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An Essentialist Theory of “Hybrids”:
From Animal Kinds to Ethnic Categories and Race

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Abstract

This paper presents a theory of the perception of hybrids resulting from crossbreeding natural animals that pertain to different species and of children parented by couples with a mixed ethnic or racial background. The theory states that natural living beings including humans are perceived as possessing a deeply ingrained characteristic that is called essence or “blood” or genes in everyday discourse and that uniquely determines their category membership. If by whatever means genes or essences of two animals of different species are combined in a hybrid, the two incompatible essences collapse, leaving the hybrid in a state of non-identity and non-belonging. People despise this state and reject the hybrid (Study 1). This devaluation effect holds with cross-kind hybrids and with hybrids that arise from genetically combining animals from incompatible habitats across three cultures, Austria, India and Japan (Study 2). In the social world, groups and ethnic or racial categories frequently are essentialized in an analog way. When people with an essentialist mindset judge ethnically or racially mixed offspring they perceive a collapse of ethnic or racial essence and, consequentially, denigrate these children as compared to children from “pure” ingroup or outgroup parents (Study 3). The findings are discussed in terms of the widespread yuk-factor against genetically modified animals, in terms of the cultural concept of monstrosity, racism and prejudice.

KEY WORDS: hybrids, essence, categories, natural kinds, ethnic groups, race, discrimination, racism
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1 Introduction

1.1 Hybrids and the natural order

In their history, cultures establish systems of symbolic order that structure the life-world and give it stability. Part of this structure are categories of things that are considered to be of natural origin and basically unalterable by human intervention; they are called natural kinds. An important sector of natural kinds are animals that are, the world-over, perceived as of natural origin, notwithstanding domesticated animals that were brought about on a time scale that extended far beyond the rhythm of human generations and where the human intervention, thus, escaped individual attention. Only recently has technology allowed tailoring new organisms in a matter of months by splicing genes from one natural species into the genome of another species. These genetic hybrids are serious contenders for falling outside of the established order of life forms.

In offensive parlance and in racist discourse, expressions similar in meaning to the term “hybrid” are often used to characterize persons of mixed racial or ethnic origin. Although biology is clear on the fact that all human social, ethnic and racial groups pertain to the same species and are biologically equal, under certain conditions everyday discourse tends to postulate “natural” differences between social groups. This may give rise to a hitherto unresearched form of racism that prejudices offspring of cross-ethnic parents and is a pressing issue today, where migration between regions and continents is the norm rather than the exception. Immigrants mix and mingle with the local population creating ethnically mixed sectors in countries that is a potential target to prejudice and racist discrimination.
In this paper we suggest a theory that explains both phenomena, the perception of “natural” hybrids and the essentializer’s reaction to “racial and ethnic hybrids” by the same cognitive and cultural logic. Hence, it is crucial to consider both realms simultaneously because both are subject to socially determined ideas of order and powerful representations. We argue that the mechanism is based on a way of thinking that tends to essentialize natural and social categories, making their members mutually exclusive entities, where essence is widely understood as being equivalent to an exemplar’s genetic endowment. The question we address here, then, is how respondents perceive “genetic mixtures” of animal species and of ethnic and racial categories.

1.2 Essentialist thinking and its consequences

1.2.1 The natural realm

The concept of natural kind refers to naturally occurring things, setting them apart from artifacts. Natural kinds are perceived as having sharp boundaries, whereas artifacts allow for gradual membership of exemplars (Estes, 2003). Membership in a natural kind allows more inferences to be drawn about unobservable features than do artifacts (Ahn, et al., 2001; Gelman, 2003).

The most important characteristic of natural kinds is that they are subject to essentialist thinking in everyday life. Essentialist thinking has been identified with children and adults and it means that people assume there exists an underlying substance in all members of a natural category, which determines the organism’s specific outfit and category membership. This substance is called essence. Hence, if an organism is seen to possess the essence typical of a category, then it is a member of this category; and, if an organism is a member of an essentialized category, then it must possess the essence: Essence is a necessary and sufficient criterion for category membership.
Often essence is understood as a placeholder term standing for some folk-scientific 
“subsurface” property, such as genes or “blood”, that are causally responsible for observable 
features of members of a kind (Gelman, 2003; Medin & Ortony, 1989; Sloman & Malt, 
2003). Essentialist thinking allows to override perceptual similarity: Imagining a cat, for 
example, that is mechanically or surgically transformed to look like a skunk, does not lead 
children to mistake it as a skunk (Keil, 1992). That is, essence-based category membership 
resists human attempts at alteration (Haslam, Rothschild, & Ernst, 2000; Kronberger & 
Wagner, 2007; Rothbart & Taylor, 1992). Further, essentialist thinking allows children to 
identify the innate potential for properties that are transferred from parents to offspring and to 
insist on non-obvious or internal properties that define the overall structure of a set of 
attributes. Children who learned about an animal that it was separated from its biological 
parents just after birth, and that was raised by “foster parents” of a different species insisted 
that physical attributes and behavioural characteristics of the “child animal” will resemble its 
biological parents (Gelman & Wellman, 1991). These findings also hold with human social 
categories such as language groups where 5-year-olds believe that an adopted child will speak 
the language of its biological parents (Hirschfeld & Gelman, 1997). Taken together, 
essentialist thinking makes children and adults treat living kinds as if they had an innate and 
non-obvious basis, stable category membership, and non-arbitrary boundary (Ahn & Kim, 

1.2.2 The social realm

Generally, attributing essence onto a category is tantamount to making the category a 
natural kind and, vice versa, naturalizing a category endows it with an essence. Therefore, 
“strictly natural” categories are not the only realm where essentialist thinking can be 
observed. The effects of essentialist attributions in the social realm have a bearing on
Stereotyping, xenophobia, outgroup discrimination and racism (Allport, 1954; Rothbart & Taylor, 1992; Wagner, Holtz, & Kashima, 2009). Category labels, for example, may have disproportionate power in making people believe that members of certain categories share an essence with all other members of that category (Raudsepp & Wagner, in press; Yzerbyt, Corneille, & Estrada, 2001; Yzerbyt, Rocher, & Schadron, 1997). Some social category labels, hence, may lead people to perceive and treat the category as a natural kind.

Other labels may foster the perception of the ensemble of the category’s members as more entitative than justified. These labelling effects are likely to depend on the cultural weight and social value that the representation of the category implies (cf. Howarth, 2002; Morton, Hornsey, & Postmes, 2009). If, for example, the categories of men and women or of different races are represented in an essentialized way and their characteristics explained by genetic differences, people judge categories of sex or race as distinct, as possessing clear boundaries, as more homogeneous and more stable in their behaviour patterns than when represented in a non-essentializing way (Hoffman & Hurst, 1990; Martin & Parker, 1995; Pehrson, Brown, & Zagefka, 2009).

