







The science of cuteness: where teddy bears' beauty, comfort and care converge

Nathalie Blanc ^{a*}, Anne-Sophie Tribot ^{b*}, Thierry Brassac ^c and Nicolas Mouquet ^{d,e}

^aEpsilon-LAPECS, Univ Montpellier Paul-Valéry, Montpellier, France; ^bCNRS, TELEMME, Aix Marseille Univ, Aix-en-Provence, France; ^cScience & Society Dpt, Univ Montpellier, Montpellier, France; ^dMARBEC, Univ Montpellier, CNRS, Ifremer, IRD, Montpellier, France; ^eFRB – CESAB, Montpellier, France

ABSTRACT

This study examines the attribution of teddy bear cuteness based on visual evaluation of aesthetic, comfort, and care motivation. Using 436 teddy bear photos, the research quantifies the relationship between aesthetic attractiveness and comfort attribution, and whether their interaction enhances individuals' care motivation. The study involved 11,188 French participants, aged from 3 to 92 years old, recruited online. Beauty, comfort, and care values were highly correlated, meaning that visual cuteness of teddy bears relies on a combination of visual attractiveness and comfort attribution that trigger care motivation. Among visual characteristics, perceived softness was identified as the key determinant of cuteness. The age of the participants had an effect on preference patterns, suggesting an influence of stereotypical representations of teddy bears. This study provides a better understanding of the visual determinants of cuteness, and highlights how aesthetic and emotional evaluations of teddy bears influence care behaviors.

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Introduction

The comforting power of teddy bears: alleviating stress, pain and anxiety

The most common attribute of teddy bears is their ability to provide comfort. This characteristic is conveyed in a number of studies using teddy bears with children and/or adults to overcome stressful or even painful situations. Take the example of the famous Teddy Bear Hospital (TBH) project, which was developed over 20 years ago to help children discover the medical field and help them cope with the negative emotions associated with medical procedures. According to this intervention, which is becoming increasingly popular with young children all around the world (i.e. nursery school, primary schools), children who discover the hospital environment to care for their teddy bear in contact with medical staff enable them to apprehend the experience of medical treatment differently with positive outcomes (e.g. Bloch & Toker, 2008). Although the effectiveness of the TBH project still needs to be widely confirmed and verified in future studies (Rashid et al., 2021), a recent study has highlighted its benefits with preschoolers (e.g. Mildenberger et al., 2024): This intervention based on a role-playing game (i.e. children act as parents for their sick teddies) not only reduces their


anxiety regarding medical personnel and hospitalization but also increases their knowledge of medical context.

Promising results have also been reported in children aged 4 to 16 years who were confronted to pediatric magnetic resonance imaging (MRI). Specifically, Morel et al. (2020) used a mock scanner with a teddy bear to provide explanation of the MRI exam, which can be highly stressful for children and their parents. These authors compared two groups with only one receiving teddy bear's mock MRI scanner. In the preparation room, young patients felt more relaxed after the teddy bear's mock scanner explanation. Overall, the level of anxiety was reduced for those who were exposed to the mock scanner using a teddy bear to convey medical explanation. Also, because they were encouraged to keep the teddy bear in their arms during the MRI examination, the motion artifacts rate was lower during the exam.

Similar findings were reported with teddy bears reducing the pain of social exclusion and increasing prosocial behavior (Tai et al., 2011). In two experiments, adults were placed either in a situation of social exclusion or in a situation of social inclusion. Their prosocial behaviors and emotions were measured to assess whether touching a teddy bear (instead of viewing a teddy bear from a distance) can mitigate the negative effects of social exclusion. Taken together, the two studies

CONTACT Nathalie Blanc  nathalie.blanc@univ-montp3.fr  Univ Montpellier Paul-Valéry, Epsilon-LAPECS, Montpellier, France; Anne-Sophie Tribot  anne-sophie.tribot@univ-amu.fr  Aix Marseille Univ, CNRS, TELEMME, Aix-en-Provence, France

*These authors share first authorship.

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revealed that when excluded, adults behave more prosocially if they had the opportunity to touch a teddy bear, since positive emotions that emerged mediate the link between touching a teddy bear and the occurrence of prosocial behavior. Closely related to these findings, a study (Svetlova et al., 2010) also provided converging evidence that 30-month-old children spontaneously display prosocial behavior by giving an adult (i.e. the experimenter) their teddy bear in a situation where the adult has become sad. The emotion-based helping behavior examined in this study allows links to be established between the prosocial behavior assessed in children using the teddy bears and children's ability to make the inference that the adult will be comforted if he/she can touch their teddy bear.

In all these studies, teddy bears are seen as inherent sources of comfort, capable of alleviating the anxiety associated with a medical examination or reducing the negative effects associated with a situation of social exclusion. However, very little information has been provided on the characteristics of the teddy bears used, which has led to a *de facto* adherence to the attribution of this quality – yet a key question remains: which teddy bear, and what makes some more comforting than others? In this context, a study (Tribot et al., 2023) looked at the visual, olfactory and kinesthetic properties of teddy bears that spontaneously underlie the attribution of comfort. The participants (children and adults) were invited to take part in a participatory study in which they were asked to carry out various tasks, one of which was to assess the comfort of different teddy bears (including their own). Through a series of sequential matches between two bears (including their own), the participants had to choose which of the two bears they would prefer to cuddle if they were sad or scared. The comfort value of each bear used in this participatory experiment was calculated on the basis of the average number of matches won. When the emotional bond shared with the teddy bear was removed (since the matches involving their own bears were systematically won), it appeared that a combination of visual, olfactory and kinesthetic characteristics plays a significant role in the attribution of teddy bears' comfort, with a more pronounced importance for the senses involving touch. These results were independent from participants' age and gender.

Cuteness in focus: the interplay between visual beauty, comfort and care

While the importance of kinesthetic properties in comfort attribution of teddy bears was clearly highlighted in our previous study (Tribot et al., 2023), the consideration

of visual characteristics presented certain limitations. For example, colorimetric characteristics were not measured objectively, but reported by participants with reference to unique color classes. In the absence of physical interaction with the teddy bear, the morphometric properties that would participate in the attribution of comfort remain therefore unclear. More generally, the probable interaction between perceived comfort and visual aesthetic preference needs to be further considered. Such a relationship has been investigated for aesthetic experience with art, although remaining poorly understood (Fekete et al., 2022). Promising evidence suggests the effects of viewing artwork on reducing stress and pain (Fekete et al., 2022; Law et al., 2021). For instance, a study found that viewing beautiful paintings reduced pain perception by providing positive attentional distraction (Tommaso et al., 2008). Another study showed that art gallery visits caused a significant reduction of stress assessed by salivary cortisol level (Clow & Fredhøj, 2006). More generally, several studies focusing on art and psychological well-being suggest that art improves health and well-being among individuals (Mastandrea et al., 2019).

