ in its contents: The stimuli can depict something salient (e.g., disparaging, sexual, disgusting, dark) that can elicit strong emotions, or it can have a harmless and innocent content (Freud 1905; Ferguson and Ford 2014; Ruch 1992). Structure and content mutually influence humour appreciation (Heintz 2019; Ruch and Hehl 2007; Ruch and Platt 2012). Their importance has also been shown for different types of humorous stimuli (e.g., jokes, cartoons, pictures, TV advertisements; Eysenck 1942; Eysenck 1943; Heintz 2019; Hofmann and Ruch 2017; Ruch 1992).

In addition to variation in the humorous stimuli, responses to humour can vary along three dimensions (Ruch and Rath 1993): One positive response (funniness) and two negative responses (boredom and aversiveness/offensiveness). While aversiveness/offensiveness is usually unrelated to funniness, boredom and funniness were found to be negatively correlated (Heintz 2019; Ruch 1992; Ruch and Rath 1993). Most studies on humour research however focus on the dimension of funniness alone, as the present study will do.

1.2 Humour comprehension

In contrast to humour appreciation, research on humour comprehension has mostly focused on the neuropsychological processing of humorous stimuli (e.g., Bartolo et al. 2006; Chan et al. 2013; Perchtold-Stefan et al. 2020; Samson et al. 2008; Uekermann et al. 2007). These studies uncovered different stages involved in comprehending a humorous stimuli: First, the stimulus needs to be recognised as humorous (i.e., the incongruity needs to be detected) and second it must be understood (i.e., the punch line must be re-interpreted to fit to the initial setup and hence resolved). The third stage captures humour appreciation. A second prominent research strand in humour comprehension involves clinical studies on impairments due to different conditions, such as autism (Wu et al. 2014), schizophrenia (Adamczyk et al. 2017), and reading and learning disabilities (Semrud-Clikeman and Glass 2008; for general overviews, see Rodden 2018a; Rodden 2018b). Less is known, by contrast, about individual differences in humour comprehension in healthy adults.

A comparison of the literature on humour comprehension is impaired by the lack of standardised definitions and measures. For example, nonsense is included in some studies as a humorous stimulus (e.g., Wu et al., 2014), while in other studies nonsense is used to create non-sequitur endings for control stimuli (e.g., Semrud-Clikeman and Glass 2008; Uekermann et al. 2007). Additionally, most studies employ different stimuli and different categorisations of these stimuli, such as according to content, structure, or specific to the population under study. Finally, different approaches to assessing humour comprehension have been used. The most frequent approach entails presenting a set of alternative punch lines, requiring participants to choose the correct (i.e., funny) alternative (joke completion tasks; see Bower and Steyvers 2020; Brownell et al. 1983; Feingold 1983). Other possibilities include self-ratings of the degree of comprehension or difficulty of comprehension (e.g. Derks et al. 2007), latency of choosing the correct alternative from different latent content statements of cartoons (e.g., Kozbelt and Nishioka 2010), categorising jokes and non-jokes (Cunningham and Derks 2005), and eliciting open responses on how the humorous stimulus was interpreted, which are then scored for the degree of comprehension (e.g., Bergen 2009; McGhee 1971). The present study will employ a newly developed joke completion task to assess humour comprehension (Forabosco et al. 2019).

1.3 Overlaps between humour appreciation and comprehension

The neuropsychological studies reviewed earlier clearly indicate that humour comprehension and appreciation are separate processes in the brain (e.g., Bartolo et al. 2006; Chan et al. 2013). These studies, as well as the theories on humour processing, often implicitly assume that humour comprehension is a necessary, yet insufficient step to appreciate a stimulus; for example, the *cognitive congruency principle* states that humour is most appreciated when it is neither too difficult nor too simple to comprehend (McGhee 1976; Zigler et al. 1966; Zigler et al. 1967). Other studies based on self-reports found that the degree and ease of comprehension were positively related to funniness (Cunningham and Derks 2005; Derks et al. 2007; Goldstein 1970; Kozbelt und Nishioka 2010; Masten 1986). When looking at effect sizes, however, humour comprehension and appreciation were found to share up to 16% of variance (medium to large effect). Hence, although comprehension can facilitate appreciation, the literature does not support the general idea that comprehension is strictly necessary, and certainly not sufficient, for finding a stimulus funny.

1.4 Aims of the present study

The present study aims at better understanding the interplay between humour comprehension and appreciation. The first research question investigates how completing a multiple-choice humour comprehension task influences subsequent humour appreciation (funniness). The second research question investigates the relationship between humour comprehension and appreciation. Both of these questions will be answered at different levels of abstraction: In single jokes, in jokes with different contents (harmless and tendentious) and difficulty (elementary and advanced), and across the total set of 20 jokes.