This can be seen in numerous examples of real world conflicts: Since its independence from the Soviet Union 1989 the Estonian government, for example, followed an ethnic policy in granting citizenship to Estonia’s inhabitants. Since about a third of the population consists of Russians, many of whom settled decades ago, only inhabitants with a proven Estonian “biological” descent since the pre-1940s, were granted citizenship, leaving a large proportion effectively “stateless”. This essentialist view of Estonian-ness was and still is a powerful fuel for verbal and overt violence between Estonians and Russians (Raudsepp & Wagner, in press).

Essentializing social categories may result in two related effects, naturalization and entitativity. Perceiving discreteness, naturalness, immutability, stability, and necessity make
the target a natural kind such as race and gender. Perceiving uniformity, informativeness, inheritance, and exclusivity tend to make the target group a unitary entity such as homosexual, religious, and political groups (Demoulin, Leyens, & Yzerbyt, 2006; Haslam, Bain, Douge, Lee, & Bastian, 2005; Haslam, Bastian, & Bissett, 2004). In both cases, the social categories are being essentialized in the sense that beyond superficial differences group members are basically the same according to some deeply embedded characteristic. This tendency is further enhanced in chains of interpersonal communication (Kashima, et al., in press; Kashima, Yzerbyt, Judd, & Corneille, 2004).

### 1.3 The constitution of hybrids

Research on psychological essentialism provides the following definition of how essence is thought about in everyday life (Ahn, et al., 2001; Gelman, 2003; Wagner, et al., 2009):

1. Essence is stable and inherent to its carrier and constitutes the carrier by causally determining its defining features. That is, it endows its carriers with permanent and unique attributes that are specific for all members of a category and constitute an inviolable identity (Kronberger & Wagner, 2007). It is transferred by descent, not by touch or other forms of proximity.

2. Essence is discrete: It is perceived as a yes-or-no affair; either an entity has it or not but there is no middle way. A living kind exemplar cannot possess a certain quantity or degree of an essence. As a consequence, essences are mutually exclusive. An exemplar of a kind or category can only possess one specific essence.

3. Attributing an essence is coextensive with making a category a natural entity and naturalizes the defining features of the category’s exemplars.

This definition brings us immediately to the case of hybrids: If members of a kind or category are attributed an essence, then this attribution makes the exemplar inherently and
unalterably different from members of other kinds or categories; and because an essence
resists blending and decomposition and cannot be divided or mixed with another essence
without losing its function in defining a category, then any “essence-mixture” could not exert
its “causal” powers in shaping the necessary and defining features of the mixed exemplars.
Consequently, mixing the genes of two animal species or of two other essentialized categories
creates a “non-entity” that is perceived as not belonging to any accepted category; perceivers
with an essentialist mindset will reject and also despise a “mixed exemplar”.

A first case in point is ample research on the response of people the world over against
genetically modified organisms, particularly animals and humans. When confronting genetic
engineering and its end products the people’s reaction reflects utter rejection and deep
concern, as if these new organisms fundamentally challenged Nature’s order (Gaskell, et al.,
2000; Laros & Steenkamp, 2004; Macnaghten, 2004; Wagner, Kronberger, Allum, et al.,
2002). The ensuing discourses elaborate images and metaphors that frame the idea of genetic
hybrids in often fantastic forms expressing a pronounced gut-feeling of disgust (Castro &
Gomes, 2005; Nerlich, Clarke, & Dingwall, 2000; Wagner, Kronberger, & Seifert, 2002).
Animal hybrids are a life form without match in the natural world that inspires dread
irrespective of whether hybrids are imagined as chimeras or as superficially similar to the
corresponding natural animals. It is the mere presence of genes—that is, essences—from two
species in the same animal that places the hybrid outside of the established order and makes
them frightening. In other words, genetic hybrids do not possess an inherent, discreet and
exclusive identity defining their categorical belonging. Hybrids are rejected as legitimate
animals, judged negatively and sometimes even considered monstrous (Wagner, Kronberger,
Berg, & Torgersen, 2006).

In the social domain, essence “games” are widespread as shown by scholars on
dehumanization (Bandura, 2002; Haslam, 2006; Yzerbyt, Judd, & Corneille, 2004) and
“infra-humanization” (Leyens, et al., 2003). Attributing non- or infra-humanness to disliked outgroups effectively robs their members of the essence of humanness, at the end justifying dominance relationships, aggression and violence. It is part of a justificatory discourse about socio-political structure and group dominance (Mahalingam, 2003; Pratto & Zanna, 1999). Additionally, naturalizing the outgroup robs its members the higher emotions (Vaes, Paladino, & Leyens, 2006). As an epistemic device, essentialism simplifies the social world in reducing ambiguity and providing easy cognitive closure (Jost, Glaser, Kruglanski, & Sulloway, 2003; Keller & Bless, 2004; Wagner et. al., 2009). Although the examples of de- and infra-humanization do not refer to hybrids, they do reflect essentialist thinking. Being attributed a (human) essence is the precondition for full membership in the category of humanity.

Another example comes from racism research: German Neo-Nazi discourse essentializes ethnic groups by ascribing them immutable group-specific attributes that effectively make them “natural kinds”. The group of Jews appears as a kind of their own with super-human powers and influence. Africans and Blacks are despised, firstly because their essential characteristics prohibit them to be categorized as Germans—i.e. to become German by nationality—due to their incompatible essence, and secondly when they procreate with Whites. Mixed procreation produces “half-breeds” that are met with disgust (Holtz & Wagner, 2009).

In the light of the foregoing observations we suggest the following framework to explain the perception of hybrids: In folk thinking,

(a) animal kinds are perceived as being endowed with a kind-specific essence that makes their exemplars unequivocal representatives of a species; and under certain societal and political conditions social categories are attributed an essence that inherently differentiates representatives of the category from representatives of another social category or group.
(b) Although under “natural conditions” members of essentially different categories or kinds do not mix and mingle and, in the majority of cases, not procreate, sometimes mixing may occur. It may happen by technological means as in genetic engineering or by members of ethnic or race groups procreating across group boundaries in “utter disregard of social norms” set by racist compatriots and bigots in many cultures.

(c) In hybridization the essences of the hybrid’s incompatible parents come in contact and “collapse” as a consequence. The new organism or person straddles the boundary between two incompatible categories and lacks any inference potential as to its bodily or behavioral attributes because the commonly assumed one-to-one relationship between phenotype and underlying essence is blurred and undefined. Consequently, besides of being unfamiliar, an essentializer will perceive the hybrid as highly unnatural, unpleasant, negative, as a threat to the received “natural order” and as lacking category identity. Hybrids transcend the categorical grid of the local world as seen by the essentializer and imply category confusion.

