

Personality assessment in human and nonhuman species

Towards an integrating approach of psychology and biology

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Abstract

An overarching framework which integrates personality assessments from biology and psychology has not yet been developed. Personality is a term addressing the differences among individuals in biology and psychology. The questions of interest and point of view differ between the two domains. Psychology uses questionnaires based on language, where the most prominent one is the Big Five factors analyses, which analyses five personality dimensions in humans. Studies on animal personalities are relatively young and often based on behavioural measurements in biology. The methods differ in a way that makes it very difficult to compare humans with animals. Research indicates that animals have a personality which in some domains similar with humans, but too different in order to be measured with the Big Five. The theoretical method called the behavioural repertoire bottom-up approach first looks at the spontaneous behaviour after which the trait domains are identified. This method might be a starting point in the development of an overarching framework.

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Introduction

Creating an integrated method of assessing personality is a hot topic today, since an overarching framework, which can cover humans as well as animals, does not yet exist. The discussion about the characteristics of such a framework is very recent. Personality is a term used in both in the biological and psychological domain. Although both fields are interested in behavior, they still have their own focus. Both domains have their own point of view on this topic. For psychologists personality is a term concerting human beings. They are interested in questions like the relationship between personality and academic performance, well being, identity and so on. Biologists seem to focus more on the personality observed in animals and the context is ecological, where adaptation, fitness consequences and evolution play important roles.

Although both disciplines look at a subject that bares the same name, the methods of research could not be more different. An overarching framework that explains personality in humans as well as animals does not exist. Is it possible to create an overarching theoretical and methodological framework for personality assessment in human and nonhuman species? The diversity among species is enormous, making it quite challenging to find a fitting methodology.

Why is it important to create such a framework? When personality can be studied in humans and nonhuman species, using the same methodology, that would be great way to make comparisons across species different phylogenies, ecologies and social systems.

Although animals may not seem to be very useful in the understanding of personality in *humans*, this does not have to be the case. In history Pavlov, Tolman and Skinner already used animals in studies of learning and Thorndike and Kohler for problem-solving and Harlow on attachment¹. A methodological approach on assessing personality in animals and humans might help to understand the possible evolutionary origin of personality traits and their

genetics. By comparing ourselves to animals we might understand better what makes us human.

In order to explore the possibilities of making an overarching framework both domains contributing to personality in humans and animals, namely psychology and biology, have to be addressed. Their definition on personality will be compared, for it is important that both fields discussing the same subject. Then the way of doing research will be briefly described and compared. After this some remarks will be given about the attempt of integrating the both domains so far. At the end of this paper there is a discussion on the question whether it is possible and achievable to gain more insight into personality by making a comparative approach in human and nonhuman species.

Comparing the definition ‘personality’

In order to construct an overarching framework it must first be determined whether psychologists and biologists are talking about the same subject when speaking of ‘personality’.

According to the *Gale Encyclopedia of Psychology* the definition of personality is: “The unique pattern of psychological and behavioural characteristics by which each person can be distinguished from other people”. This encyclopedia also claims that the explanations of all mental and behavioural processes in humans can be considered theories of personality and that these theories describe personal characteristics and behaviour².

In the book *Personality Psychology* authors Randy J. Larsen and David M. Buss defines personality as follows: “Personality is the set of psychological traits and mechanisms within the individual that are organized and relatively enduring and that influence his or hers interactions with, and adaptations to, the intrapsychic, physical, and social environment.” Personality traits are stable, relatively permanent characteristics which refer to an aspect of personality and can therefore be used to address differences or similarities

between individuals. Saying that someone is shy, means that this person is more timid than others. It can also mean that persons who are shy, behave the same in social situations. Traits describe the average tendencies of a person.

Personality is described as consistent in different situations and, especially during adulthood, enduring over time³.

Personality, or behavioural syndrome, in biology refers to correlated behaviour, consistent over time and across situations. Behavioural syndrome refers to correlated behaviour in contexts *or* time and is a bit broader than the term personality, which originally came from the psychology domain.

When stating that behaviour should be consistent over different contexts, these contexts refer to all the external stimuli an animal could be exposed to in its environment. Therefore, food, light, temperature and other animals are all examples of components within a context.