Outside the realm of art, the field on environmental aesthetics provided a number of studies arguing that exposure to environments with high perceived aesthetic value can significantly enhance individuals' overall well-being (Abraham et al., 2010; Velarde et al., 2007). Similarly, aesthetic value of animals is intrinsically related to their attractiveness and shapes human attitudes to more positive effects and emotional bonds toward animals (Borgi & Cirulli, 2016; Gould, 1979; Herzog, 2011; Knight, 2008; Serpell, 2004). Resulting attachment of human–animal interaction brings joy, comfort and significant health benefits for people (Beck, 2014; Walsh, 2009). In those cases, attractiveness and visual properties may elicit a behavioral carefulness, associated with attentional focus (Nittono et al., 2012), nurturing behavior (Sherman et al., 2009), empathy (Zickfeld et al., 2018) and expression of positive feelings (Nittono & Ihara, 2017). This is particularly demonstrated in the case of biodiversity conservation, since the most visually charismatic species (based on beauty and cuteness, Albert et al., 2018) generally benefit from more conservation efforts (Colléony et al., 2017), and raises more scientific and societal interest (Mouquet et al., 2024; Troudet et al., 2017).

The positive emotional and sensory feedback of an aesthetic experience are generally characterized as a perceptual interpretation of beauty (Ramachandran & Hirstein, 1999). This specific interaction between beauty, comfort and carefulness can in turn be considered as cuteness (Borgi & Cirulli, 2016; Dale et al., 2016).

Cuteness is a set of attributes that elicit affective responses, particularly associated with juvenile facial features in the literature, referred to as ‘baby schema’ (Borgi et al., 2014; Nittono et al., 2012). However, visual attractiveness and perceived beauty are also to be considered when characterizing cuteness (Dale et al., 2016).

Considering that beauty and comfort are intimately linked, it is likely that individuals’ prior knowledge and mental representations associated with the teddy bear stereotype participate in the structuring of cuteness. The case of the teddy bear is special: neither a work of art nor an animal, but an inanimate object in the image of an existing animal and designed to be attractive and bring comfort. The teddy bear has been particularly stereotyped since its creation in the early twentieth century (He, 2014), typically brown, with a button-shaped nose, a large head (Borredon et al., 2025), and short limbs. Although contemporary teddy bears materialize in various shapes, colors and materials, its stereotype is still collectively shared across Western societies as evidenced by the media and popular culture (Caldas-Coulthard & van Leeuwen, 2003). However, it is possible that young children are less influenced by these stereotypes, simply because they are exposed to more diverse forms of teddy bears from a young age.

Although comfort attribution and aesthetic judgment seem to be largely intertwined through emotional evaluations, carefulness and protection motivation seem to be more of a cognitive evaluation resulting in a post hoc behavioral intention. Therefore, the relationship between protection motivation with perceived beauty and the attribution of comfort remains to be highlighted. The teddy bear presents a relevant case study as a lever to induce prosocial behavior, in which the observation of a motivation for protection would be a means of assessing the prosocial behavior of individuals. Previous studies highlighted the role of empathy and mindset in fostering prosocial behavior in different contexts. In 2024, a study by Ishtiyag and colleagues explored the link between empathy and prosocial behavior in individuals aged 18 to 30, with 90 participants. They found a strong positive correlation, indicating that higher empathy leads to more prosocial behavior. Another study conducted by Wice et al. (2020) examined the relationship between empathy, prosocial behavior, and interactions with animals in 3rd grade children ($n = 158$). They indicated that children with more frequent, companionate interactions with animals had higher empathy, which was positively linked to prosocial behavior, as reported by teachers. These results suggest that

empathy mediates the effect of positive animal interactions on prosocial behavior, supporting the role of such interactions in emotional development in children. Regarding the relationship between beauty and prosocial behaviors, a study (Hung & Faust, 2024) focused on how people’s mindset about beauty – whether they believe it is fixed or can be improved – affects their prosocial and altruistic actions. In a series of 10 experiments with 4,449 participants, they observed that those with a ‘beauty growth mindset’ were more likely to donate to charity, get vaccinated, and engage in other prosocial behaviors compared to those with a fixed mindset. This research highlights how a beauty growth mindset could have broader societal impacts by promoting prosocial behavior. Together, these studies demonstrate how empathy, emotional responses, and mindsets – whether related to beauty or protection – can promote compassionate actions, emphasizing their societal value across various age groups and contexts.

Studying teddy bears in this context provides a practical example of how objects associated with comfort, cuteness and emotional attachment can be used to assess prosocial behavior.

Purpose of the study

This study aims to explore how human engagement with teddy bears is shaped by visual perception, particularly focusing on the morphometric and colorimetric features that contribute to the attribution of beauty, comfort, and care. By examining photographs, the study seeks to quantify the relationship between aesthetic experience and comfort attribution, and to test whether their combination increases the desire to protect the teddy bear. The hypothesis is that human engagement with teddy bears is influenced by stereotypical representations of these objects, with older individuals more likely to endorse these stereotypes due to prior knowledge and exposure. By examining teddy bears, the study also investigates how attributes such as beauty and comfort attribution indirectly influence prosocial behavior, specifically through protection motivation (care). This link between emotional evaluation and behavioral intention highlights the teddy bear as a valuable tool for studying how psychological processes related to care and protection drive individuals’ willingness to act compassionately. By understanding these dynamics, the study contributes to a broader understanding of how aesthetic and emotional factors shape prosocial actions and promote well-being.

Material and methods

Participants

The participants consisted of 11,188 French people aged from 3 to 92 years, recruited online through channels including social media and mailing lists within both personal and professional networks in France. The study was open to children and adults, regardless of age. Among the participants, 66.6% were female, the median age was 27, and 46% of participants had a Master degree or a PhD (Figure 1). Given the disparity in the distribution of participants regarding age, gender and level of education, the effect of these variables (Figure 1) on other assessed factors has been systematically tested in the analyses. The majority of participants have or had a cuddly toy (86%) of which 37% is or was a teddy bear.

Individuals reporting color vision problems were excluded from the analyses.

Online survey

The online survey (S1) consisted of a photo questionnaire distributed from June 2020 to November 2020. The survey was available in French, anonymized and hosted on the online platform Biodiful (biodiful.org). At the beginning of the questionnaire, a consent form was validated in accordance with the regulations provided by the CNIL (National Commission for Information Technology and Civil Liberties of France) and EU General Data Protection Regulation (GDPR).