The present theory deals with the interplay between essence-defined kind and category membership and affective reactions to essence violation. In the following studies, we disentangle the preconditions of judgments about hybrids in the case of animals and ethnic membership: In study 1 we ask respondents to judge naturally occurring hybrids such as the mule and “geep” (a cross-breed of goat and sheep) as to their possessing an essence or not and how they are evaluated. In the second study, we compare the perception of fictitious hybrids supposedly engineered by combining genes from close or disparate species in three different cultures. In study 3, respondents are presented with pure as well as ethnically and racially mixed children.
2 Study one: Loss of essence and devaluation of hybrids

2.1 Hypotheses
In this study we address how animal hybrids are perceived using a familiar hybrid, the mule, and an unfamiliar hybrid, the “geep”, a result of crossing sheep and goat. We expected

(H1.1) that, in contrast to its natural parents, the hybrid will be perceived as not possessing a unique essence;

(H1.2) that hybrids will be judged as more negative than their parents;

(H1.3) that the unfamiliar geep will be judged more negatively than the more familiar mule;

(H1.4) that perceived violation of essence will be a significant predictor of the negative evaluation.

2.2 Method

2.2.1 Sample
We randomly assigned 241 students from the University of Linz (35% male, 65% female) to the experimental conditions. Age ranged from 18 to 57 years (Median=24).

2.2.2 Material
The study was a 2*3*3 mixed design involving the following factor:

(1) Hybrids: A mule, which is a horse crossed with an ass (high familiarity); and a “geep”, which is a goat crossed with a sheep (low familiarity).

(2) Method of crossbreeding: Sexual procreation, in-vitro fertilization (IVF), and genetic engineering. It should be noted that geeps really exist as a result of assisted sexual procreation of goat and sheep. In the general public this is relatively unknown, though.

(3) Role of animal (within subjects): Gene donor, gene recipient, and genetic hybrid.
Six versions of the questionnaire, permutations of the between subjects factors 1 and 2 combinations, were used. Additionally, each of the two categories, mule vs. geep, was balanced with regard to the sequence of donor and recipient animals. The study was introduced as research on the perception of animals. After the respondents had rated the genetic parents they were asked: “… Please imagine genes from a [gene donor, e.g. horse] being transferred onto a [gene recipient, e.g. ass] by way of [method, e.g. IVF]. This produces a genetic combination of both animals. It is called a hybrid.”

Respondents rated each animal, gene donor, recipient, and hybrid on five seven-point bipolar adjective scales. The scales were: harmless-eerie, beautiful-ugly, gentle-dangerous, tame-wild, and appealing-repulsive. The positive vs. negative polarity of the items was varied in the questionnaire. Further, respondents judged their agreement to

“The essence (in German: “Wesen”) of [donor/recipient/hybrid] is clearly defined”;

“Hybridization by [method] violates the essence of the animals”;

“This hybrid animal can be judged as monstrous”;

“How frightening is this hybrid to you?”;

and “Have you ever heard of this [hybrid] before?”

2.2.3 Procedure

Respondents were asked to participate in the experiment and the questionnaire was answered in the presence of the experimenter within a maximum of 20 minutes. At the end of the experiment, the participants were debriefed.
2.3 Results

2.3.1 Manipulation check

We checked the manipulation of the factor familiarity by a 2*3 ANOVA with type of hybrid (mule vs. geep) by method (sexual vs. IVF vs. genetic engineering) as factors and the item “Have you ever heard of this [hybrid]?” as dependent variable. The factor type of hybrid was significant (F(1,231)=297.25, p≤0.0001). The mule was indeed more familiar (M=5.29) than the geep (M=1.68).

2.3.2 Do hybrids possess a unique essence?

The score on the unique-essence item for parents and hybrid was the dependent variable in a 2*3*3 mixed ANOVA with type of hybrid (mule vs. geep) and method (sexual vs. IVF vs. genetic engineering) as the between-subjects factor, and role of animal (gene donor vs. recipient vs. hybrid) as within-subjects factor.

Mauchly’s test of sphericity was significant (Mauchly’s W=0.14, Chi²=460.18, df=2, p≤0.0001). Therefore we use the Greenhouse-Geisser statistics in the following.

According to hypothesis H1.1, the main effect role of animal was significant (F_{Greenhouse-Geisser}(1.08,470)=30.52, p=0.0001, eta²=0.12). Within-subjects contrasts comparing gene donor to hybrid and recipient to hybrid were all significant at p=0.0001 and effect sizes ranged from 11% to 12%. The gene donor (M=4.81) and the gene recipient (M=4.88) were judged as possessing a unique essence, the hybrid much less so (M=2.54). Respondents perceive natural animals as possessing a well-defined essence while hybrids are lacking in essence. No other main effects nor interactions were significant.
2.3.3 Are hybrids perceived more negatively than natural animals?

To test hypothesis H1.2 we ran a 2*3*3 mixed MANOVA with type of hybrid (mule vs. geep) and method (sexual vs. IVF vs. genetic engineering) as the between-subjects factor, and role of animal (gene donor vs. recipient vs. hybrid) as the within-subjects factor. The dependent variables were eerieness, ugliness, dangerousness, wildness, and repulsiveness for each, donor, recipient and hybrid.

According to the hypothesis the multivariate main effect, role of animal, was significant (F_{multivariate}(10,223)=18.62, p≤0.0001, \text{eta}^2=0.46). The univariate effects for all adjectives were significant at p=0.0001 with effect sizes ranging from 9% to 24%.

Contrasting each, gene donor and recipient, against the hybrid was significant for all adjectives at p=0.0001 with effect sizes ranging from 14% to 29%: The hybrids are judged as more eerie, uglier, more dangerous, wilder, and more repulsive than their parents. In other words, hybrids are perceived as much more negative than their natural parents, horse, ass, goat and sheep (Figure 2.1).