2 Methods

2.1 Sample

A total of 310 participants started the study. Our analyses are based on the 238 participants (77%) who completed the whole survey. They had a mean age of 41.97 years ($SD = 13.77$, range 18–77 years), 45% were male and 55% were female, 11% had a secondary school degree, 39% had a high school degree, and 50% had a university degree. All participants were from the general population in Northern Italy and participated individually and in person. Data collection took place in nine different locations (e.g. library, medical settings, work

environments, public and commercial places) and was always supervised by one experimenter. Of note, the sample of the present study partly overlaps with Forabosco et al.'s (2020) sample; importantly, none of the present results have been reported previously.

2.2 Measures

Twenty jokes were selected according to their contents (harmless or tendentious, e.g. with mocking or sexual content) and level of difficulty (elementary/easy to understand or advanced/more difficult to understand). This resulted in four joke categories: neutral-elementary (N-E, 5 jokes), neutral-advanced (N-A, 7 jokes), tendentious-elementary (T-E, 3 jokes), and tendentious-advanced (T-A, 5 jokes). The jokes were presented in five random orders. Forabosco et al. (2019) described this joke selection in detail.

Participants also indicated whether they were familiar with the jokes or not. Average familiarity with the jokes was 3%, and only 26% of the participants indicated any familiarity with the jokes (range from 1–9 jokes per participant). Importantly, the groups with and without the humour comprehension task did not differ in terms of their familiarity with the jokes ($p = .805$).

Additionally, 82% of the participants ($n = 196$) first performed the humour comprehension task. Of note, there were no significant gender ($p = .680$) or age differences ($p = .060$) between the groups who performed vs. those who did not perform the humour comprehension task. In this task, they were presented with four possible response options (punchlines) to finish the jokes. Only one of the response options was the original and hence correct ending. English translations of all jokes are listed in the appendix (the original Italian jokes and response options are listed in Forabosco et al. 2020). An example joke with the four options is as follows (correct response: D):

- Joke 6: Cartesio is sitting in a bar. The bartender asks him whether he would like another drink. Cartesio replays: "I don't think..."*
- A. and immediately he walks out.*
 - B. and suddenly he falls from the stool.*
 - C. and he grimaces.*
 - D. and in a flash he disappears.*

All participants rated the jokes on funniness (5-point scale from 1 to 6), with higher scores indicating more funniness. Humour comprehension was rated as 0 (if a wrong option was selected) or 1 (if the correct option was selected). Total funniness (Cronbach's $\alpha = .92$) and comprehension (Cronbach's $\alpha = .85$) were reliable, as were the subscales for neutral (funniness $\alpha = .86$, comprehension $\alpha = .75$), tendentious (funniness $\alpha = .85$, comprehension $\alpha = .70$), elementary (funniness $\alpha = .82$, comprehension $\alpha = .73$), and advanced (funniness $\alpha = .88$, comprehension $\alpha = .75$). The reliabilities of the four content \times difficulty combinations were lower, ranging from .70–.80 for the funniness ratings and .47–.68 for the comprehensions ratings.

2.3 Analyses

The first research question concerns how completing a humour comprehension task influences subsequent humour appreciation (funniness). To test this research question, we computed analyses of covariance (ANCOVA) with the two groups (performed vs. did not perform the humour comprehension task) as between-participant variable, gender and age as covariates, and funniness as dependent variable. These ANCOVAs were conducted across the whole set of 20 jokes, separate for each of the humour contents (neutral and tendentious) and levels of difficulty (elementary and advanced), the combined humour categories (i.e. neutral-elementary, neutral-advanced, tendentious-elementary and tendentious-advanced) and for each individual joke.

The second research question investigates the relationship between humour comprehension and appreciation. We tested this research question in two ways: Firstly, we conducted partial Spearman rank correlations (ρ_p) between the humour appreciation and comprehension ratings, controlling for gender and age. These correlations were conducted across the whole set of 20 jokes, separate for each of the humour contents (neutral and tendentious) and levels of difficulty (elementary and advanced) and the four combined humour categories. Secondly, ANCOVAs were computed separately for each joke, with the between-participant variable of those who understood vs. did not understand the joke (with varying groups and sizes for each joke), gender and age as covariates, and funniness as dependent variable.

All analyses were conducted controlling for age and gender, as we expected differences due to these variables based on previous studies (e.g., Chan 2016; Greengross 2020; Hofmann et al. 2020, Ruch, McGhee and Hehl 1990) and as they were related to comprehension and appreciation for several jokes in the present study. Significant levels were set at the typical level of 5% (i.e. $p < .05$). Effect sizes were categorised as follows (based on Cohen's 1992 guidelines): ρ_p (.10-.29 = small, .30-.49 = medium, and $> .50$ = large), and η^2 (.01-.06 = small, .06-.14 = medium, and $> .14$ = large). All analyses were conducted using R (R Core Team, 2020) and the package *psych* (Revelle, 2020).

3 Results

3.1 How does the humour comprehension task affect humour appreciation?

The first research question concerns the impact of completing a multiple-choice humour comprehension task on subsequent humour appreciation. Table 1 shows the comparisons of the funniness of jokes of the groups that performed vs. did not perform the humour comprehension task for the different levels of analyses. For all analyses, gender and age were used as control variables (covariates).

