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# Identifying Groups of Trust in Science in South Africa and Germany: A Comparative Study

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## Introduction

Public trust in science is among the critical variables for science communication as it is crucial to align the public's behaviour with scientific information—especially during crises such as the COVID-19 pandemic (Algan et al., 2021; Dohle et al., 2020; Plohl & Musil, 2021). A stable level of trust in science may increasingly be challenged by heterogeneous online content (e.g., Neuberger, 2014). This will potentially lead to the

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formation of diverse digitised publics (Bruns, 2023) and affect public trust in science (e.g., Weingart & Guenther, 2016). Nowadays, a large part of the public primarily obtains science-related information online—including content in journalistic online media and also social media (e.g., European Commission, 2021).

Although national differences may exist regarding the use of online media, perceptions of science and trust in science, the perspectives of Western countries often dominate science communication literature (Peters, 2022). This chapter tries to broaden the Western perspective through a cross-national comparison between South Africa (ZA) and Germany (DE). The two countries differ considerably in the demographic structure of the population (Statistisches Bundesamt, 2023; Stats SA, 2020), exposure to and attitudes towards science (e.g., Reddy et al., 2013; Wissenschaft im Dialog, 2021) as well as the use of social media (DataReportal, 2022). For example, the ZA population is significantly younger than the DE population and more actively uses social media—also regarding scientific topics.

After a brief section about the relevance of social media use for public trust in science, we will further elucidate the differences between the two countries as a basis for a cross-national comparison (see also Chapter 22). We will then present and compare results from online user typologies in ZA ($n$ = 1,541) and DE ($n$ = 4,440) based on different dimensions of trust in scientists (expertise, integrity, benevolence, transparency and dialogue orientation; Reif & Guenther, 2022; Reif et al., 2024b; see also

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Chapter 19). These groups are further compared regarding the frequency of contact with science via different information channels—including social media. We will discuss the findings with reference to national and cultural differences and the COVID-19 pandemic.

## Trust in Science and the Use of Social Media

In recent years, the growing importance of online platforms, especially social media, and their implications for science communication have been the focus of extensive scholarly discourses. Within these discussions, there is a critical consideration of potential adverse impacts on trust in science, attributed to the multitude of actors and their respective strategic interests (Huber et al., 2019; Weingart, 2017; Weingart & Guenther, 2016). After all, the heterogeneity of online content (e.g., Neuberger, 2014) includes false information and conspiracy narratives that spread particularly quickly through social media (Mahl et al., 2022).

However, social media also facilitate access to and exchange with science (e.g., Taddicken & Krämer, 2021), contributing to more transparency and potentially strengthening trust in science (Reif, 2021). For instance, even among people with little interest in a scientific topic, such as climate change, digital science communication can raise awareness regarding the issue (Taddicken & Reif, 2016). Contrasting trends in the use of social media are thus emerging, which could be reflected in individual differences in one's trust relationship with science. Here, typologies provide a useful approach to consider the increasing individualisation on the group level. So far, studies about audiences of science communication found four to six population groups that differ regarding their attitudes towards science and exposure to scientific information. More specifically, groups with the most positive attitudes or—if considered as variable—the highest trust in science use more diverse ways of contact with science most frequently. In contrast, the groups with rather science-sceptical tendencies are the smallest groups with the lowest exposure to science and less diverse interactions with science (Guenther & Weingart, 2018; Schäfer et al., 2018).

Heterogeneous online content regarding science-related information increased during the COVID-19 pandemic, which can be considered the first major pandemic "in the era of widespread social media" (Eichengreen et al., 2021, p. 10). The World Health Organisation (2021) coined the phrase "infodemic", which describes the vast amount and spread of online information, including substantial misinformation. Therefore, a potential decrease in public trust in science was publicly and scientifically debated.

## Comparison Between South Africa and Germany

Here, we will compare ZA and DE as they differ considerably regarding demographics, exposure to science (Guenther et al., 2022; Wissenschaft im Dialog, 2021), social media use and conspiracy beliefs (Ibbetson, 2021). With this approach, we want to highlight the non-western perspective.