FIGURE 2.1

The factor type of hybrid, i.e. the familiar mule vs. the unfamiliar geep, was also significant (F_{multivariate}(5,228)=9.10, p≤0.0001, \text{eta}^2=0.17). The unfamiliar geep is judged as uglier (M_{geep}=3.95 vs. M_{mule}=3.38; F(1,232)=20.64, p=0.0001, \text{eta}^2=0.08) and more repulsive (M_{geep}=3.89 vs. M_{mule}=3.51; F(1,232)=8.74, p=0.0001, \text{eta}^2=0.04) than the mule. Probably due to its bigger and stronger parents, the mule is perceived a bit wilder (M=3.50) than the geep (M=3.19; F(1,232)=7.08, p=0.01, \text{eta}^2=0.03), and there is no significant difference between the hybrids’ eeriness and dangerousness, both are seen as a threat. Hypothesis H1.3 is only partially supported.
The interaction type of hybrid by role of animal was significant for the adjective eeriness only ($F_{\text{multivariate}}(10,922)=2.04$, $p=0.03$, $\eta^2=0.02$; $F_{\text{univariate}}(2,464)=12.89$, $p=0.0001$, $\eta^2=0.03$). The difference between the gene donor’s ($M=2.87$) respectively the recipient’s ($M=2.65$) and the mule’s eeriness ($M=3.44$) is less than the respective difference for the geep ($M_{\text{donor}}=2.26$, $M_{\text{recipient}}=2.40$, $M_{\text{geep}}=3.75$). This interaction is irrelevant to the hypothesis.

2.3.4 What determines the hybrids’ negativity?

Hypothesis H1.4 states that the perceived violation of the hybrid’s essence will be the prime determinant of its negativity. We calculated a multiple regression with perceived violation of essence, the hybrid’s familiarity, and its perceived threat as predictors of negativity that was linguistically framed as “monstrosity” (Table 2.1).

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<thead>
<tr>
<th>TABLE 2.1</th>
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<td>The results show the central role played by essence in thinking about animal kinds and hybrid devaluation. In line with our hypothesis, perceiving essence as being violated is by far the strongest determinant of devaluation besides the affect of fear. The hybrid’s familiarity is the weakest predictor.</td>
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3 Study two: A cross-cultural replication of animal hybrids’ devaluation

3.1 Design and hypotheses

This study replicates the hybrid devaluation effect in three countries: Austria, India, and Japan. Despite cultural differences between the three countries, we did not expect any culture specific effect that would go contrary to the general hypothesis of genetic animal hybrids being devalued. On one hand, all cultures can be expected to value categorical order in the natural realm (cf. Douglas, 1966), and, on the other hand, the tendency to think in essentialist
terms may differ in degrees but not in principle across cultures. If we found a cross-cultural effect affecting the principal hypothesis, this would put the general validity of psychological essentialism in doubt. In other words: we increased the sample by including people from three countries, not because we expected them to be different, but because we expected them to be similar enough with regard to our research question.

In this study we refer to animal species and kinds. While we use the term “species” to designate swallows, penguins and trouts, the term kind refers to a broader category of animals that are frequently addressed by the same term in everyday language, such as fish and birds, sometimes also referred to as life-forms (Atran, 1990). We focused on within-species, within-kind, as well as cross-kinds genetic transfers, and the transfer of genes for adaptive and maladaptive capabilities. The reasoning was that, if animal kinds are perceived as being characterized by their essences that determine their unique behavioural and corporal outfit, people should show a hybrid devaluation effect under both conditions, mixing kinds and mixing capabilities: Birds without at least rudimentary wings are barely imaginable, even though not all birds fly and neither are fish without fins. Indeed, the theory of biological evolution tells us why this is the case and it also tells us that the perceptual and cognitive apparatus of humans is tuned to their task of perceiving the environment in a largely veridical fashion. In this sense the perceptual process of identifying natural kinds by their capabilities and body shape is the result of a coevolution of living beings’ shapes and the human cognitive faculty as suggested by evolutionary epistemology and where essentialist thinking might have its roots.

The design of the experiment is shown in Table 3.1. It involves two between-subjects factors. (1) Adaptive vs. maladaptive capabilities: Transplanting genes to express a capability that fits versus does not fit the habitat of an animal. A conflict of capabilities exists if an animal that is well adapted to life in water such as a trout, receives genes from an animal that
is well adapted to life in the air such as a swallow; (2) Within-kind vs. cross-kinds: Transplanting genes from an animal of the same kind or life form as the recipient versus from an animal of a different kind.

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**TABLE 3.1**

We hypothesize:

*(H2.1)* that hybrids will be judged more negatively and more threatening than their genetic parents.

*(H2.2)* The negativity and threat score will be higher for cross-kind hybrids than for within-kind hybrids and also higher for hybrids resulting from parents with conflicting capabilities than for those without such a conflict.

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**3.2 Method**

**3.2.1 Participants**

*Austria.* We recruited 192 students (95 male, 97 female) from the University of Linz. Their age ranged from 18 to 41 years (Median = 22).

*India.* 192 students (96 male, 96 female) were recruited from the University of Mumbai. Their age ranged from 18 to 30 years (Median = 22).

*Japan.* A total of 285 persons (132 male, 153 female) were asked to participate. 120 were students at Mie University and the rest consisted of a general sample recruited from Mie, Aichi, and Wakayama Prefectures. Age in this group ranged from 18 to 74 years (Median = 33).
3.2.2 Material

Each participant was randomly assigned one of 16 versions of a questionnaire. The questionnaire versions were permutations of four animals as gene donors (swallow, penguin, trout, flying fish) and the same four animals as gene recipients. The combinations involved typical and atypical exemplars of kinds. The swallow, for example, is a typical bird that can fly but not swim, and the penguin is an atypical representative of birds that can swim but not fly. The same structure applies to the fish, although a flying fish is certainly not a great flyer, while a penguin is a good diver (see Table 3.1).

Simultaneously, the participants were presented with color photographs of the respective donor and recipient animals. The photographs were accompanied by short descriptions that emphasized their outstanding capabilities while playing down their less developed capabilities: (a) The swallow is a bird with a dynamic body that allows it to fly well up to 10,000 kilometers; (b) The trout is a very agile fish, which due to its streamlined body can swim very fast and well; (c) The penguin is a bird that can barely fly, but due to its streamlined body, it can swim and dive as deep as 500 meters; (d) The flying fish cannot swim very well, but with its big fins, it can fly through the air as far as about 50 meters.

The gene donor animal, the gene recipient animal, and the hybrid constituted a within-subjects factor and were each rated on the following six-point adjective polarity scales: harmless-threatening, gentle-dangerous, beautiful-ugly, clean/pure–unclean/impure, clever-dumb, free-unfree, and fearless-fearful. The polarity of the adjectives was balanced, such that in about half of the scales the negative adjective was first and in the other half vice versa. Additionally, respondents rated the degree to which the hybrid would be able to dive/swim, and to fly on six-point scales.
3.2.3 Procedure

The experimenter was present during the filling out of the questionnaire and showed the photographs to the participants. This took about 20 minutes. At the end of the experiment, the participants were debriefed.