The photo questionnaire (S1) was structured into three sets, corresponding to the different studied dimensions of human engagement with teddy bears: beauty, comfort and care (Figure 2). In the first set, two photos of teddy bears were randomly displayed, and the participants had to click on the teddy bear that they perceived as the most beautiful. Each choice made by the participant was considered

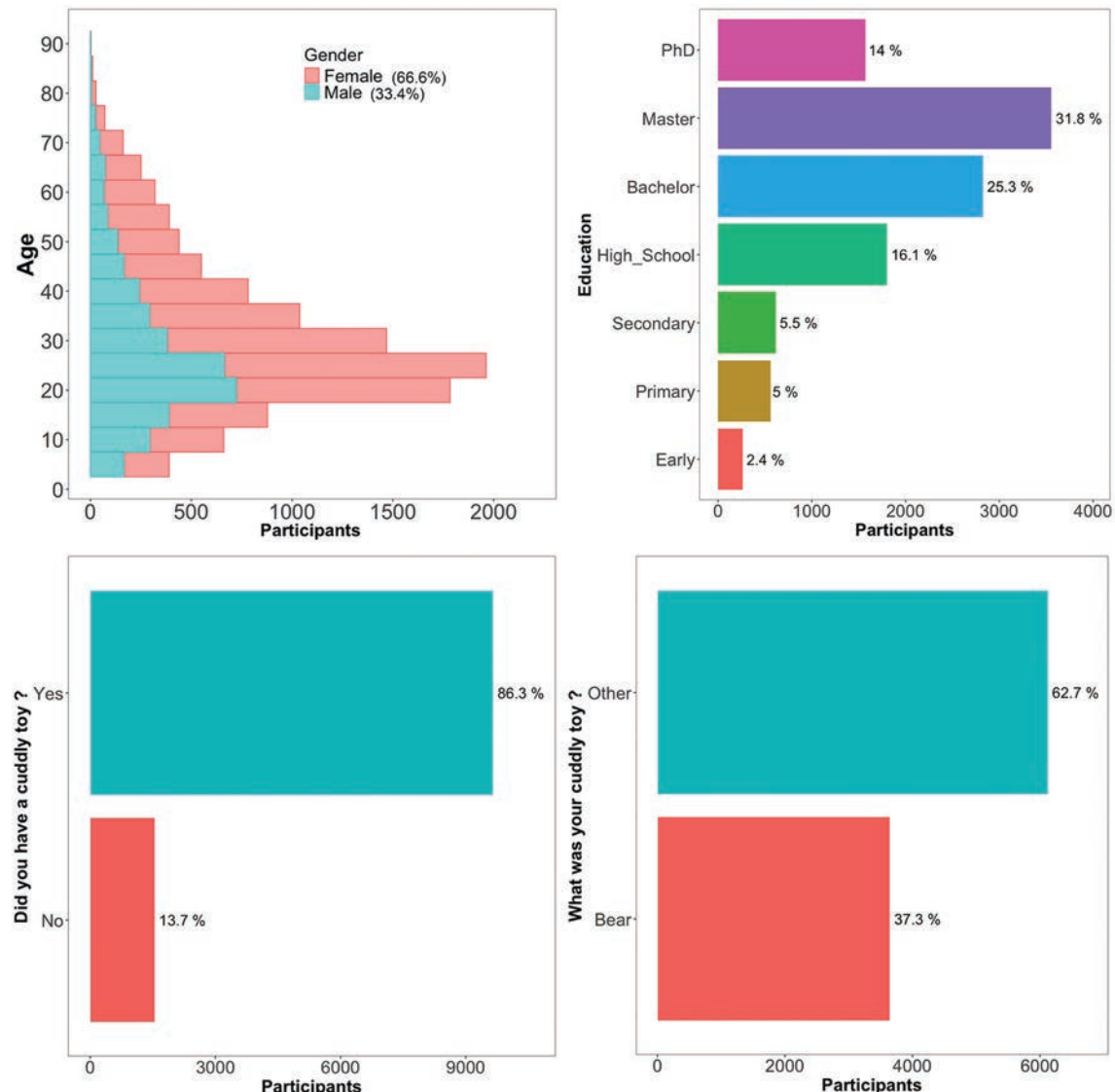


Figure 1. Sample of participants. Distribution of participants according to gender and age, level of education, ownership of a cuddly toy, and ownership of a teddy bear.

a 'match'. This procedure was repeated 15 times per participant with different matches of photos randomly displayed. The same sequence was then applied for the two next sets, with only the instructions changing: participants had to click on the teddy bear they perceived as the most comforting in the second set, and on the one they felt the strongest urge to protect if threatened in the third set. The photos were displayed randomly in the three sets (i.e. the participants evaluated different bears in each set). Thus, the participants' evaluations were not influenced by the constant order of the sets and their previous responses. Each set was displayed with a different background color. Each photo was displayed with a graduated ruler notably to help participants to visualize the actual size of the teddy bear. This information was not intended to be analyzed as a determining factor of beauty, comfort and care; it was rather given to the participants for informational purposes. The final part of the survey consisted of questions regarding socio-demographic variables (gender, age, level of education). Age was then categorized in five classes: Children (3 to 10 years old), Adolescents (11 to 16), Young adults (19 to 30), Adults (30 to 60) and Older adults (≥ 60) and questions designed to identify participants who have or had a teddy bear ('Do/Did you have a cuddly toy?'; 'Is/Was this cuddly toy a teddy bear?').

Material

Teddy bears photographs

A total of 436 photos of teddy bears were used for this study. Among them, 280 came from a citizen science campaign conducted in France since 2019 (see Tribot et al., 2023; <https://nounours.umontpellier.fr/>). To increase the morphometric and colorimetric diversity of teddy bears used in our survey, we added 156 photos of teddy bears found on the internet using Google Images. For each of the 436 photos, the background was removed and the image size was standardized to fit in 500×500 pixels and 96 dpi. An illustration of the principal component analysis of the teddy bears' distribution according to their morphometric and colorimetric attributes is shown in Figure 3 and it illustrates how the teddy bears added from the internet completed the collection from the citizen science campaign. Axis 1 (20% of explained variance), was mostly explained by muzzle volume (18%), nose circumference (18%) and width of the chest (15%). Axis 2 (16% of explained variance) was mostly explained by colorimetric factors: lightness (22%), contrast (14%) and saturation (12%). Details regarding the measurement of these features are given in the paragraph below. The photos from Google Images were not always royalty-