### General Structure and Demographics

ZA is located in the southernmost part of Africa and is considered a middle-income country. DE is situated in Central Europe, in the Northern Hemisphere, and is regarded as the world's third-largest economy. Despite being much smaller in land area, DE has a larger population than ZA (84 million compared to 60 million; Stats SA, 2020). The ZA population, however, is remarkably diverse regarding ethnic and cultural backgrounds, which is reflected in their eleven official languages, compared to the one official language of DE (German). Also, the two countries show interesting differences regarding the cultural dimensions defined by Hofstede (2011) that may be connected to public trust in science (see Huber et al., 2019). While DE is a highly individualistic country and high in uncertainty avoidance, it is low in power distance. In contrast, SA is a collectivistic country of low uncertainty avoidance and high power distance. Another significant difference is the age structure of the populations. ZA has a relatively young population and only a small proportion of people over the age of 60 (9%; Stats SA, 2020), the German population is ageing and has a much higher proportion of people over 60 (35%; Statistisches Bundesamt, 2023).

## Exposure to and Role of Science

One of the significant differences between the countries is that ZA is characterised by large rural areas that are spatially as well as culturally distant from science (Guenther et al., 2018). Across the country, there are 26 public universities and considerable disparities in access to quality education when compared to the urban areas. In DE, education is generally free, and according to the German Federal Ministry of Education and Research (BMBF, 2023), almost 1,000 universities and research institutes exist throughout the country, reflecting a generally significant role of science and a strong emphasis on research and innovation.

According to the annual science barometer, people in DE held a consistently moderate level of trust in science until 2019. With the start of the pandemic, however, the percentage of respondents who stated a complete trust in science has quadrupled (9% in 2019, 36% in 2020), which indicates that the pandemic has been a pivotal experience for public trust in science. Three years later, the survey still shows a somewhat higher level of public trust in science compared to the 2019 values (Wissenschaft im Dialog, 2023). There is no comparable longitudinal data available for ZA. However, some studies note that the ZA public is considered unique regarding perceptions of science and technology, as people in ZA have more substantial reservations about science, the more they believe in the promises of science (Guenther & Weingart, 2016; Guenther et al., 2022; Reddy et al., 2013).

## The Use of Social Media

Due to structural differences in access to the internet, the rate of social media users is lower in ZA (46%) compared to DE (87%). Nevertheless, in ZA, average daily social media use is more than twice as high (3 h

43 min) as in DE (1 h 29 min; DataReportal, 2022). The population of ZA also holds stronger beliefs in conspiracy theories commonly spread via social media. While 68% of the ZA population believes that secret organisations control the world, only 31% of the German population agrees with that statement (Ibbetson, 2021).

Based on these structural and cultural differences between the countries, we want to examine the following research questions (RQs):

RQ1: Which groups of trust in science can be identified among South African and German online users?
RQ2: How do these trust groups differ regarding the frequency of their contact with science?

# Data and Method

## Sampling

We conducted similar online surveys in ZA and DE on the public perceptions of science using online access panels (*Ask Afrika* for ZA, *YouGov* for DE). Several structural differences need to be mentioned, as they may have affected the data. The time of data collection for the ZA study was at the end of 2020 and, thus, at the beginning of the second wave of the COVID-19 pandemic. The German survey was conducted at the end of the fifth wave of the pandemic in March/April 2022. The sample sizes differ vastly ($n_{ZA}$ = 1,624; $n_{DE}$ = 4,824) because the DE survey was embedded within a larger project. Despite the eleven official languages in ZA, the questionnaire was only distributed in English. In DE, the survey was conducted in German. Regardless of the applied quota plans,[1] the ZA sample considerably deviated from the population (Stats SA, 2020), whereas the DE sample was representative for the quoted variables (Statistisches Bundesamt, 2023). It should be noted that the sample for ZA was significantly more highly educated (63%

[1] For ZA: Age, gender, province, geographical setting, population group; for DE: age, gender, region (federal state).

had a college certificate or university degree) than that for DE (30%). In the ZA sample, the mean age was 34 years; in the DE sample, it was 51 years (for detailed descriptions of the methods see Reif et al., 2024a, 2024c).

## Measures

For both surveys, we used similar measures with 5-point rating scales to allow a comparison of the countries. Few differences, however, resulted from the translation of items and the measures being further developed in the almost year and a half between the two surveys.