3.3 Results

3.3.1 Manipulation check

To check whether the participants accepted the description of animal capabilities, we calculated a 3*4 MANOVA with country (Austria vs. India vs. Japan) and gene recipient animal (swallow vs. trout vs. penguin vs. flying fish) as factors and the gene recipient’s score for flying and diving/swimming as dependent variables. The main effect for recipient animals was significant for both dependent variables ($F_{\text{flying}}(3, 662) = 661.42, p = 0.0001, \eta^2 = 0.75$; $F_{\text{diving/swimming}}(3, 662) = 160.97, p = 0.0001, \eta^2 = 0.42$).

We calculated the same 4 x 3 ANOVA for gene donor animals. The main effect for donor animals was significant for both dependent variables ($F_{\text{flying}}(3, 660) = 582.36, p = 0.0001, \eta^2 = 0.73$; $F_{\text{diving/swimming}}(3, 660) = 107.15, p = 0.0001, \eta^2 = 0.33$). In line with our manipulation, the swallow and the flying fish were judged as significantly more capable of flying than either the trout. On the other hand, The trout and the penguin were judged as more capable of swimming/diving than either the swallow or the flying fish.

3.3.2 Natural animals versus hybrids

We calculated a 3*2*2*3 mixed MANOVA with country (Austria vs. India vs. Japan), kind conflict (within-kind vs. cross-kinds), and capability conflict (fitting capabilities vs. unfitting capabilities) as between-subjects factors, role of animal (gene donor vs. recipient vs. hybrid)
as repeated measure, and the value-charged adjectives “threatening”, “dangerous”, “ugly”, “impure”, “dumb”, “unfree”, and “fearful” as dependent variables.

According to hypothesis H2.1, the multivariate main effect role of animal was significant ($F_{\text{multivariate}}(14,637)=68.57, p=0.0001, \eta^2=0.60$). Table 3.2 shows the means and univariate results. Across cultures hybrids were judged as more threatening, dangerous, ugly, impure, dumb, unfree and fearful than their natural parents, that is, they are perceived in a definitely negative way.

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<th>TABLE 3.2</th>
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The MANOVA also yielded a significant main effect for country ($F(14,1290)=16.20, p=0.0001, \eta^2=0.15$) and an interaction country by role of animal ($F(28,1276)=12.49, p=0.0001, \eta^2=0.22$). Both effects indicate that respondents in one country tend to judge the animals and hybrids slightly differently on some adjective scales than in the other country. The Laboratory of Comparative Human Cognition (1979) advises against interpreting anything less than double interactions involving culture as a factor. Main effects and simple interactions are usually due to cultural effects of scale use.

2.3.3 Determinants of negativity: cross-kinds vs. unfitting capabilities

We calculated a $3*2*2$ ANOVA with country (Austria vs. India vs. Japan), kind conflict (within kind vs. cross-kinds), and capability conflict (fitting capabilities vs. unfitting capabilities) as between-subjects factors and the average of the seven adjective scores of the hybrids—“threatening”, “dangerous”, “ugly”, “impure”, “dumb”, “unfree”, “fearful”—as dependent variable ($\alpha_{\text{Cronbach}}=0.79$).
Hypotheses H2.2 and H2.2 state that the negativity effect will be larger for cross-kind hybrids than for within-kind hybrids, and larger for hybrids with a conflict of capabilities than for hybrids without such a conflict. The respective main effects were significant:

Kind conflict: $F(1,657)=11.76$, $p=0.001$, $\eta^2=0.02$; $M_{\text{within kind}}=4.03$, $M_{\text{cross-kinds}}=4.32$.

Capabilities conflict: $F(1,657)=14.10$, $p=0.0001$, $\eta^2=0.02$; $M_{\text{no conflict}}=4.01$, $M_{\text{conflict}}=4.32$.

A conflict of animal kinds, that is for example, introducing a gene from a trout into a penguin (fish vs. bird), results in the hybrid being judged more negatively than when the hybrid comes about by introducing a gene from a swallow into a penguin (both are birds). Equally, a hybrid resulting from two animals depending on different capabilities, such as for example, a swallow (flying) with genes from a trout (diving) is seen as more negative than a hybrid resulting from two animals with similar capabilities, such as for example, a trout (diving) with genes from a penguin (also diving).

There was also a weak double interaction country by kind conflict by capabilities conflict ($F(2,657)=4.60$, $p=0.01$, $\eta^2=0.02$). It shows, basically, that negativity is determined in Japan by cross-kinds hybridization, in India by combining incompatible capabilities, and in Austria by an interaction of both, cross-kind gene transfer and the combination of incompatible capabilities. Hence, hybridization is despised in all three cultures, but differently determined, either by transgressing the kind-boundaries or by supposedly mixing capabilities that might not be adaptive. These effect warrant further inquiry to determine to what extent essentialist thinking might differ cross-culturally.
4 Study three: Generalizing the effect to mixed ethnic offspring

4.1 Design and hypotheses

In the foregoing studies we showed the effect of hybridization of animals due to essentialist thinking. As we argued in the introduction, essentialist thinking is not restricted to natural kinds, but exists also with social categories and groups. Hence, if our reasoning about hybridization is valid, a hybridization effect similar to our animal studies is also to be expected with human categories. Even though the social and ethnic sphere is regulated by political norms that prescribe equality among people of different social, ethnic and racial background, social psychological research consistently shows that everyday judgments the world over continue to be governed by stereotype, prejudice, racism and bigotry (e.g. Winant, 2006). It should not come as a surprise, hence, that, when perceivers essentialize social categories and treat them as if they were natural kinds, the offspring of mixed marriages is perceived as a “hybrid” lacking category identity because of the parents’ supposed incompatible essences. Hence, high essentializers should judge social “hybrids”—that is, offspring of ethnically or racially mixed couples—more negatively than offspring of ethnically and racially “uniform” couples. In general, politically right leaning people are more likely to attribute essence and entitativity onto social categories than left leaning persons (e.g. Stenstrom, Lickel, Denson, & Miller, 2008). Study 3 is designed to test this conjecture. We hypothesize:

(H3) that respondents judge children from ethnically or racially mixed couples more negatively than children from “pure” couples, be they from the ingroup or the outgroup. This effect should be particularly strong for political right-wingers, who are known to be high essentializers, and less so for left-wingers.
4.2 Method

4.2.1 Subjects

A total of 258 students at the University of Linz were approached by e-mail and asked to participate in an online-experiment. Of these, 212 completed the experiment. Their median age was 26 years, 34% were men and 66% were women. Anticipating that it might be difficult to gather enough right-wing respondents we sampled students not only from the social and economic sciences, but also from science and law. They were approached in lectures, asked to participate in a study and given the URL and login-key to the non-public website of the experiment. Still the majority of the sample (N=164) was scored on the left-leaning side of the respective item and only a minority on the right (N=48).