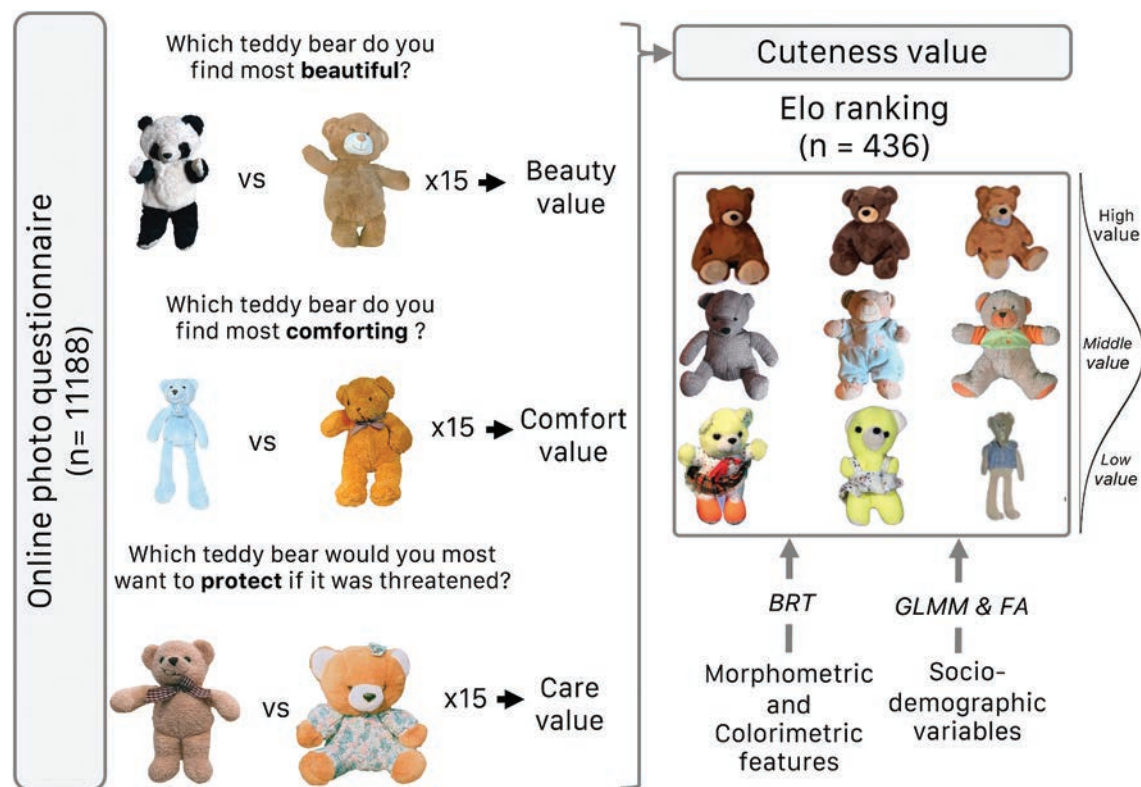


Figure 2. Graphical abstract of the methods and analyses. Images sources: redrawn from Google images and <https://nounours.umontpellier.fr/>, CC-NC.

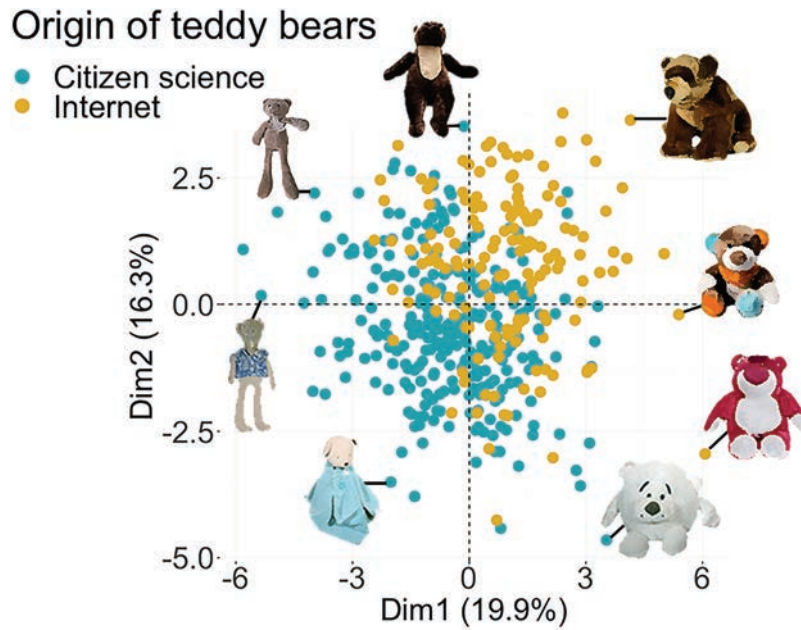


Figure 3. Principal component analysis of the distribution of teddy bears according to their morphometric and colorimetric features. Representation of teddy bear coordinates in two-dimensional space. Yellow points represent teddy bears from the internet (whose photos are redrawn in this figure). Blue points represent teddy bears collected as part of the participatory science project (Tribot et al., 2023; <https://nounours.umontpellier.fr> CC-NC).

free, unlike the photographs collected as part of the participatory science project (Tribot et al., 2023; <https://nounours.umontpellier.fr>). For this reason, the teddy bears from Google Images were schematically redrawn for each of the figures in this article, so as to represent the color and general shape of the bear, without being a copy of it.

Morphometric features of teddy bears

The morphometric features of teddy bear were measured in cm using ImageJ software (<https://imagej.nih.gov/ij/>) based on the photographs: Total body length; height, width and depth of the head; length, height and width of the muzzle (converted to volume); height and width of the nose (converted to surface); length of the ears; diameter of the eyes; width and depth of the chest; length of front and back legs. Since participants in the online survey could not assess the actual size of the teddy bear, total body length was not included in the analyses, and each of the metric variables was divided by the total length to obtain standardized data.

Additionally, posture, presence of smile and hair length were recorded. For this last variable, the data had been provided by participants in the participatory science program, using a ruler composed of seven textile patches, classified according to their length (see Tribot et al., 2023). The participants were asked to choose by touch the patch that was closest to the teddy bear's fur.

For teddy bears from the internet, the same classification was done by visual observation. Finally, we summarized the juvenile traits of the teddy bears in two variables: large eyes (the ratio of the diameter of the eyes to the width of the head) and small nose (the ratio of the length of the muzzle to the length of the head). Continuous variables were log transformed (when needed) and standardized.

Colorimetric features

Several metrics were computed to characterize the colorimetric features of the teddy bears, based on previous literature focusing on aesthetic neurosciences (Chatterjee, 2014; Ramachandran & Seckel, 2012; Reber et al., 2004; Redies, 2015; Shimamura & Palmer, 2012) and on aesthetic judgement of animal photos in particular (Borgi et al., 2014; Frynta et al., 2014; Langlois et al., 2022; Nittono et al., 2012; Tribot et al., 2018). The measured metrics describe the heterogeneity of colors, saturation, lightness and contrast, and were measured following the methods described in Langlois et al. (2022).

Color heterogeneity characterizes the diversity of different colors of teddy bear, based on the K-means clustering algorithm that allocates every pixel of an image to the nearest cluster according to CIELAB values of each pixel. CIELAB color space expresses color as three axes: L* for lightness (from black at 0 and white at 100); a* for the value within the green-red gradient; and b* for the

value within the blue-yellow gradient. To compute color heterogeneity, we measured the mean distance between all cluster centers on the a^*b^* color space. The higher the mean, the more heterogeneous and distant are the colors of the different clusters. Saturation and Lightness were measured using HSV (Hue, Saturation, Value) color space that differentiates saturation (S) from perceptual lightness (V). S represents the intensity of the color, whereas V ranges from black to white. As color (Hue) was already characterized by the CIELAB color space analysis, HSV color space has been used only for saturation and lightness. For each image, mean lightness and mean saturation of the pixels has been computed. Contrast was measured by the standard deviation of the mean Lightness values. Images with high standard deviation values indicate large ranges of lightness, and thus highly contrasted pixels.

Analyses

Measurement of cuteness value based on beauty, comfort and care

We computed values of beauty, comfort and care for each teddy bear based on the results of the three sets of pairwise photos comparisons (match) described above. The values were calculated using EloChoice v 0.29.4 R package (Clark et al., 2018), based on the Elo rating, which computes a value for each image based on the won and lost match and updates the general ranking after each pairwise match. Elo rating is a suitable tool to individually rate a large number of images without participants having to evaluate the entire pool. Since the order of matches has a slight influence on the values, we recalculated the Elo rating by randomizing the order of matches over 1000 iterations, and calculated the mean value.