Table 1

Descriptive statistics and mean comparisons of the funniness ratings of the groups that performed vs. did not perform the humour comprehension (HC) task

Jokes	With HC task (<i>n</i> = 196)		Without HC task (<i>n</i> = 42)		ANCOVA			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>p</i>	η^2	Sig. covariates
Total	3.06	0.88	3.43	0.86	5.36	.022	.022	Age
Neutral	3.05	0.87	3.40	0.94	4.86	.029	.020	
Tendentious	3.08	0.99	3.46	0.88	4.91	.028	.020	Gender & age
Elementary	3.08	0.91	3.47	0.93	5.11	.025	.020	Age
Advanced	3.05	0.92	3.40	0.91	4.78	.030	.020	
N-E	3.26	0.93	3.65	1.00	4.95	.027	.020	Age
Joke 1	3.24	1.25	3.48	1.45	0.90	.344		
Joke 2	3.11	1.25	3.57	1.23	3.15	.077		Age
Joke 8	2.54	1.36	2.81	1.49	0.72	.398		Age
Joke 9	3.47	1.43	4.02	1.51	5.30	.022	.022	
Joke 16	3.92	1.40	4.38	1.32	3.09	.080		Age
N-A	2.91	0.95	3.22	1.05	3.59	.059		
Joke 3	3.10	1.45	2.83	1.67	1.39	.240		
Joke 4	2.62	1.46	3.43	1.61	10.24	.002	.042	
Joke 10	3.06	1.41	3.31	1.39	1.14	.288		
Joke 11	2.92	1.52	2.88	1.71	0.00	.990		
Joke 15	2.67	1.33	2.45	1.31	5.15	.024	.021	
Joke 18	2.88	1.32	3.45	1.64	5.82	.017	.024	
Joke 19	3.14	1.43	4.21	1.49	21.24	<.001	.078	Gender
T-E	2.78	1.11	3.17	1.08	3.20	.075		Age
Joke 5	3.08	1.40	3.48	1.45	2.18	.141		Age
Joke 12	2.77	1.48	2.69	1.58	0.24	.627		Gender & age
Joke 13	2.49	1.36	3.33	1.63	10.31	.002	.040	Age
T-A	3.26	1.02	3.64	0.94	4.99	.027	.020	Gender
Joke 6	3.00	1.44	3.12	1.52	0.10	.758		
Joke 7	3.22	1.50	3.81	1.63	5.51	.020		Gender
Joke 14	3.37	1.37	3.93	1.58				
Joke 17	4.20	1.37	4.55	1.19	2.46	.118		Gender
Joke 20	2.48	1.33	2.81	1.58	1.84	.177		Gender

Notes. ANCOVA = analysis of covariance with age and gender as control variables and condition (with or without humour comprehension task) as independent variable, Sig. covariates = significant covariates, N-E = neutral-elementary, N-A = neutral-advanced, T-E = tendentious-elementary, T-A = tendentious-advanced.

As can be seen in Table 1, all analyses across jokes (except for the neutral-advanced and tendentious-elementary jokes with only a marginal ps of .059 and .075, respectively) showed significant effects; that is, the group that performed the humour comprehension task rated the jokes as less funny than those who did not perform the task (all with small effects). When investigating the individual jokes, 6 of the 20 jokes (30%) differed significantly between the groups (all with small to one with medium-sized effects). This pattern varied within the different joke categories, ranging from 0% of the tendentious-advanced jokes to 57% of the neutral-advanced jokes. The jokes with the largest effect was Joke 19.

3.2 How are humour comprehension and humour appreciation related?

The second research question concerns the relationship between humour comprehension and appreciation. The Spearman rank correlations between the total funniness and comprehension scores were non-significant ($\rho_p = .12, p = .09$). Separating the jokes according to content or difficulty revealed a mixed pattern: Comprehension and funniness of tendentious ($\rho_p = .09, p = .220$) and elementary jokes ($\rho_p = .03, p = .660$) did not correlate significantly. By contrast, comprehension and funniness were positively correlated for neutral ($\rho_p = .15, p = .040$) and advanced jokes ($\rho_p = .18, p = .010$). When separating the four joke categories, again a mixed pattern emerged: Comprehension and funniness of elementary-neutral ($\rho_p = .03, p = .640$) and advanced-tendentious ($\rho_p = .05, p = .460$) did not correlate significantly. By contrast, comprehension and funniness were positively correlated for neutral-advanced ($\rho_p = .24, p < .001$) and elementary-tendentious jokes ($\rho_p = .18, p = .010$). We also checked the scatterplots of each of these correlations, but no inverse u-function between comprehension and funniness was observed.

Table 2 shows the comparisons of individual jokes of the funniness ratings of the groups that understood vs. did not understand the joke (i.e., those who selected the correct punch line vs. those that chose one of the three alternative punch lines). Overall, 15 of the 20 jokes (75%) showed significant differences in funniness, with 7 effects being small (35%), 5 medium-sized (25%), and 3 large (15%). These percentages again differed depending on the joke category, ranging from 40% (tendentious-advanced) to 100% (tendentious-elementary). The largest differences were observed for jokes 18, 19, and 5.