4.2.2 Material

The study was a 2*3*2 between subjects design, cross-cutting an ethnic factor (Austrians and Turks vs. Austrians and Africans as parent combinations) and a pure/hybrid factor (pure ingroup parents vs. mixed ingroup/outgroup parents vs. pure outgroup parents). A parent combination could be pure ingroup (man and woman Austrian), pure outgroup (man and woman, both either African or Turkish) or mixed (Austrian man/Turkish woman, Austrian woman/Turkish man, Austrian man/African woman, Austrian woman/African man). The third factor was political leaning, the proxy for essentialism. The respondents were asked to imagine each couple to have offspring that was to be rated. The setup was an online experiment where each participant was randomly assigned one experimental condition.

After a distractor task introducing the participants to the use of online scales, they were presented a story about a man either of Austrian, Turkish or African origin who was born in 1960 and a woman either of Austrian, Turkish or African origin born in 1963. Both got to
know each other at a friend’s party in Austria 25 years ago. They married two years later and parented a child who grew up in Austria and took a “normal” development.

Subsequently respondents rated the child on a series of six-point bipolar adjective scales that included trustworthy-threatening, natural-unnatural, attractive-repugnant, and industrious-slothful, which, from a pre-test, were known to be highly value charged with regard to person judgments. Other and less charged adjective pairs were, for example: friendly-unfriendly, interesting-uninteresting, polite-impolite, and developed-underdeveloped. Subsequently respondents rated their political leaning on a ten-point scale ranging from “left” to “right”, gave their attitude on the item “In my country there are too many foreigners” on a 4-point scale. At the end they indicated their gender, age, and education.

4.2.3 Procedure

Respondents logged into the website and answered the questionnaire online. On average this took about 12 minutes. Upon completion they were offered to leave their e-mail address and be notified about the results.

4.3 Results

Besides being high essentializers, right wing respondents should be more xenophobic than political left-wingers, where xenophobia is a good indicator of essentialist thinking. In fact, the correlation between political orientation and xenophobia is significant (R=0.45, p=0.0001, N=221).

To test hypothesis H3 the scores for political orientation were dichotomized at the midpoint, resulting in 164 left-leaning and 48 right-leaning respondents. We calculated a 2*3*2 MANOVA with the ethnic factor (Austrian/Turkish parent combination vs. Austrian/African parent combination), the pure/hybrid child factor (offspring of pure ingroup
couple vs. mixed ingroup/outgroup couple vs. pure outgroup couple), and political leaning/essentialism (left/low vs. right/high) as factors and the four value charged adjective scales, trustworthy-threatenining, natural-unnatural, attractive-repugnant, industrious-slothful, as dependent variables.

According to the hypothesis we expected the “pure” offspring to be judged as more positive than the “hybrid” offspring. This effect should be stronger with politically right-leaning than with left-leaning respondents, implying an interaction between the pure ingroup/mixed/pure outgroup offspring factor and the political orientation factor. This interaction was significant (F<sub>multivariate/Pillais Trace</sub>(8, 396)=3.10, p=0.002, eta²=0.06) on all scales:

\[ F_{\text{trustworthy-threatenining}}(2,200)=7.60, \quad p=0.001, \quad \text{eta}^2=0.07; \]
\[ F_{\text{natural-unnatural}}(2,200)=6.22, \quad p=0.002, \quad \text{eta}^2=0.06; \]
\[ F_{\text{attractive-repugnant}}(2,200)=8.27, \quad p=0.0001, \quad \text{eta}^2=0.08; \]
\[ F_{\text{industrious-slothful}}(2,200)=8.17, \quad p=0.0001, \quad \text{eta}^2=0.08. \]

The results reveal an interesting pattern (Figure 4.1). As expected, right-leaning essentializers consistently devalue children of mixed descent relative to pure ingroup and outgroup children. Surprisingly, for left-leaning respondents the effect is not only reduced, but shows an exactly opposite pattern. They consistently overvalue children of mixed descent compared to children of pure ingroup and outgroup descent.

It must be noted here that the average values of all value laden adjectives are around or below a score of “3”. Being measured on a six-point scale, even the adjective means of the essentializers remain well below the midpoint of the scale of “3.5”, that is on the scale’s positive side. The hybridization effect in our sample, hence, is not about a negative evaluation
of the mixed ethnic children in absolute terms but about subtle differences between respondents with a higher, and those with a lower tendency to essentialize ethnic categories.

4.4 Discussion

The findings in this study reveal that a devaluation of hybrids does not only exist with animals but also with social categories. Essentializers perceive children of mixed ethnic descent as significantly different from pure ingroup and outgroup children: Offspring of mixed descent is judged as more threatening, unnatural, repugnant and slothful than “pure” offspring. However, this effect is reversed with left-leaning, not essentializing people: they overvalue “hybrid” children relative to “pure” offspring.

Note that the devaluation effect cannot be a consequence of the Turkish and African immigrants being a minority with low social status in European countries, meaning that members of the higher status majority despise inter-marriage with low status partners. If this were so, then also pure outgroup couples’ offspring should be devalued, which is not the case: Ethnic outgroup offspring are perceived equally positive as ingroup offspring. Therefore the effect is not due to low status outgroup discrimination.

We further confirmed this tendency in an interview study with six Turkish interviewees. Four of them were convinced that people from their own ethnic group were too different from the Austrian majority population to warrant inter-ethnic relationships and/or offspring. Children from mixed marriages “will be characterized by a loss of identity”, “will not know where they belong” and at the end will “be viewed negatively from both sides”. Interviewees who were prominent on this view were also conservative in their Turkish identity and mentioned the basic incompatibility of the two cultures, which is just another expression of a cultural essence.
The devaluation effect observed with essentilizers can readily be explained within the present essentialist framework of a theory of hybrids. In their view, when parents of the same ethnic or racial background procreate, the offspring is prone to suffer a lack of proper essence, because both parents convey “incompatible essences” onto their child. This is the same effect as we observed with within-species procreation of animals. Parents with significantly different ethnic or racial background are being imagined as carrying different and, indeed, incompatible essences that, when conveyed to their offspring, lead to an “essence collapse” that robs the child of its proper essence outfit and identity of its own.

The case is different with politically left-leaning persons. Why would somebody value children of mixed descent higher than children of either pure ingroup or pure outgroup descent? We can only guess at this time: Perhaps, politically liberal and leftist people feel a need to compensate what they perceive as an often un-welcome reception of ethnically or racially mixed children by the majority population. As a consequence, left-leaning people might positively discriminate them in comparison to children of pure descent. In any case, the over-valuation as well as the devaluation effect of cross-ethnic offspring compared to within ethnic offspring affords further investigation as it contradicts the familiar finding of a general outgroup discrimination (e.g. Tajfel, 1981).