Since beauty, comfort and care values were highly correlated (Figure 4), we calculated the mean of these three variables (see results and discussion) to compute a cuteness value for each teddy bear. In order to assess the part of explained variance of cuteness, and to more precisely analyze the covariance between beauty, comfort and care, we used latent variable model and factor analysis. Based on covariances, cuteness was here estimated as a latent variable, based on beauty, comfort and care defined as observed variables. The effect of the observed variables on the latent variable was then estimated using factor analysis and comparison of variance estimate values. The same analyses were done on different contrasting age groups (children up to 10 vs. adults over 60) to test the effect of age on the hierarchy of the three dimensions of cuteness.

Effect of socio-demographic variables on cuteness value attribution

The effect of age, gender, education level, cuddly toys ownership and teddy bear ownership on cuteness, beauty, comfort and care values were tested using a generalized linear mixed-effects model (GLMM) with a binomial error structure (using the glmer function from the lme4 v 1.1–26 R package). Model was fitted to predict the outcome of match for each photo according to fixed predictors, including a random effect attributing independent intercept for each photo. We categorised age in five categories to fit the model: Children (3 to 10 years old), Adolescents (11 to 16), Young adults (19 to 30), Adults (30 to 60) and Older adults (≥ 60). An ANOVA was then computed to provide a ranking of the socio-demographic variables based on their contribution to the model, allowing to assess which variables have the most significant effect on the likelihood of an image

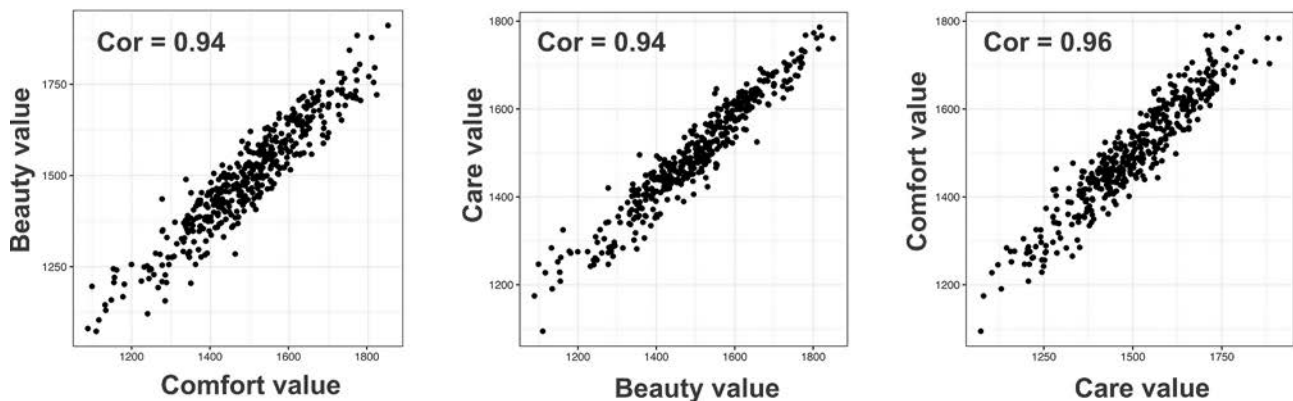


Figure 4. Correlations between beauty, comfort and care values. Cor = Pearson's correlation coefficients; all p -values $< .001$.

winning. This effect is assessed using Chi-squared p-values resulting from the ANOVA. A Chi-squared p-value higher than 0.05 indicates that the given variable does not contribute significantly to explain the variance in the match outcome.

Effect of teddy bears features on cuteness value

We used Boosted Regression Tree (BRT) models to test and quantify the effect of colorimetric and morphometric features of teddy bears on cuteness values. BRT combines multiple decision trees. Decision trees are statistical algorithms that subset data based on input features. Each node of the tree represents a decision based on a feature, each branch represents an outcome of the decision, and each leaf node represents a predicted outcome (class of data). In BRT models, each tree is built sequentially, correcting errors from the previous one, and the final model is a weighted sum of these trees. This 'boosting' process reduces bias and variance, making it effective for regression tasks. The importance of each variable in the final model was assessed using the percentage of explained variance. In addition, partial dependence plots were computed to assess the relationship between each feature and the cuteness value. These plots help visualize how changes in variables affect the model's predictions, highlighting the variable's influence and importance in the BRT model.

Results

Teddy bears' cuteness value

Beauty, comfort and care values were highly correlated (Figure 4). Thus, we calculated the mean of these three variables to compute a cuteness value for each teddy bear. Cuteness values ranked from 1086 to 1835. Examples of teddy bears with higher and lower cuteness values are given in Figure 5. The importance of each of these variables on latent cuteness was then estimated using factor analysis. Based on this latent variable model and factor analysis (S2), we found that variance of latent cuteness was mainly explained by comfort (55%), followed by beauty (27%) and care (18%). We found a different result for children under 10 years old, since cuteness was equally explained by comfort (36%), beauty (32%) and care (36%).

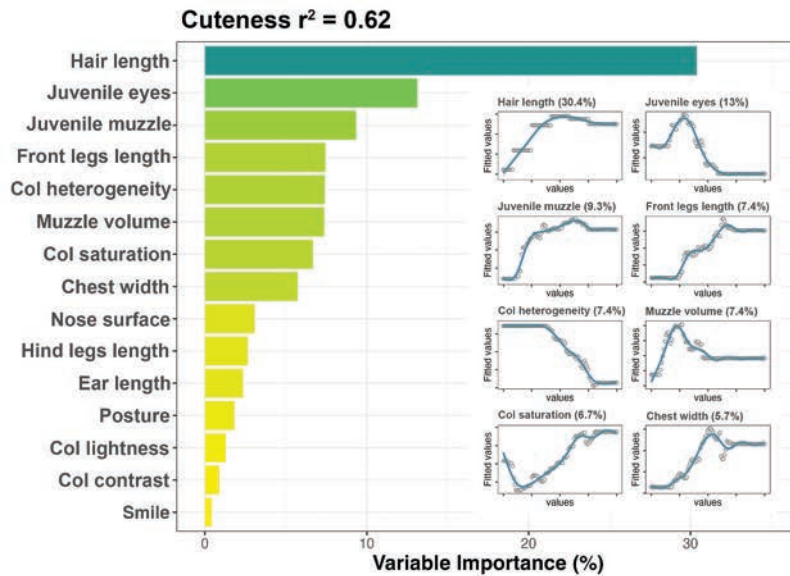
Teddy bears' cuteness morphometric and colorimetric determinants

We used Boosted Regression Trees (BRT) to model the effect of colorimetric and morphometric features of teddy bears on cuteness values. We found a predominant effect of hair length (Figure 6), followed by juvenile features (based on relative sizes of eyes and muzzle). Partial plots showed a positive and saturating effect of hair length, and a hump-shaped relationship with juvenile features. Overall, other significant features had a saturating positive