The behaviour of an individual relative to another one is the main focus of analyses. Even when an individual may respond different over several contexts or time points, this can still be seen as personality when this individual scores at the same level compared to other individuals. This creates a ranking in a given population, and it is this ranking rather than the measured behaviours itself that should be consistent over time and contexts in order to be called personality^{4,5}.

In contrast to psychology traits are explained in biology on behalf of fitness consequences, genetic, physiological and evolutionary aspects. In the psychology domain personality is seen as a phenomena that makes every individual unique. In biology it is rather the frequencies of traits that is of interest, like the amount of animals which could be characterised as 'bold' in a given population.

Nevertheless, the basic of what is understood under 'personality' is the same. It is about behavioural traits that are relatively stable. The tendency of individuals to react differently in a certain context at a given time. Personality is a term addressing the differences among individuals in biology and psychology.

Although the questions of interest and point of view may differ, the definition is basically the same.

Assessment

Humans

The main focus of psychologists are human beings. Research is mainly done by questionnaires, also called personality inventories. This method of personality assessment is based on questions of a persons feelings or reactions in certain situations. These tests are standardized and quite often there is no need for an observer to be present, since a computer can do the scoring afterwards. Personality inventories can measure different traits by asking the test taker to agree or disagree on several questions or statements².

The Lexical Hypotheses claims that the most important personality traits will eventually be encoded in language, therefore making it possible to make a taxonomy of these traits². In order to make a tool for identifying and structuring personality attributes there was made a database of 18.000 expressions in England. Eventually 1700 were good enough for assessing humans. This was the beginning of the creation of the Big Five, which is the most prominent test used in psychology today⁶. In Holland a list was made of 9000 adjectives of which 1203 were good enough to use. The reason for this is that those words were not used quite often and most people were not familiar with them. The creation of the Big Five begun by hundreds of participants who assed themselves and other people also assed these participants. The participants wrote down how much each adjective was a good indication of themselves. The adjectives were then systematically analyzed in order to find correlations. When a lot of people gave various traits the same combination of grades it could be assumed that those traits have the same underlying background or basic quality. To indicate what the basic quality was of the correlated traits an adjective or noun was used which gave a summary of all

these traits. After analyzing all assessments of all 1203 traits it came down to five basic factors. These became known as the Big Five.

In 1963 Warren Norman named the five factors: extraversion, agreeableness, conscientiousness, emotional stability and culture.

Each factor consists of a cluster of more specific traits which qualities that correlate together. The trait words (20 personality variables) are descriptive (not pragmatic) and are relatively neutral in the context of their use. The five social factors (The Big Five) are adequate to describe the range of personality traits. The present American-English five-factor structure has a similarity with the Norman Five-Factor Model. Different is the addition 'Surgency' by factor 'Extraversion', 'Culture' has changed the label to 'Intellect' and has more trait variables for each factor pole.

This model has the following dimensions with twenty terms per pole:

- I Extraversion/Surgency
- II Agreeableness
- III Conscientiousness
- IV Emotional stability
- V Intellect

The Big Five personality-factors is an efficient model which makes it possible to identify personality traits. This descriptive instrumental scientific system of communication makes sure that every trait, being normal or abnormal, can be expressed in one of the five factors or a combination of factors. The Big Five measures the personality from the five basic qualities described above, each of these basic qualities represent and ending of a pole of a dimension and has an opposite. For example the opposite of extraversion is introversion. Every personality trait which exists in our lexicon can only be put in a category of these dimensions (they don't correlate with each other).

Nowadays, the Big Five is used in ten languages. Cultural differences influence the constellations of the lexicons and the level of trait terms and structures. Because of this finding valid trait structures for all cultures is

impossible. However all languages and cultures currently using the Big Five have approximately five dimensions and are all very closely linked to the original Big Five factors. Since there is a need for a standard of comparison between many national taxonomies the AB5C model has been developed in pursuing an optimal representation for the differentiation description of the five trait domains.

AB5C stands for Abridged Big Five-dimensional Circumplex. The 'abridged' part comes from the fact that almost every individual feature is related with no more than two of the five dimensions. The AB5C model can be visualised as a table, containing the periodic system of all personality traits.

The Big Five model is a template structure to serve a standard medium of communication and other psychological-technical concepts. It is not an universally validated system. The model impresses with simplicity and its number of dimensions. It is the beginning of new research for sharpening and differentiating the model⁶.