5 General discussion

5.1 General findings

The studies cover the consequences of essentialist thinking for the perception of hybrids from natural objects, such as animals, to exemplars of social and ethnic categories. Study 1 provides evidence that in the imagination of our respondents, genetic parents possess a unique essence but hybrids do not. Irrespective of the method—sexual, in-vitro or genetic engineering procreation—animal hybrids are perceived as though they possessed no essence
of their own and as if their parents’ essences were being violated by the genetic combination of incompatible kinds. As a consequence, hybrids are judged as more eerie, ugly, dangerous, wild, and repulsive than their parents. This finding is replicated in study 2, which shows the devaluation effect to hold with cross-kind hybrids and with hybrids that arise from genetically combining animals with divergent capabilities. Study 3, finally, shows that respondents with an essentialist mindset show a devaluation effect with ethnically or racially mixed offspring. Political liberals do not.

5.2 The non-essence of hybrids

A lack of essence places hybrids outside of the categorical structure of the animal world, as would be expected if membership in living kinds were perceived as a yes or no affair (Estes, 2003; Sloman & Malt, 2003). This jeopardizes their “animalness” and renders the hybrids as not “being like any other animal”. As a consequence, animal hybrids are perceived in a deprecative way.

Although his devaluation might in part be a trivial outcome of the hybrid’s inevitable unfamiliarity, our regression analysis shown in Table 2.3 speaks a different language: The strongest determinant of deprecation is not unfamiliarity, but rather the perception of the hybrids’ essences being violated. This resonates with our everyday anecdotal evidence that we rarely deprecate novel things, even rather unfamiliar animals. There are, for example sometimes new breeds of dogs that we have not seen before. We may be bewildered and find them looking strange in appearance, but we would not systematically judge them as threatening, ugly, repulsive, or dangerous even though new races of dogs result from cross-breeding sometimes surprisingly incompatible parent dogs; what is crucial in this respect is the fact that parents and the new race alike are all seen as instances of the dog-kind.
Hence, deprecating the hybrid is not the consequence of a simple category crisis. Because the projection of a kind-specific essence is constitutive of any natural kind’s identity, the hybrid’s identity is jeopardized and eventually lost; essences don’t mix and the result is utterly unnatural (Kronberger & Wagner, 2007). Therefore, the method of crossbreeding, be it sexual intercourse or genetic modification, is secondary to the perceived impermeability of natural kind boundaries in everyday thinking (for an argument from bioethics see Thompson, 2003). Genetic modification itself is not the ultimate reason for perceiving hybrids as unnatural, as Rozin (2005) argues, but rather the crossing of kind boundaries and the confusion of essences.

The spontaneous reaction to hybrids appears to be a spontaneous affective response and implicit inference (Uleman, Saribay, & Gonzalez, 2008). This may be due to kind and hybrid perception to be the result of a holistic way of thinking (Atran, 2002). Far from being similar to a simple process of conceptual combination, hybrids come about by combinations of animals—and members of ethnic and racial categories—who are compounds of non-decomposable sets of attributes. Their combination results in feelings of repugnance, which is an autonomous affective reaction that emerges when confronting living beings without a clear identity, effectively excluding the hybrid from the accepted natural order. This process of cognition and affect interacting in complex ways poses interesting questions for future research.

The exclusion of an unfitting exemplar from the natural order is sometimes referred to as “monstrosity”. The term “monster” is not infrequent in Western cultural history and the ups and downs of its use in society mark periods of societal turmoil and enlightenment (Daston & Park, 2001). Perceiving monstrosity has always an ambivalent touch to it: On the one hand it inspires fear and aversion, on the other curiosity and interest. Traditionally, freak births were called monstrous, as was mental (Goodey, 2005) and physical handicap (Livneh, 1980).
Nowadays the terms monster and “monstrosity” have fallen into disrepute and only a few instances can be found in public discourse, fiction and mass media.

We conjecture that animal hybrids brought about by genetic modification provoke the “yuk factor” due to their inherent monstrosity. The yuk-factor, hence, would not be a reaction to genetic engineering but a more general reaction to the violation of essences, which renders the hybrid monstrous (Wagner et al., 2006). In our interpretation, perceived monstrosity is an inherent feature of cognizing violations of essence and marks the defilement of living beings.

5.3 Social categories, essentialization, and exclusion

One entailment of attributing social groups and their members an essence is their becoming naturalized and creating a tendency to exclude a-typical members (Wagner, et al., 2009). This effect might have always been with us, but recently it has gained additional impetus by popularizing genetic mechanisms for behaviors and group differences (Keller, 2005; Lemke, 2005; Phelan, 2005), which is akin to essentializing the gene bearers’ group identity. However, where there is naturalization there is also denaturalization, which, in certain contexts, may go hand in hand with attributions of monstrosity. Dalton (2006) identifies the concept of monstrosity in legal proceedings about homosexual sex offenders, and Holtz and Wagner (2009) demonstrate the bigot’s tendency to attribute a sort of monstrosity to offspring of mixed couples: Several messages in a neo-Nazi Internet forum express strong hostility against, for example, the offspring of black and white German mixed couples. They call such children “miserable creatures”, because it is believed they will not be able to lead a fulfilling life or attain a complete human identity, which is based on the heritage of one’s culture. Clearly, for racists, culture and nature form an inseparable whole that defines the essence of ethnic groups. As a result, the offspring of mixed marriages are perceived as lacking a clearly defined identity. The sample in our third study included moderately right leaning respondents
who usually identify highly with the ingroup and tend to essentialize, and project entitativity upon the ingroup and the outgroup. Even their responses mimic a cognitive tendency to deprive inter-ethnic offspring of identity and value.

An interesting example that fits the present argument comes from research on the perception of robots. When respondents judge robots ranging from pure industrial robots through “androids” that mimic humans in terms of appearance and behavior, the subjects’ ratings of easiness and comfort in their presence show a typical progression: Departing from neutrality for machines, the scores of easiness increase up to a point where androids become superficially quite humanlike but still exhibit somewhat jolty movement; at this point the scores of easiness drop dramatically, forming a so-called “uncanny valley”. Only when androids become virtually indistinguishable from humans in appearance and behavior, the respondents again feel comfortable in their presence (MacDorman & Ishiguro, 2006; Mori, 1970). In a way the android appears as a hybrid because its glitches in mimicking human behavior do not warrant attributing it a human essence that a perfectly constructed android might deserve.