In both countries, trust in science was measured (1) by four items addressing three different levels of trust in science as direct measures by asking, "*How much do you trust in…*": scientists in general (micro-level), scientists at universities and research institutes (meso-level 1), scientists in private companies/industry (meso-level 2) and science (macro-level). The response scale ranged from 1, "do not trust at all", to 5, "trust a great deal". (2) Our key measures of trust in science addressed the five theoretical dimensions captured as reasons to trust in scientists (micro-level, see also Chapter 19). Based on the research literature (Besley et al., 2021; Hendriks et al., 2015; Reif & Guenther, 2022; Wissenschaft im Dialog, 2021), we measured scientists' perceived expertise, integrity, benevolence, transparency and dialogue orientation with the public using the Public Trust in Science (PuTruS) scale with two or three items each in ZA and three items each in DE (Reif et al., 2024b). Each item was developed to complete the statement "*Scientists can be trusted because they…*" and could be answered with 1, "strongly disagree", to 5, "strongly agree". One example of an item to determine expertise was "*…are real experts in their particular fields*" for ZA ($\alpha = 0.72$)[2] and "*…are experienced experts in their particular topic*" for DE ($\alpha = 0.89$). Among other items, in both surveys, integrity was measured with the item "*…adhere to strict rules and standards in their work*" ($\alpha_{ZA} = 0.77$; $\alpha_D = 0.85$) and benevolence with the item "*…work for the common good*" ($\alpha_{ZA} = 0.79$; $\alpha_{DE} = 0.85$).

[2] Cronbach's alpha was used to measure the internal consistency (reliability) of the scale per dimension of trust in science.

One example of the transparency items was "*…regularly inform the public about relevant and important results of their research*" for ZA ($\alpha = 0.83$) this was slightly adjusted in the German sample to "*…inform the public about relevant results of their research*" ($\alpha = 0.82$). Similarly, measures for dialogue orientation differ slightly between the countries: e.g., "*…listen to public opinions on their topics and research*" for ZA ($\alpha = 0.79$), "*…listen to what the public thinks about their topic and their research*" for DE ($\alpha = 0.86$).

We also asked respondents, "*How often do you hear about science through the following?*" and offered an extensive item battery with diverse ways of being informed about science and scientific issues. For each type of contact, respondents stated how often they used it from 1, "never", to 5, "very often". The different types of contact with science were theoretically based on Reif and Guenther (2022), including direct contact with science (e.g., *conversations with scientists*; $\alpha_{ZA} = 0.84$; $\alpha_{DE} = 0.81$), contact via social agents (*conversations with others, such as family, colleagues or friends*), via journalistic media (e.g., *TV, radio*; $\alpha_{ZA} = 0.83$; $\alpha_{DE} = 0.79$), or social media (e.g., *blogs, social networking sites*; $\alpha_{ZA} = 0.85$; $\alpha_{DE} = 0.84$).[3]

## Data Analyses

We used mean indices for the five dimensions of trust in science and conducted a latent profile analysis (LPA) with both samples in *RStudio* (*tidyLPA*). This method assumes the existence of an unobserved categorical variable dividing the population into distinct groups (latent profiles). Based on the selected variables, an LPA model identifies the appropriate number of latent profiles and clusters most similar cases. Our analyses revealed four distinct groups for ZA and five groups for DE. Due to missing values, the final sample size for ZA was $n = 1{,}541$ and $n = 4{,}440$ for DE. We calculated Analyses of Variance (ANOVAs) for the trust

[3] See Guenther et al. (2022) for further information.

measures to answer the first RQ to compare the means per country and group. We repeated the same procedure for the second RQ's frequency of contact with science.

## Results

### Groups of Trust in Science Among Online Users in ZA and DE (RQ1)

According to the means, respondents in the ZA sample reported higher trust in scientists in general ($M = 3.95$; $SD = 1.02$), scientists working at universities ($M = 4.08$; $SD = 0.97$) and science as a functional system ($M = 3.99$; $SD = 0.96$) than respondents in the German sample (about half a scale point, $M = 3.40, 3.57, 3.60$; $SD = 0.92, 1.00, 0.99$). In ZA, trust in scientists in private companies/industry ($M = 3.87$; $SD = 1.07$) exceeded the level in DE ($M = 2.93$; $SD = 0.97$) by a whole scale point. While people in ZA, in general, hardly distinguished between the levels, respondents in DE especially trusted in the functional system of science and university scientists but showed the least trust in scientists in the private industry.