Animals

Research on animal personalities is still a very relatively young field in biology. Personality is a term borrowed from psychologists, who used it addressing mainly humans. Personality in psychology is mainly which lexicon factor analyses, which is difficult for assessing animals that lack communication using language as we know it. But maybe the most important reason why biologists have not looked at personalities before, was because it was considered as inconvenient 'noise', making it harder to measure the results from a certain treatment. However young this field of research might be, there have been studies conducted in the field of animal personalities using many vertebrates from many different taxa. Studies have been performed on guppies, octopuses, rats, monkeys, salamanders, zebra finches, hyenas and so on.

When studying the personality of animals, this includes studies which gain descriptive information on the nature and specificity of behavioural

profiles and the links between them. Genetics and physiological information gives insight about the mechanisms that underlie these behaviours. Ontogenetic studies reveal the plasticity of the phenotypes and the way this can be adjusted in several environments. In the biological field the evolutionary background is always a major aspect of almost every research. Therefore field studies also present a significant contribution for giving information about the coexistence of different behaviours, while it would be logical to think that one strategy would be preferred, and others are eliminated by selection⁷.

The physiology of behaviour can be a factor of interest in biology. For instance when looking at animals coping with stress the body temperature and breathing rate can be measured or the changes of the basal metabolism. The level of activity, amount of hormones in the blood or metabolite in faecal samples, these are all just some examples of factors used in studies on behaviour.

Empirical studies of animal personalities have been done according to two methods. One is the coding of animal scores using test which are standardized. In the second one, observers rank the personality traits, which is subjective. These questionnaires (most often factor analyses) look very similar to the personality assessments used in psychology. Next the two methods will be described briefly.

The first method is used in the majority within the research on animal personality. It contains several behavioural tests in which the animals behaviour is defined and coded, making it as objective and quantifiably as conceivable. An example is the 'novel object test', where the animal is confronted with an object never seen before, which is thought to be a bit scary. The latency to approach this object is scored.

Another test is the open field test, where the latency to explore the area away from the wall is scored. These behavioural tests can be compared in two ways, whether the behaviour is seen as the same (latency to approach) or different (exploration or boldness)^{1,5}. These two experiments are just examples, for there

are plenty more behavioural tests in biology testing for boldness and exploration. Also aggressiveness (for example the tendency to bite or the tendency to attack), maternal protectiveness (by measuring grooming), dominance or frequency of foraging are examples of behaviour which can be tested by a coding method.

Noncaptive animals have been tested far less than captive animals¹.

The second method is by ratings of observers who are familiar with the animals and can give descriptions of them such as 'depressed', 'playful', 'curious' and so on. These descriptions have the advantage of using the experience of the observers but is also subjective. Nevertheless, it is assumed that data collected from several observers makes reliable scores which are good enough to work with. Some tests are not only performed by several researchers, but also done at several time points.

Some examples of the descriptions used in this kind of testing are: 'Moves around a lot', responsive to stimuli' and 'seeks reassurance from others'¹.

Criticism on this type of methodology is that the observers are predisposed by the given descriptions. It may be that they would make other distinctions themselves or otherwise said this method is unscientific because it suffers from anthropomorphism. However a research performed by Wemelsfelder et al. (2000) indicated otherwise. In his experiment 18 naïve observers were given the chance to make descriptions for their own when assessing the behaviour of pigs. At the end all the data was analysed using a multivariate statistical technique called Generalized Procrustes Analysis (GPA). In this study the authors conclude that the observers showed a high level of equivalence in making criteria⁸.

Dogs, cats and primates are most often used in this type of testing¹.

Overall observations

Looking at studies on human and animal personality some observations can be made. The first one is that personality in humans is studied in a broader

way than compared to animals. Gosling (2001) states: “Presumably, the discrepancy between the domains of human and animal personality is largely driven by the nature of the latter concepts, which require participants to articulate their internal motives, feelings, and beliefs. Clearly, any phenomena dependent on self-reports by the research participants cannot be examined in nonhuman populations.”