5.4 What about Mestizo cultures?

In the course of world history peoples from various regions in the world migrated to other regions, colonized, conquered and subjugated other countries, states and tribes. Most of the time this meant that the new arrivals and the indigenous population mixed to a lesser or larger degree. A case in point is Latin America where large proportions of the population are Mestizos, that is people with a mixed Amerindian and Spanish descent. Other examples are parts of the Asian-Pacific countries like the Philippines, East Timor etc. Shouldn’t such Mestizo cultures embrace “hybridization”?
In Mexico Mestizos make up far more than 50% of the population. Hence, in countries with a large ethnically mixed population, cross-ethnic marriage should be seen as the normal case and not as something problematic. To check for this possibility we conducted five informal ethnographic interviews with members of the dominant Mestizo population. Most interviewees, particularly if their political orientation was conservative and right-wing, voiced rejection of Amerindian/Mestizo interethnic marriage and offspring. They justified their position by referring to their own ethnic group—Mestizo—as essentially different from the indigenous population, both of whom should stay separate and live in their respective worlds.

We interpret the interview results to indicate that the Mestizo majority in Mexico became a kind of its own during the course of history and no longer is considered a “mix of races”; this is well expressed in the official designation “La Raza Méxicana”. Once such a category is objectified in historical documents and became standard currency in local discourse, it is being endowed with an essence of itself and its conservative members develop an interest in maintaining its identity.

It should never be forgotten that we expect ethnically mixed offspring to be rejected only by essentializers, not by everybody. As our results surprisingly showed, politically moderate to left-wing respondents—low essentializers—appear to over-value inter-ethnic offspring. It would be the task of future research to delimit the range of validity of the hybridization effect.

5.5 Conclusion

The link between essentialist thinking, perceiving a collapse of essence, monstrosity and social exclusion of mixed category exemplars is closely interwoven. If we wish to gain a better understanding of how the mind makes social sense of the animate world including humans, this representational system must be considered in its entirety. Without a notion of
the cognitive and affective entailments of essentialism and essence mixing, theories of group perception may fall somewhat short of an adequate description, particularly in times of global migration.

In conclusion, we consider essentialization of living beings a spontaneous and virtually universal cognitive tendency. This tendency can be used as a versatile representational tool when it comes to social groups and categories. It allows justifying social relations, status and prejudice in conservative “folk politics” and it is essentialization as a political tool that must be overcome.
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Table 2.1

Study 1: Perceived negativity (monstrosity) regressed on four predictors.

<table>
<thead>
<tr>
<th>Predictor Description</th>
<th>Standardized Beta</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essence violation: “Through the combination of a [donor’s] and a [recipient’s] genome, the essence of the hybrid is being violated”</td>
<td>0.39</td>
<td>6.25</td>
<td>0.00</td>
</tr>
<tr>
<td>Fear: “How frightening is this hybrid for you?”</td>
<td>0.30</td>
<td>4.68</td>
<td>0.00</td>
</tr>
<tr>
<td>Familiarity: “Have you ever heard of this hybrid?”</td>
<td>-0.12</td>
<td>-2.25</td>
<td>0.03</td>
</tr>
</tbody>
</table>

*Note: Adjusted $R^2=0.43$, $F(3,233)=59.33$, $p=0.00$.*/
Table 3.1

Study 2: Experimental design for kind conflict by capabilities conflict.

<table>
<thead>
<tr>
<th>Genetically transplanted capability donated by…</th>
<th>Genetically transplanted capability that is…</th>
<th>…adaptive for gene recipient</th>
<th>…maladaptive for gene recipient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genes for flying (from swallow) into another swallow</td>
<td>Genes for flying (from swallow) into a swimming bird (penguin)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genes for swimming (from trout) into another trout</td>
<td>Genes for swimming (from trout) into a “flying” fish (flying fish)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genes for swimming (from penguin) into another penguin</td>
<td>Genes for swimming (from penguin) into a flying bird (swallow)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genes for “flying” (from flying fish) into another flying fish</td>
<td>Genes for flying (from flying fish) into a swimming fish (trout)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genes for swimming (from trout) into a “flying” fish (flying fish)</td>
<td>Genes for flying (from swallow) into a swimming fish (trout)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genes for swimming (from trout) into a swimming bird (penguin)</td>
<td>Genes for swimming (from trout) into a flying bird (swallow)</td>
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<tr>
<td>Genes for swimming (from penguin) into a swimming fish (trout)</td>
<td>Genes for swimming (from penguin) into a “flying” fish (flying fish)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genes for flying (from flying fish) into a flying bird (swallow)</td>
<td>Genes for flying (from flying fish) into a swimming bird (penguin)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3.2

Study 2: Mean adjective scores by role of animal.

<table>
<thead>
<tr>
<th>Mean</th>
<th>Gene donor</th>
<th>Gene recipient</th>
<th>Hybrid</th>
<th>F(2,1300)</th>
<th>Eta²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threatening</td>
<td>2.32 a</td>
<td>2.40 a</td>
<td>4.40 b</td>
<td>365.83**</td>
<td>0.36</td>
</tr>
<tr>
<td>Dangerous</td>
<td>2.65 a</td>
<td>2.79 a</td>
<td>4.22 b</td>
<td>257.36**</td>
<td>0.28</td>
</tr>
<tr>
<td>Ugly</td>
<td>2.78 a</td>
<td>2.95 a</td>
<td>4.44 b</td>
<td>347.18**</td>
<td>0.35</td>
</tr>
<tr>
<td>Impure</td>
<td>3.02 a</td>
<td>3.13 a</td>
<td>4.26 b</td>
<td>178.10**</td>
<td>0.22</td>
</tr>
<tr>
<td>Dumb</td>
<td>3.23 a</td>
<td>3.33 a</td>
<td>3.82 b</td>
<td>45.01**</td>
<td>0.07</td>
</tr>
<tr>
<td>Unfree</td>
<td>2.51 a</td>
<td>2.47 a</td>
<td>3.91 b</td>
<td>215.30**</td>
<td>0.25</td>
</tr>
<tr>
<td>Fearful</td>
<td>3.27 a</td>
<td>3.24 a</td>
<td>4.14 b</td>
<td>100.19**</td>
<td>0.13</td>
</tr>
</tbody>
</table>

** p≤0.0001

Note: Means with different superscripts within a row are significantly different according to linear contrasts.
FIGURE 2.1
FIGURE 4.1
Figure Captions

Figure 2.1
Study 1: Means of adjective scores by role of animal. The higher, the more negative the score.

Figure 4.1
Study 3: Perceived trustworthiness, naturalness, attractivity and industriousness of children by pure vs. ethnically mixed parents and by non-essentializers vs. essentializers.

*Note:* The midpoint of the scale is 3.50, the maximum is 6.00. Differences between points with different letters are significant at $p \leq 0.05$. 