Figure 5. Example of 24 bears showing a decreasing gradient of cuteness scores. Images sources: redrawn from the image collected on Google images and <https://nounours.umontpellier.fr>, CC-NC.

a) BRT model based on all participants



b) Model based on children under 10 years old

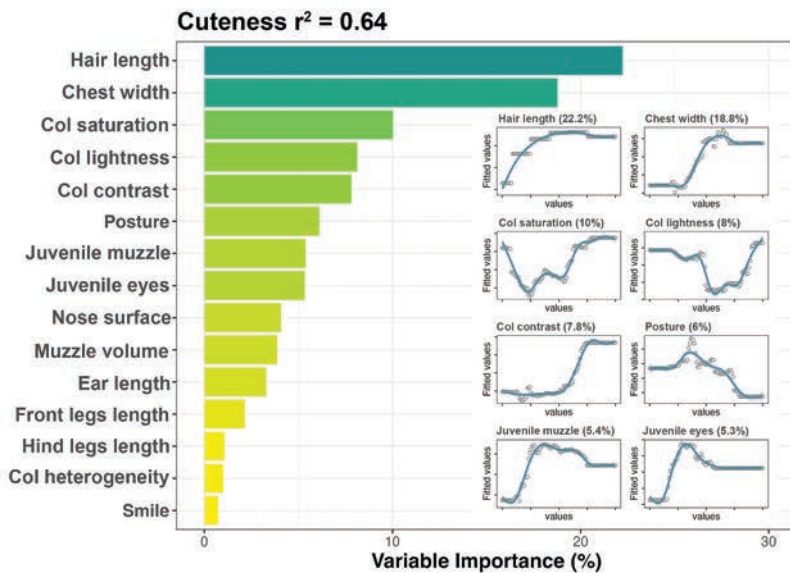


Figure 6. Boosted Regression trees (BRT) modelling the effect of colorimetric and morphometric features of teddy bears on cuteness scores. Horizontal plot shows the importance of each variable as a percentage of explained variance in the BRT model considering a) all participants, and b) children under 10 years. The coefficient of determination r^2 provides information about the model's fitness. The curves shown on the right size are the partial plots associated with the model, and give a visualization of the relationship between cuteness scores and main important variables. Col = color.

effect on cuteness, except for color heterogeneity that showed a negative relationship.

Difference between children and adults in the assignment of cuteness value

The generalized linear mixed model (GLMM) did not reveal significant effects of age, gender, education level, cuddly toys ownership and teddy bear ownership

on cuteness, beauty, comfort and care values (all Chi squared p -values >0.05).

However, age has a visible effect when confronting extreme classes: children (3 to 10 years) and older adults above 60. ($S3$, Pearson's correlation coefficient = .531). We found trends in the effect of age on the ranking of teddy bears according to cuteness (Figure 7). Overall, children showed a particular preference for pandas and teddy bears in less stereotypical colors (green, purple, pink, yellow

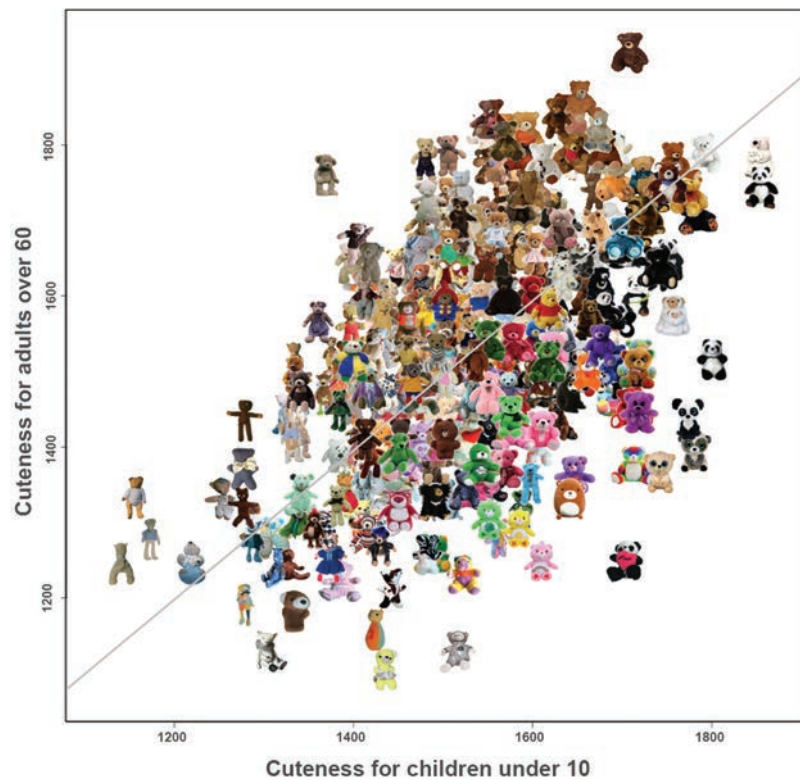


Figure 7. Cuteness scores of the teddy bears according to age class. Each teddy bear is positioned on the graph according to the cuteness scores attributed by adults over 60 ($n = 764$) and children under 10 ($n = 809$). The grey line is 1:1 centered and allows to divide the pool of teddy bears in two: teddy bears above the line have higher scores among adults than children, and teddy bears below the line have higher scores among children than adults. The Pearson correlation coefficient between adult and child scores was .531. Images sources: redrawn from Google image and <https://nounours.umontpellier.fr>, CC-NC.

and blue). Children seemed to prefer bright, saturated colors. Conversely, older adults showed a preference for more classic teddy bears, with brown tones.

These results are confirmed by comparing the effect of colorimetric and morphometric features of teddy bears on cuteness between children and older adults (Figure 8). When considering these contrasted age classes, the BRT model results showed notable differences. Although perceived softness (hair length) played a preponderant role for both children and older adults, chest width and variables associated with colorimetric features (saturation, lightness, contrast) had more importance than juvenile features for children. Partial plots showed that children were more attracted to teddy bears with high-contrast, saturated, and bright colors. We also found that the hump-shaped relationship with juvenile features was more pronounced for older adults suggesting that high values of juvenile features induce aversion for older adults.