Another observation is that most research done is within-species comparisons. For the psychology domain this is evident, for there is only one species to examine: the human being. In the biology though, there is also another type of comparison that can be made, namely the cross-species comparisons. Here observations arise like: species A has a higher mean level of a certain trait compared to species B, or species A has a certain trait that does not exist in species B. The first observation gives us information about individual differences and the selective benefits, while the second examines the origins and adaptational significance of specific traits¹.

The methods are too different for a good integration of both domains, today. Psychologists are keen on questionnaires based primarily on language and focus on one species, while biologists look at behaviour and also account the physiological aspects to be worth to take a look at. Factor analyses filled in by observers seem to be a method from the psychology domain that could be used in biology as well. However, this will still create problems, for it is a whole different thing to observe an animal than it is to observe a human being. Human language makes ratings prone to projections of human-like characteristics that may not exist in nonhuman species. Also some species may have traits that are not described in the factor analyses⁹. Furthermore, the observers belong to the same species of humans and not of any animal. The point of view, implicit theories and knowledge about nonconspecific species are therefore always different from rating human beings. An overarching framework should be able to integrate both psychology and biology.

Personality in humans and animals

Do animals have a personality which is a lot like humans have? Because of the different methodologies used in both domains, it is hard to compare human and animal personalities. So far, there have not been many attempts in order to bridge this gap. The psychology domain is the most experienced in assessing personality, using the Big Five as its most prominent test. However, within the psychological domain there have not been a lot of attempts in linking animals with humans with regards to personality.

The biologist Samuel Gosling (1999) did made an attempt to study animal personality using the Big Five in a meta-analysis. He selected from more than hundred studies the ones that had not only used more than twenty animals, but also observed at least a reasonable amount of personality traits. He came up with a review consisting 19 factor analytic studies, containing 12 different species. Besides the five factors from the Big Five, (Extraversion, Neuroticism, Agreeableness, Conscientiousness, and Openness), Gosling also added two extra dimensions which might be of interest when looking at animal personality: Dominance and Activity. Extraversion, Neuroticism and Agreeableness, showed to be considerably general across species. According to Gosling, the evidence indicated that nonhuman primates, nonprimate mammals, and even guppies and octopuses all have their own individual differences within these three dimensions of the Big Five. In 7 of the 12 species this was found for Openness. Some parts of this dimension is hard to test in animals, like interest in art or openness to ideas. Still, interest in a novel object could be scored. For Conscientiousness it was even harder to find this in all the species. Only chimpanzees seem to have this separate factor, besides humans. When looking at Dominance it was found that this factor had more implications referring personality in animals than in humans. In humans Dominance is only related to Extraversion, but in animals it is also related to a low level of Agreeableness (physical aggression) and a low level of Neuroticism

(low fearfulness). The second extra Dimension added may not be a very good one to handle, since only 2 out of 9 studies showed support¹.

This study indicates that animals have a personality that is at some level comparable with humans, but can not be mapped quite the same, as the Big Five did not find satisfactory results in every dimension. Since the Big Five is constructed for humans, it merely gives us a raw sketch. When looking at this sketch it looks like animals do not share the same personality dimensions with humans, for only 2 out of 5 dimensions could be found in all species. Another important remark is that there was quite some variance among the different species. This points out that, in order to make accurate comparisons among different species (where human beings are also included), a new overarching methodological framework has to be developed. The Big Five is not suitable for animals, but was suitable enough to indicate that it might be possible to construct such a framework, since animals do seem to show at least some identical personality components with humans.

Integrating psychological and biological methodologies

Would it be possible to integrate methods from psychology in the biology domain and vice versa? It is worth noting that in most studies on animals only one or two dimensions are studied, while the Big Five is a standardized test which analyses all dimensions in human beings. As shown in the study of Gosling, it is hard to find a suitable way that fits human and non-human species. His attempt was one of the first attempts to make a bridge between psychology and biology, so in this way it is not surprising that his method is merely a sketch. What is a pity, is that he is not very clear about his way of analyzing. He only explains which studies he took, but does not show how he used this data to score for the 5 dimensions. For example a question from the Big Five is 'do you like art?'. This is impossible to ask an animal. The alternative approach of Gosling is not given in the article. This makes it a bit weaker, but

since he is the only one making a comparison amongst species, there are no other studies to be found as an alternative. Still, as Gosling found 2 out of the 5 Big Five dimensions are also present in animals, this result is intriguing and may be a starting point for new discoveries.