Table 2

Descriptive statistics and mean comparisons of the funniness ratings of the groups that understood vs. did not understand the joke

Variables	Not understood			Understood			ANCOVA			
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>p</i>	η^2	Sig. covariates
N-E										
Joke 1	57	2.93	1.36	139	3.37	1.18	5.77	.017	.029	
Joke 2	8	2.50	1.07	188	3.13	1.26	4.79	.030	.022	Age
Joke 8	56	2.14	1.17	140	2.70	1.40	8.79	.003	.041	Gender & age
Joke 9	53	2.75	1.40	143	3.73	1.36	20.50	<.001	.094	Gender
Joke 16	9	3.33	1.73	187	3.95	1.38	2.01	.158		
N-A										
Joke 3	109	2.76	1.43	87	3.52	1.37	14.35	<.001	.069	
Joke 4	117	2.22	1.29	79	3.20	1.51	23.64	<.001	.109	
Joke 10	53	2.55	1.14	143	3.24	1.46	9.25	.003	.046	
Joke 11	71	2.21	1.18	125	3.33	1.55	26.77	<.001	.122	
Joke 15	176	2.70	1.31	20	2.35	1.50	1.32	.252		Gender
Joke 18	140	2.54	1.20	56	3.71	1.25	36.92	<.001	.159	
Joke 19	88	2.50	1.30	108	3.66	1.31	39.94	<.001	.156	Gender
T-E										
Joke 5	63	2.33	1.08	133	3.43	1.41	33.52	<.001	.143	Gender & age
Joke 12	47	2.17	1.05	149	2.96	1.55	8.78	.003	.041	Gender
Joke 13	47	2.26	1.11	149	2.56	1.42	5.77	.017	.029	
T-A										
Joke 6	41	2.76	1.32	155	3.06	1.46	1.73	.190		
Joke 7	96	3.00	1.52	100	3.44	1.45	5.17	.024	.024	Gender
Joke 14	47	3.17	1.34	149	3.44	1.38	1.81	.180		Gender
Joke 17	26	3.19	1.23	170	4.36	1.32	18.63	<.001	.085	Gender
Joke 20	109	2.33	1.27	87	2.67	1.39	2.80	.096		Gender

Notes. ANCOVA = analysis of covariance with age and gender as control variables and comprehension (understood vs. not understood) as independent variable, Sig. covariates = significant covariates, N-E = neutral-elementary, N-A = neutral-advanced, T-E = tendentious-elementary, T-A = tendentious-advanced.

4 Discussion

The present study aimed at better understanding the interplay between the comprehension and appreciation of jokes. Regarding the first research question, solving a joke completion humour comprehension task prior to rating stimuli for humour appreciation affected a third of the jokes under study and most total and category scores. Thus, employing a humour comprehension task before obtaining funniness ratings led to a small underestimation of the jokes' funniness and hence artificially lowered humour appreciation. Potentially, the cognitive problem-solving task detracted from experiencing amusement and hence lowered the funniness ratings. This effect was particularly prevalent for the neutral-advanced jokes, especially Joke 19, which reads as follows: "Wife to her husband: 'Go to the market and take 5 apples. If they have eggs, take 10 of them.' The husband goes to the market and asks: 'Have you got any eggs?' 'Yes'. 'Well, then 10 apples'".

The joke completion task employed in the present study is the prevalent assessment of humour comprehension in the literature. As this method has to precede humour appreciation

ratings, it is likely that the levels of humour appreciation have been underestimated in previous studies that employed this type of task. An open question is how this bias introduced by the humour comprehension task affects the relationship between humour comprehension and appreciation. Systematically comparing different methods of humour comprehension, best including methods that are administered before and after the humour appreciation ratings, would help to yield insights into this issue. Additionally, testing the convergent validity of these different humour comprehension tasks would be important, as the humour appreciation tasks could, in turn, also influence subsequent humour comprehension ratings.

The second research question targeted the relationships between the comprehension and funniness of the jokes. In line with previous studies that showed a positive relationship between these two humour domains (Cunningham and Derks 2005; Derks et al. 2007; Goldstein 1970; Kozbelt and Nishioka 2010; Masten 1986), the present study found higher funniness scores in 75% of the jokes when they were understood vs. not understood (with up to large effects). By contrast, at the abstract level across jokes, funniness and comprehension were unrelated. Dividing the jokes into the different categories helped to further clarify these contrasting findings: Comprehension and funniness scores of tendentious (especially advanced-tendentious) and elementary (especially elementary-neutral) jokes were unrelated, while the scores of neutral, advanced, and neutral-advanced jokes were positively correlated. A possible interpretation of these findings is that comprehension might be less relevant for tendentious contents, as they could already be enjoyed, or disliked, without resolving the punch line. For elementary jokes, most participants (more than two-thirds) chose the correct punch line, so these jokes did not pose a challenge to be understood. Surprisingly, elementary-tendentious jokes showed positive correlations between funniness and comprehension. Importantly, these correlations were all small, which further support the notion that comprehension can contribute, but is neither necessary nor sufficient for appreciation. No support was found for the cognitive congruency principle (McGhee 1976; Zigler et al. 1966; Zigler et al. 1967), which would have predicted an inverted-U relationship between funniness and comprehension.