Discussion

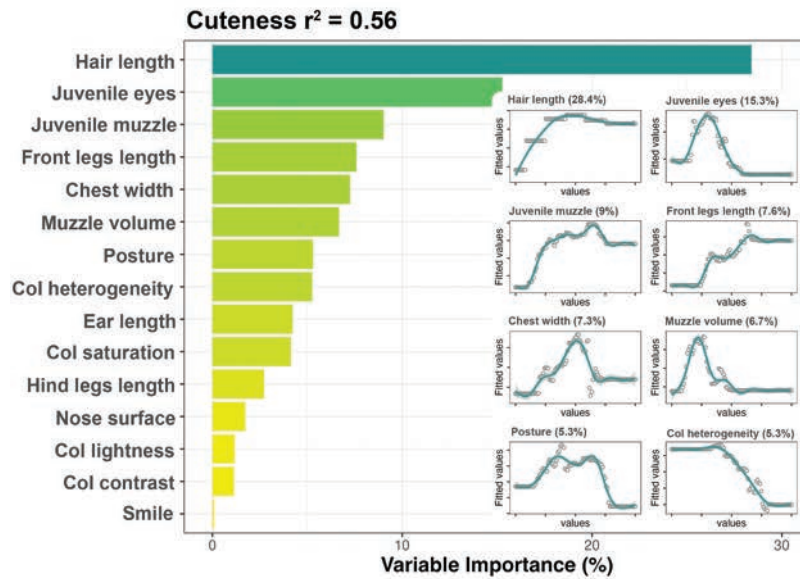
Teddy bears are commonly regarded in psychology as comfort objects. While a previous study identified the

multisensory characteristics involved in the attribution of teddy bear's comforting power (Tribot et al., 2023), the benefits derived from the visual perception alone remains underexplored (Koole et al., 2014; Tai et al., 2011). In particular, the role of aesthetic experience in comfort attribution has not been thoroughly examined. In the present study, we investigated the interaction between perceived beauty and comfort attribution. Also, we further explored how these two dimensions influence care motivation. We finally proposed to consider cuteness as the intersection of these three components. A photo-questionnaire was designed to compute beauty, comfort and care values to teddy bears based on participants' judgments. We also assessed the extent to which teddy bears' visual characteristics contribute to cuteness.

Correlation between beauty, comfort and care

One of the most important results of this study is that beauty, comfort and care values were found to be highly correlated. In other words, aesthetic perception and comfort attribution were intrinsically associated. In turn, these factors were correlated to a motivation for

a) BRT model based on older adults (>60)



b) BRT model based on children (3-10)

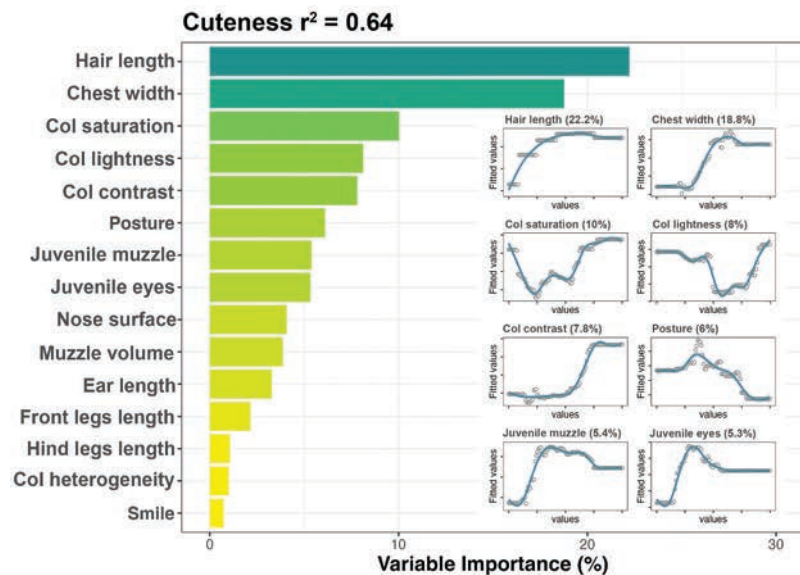


Figure 8. Boosted Regression trees (BRT) modelling the effect of colorimetric and morphometric features of teddy bears on cuteness scores according to children and older adults. Horizontal plot shows the importance of each variable as a percentage of explained variance in the BRT model considering a) children (3–10 years) and b) older adults (>60). The coefficient of determination r^2 provides information about the model's fitness. The curves shown on the right size are the partial plots associated with the model, and give a visualization of the relationship between cuteness scores and main important variables. Col = color.

protection. Thus, we assume that visual cuteness of teddy bears can be considered as a combination of visual attractiveness and comfort attribution that trigger care motivation and prosocial behavior. Also, by accounting for all participants and considering cuteness as a latent variable, comfort value had a higher effect on cuteness than beauty. This suggests that comforting power remains the most prominent emotional dimension in an interaction with a teddy bear, even during a visual evaluation. For children under 10 years old,

cuteness was equally explained by comfort and beauty, suggesting that young children perceive the factors contributing to cuteness as more intertwined. Children appear to be equally sensitive to all three dimensions. This suggests that there is no dominant criterion for defining cuteness, unlike adults in whom the criterion of comfort dominates the definition of cuteness. In addition, the visual comparison between teddy bears with the highest and lowest cuteness ratings clearly shows that the least cute bears are generally worn out,

damaged, or have highly unconventional designs. Conversely, the cutest ones are typically more conventionally designed, close to the teddy bear stereotype, and are overall in good shape.

Taken together, these results are consistent with those of previous studies that have reported that the simple act of looking at a teddy bear (matching in appearance with the usual stereotype) can reduce the negative emotions linked to social exclusion or to existential concerns (Koole et al., 2014; Tai et al., 2011). These results also support the idea that the teddy bear could be a lever to further assess prosocial behaviors in children: their motivation for protection can be linked to empathy, this latter being connected to prosocial behavior in adults (Ishtiyag et al., 2024) and in children (Wice et al., 2020), but also to beauty (Hung & Faust, 2024).

Visual characteristics impacting cuteness

Among the visual characteristics assessed, hair length has a predominant positive effect on cuteness, regardless of age (see also Tribot et al., 2023). We interpret this result as a persistence of characteristics related to the sense of touch inferred from a visual assessment. Since hair length and softness are correlated (Singh et al., 2014), it seems that the evaluation of the teddy bears' softness also occurs through visual perception, and significantly participates in cuteness attribution.

Juvenile features (based on relative size of eyes and muzzle) also had a hump-shaped relationship with cuteness, especially for older adults. However, exaggerated eye sizes negatively impacted cuteness among them. It seems that adults were more sensitive to juvenile features, whereas young children placed greater importance on chest width and colorimetric features. This suggests that kinesthetic properties are interpreted through visual assessment by children, similarly to the perception of softness. We hypothesize that chest width is here interpreted as a visual clue of pleasantness to cuddle, and bring comfort.

Regarding the posture and smile of the teddy bears, as for Tribot et al. (2023), these two visual characteristics had little impact on perceived cuteness. Regarding the smile, simply considering its presence or absence is probably not sufficient to characterize the facial expression of the teddy bears. Instead, it would be necessary to ask participants to attribute emotional states to the teddy bears and test whether positive expressions are correlated with cuteness. Up to now, there is no such empirical evidence that enables us to ascertain that link, even one study (Valuch et al., 2023) recently reported promising findings: by comparing two sets of portrait photographs (i.e. neutral vs. slightly smiling ones), they

observed spontaneous aesthetic preferences for the smiling ones. These results ask for a more in-depth examination of this effect with teddy bear faces, using an AI-based images processing tool to strictly compare the advantage of a smiling face for a same teddy bear.

Regarding colorimetric features, high saturations, lightness and contrasts were particularly associated with cuteness among young children. They also showed a preference for varied and vibrant colors such as pink, blue, or green, while adults favored teddy bears with more stereotypical colors like brown and beige tones and low color saturation. We also observed that young children showed a greater preference for pandas. This can be explained by the contrast between the black and white color patterns of the panda, which could be more visually striking and pleasing to children. This also could be interpreted as a media exposure effect since pandas are usually used as an icon to convince people about the importance of species conservation (e.g. see WWF campaigns).