So is it possible to measure the Big Five in animals? Since this method is not made for assessment in animals it is clear that it is not a perfect fit. However, as Gosling showed, still 2 out of the 5 human dimensions are found in almost every species. This means that the method does give some indication of personality in animals on at least these 2 dimensions, but also that there is a lot of room for improvement if it has to be suitable for nonhuman species as well.

Jana Uher (2008) states that problems arising in the making of such a framework that should fit for humans as well as animals, are quite similar to those in the cross-cultural psychology research, therefore lending a way in defining methods and concepts.

Leung and Bond (1989) were interested in the dimensions that can be made in cross-cultural psychology. They made an approach which is useful to use. The trait dimensions they distinguished were:

Species-specific trait dimensions, these traits are only present in a particular species, in that way no comparisons can be made with other species.

Universal trait dimensions, these traits allow comparisons across different species. Within these traits two types are distinguished: weak and strong universal traits. The weak are traits that have the same mean in several species, where the strong do show significant differences (also called species-comparative traits, for their abilities to defining the differences across the species).¹⁵

Leung and Bond made a distinction between position effects and pattern effects. Position effects are the effects of cultures on trait distribution (particularly trait means). Patterning effects are the effects of cultures in the correlation structure. Uher stated that it is important that identify the

patterning and position effect of populations (particularly species) on personality trait dimensions. Patterning effects can be found using most methods from the psychological domain, but for studying the position effects this is not the case. Only absolute data can be used, since ratings from observers can be biased by implicit comparisons with reference populations or individuals.

Species however differ from each other by other factors than just positioning and patterning effects alone. Populations can have different selective pressures and adaptations, resulting in different or unique trait domains. The important trait domains must be identified and should not be missed in the new integrating methodology. Mapping these include two steps, which are both very important for success. The first step is to select the representative trait domains. The second step it to formulate the few underlying major trait dimensions. These two steps are crucial in order to analyse the patterning and positioning effects. A good method has to be found with which positioning, patterning and different trait domains can be analysed⁹.

It is not possible to assess animals using self-reports, since animals are not able to fill them in themselves. This method is therefore not worthwhile as a starting base for an integrative methodology. Uher states that all methods from psychology, except for self-reports, can be used. This may be a bit too optimistic, since psychology uses language as a basis for making assessments. The Big Five is a prominent assessment tool, but also a lexicon method and as seen in the study of Gosling, difficult to apply on animals.

Uher focuses more on the biological view of personality assessment and made a list of methods to identify trait dimensions within a species which are worth to take a look at:

Nomination approaches: making concepts and theories about personality variation in a species. This is due to the human ability to perceive these perceptions, especially when they are trained or they have been working with the individuals a lot. An easy method to use, but prone to biased selection.

Adaptive approaches: trait dimensions will be based on their fitness consequences or possible adaptive significance in the species' past. Selection is a bit speculative, since its evolutionary approaches are based on theories most of the time.

Behavioural bottem-up approaches: naturally evolved behaviours will be observed or measured and can then be classified in a specific personality dimension. A distinction can be made between two types:

Selective behavioural approaches: study inter-individual variability in selected behaviour domains to get single trait dimensions

Behaviour repertoire approach: Starts from the species' universal behaviours and related situational features to identify potential trait domains. These domains are then studied empirically for stable inter-individual variability in order to get the underlying major trait dimensions. In the bottom-up approach the only limitations for comprehensiveness on trait manifestations will be due to practical problems, not for their rationales. The more effort that is put into such a method, the better it becomes.

Top-down approaches: trait dimensions found in a species are applied on another species to find differences and similarities in patterning effects. Implicit theories may cause a bias.

Eclectic approaches: draw on trait dimensions and methodologies from the various types of approaches.

Uher states that the best method would be to use the bottom-up approach called behavioural repertoire approach, where the first step would be to look at the spontaneous behaviour of animals and humans. Then the next step is to identify the trait domains. In that way the diversity of personality variation can be better studied than other approaches like nomination or top-down, which are easier to use.