Regarding the five dimensions that specify trust at the micro-level, ZA respondents reported higher agreement than DE respondents. For benevolence ($M_{ZA} = 3.74$; $SD_{ZA} = 1.06$; $M_{DE} = 3.12$; $SD_{DE} = 0.98$), transparency ($M_{ZA} = 3.59$; $SD_{ZA} = 1.00$; $M_D = 3.09$; $SD_{DE} = 0.95$) and dialogue orientation ($M_{ZA} = 3.53$; $SD_{ZA} = 1.11$; $M_{DE} = 2.97$; $SD_{DE} = 0.96$), the values in the ZA sample exceed the values in the DE sample by half a scale point. For integrity ($M_{ZA} = 3.73$; $SD_{ZA} = 1.04$; $M_{DE} = 3.37$; $SD_{DE} = 0.98$), the difference is smaller, and for expertise ($M_{ZA} = 3.74$; $SD_{ZA} = 0.89$; $M_{DE} = 3.69$; $SD_{DE} = 0.93$), there is no significant difference between the countries. Respondents in DE, therefore, differ considerably regarding the levels of trust in science and, taking a closer look at the micro-level, also regarding the dimensions.

The different trust groups we found for the two countries revealed some similarities but also differences in their patterns of dimensions of trust in scientists (see Fig. 20.1). For ZA and DE, the LPAs identified one group of people *fully trusting* science at the different levels with high values on the five dimensions, one group *highly trusting*, one *moderately trusting* group and one group that was *rather untrusting*. A fifth group was found for DE that was *untrusting*. In ZA, the *fully* and *highly trusting* shared a similar dimensional pattern. They especially agree that scientists can be trusted because they work for the common good (benevolence). They showed slightly weaker agreement with scientists' expertise and practices of dialogue with the public as reasons to trust them. For DE, the *fully trusting* especially differ in their patterns from the other groups identified. Their values on expertise are not as high in contrast to the other dimensions. For all other groups (*highly trusting* [DE], *moderately trusting* [ZA, DE], *rather untrusting* [ZA, DE], *untrusting* [DE]), expertise showed the highest values, while the other dimensions had lower values. The most considerable disparity between the agreement to scientists' expertise as reasons to trust them and the other dimensions emerged in the *rather untrusting* groups in both countries.

Considering the differences between the identified ZA and D trust groups as well as the demographic sample differences, we still wanted to compare the frequencies of the groups (see Fig. 20.1). In the ZA sample, the largest groups were the *highly trusting*, followed by the *fully trusting* and the *moderately trusting*. For DE, the *moderately trusting* formed the largest group, followed by the *highly trusting*. In ZA, the *rather untrusting* was the smallest proportion in the sample; in DE, the *untrusting* built the minority. The group of *rather untrusting* in DE was even slightly larger than the *fully trusting*. In sum, the most substantial difference in the distribution of the groups between ZA and DE was present for the *fully trusting* and the fact that the *untrusting* group found for DE was not identified in the ZA sample.

## The Trust Groups' Contact with Science in ZA and DE (RQ2)

The groups varied in their trust assessments and frequencies of using diverse types of contact with science (direct, mediated by social agents, journalistic media and social media). The general tendency here was