Possible explanations can be brought forward regarding the jokes with medium-sized (rather than small) effects, that is, the jokes whose funniness was most affected by the humour comprehension task and that most depended on understanding the jokes. Although Jokes 18 and 19 were categorised as neutral-advanced, they can also be alternatively interpreted as tendentious if they are seen from a gender perspective. For example, Joke 19 (see above) is intended as a joke that plays with language, but it could also be construed as mocking the stupidity of men. Similarly, Joke 18 (“The wife of a professor of Logic has just delivered a baby. She asks her husband: ‘Is a she or a he?’ The husband replies: ‘Yes’”) plays with formal logic and language. However, the punchline could be interpreted as men tending to be accused by women of being wrong, and saying “Yes” to any question would be the preferred ‘safe’ response to avoid conflict. These different interpretations would affect the process of comprehension as well as appreciation, as the framework and previous knowledge activated by the joke would differ (Suls 1972). In the two jokes, these could range from playing with language and ideas (e.g. Raskin et al. 2009) to self-related humour (e.g. Hofmann 2018; Ruch and Beermann 2011) and sexist humour (e.g. Ford et al. 2008; Riquelme et al. 2021). Additionally, the ‘wrong’ options provided in the humour comprehension task could also be interpreted in a way that made sense to the individual participant, although it was classified as the wrong punch line (see Forabosco et al. 2020). These findings and potential explanations thus highlight the importance of considering the stimuli and the individuals reacting to the stimuli simultaneously (see Ruch and Hehl 2007).

4.1 Limitations and future directions

First, the present study focused on jokes, and it would hence be interesting to test if the conclusions also hold for other types of humorous stimuli (e.g., cartoons, memes, videos). Second, we did not distinguish different structures in jokes (i.e., incongruity-resolution and nonsense), which might interact with content and difficulty in influencing the relationship between comprehension and appreciation (Ruch 1983; Ruch and Hehl 2007). Third, we only assessed the positive response to humour (i.e., funniness). It is unclear to what extent the present findings can be generalised to negative responses (i.e., boredom and aversiveness/offensiveness; see Heintz 2020; Ruch and Rath 1993). Fourth, adding more open-ended measures of humour comprehension would enable investigating differences in how jokes are understood. The more abstract and complex a joke, the more likely it will elicit different or multiple interpretations. This might help explain some of the present findings regarding the neutral-advanced jokes 18 and 19 in the present study, as well as nonsense stimuli, which are inherently more ambiguous than incongruity-resolution stimuli. Fifth, age and gender were treated as control variables in the present study, which were especially relevant for tendentious jokes in line with previous literature (e.g., Hofmann et al. 2020). It would be interesting to systematically investigate the effect of other sociodemographic variables on the interplay between humour comprehension and appreciation in future studies. Furthermore, other individual-difference variables might influence the interplay between humour comprehension and humour appreciation, such as humorous temperament and mood (Ruch Köhler and Van Thriel 1996, 1997), intelligence (e.g. Feingold 1983), gelotophobia (the fear of being laughed at; Ruch, Hofmann, Platt and Proyer 2014), and preferences for certain comic styles (Ruch et al. 2018). Sixth, we conducted a large number of statistical analyses, which raises the issue of alpha-error accumulation. As the current study was mainly exploratory in nature, we decided to keep the traditional alpha-error value of 5% ($p < .05$), rather than applying more conservative corrections for multiple testing (see Bender and Lange 2001). Seventh, we employed a between-participant design for completing vs. not-completing the humour comprehension task. As the latter was only a small group, the results for the first research question could potentially be systematically biased. Hence, future studies could use two parallel versions of humorous stimuli to implement a within-participant design with two counterbalanced conditions (humour appreciation task with and without humour comprehension task). This would provide more robust and powerful evidence of the impact of humour comprehension on humour appreciation.

4.2 Conclusion

The present study showed that completing a joke completion humour comprehension task lowered subsequent funniness ratings. Additionally, humour comprehension and funniness showed only negligible or small correlations across jokes, while differences were more pronounced at the level of individual jokes. Jokes with neutral contents and which were advanced (i.e., more difficult to understand) showed the largest relationships between funniness and comprehension. Thus, considering the level of abstraction as well as the contents and difficulty of the jokes matter for the interplay between humour comprehension and appreciation.