Impact of stereotypes on cuteness perception

The overall results indicate that adults have more stereotypical preferences for teddy bears compared to children. Exaggerated features or those that deviate from the typical teddy bear design are less appealing to adults than to children. Indeed, in this study, we observed this effect for eye size and fur color: Teddy bears with large eyes are preferred by children but have a negative impact on adults. Children also favor various bears' colors such as green, blue or pink, while adults tend to prefer more classic brown or beige tones. Conversely, we assume that teddy bears' perceived conformity by adults is related to a socially held standard, a 'sweet spot' whose characteristics remain within the bounds of acceptable exaggerations (Borredon et al., 2025).

However, there is one notable observation that is consistent across all age groups: damaged teddy bears are the least cute. When observing an anthropomorphized object that appears 'shabby' one might expect it to arouse empathy and a desire to care for it. However, in the case of teddy bears, the opposite effect is observed. One hypothesis is that objects in good condition are preferred to maintain a sense of security and well-being. This could be related to the functional beauty hypothesis (Parsons & Carlson, 2008) arguing that beauty is closely tied to objects' functionality: an object is pleasing when it effectively fulfills its function. Obviously, a damaged teddy bear seems thus not fully functional to provide emotional comfort. It should be noted that such a phenomenon will probably only be observed in the case where the teddy bear does not

belong to the observer, since the emotional bonds resulting from the ownership surpass the effects of any teddy bears' features (see Tribot et al., 2023).

Limits

While this study is very informative on the links between beauty, comfort and protection motivation, as assessed from a series of photographs of teddy bears, it does have two limitations that should be pointed out. First, the majority of participants reported having or having had a stuffed animal as a comfort object. Among them, more than a third is or was a teddy bear. We acknowledge that this may be related to a self-selection bias, in which the selection process relies on individuals' decision to participate in the survey (Bethlehem, 2010). We thus assume that participants with a teddy bear were more likely to participate in this study since they felt directly concerned by this specific topic. However, this observation should also be considered in light of the commercial success of stuffed animals: as declared in the media by a NPD Group analyst (Tutt, 2022), it seems that around 10 million plush toys are sold per year in France. This declaration, crossed with our results, again demonstrates the omnipresence of these objects in many families.

Secondly, the responses from children aged between 3 and 7 should be treated with caution, as they completed the questionnaire with the help of their parents, mainly because they are not capable of reading and answering a questionnaire available online on their own. However, this limitation remains acceptable, as the very heart of the study is based on the task of judging pairs of teddy bear photographs, a judgement that the children in this age group were perfectly capable of carrying out. While the presence of parents cannot be ignored in the collection of children's responses, a future study would benefit from reproducing the task in the laboratory, without the presence of parents.

Perspectives

The contributions of this study point to several avenues of research in which the use of teddy bears offers interesting prospects. First, in this study, we outlined a possible approach for assessing prosocial behavior through an object that elicits affective and emotional responses. We suggest that the teddy bear could be particularly useful for probing empathic development and prosocial behaviors in children, as no study to date has implemented such an experiment. Based on the study conducted by Svetlova et al. (2010), making situations where children can experience prosocial behavior

in sharing a teddy bear to provide comfort to peers (instead of an adult) would be a nice way to pursue their findings. Moreover, it also offers a concrete framework to test the comfort provided as a function of the aesthetics values of the bear offered. There is no doubt that this experimental scenario would be highly informative, building on what we already know. In line with this idea, Kokkinaki (2023) explored the effects of one intervention that consisted in asking children (i.e. primary school) to bring their teddy bears at school to perform an art workshop. Through this art intervention, children benefited from the presence of their teddy bears, with feelings of comfort, companionship and intimacy. Kokkinaki (2023) also reported that children developed empathy for others with teddy bears' presence favoring connections with classmates. Overall, teddy bears could be further considered as a lever to sustain empathy development in children.

We also argue that teddy bears should be mobilized with elderly people. Similarly to the Teddy Bear Hospital initiative (Bloch & Toker, 2008; Mildemberger et al., 2024; Rashid et al., 2021), such objects may be used to establish communication and reassurance situations in medical and therapeutic contexts. We also believe that teddy bears are deeply tied to memories and life experiences and can act as a memory trigger (like a 'Proust's madeleine') to bring comfort and raise oneself's narratives. Closely linked to this idea, the use of stuffed animals to provide comfort to the elderly has been pointed out by Bergin, in Bergin, 1987. In his work, he encouraged this practice to reduce depression in the elderly. Márquez-Sánchez et al. (2023) recently underlined that their therapeutic use can be of interest to improve the well-being of people with dementia as well as other pathologies (see also Moyle et al., 2019). Today, electronic plush toys may be able to provide solutions to different problems, serving either as a form of temporary distraction from pain in medical context or as a medium to improve communication. However, additional research is still needed to further qualify the contribution of teddy bears (and/or electronic plush toys) with elderly people in various contexts, but also to extend preliminary findings regarding their resilience power (e.g. Heljakka, 2023) and emotional regulation contribution (Theofanopoulou et al., 2019) at all stages of life.

Beyond considerations of human well-being, we point out that plush toys could also have environmental applications. Given the strong correlation between cuteness and the motivation for protection, it would be relevant to examine to what extent plush toys can be used to raise children's awareness of environmental issues and biodiversity conservation.

The concept of cuteness could indeed be used to encourage pro-environmental attitudes, capitalizing on the appeal of cute objects to foster conservation efforts towards unattractive species. Cuteness could be employed to overcome disgust or aversion to certain organisms, and as an affective and emotional lever for sharing scientific knowledge. Although, such a mediation requires objects that reach a good balance between cuteness attributes and sufficient realism to bring scientific ecological knowledge.

Conclusion

In conclusion, this study highlights the significant relationship between perceived beauty, comfort, and care motivation in the context of teddy bears, suggesting that aesthetic appeal and comforting qualities are closely linked in driving emotional responses and prosocial behavior. These perceptions seem strongly influenced by stereotypical representations of teddy bears, particularly among adults. Our findings indicate that teddy bears' visual characteristics such as hair length highly contribute to cuteness perception, suggesting a persistence of traits associated with touch, inferred through visual evaluation.

This research provides a better understanding of the visual determinants of teddy bears' cuteness. It also contributes to a broader understanding of how aesthetic and affective evaluations mediate care behaviors, and opens avenues for exploring teddy bears as tools to sustain empathy and prosocial behavior development, particularly in children. Further investigation into the role of plush toys in various therapeutic and educational contexts, including their potential for environmental awareness, offers promising directions for future studies.

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ORCID

Nathalie Blanc  <http://orcid.org/0000-0003-1327-0280>
 Anne-Sophie Tribot  <http://orcid.org/0000-0002-8194-5393>
 Thierry Brassac  <http://orcid.org/0000-0003-1413-4280>
 Nicolas Mouquet  <http://orcid.org/0000-0003-1840-6984>

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