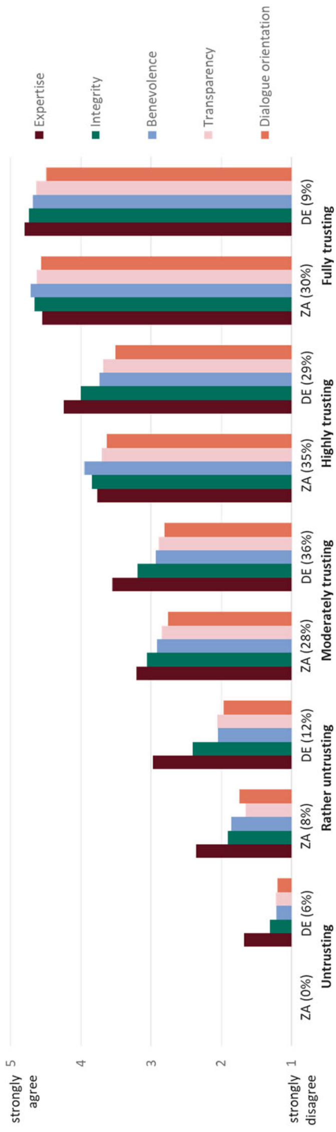


**Fig. 20.1** Description of trust dimensions (means) for the groups per country

the same for ZA and DE, indicating that people who trusted more in science had more frequent exposure to it (and vice versa; see Fig. 20.2). In both countries, respondents indicated that they heard about science and scientific information most often by talking to other people. Direct conversations with scientists and different ways of contact were the least frequent. While for ZA, social media was used slightly more frequently than journalistic media, it was the other way around in DE, and the differences were more pronounced.

In general, the differences between the types of contact were greater for the DE sample. In ZA, respondents indicated being in contact with science and scientific information much more regularly than in the DE sample.

As an additional information, right-wing populist media were considered in the DE survey, which is why we could detect the interesting tendency that the *untrusting* group reported the highest frequency of

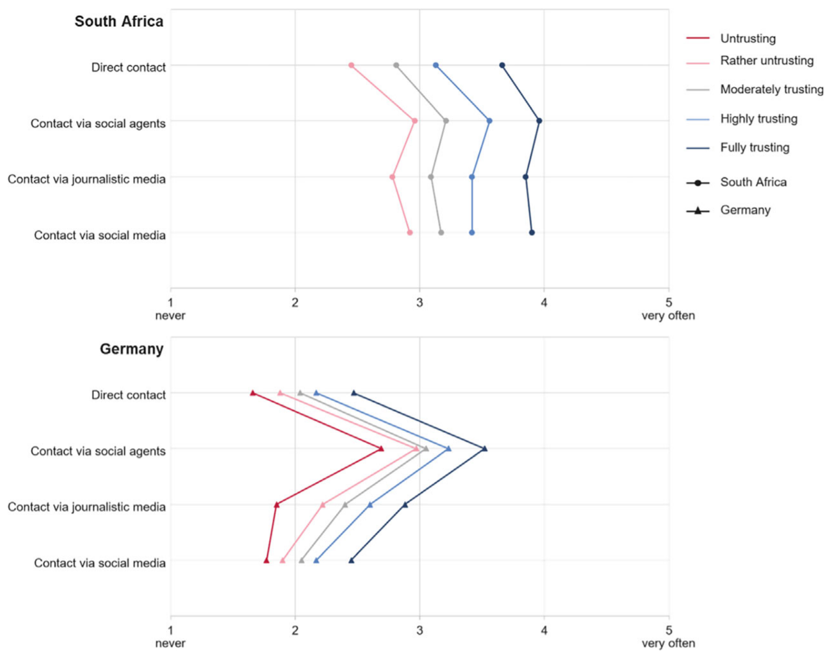


**Fig. 20.2** Frequency of contact with science (mean) for the groups per country

interacting with so-called alternative media. For the *untrusting,* it was the second most common way of being in contact with science after conversations with social agents.

## Discussion and Conclusion

In this chapter, we compared the results of two LPAs conducted for online samples in ZA and DE to identify different groups of online users in both countries concerning their trust in science. We expanded research by a cross-national comparison using similar measures of the dimensions of how and why people trust scientists and their use of scientific information.

First, we found four similar groups within ZA and DE online users according to their levels of trust in science (from lowest to highest, RQ1): *rather untrusting, moderately trusting, highly trusting* and *fully trusting* groups. In both countries, the *rather untrusting* and *moderately trusting* indicated the highest trust values on expertise. The emphasis on expertise in the DE sample was higher in general. The *fully trusting*, by contrast, gave similar value to all five dimensions as reasons to trust scientists. The differences in the ZA sample were more minor. For the *highly trusting*, the dimensional patterns varied between the countries. In DE, this group revealed the strongest agreement to scientists' expertise; in ZA, benevolence was the most agreed upon. One potential explanation for why less trusting groups exhibit higher values only for expertise might be their overall low level of general trust. It could also suggest that all five dimensions of trust are crucial for public trust in science, as posited theoretically. In contrast, expertise represents a fundamental component of trust in scientists that is less questioned by the public. The varying values observed for benevolence and other non-expertise dimensions across countries may stem from cultural differences. For instance, ZA, being a collectivist country according to cultural dimensions identified by Hofstede (2011), may foster the belief that scientists work for the benefit of the community, whereas DE, characterised as individualistic, may lean towards perceiving scientists as being driven by individual interests. Further comparative research is needed to test this hypothesis. With