5 References

- Adamczyk, Przemysław, Mirosław Wyczesany, Aleksandra Domagalik, Artur Daren, Kamil Cepuch, Piotr Błądziński, Andrzej Cechnicki, and Tadeusz Marek. 2017. Neural circuit of verbal humor comprehension in schizophrenia—an fMRI study. *NeuroImage: Clinical* 15, 525–540.
- Bartolo, Angela, Francesca Benuzzi, Luca Nocetti, Patrizia Baraldi, and Paolo Nichelli. 2006. Humor comprehension and appreciation: an fMRWI study. *Journal of Cognitive Neuroscience* 18(11), 1789–1798.
- Beermann, Ursula and Willibald Ruch. 2011. Can people really “laugh at themselves?”—Experimental and correlational evidence. *Emotion* 11(3), 492–501.
- Bender, Ralf, and Stefan Lange. 2001. Adjusting for multiple testing—when and how? *Journal of Clinical Epidemiology* 54(4), 343–349.
- Bergen, Doris. 2009. Gifted children’s humor preferences, sense of humor, and comprehension of riddles. *Humor: International Journal of Humor Research* 22(4), 419–436.
- Bower, Alexander H., and Mark Steyvers. 2020. An Aha! Walks into a Bar: Joke Completion as a Form of Insight Problem Solving. *Proceedings of the 42nd Annual Conference of the Cognitive Science Society (CogSci 2020)*, 3034–3040.
- Brownell, Hiram H., Dee Michel, John Powelson, and Howard Gardner. 1983. Surprise but not coherence: Sensitivity to verbal humor in right-hemisphere patients. *Brain and Language* 18(1), 20–27.
- Carretero-Dios, Hugo, Cristino Pérez, and Gualberto Buela-Casal. 2010. Assessing the appreciation of the content and structure of humor: Construction of a new scale. *Humor: International Journal of Humor Research* 23, 307–325.
- Chan, Yu-Chen. 2016. Neural correlates of sex/gender differences in humor processing for different joke types. *Frontiers in Psychology* 7, 536.
- Chan, Yu-Chen, Tai-Li, Chou, Hsueh-Chih Chen, Yu-Chu Yeh, Joseph P. Lavalley, Keng-Chen Liang, and Kuo-En Chang (2013). Towards a neural circuit model of verbal humor processing: An fMRI study of the neural substrates of incongruity detection and resolution. *Neuroimage* 66, 169–176.
- Cohen, Jacob. 1992. A power primer. *Psychological Bulletin* 112, 155–159.
- Cunningham, William A. and Peter Derks. 2005. Humor appreciation and latency of comprehension. *Humor: International Journal of Humor Research* 18, 389–403.
- Derks, Peter, Rosemary E. Staley, and Martie G. Haselton. 2007. “Sense” of humor: Perception, intelligence, or expertise? In: Willibald Ruch (ed), *The Sense of Humor: Explorations of a Personality Characteristic* (2nd ed.), pp. 143–158. Berlin: De Gruyter.
- Eysenck, Hans Jürgen (1942). The appreciation of humour: An experimental and theoretical study. *British Journal of Psychology* 32, 295–309.
- Eysenck, Hans Jürgen (1944). National differences in “sense of humor”: Three experimental and statistical studies. *Journal of Personality* 13, 37–54.
- Feingold, Alan. 1983. Measuring humor ability: Revision and construct validation of the Humor Perceptiveness Test. *Perceptual and Motor Skills* 56(1), 159–166.
- Ferguson, Mark A. and Thomas E. Ford. 2008. Disparagement humor: A theoretical and empirical review of psychoanalytic, superiority, and social identity theories. *Humor: International Journal of Humor Research* 21, 283–312.
- Freud, Sigmund. 1905. *Der Witz und seine Beziehung zum Unbewussten*. [The joke and its relation to the unconscious.] Vienna: Deuticke.
- Forabosco, Giovannantonio, Alberto Dionigi, Filippo Cioni and Sonja Heintz (2019). Barzellette: comprensione e divertimento. Uno studio preliminare. [Jokes:

- Comprehension and funniness. A preliminary study.] *Rivista Italiana di Studi sull'Umore* 2(2), 90–100.
- Forabosco, Giovannantonio, Alberto Dionigi, Filippo Cioni and Sonja Heintz (2020). Umore e intelligenza: Uno studio sperimentale. [Humor and intelligence. An experimental study.] *Rivista Italiana di Studi sull'Umore*, 3(1), 24–35.
- Ford, Thomas E., Christie F. Boxer, Jacob Armstrong, and Jessica R. Edell. 2008. More than “just a joke”: The prejudice-releasing function of sexist humor. *Personality and Social Psychology Bulletin* 34(2), 159–170.
- Greengross, Gil. 2020. Sex and gender differences in humor: Introduction and overview. *Humor: International Journal of Humor Research* 33(2), 175–178.
- Heintz, Sonja. 2020. Separating content and structure in humor appreciation: A bimodal structural equation modeling approach. *Journal of Individual Differences*, 41, 37–44.
- Hofmann, Jennifer. 2018. Putting “Laughing at yourself” to the test. *Humor: International Journal of Humor Research* 31(2), 273–286.
- Hofmann, Jennifer and Willibald Ruch. 2017. Humorous TV ads and the 3WD: Evidence for generalizability of humour appreciation across media? *The European Journal of Humour Research*, 5(4), 194–215.
- Hofmann, Jennifer, Tracey Platt, Chloe Lau and Jorge Torres-Marín. 2020. Gender differences in humor traits, appreciation, production, comprehension, (neural) responses, use, and correlates: A systematic review. *Current Psychology*. <https://doi.org/10.1007/s12144-020-00724-1>
- Kozbelt, Aaron and Kana Nishioka. 2010. Humor comprehension, humor production, and insight: An exploratory study. *Humor: International Journal of Humor Research* 23(3), 375–401.
- Martin, Rod A. and Thomas E. Ford. 2018. *The psychology of humor: An integrative approach* (2nd ed.). Oxford: Academic Press.
- McGhee, Paul E. (1971). The role of operational thinking in children's comprehension and appreciation of humor. *Child Development* 42(3), 733–744.
- McGhee, Paul E. 1976. Children's appreciation of humor: A test of the cognitive congruency principle. *Child Development* 47(2), 420–442.
- Perchtold-Stefan, Corinna M., Ilona Papousek, Christian Rominger, Magdalena Schertler, Elisabeth M. Weiss and Andreas Fink. 2020. Humor comprehension and creative cognition: Shared and distinct neurocognitive mechanisms as indicated by EEG alpha activity. *NeuroImage*, 116695.
- R Core Team (2020). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>
- Raskin, Victor, Christian F. Hempelmann, and Julia M. Taylor. 2009. How to understand and assess a theory: The evolution of the SSTH into the GTVH and now into the OSTH. *Journal of Literary Theory* 3, 285–311.
- Revelle, William (2020). *psych: Procedures for Personality and Psychological Research*, Northwestern University, Evanston, Illinois, USA, <https://CRAN.R-project.org/package=psych> Version = 1.9.12.31.
- Riquelme, Andrés R., Hugo Carretero-Dios, Jesús L. Megías, and Mónica Romero-Sánchez. 2021. Joking for gender equality: Subversive humor against sexism motivates collective action in men and women with weaker feminist identity. *Sex Roles* 84(1-2), 1–13.
- Rodden, Frank A. 2018. The neurology and psychiatry of humor, smiling and laughter: A tribute to Paul McGhee. Part I. Introduction and clinical studies. *Humor: International Journal of Humor Research* 31(2), 339–371.

- Rodden, Frank A. 2018. The neurology and psychiatry of humor, smiling, and laughter: a tribute to Paul McGhee Part II. neurological studies and brain imaging. *Humor: International Journal of Humor Research* 31(2), 373–399.
- Ruch, Willibald. 1992. Assessment of appreciation of humor: Studies with the 3 WD Humor Test. In Charles D. Spielberger and James N. Butcher (eds.), *Advances in personality* (pp. 27–75). Hillsdale: Lawrence Erlbaum Associates.
- Ruch, Willibald (ed.). 2007. *The sense of humor: Explorations of a personality characteristic* (2nd ed.). Berlin: Mouton de Gruyter.
- Ruch, Willibald 2012. Towards a new structural model of the sense of humor: Preliminary findings. In Victor Raskin and Julia M. Taylor (Chairs), *Artificial Intelligence of Humor: Papers from the 2012 AAAI Fall Symposium* (AAAI Technical Report FS-12-02, pp. 68–75).
- Ruch, Willibald and Franz-Josef Hehl. 2007. A two-mode model of humor appreciation: Its relation to aesthetic appreciation and simplicity-complexity of personality. In Willibald Ruch (ed.), *The sense of humor: Explorations of a personality characteristic* (2nd ed., pp. 109–142). Berlin: Mouton de Gruyter.
- Ruch, Willibald, Jennifer Hofmann, Tracey Platt, and René Proyer. 2014. The state-of-the art in gelotophobia research: A review and some theoretical extensions. *Humor: International Journal of Humor Research* 27(1), 23–45.
- Ruch, Willibald, Gabriele Köhler, and Christoph Van Thriel. 1996. Assessing the “humorous temperament”: Construction of the facet and standard trait forms of the State-Trait-Cheerfulness-Inventory—STCI. *Humor: International Journal of Humor Research* 9 (3-4), 303–340.
- Ruch, Willibald, Gabriele Köhler, and Christoph Van Thriel. 1997. To be in good or bad humour: Construction of the state form of the State-Trait-Cheerfulness-Inventory—STCI. *Personality and Individual Differences* 22(4), 477–491.
- Ruch, Willibald, Paul E. McGhee and Franz-Josef Hehl. 1990. Age differences in the enjoyment of incongruity-resolution and nonsense humor during adulthood. *Psychology and Aging* 5(3), 348–355.
- Ruch, Willibald and Tracey Platt. 2012. Separating content and structure in humor appreciation: The need for a bimodal model and support from research into aesthetics. In Anton Nijhold (Ed.), *3rd International workshop on computational humor* (pp. 23–27). Amsterdam: University of Amsterdam.
- Ruch, Willibald and Sigrid Rath. 1993. The nature of humor appreciation: Toward an integration of perception of stimulus properties and affective experience. *Humor: International Journal of Humor Research* 6, 363–384.
- Ruch, Willibald, Sonja Heintz, Tracey Platt, Lisa Wagner, & Rene T. Proyer. 2018. Broadening humor: Comic styles differentially tap into temperament, character, and ability. *Frontiers in Psychology* 9, 6.
- Samson, Andrea C., Stefan Zysset and Oswald Huber. 2008. Cognitive humor processing: different logical mechanisms in nonverbal cartoons—an fMRI study. *Social Neuroscience* 3(2), 125–140.
- Semrud-Clikeman, Margaret and Kimberly Glass. 2008. Comprehension of humor in children with nonverbal learning disabilities, reading disabilities, and without learning disabilities. *Annals of Dyslexia* 58(2), 163–180.
- Suls, Jerry. 1983. Cognitive processes in humor appreciation. In Paul E. McGhee & Jeffrey H. Goldstein (eds.), *Handbook of humor research* (pp. 39–57). New York: Springer.
- Uekermann, Jennifer, Irene Daum, and Shelley Channon. 2007. Toward a cognitive and social neuroscience of humor processing. *Social Cognition* 25(4), 553–572.
- Wierzbicki, Michael and Richard D. Young. 1978. The relation of intelligence and task difficulty to appreciation of humor. *The Journal of General Psychology* 99. 25–32.