Where Gosling performed a test with animals using a method originally made for humans, Uher goes the other way around in order to get an overarching framework by claiming that the best way to construct an

overarching framework would be to do experiments with humans like the ones now performed on animals. Human personality has most often been studied using self-report questionnaires, Uher states that is important to observe spontaneous behaviour as well. She is however not very specific how this behavioural approach applied on nonhuman- as well as human species should look like. In work done with primates, she used a bottom-up approach by making a ethogram, but whether she wants other scientists to do the same, is not very clear¹⁰. Also mentioned by Claudio Carere and Dario Maestriperi in an open peer commentary is that Uher is not really clear what she means by ‘the behavioural repertoire approach starts with a biological classification of the species’ universal behaviours’.¹¹ Alexander Weiss and Mark James Adams were critical, because they imparted that Uher’s approach did not provide a common instrument for determining similarities or differences between species as well as considering phylogenetic relationships between organisms. They were also skeptical for constructing an overarching framework. ‘Science is best served by multiple methods that address multiple competing hypotheses. Researchers must decide on or develop the strategies that are best suited to address their particular questions’¹². Nevertheless, the majority of all the peers that took the effort to express their opinion, were not pessimistic. As Wendy Johnson said: ‘it is a tall order, but Uher’s approach at least gives us a way to try.’ The commentaries illustrate that the debate about the characteristics of an overarching framework is a hot topic. Also scientists from the psychological domain stepped into the discussion, showing that a cross-disciplinary discussion has emerged¹³.

Gosling already performed a test according to his ideas, Uher sticks to ideas and theories so far and has not yet took these into practice. Nevertheless, her concept is an interesting starting point of a potential overarching framework.

Discussion

Most studies on animal personality were performed on mammals and within this group especially on chimpanzees. It might be interesting to conduct more experiments on other species as well.

When integrating the methodologies of two different domains, some problems may arise. The first one are the differences in terms, so a common language would be necessary to develop. Comprehensiveness can be ensured, when in the framework all the behavioural profiles of a species are present. This has as consequence that some traits can not be applied to all the species within the framework, since some are species specific. Using the same terms in a standard taxonomy makes studies better comparable and studies that did research on the same subject can be better found.

Animals lack the ability of using a complex language and since the oldest personality tests are from the psychology domain which uses language as a basis, this is difficult when creating an integrated method. Instead of finding an alternative for these tests, it is also possible to use the method as described by Uher where spontaneous behaviour is measured with animals and humans. But it will still not be possible that research on animals will ever learn us anything about self-concepts, dreams or identities. Any aspect of personality which can only be measured using a self-report or using language will be of no use in the field of animal personality

In 1980 Nagel suggested that humans can not know what it is like to be an animal. Anthropomorphic projections should be avoided as much as possible, for it might be a problem when constructing an overarching framework.

Some traits in humans are culture dependant, which may make it difficult to find animal analogy. Gosling for instance mentions ethical and artistic traits. Also finding human analogy for traits that are unique for some animal species, is a problem. For example animals with highly sensitive echolocation sensory

systems or animals that have the ability to change their sex. Species also differ in their anatomical structures, which has consequences for their behaviour¹.

Finding universal traits is another problem. In cross-psychology it was assumed that all humans have the same basic underlying psychological processes and that culture influences the development of these processes. Although there have been many studies on this subject this assumption is not yet proven. When it is hard to find a universal basis in humans, it may also become quite difficult to find them across species¹⁴.

Conclusion

The approach of integrating psychological- with biological methods in assessing personality is a very young process. There have not been very much attempts of bridging the gap and those who have are biologists, therefore their points of view on this subject are a bit limited and information about cross-species comparisons is scarce. In response to the recent article of Uher there were comments from various scientific domains, including psychology. Most commentaries had a critical yet optimistic tone. Most peers thought it would be worth to take a look at the best way of developing an overarching framework and a minority did not think that such a framework is worth developing.

If an overarching framework can be made, how useful would such a framework be? Is it possible to gain more knowledge on the ontogenetic and evolutionary development of personality as well as on the neurobiological, cognitive, motivational and behavioural levels of personality due to an integrative approach? Will the framework be of high enough quality in order to compare species, while not losing the broader view of all the different personality traits within species? How useful an overarching framework is will depend on the choices made while constructing an integrating methodology (simply said, how good the framework will end up), but also on the results that

will arise when applying it, and the comparisons that can be made with those. This question will therefore take more time and effort in order to be solved.

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