DE also scoring high on uncertainty avoidance, the strategy to compensate for uncertainty may be a strong reliance on expertise (Hofstede, 2011).

Interestingly, we only found a group *untrusting* in science in DE. Furthermore, the least trusting groups in both countries were the smallest. While for DE, the *fully trusting* was the second smallest group, in ZA, they were the second largest. In DE, the largest group was the *moderately trusting*; in ZA, the *highly trusting* group was most prevalent. However, the demographic differences of the samples must be kept in mind. The DE sample of online users was similar to the DE population in terms of formal education, and the ZA sample was strongly skewed towards highly educated people, which may have contributed to our empirical differences. Thus, the survey may have received limited or no responses from individuals in the ZA population who trust less in science. However, it is also reasonable to assume differences in cultural dimensions as a possible explanation. The fact that ZA is a country with high values of power distance, whereas DE is low on this cultural dimension and thus more likely to question authority, seems intriguing and may reflect, in general, difference in public trust in science worthy of further research (see Hofstede, 2011).

Lastly, our results suggested that the level of public trust in science may correlate with a higher frequency of exposure to diverse types of science communication (RQ2; Guenther & Weingart, 2018; Schäfer et al., 2018). However, we found more frequent direct contact with science and use of journalistic media and social media for science-related information within the ZA sample. In both countries, social agents such as family and friends were the most frequently used contacts with science. Social media played a more important role in ZA compared to DE which may suggest a beneficial impact on public trust in science as opposed to a decline of public trust in science. The differences between the samples may also be cultural or due to the demographic sample structure. Another possible reason is the time of data collection, which was in the first year of the COVID-19 pandemic in ZA. The general tendency of a possible positive correlation between the frequency of exposure to science and trust in science may indicate the presence and beneficial impact of trust cues in science-related content addressing the five dimensions of trust in science outlined in another study (see Chapter 19). Additionally, it may imply that the measures employed here effectively capture informed trust in science (see Bromme, 2020).

When interpreting these results, several limitations need to be considered. First and foremost, the periods of data collection varied between the countries. Both surveys took place during the COVID-19 pandemic. However, the data collection in ZA was at the beginning of the second wave and before the vaccine had been developed in November 2020. For DE, data was collected during the fifth wave in March/April 2022 and after the vaccine roll-out. The timing may have contributed to the differences between ZA and DE that have been found. We cannot account for possible changes over time within one sample, as we have only presented cross-sectional data. Longitudinal research on how different trust groups are changing over time is needed. Furthermore, using online access panels for data collection and mainly quoting for gender, age and region resulted in a highly educated sample for ZA deviating from the overall population. Another possible variable that may have contributed to the skewed sample regarding formal education is that we only applied the questionnaire in English, neglecting the other ten official languages. For DE, due to the much higher overall online access, the level of formal education is better reflective of the DE population.

Despite these limitations, our findings show comparable but somewhat different groups of trust in science for ZA and DE that also differ regarding their frequency of contact with science. We would like to highlight the necessity for further cross-national comparisons (see also Chapter 22) and targeted science communication. Future research should also explore more deeply how the COVID-19 pandemic has affected public trust in science.

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**Research Ethics Statement** The survey conducted in ZA received ethical approval from Stellenbosch University (National Health Research Ethics Committee (NHREC) registration number: REC-050411-032, project number: 19084). In Germany, the Technische Universität Braunschweig's ethics committee was consulted, but ethical approval was deemed unnecessary. Utilising online access panels (Ask Afrika, YouGov) ensured that researchers did not have access to respondents' personal information, such as names and contact details. YouGov is certified to ISO 27001.

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