- Wu, Ching-Lin, Lei-Pin Tseng, Chih-Pei An, Hsueh-Chih Chen, Yu-Chen Chan, Chen-I Shih, and Shu-Ling Zhuo. 2014. Do individuals with autism lack a sense of humor? A study of humor comprehension, appreciation, and styles among high school students with autism. *Research in Autism Spectrum Disorders* 8(10), 1386–1393.
- Zigler, Edward, Jacob Levine and Laurence Gould. 1966. Cognitive processes in the development of children's appreciation of humor. *Child Development* 37, 507–518.
- Zigler, Edward, Jacob Levine and Laurence Gould. 1967. Cognitive challenge as a factor in children's humor appreciation. *Journal of Personality and Social Psychology* 6, 332–336.

Appendix. 20 jokes (ad-hoc translations from the original Italian jokes)

Joke 1:

Two thieves are getting out of prison. One asks to the other: “Shall we take something?”
“From whom?”

[“take” in Italian may refer to, say, having a coffee and also to stealing]

Joke 2:

What is the city spiders love most? Moscow

[Mosca=fly]

Joke 3:

Cos’è una banana? Una badonna babassa babassa.

[it plays on repeating “ba” before donna – woman, nana – dwarf , and before bassa – short]

Joke 4:

Cartesio is sitting in a bar. The bartender asks him whether he would like another drink.
Cartesio replies: “I don’t think...”, and suddenly he disappears.

Joke 5:

“Dad, mum is bad!” Don’t say so, it is not nice!” “But dad, mum is really bad!” “Fine, she is bad, but you are going to eat her all the same!”

Joke 6:

“Your Honor, the defendant is a poor orphan. Please, don’t be too severe judging him for the murder of his parents.”

Joke 7:

A guy speaks to a Chinese couple on their honeymoon. “The situation in China is peculiar. When did you have your last elections?” “Just before breakfast!”

Joke 8:

Mum to her child: “Eat the meat!” “I don’t like the meat. I want a hamburger”.

Joke 9:

“Come inside, it is raining!” “No, it is raining also outside.”

Joke 10:

Se russi ti picchio, se ucraini ti falco.

[Russi = Russian/snore, picchio=beat, ucraini = ukrainian falco = hawk]

Joke 11:

I can’t stand people who leave a sentence in

Joke 12:

“Little child, why are you crying?” “My mum took the kittens to be drowned!” “Such a horrible thing!” “Yeah, she said that I could have drowned them!”

Joke 13:

The baby kept crying. But the mother wouldn’t have changed him for all the gold in the world. Maybe if she had changed him he would have stopped crying.

Joke 14:

Husband to the cold wife while making love: "Dear, did I hurt you?" "No, why?" "You moved for a moment".

Joke 15:

One. How many clairvoyants does it take to change a light bulb?

Joke 16:

"Mum, there is a hair in my soup!" "That's impossible, I made it with peeled tomatoes!"
[peeled tomatoes = pelati = bold men]

Joke 17:

How many horns has a bull? It depends on the cow.
[Having horns=being cheated at]

Joke 18:

The wife of a professor of Logic has just delivered a baby. She asks her husband: "Is a she or a he?" The husband replies: "Yes".

Joke 19:

Wife to her husband: "Go to the market and take 5 apples. If they have eggs, take 10 of them." The husband goes to the market and asks: "Have you got any eggs?" "Yes". "Well, then 10 apples".

Joke 20:

An expecting mother to the doctor who is doing an echography: "Well?" "First the good news. He won't have parking problems!"