

Scientists measure the 'beauty' of coral reefs

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Computers recognize features that humans perceive as aesthetic.



High **color** intensity and diversity.
Highly **textured**.



HEALTHY

These features are good indicators of coral reef health.

High **microbial** diversity.
Few discernable high order **objects**.



UNHEALTHY



Aesthetically-pleasing reefs are **healthy** reefs.

CONCLUSION

An infographic of the study. Credit: Viputheshwar Sitaraman /Draw Science (drawscience.org)

Almost every person has an appreciation for natural environments. In addition, most people find healthy or pristine locations with high biodiversity more beautiful and aesthetically pleasing than environmentally degraded locations. In a study which computed 'aesthetics' as it relates to coral reefs, a multidisciplinary group of researchers have shown that an objective computational analysis of photographic images can be used to assess the health of a coral reef.

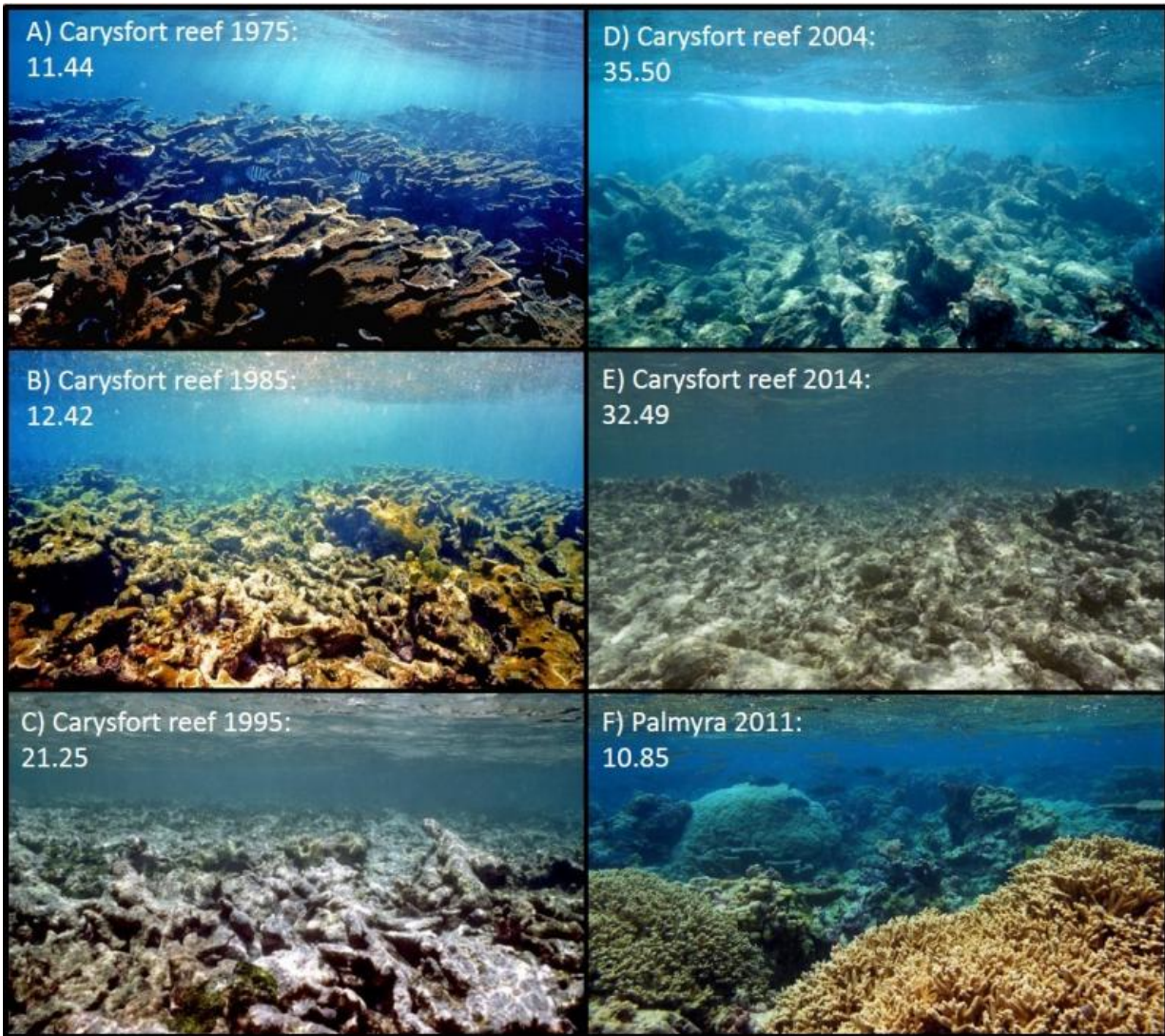
Since antiquity, philosophers and art historians around the world have searched for universally valid criteria for aesthetic principles—in other words, a way to quantitatively describe things like beauty and ugliness. The development of a powerful new computational approach will now allow for a more comprehensive assessment of what people find aesthetically pleasing.

Working together, mathematics, biology, and art history researchers from San Diego State University, the Getty Research Institute, and the Scripps Institution of Oceanography created a tool to computationally measure the aesthetic appearance of coral reefs. The results demonstrate that objective visual cues generated from random photographic images can be used to reliably assess both the beauty and health of coral reefs around the world.

The collaborators compiled and modified a list of 109 visual features that can be used to assess the aesthetic appeal of an image, such as the relative size, color, and distribution of discernable objects within the

image, as well as texture and color intensity. They then created a computer program capable of assessing these features in images and used it to analyze more than 2,000 random [photographic images](#) of coral reefs from around the world. The program produced an aesthetic score for each reef ecosystem.

The study, 'Can we measure beauty? Computational evaluation of coral reef aesthetics,' was published Nov. 10th 2015 in the scientific open access journal *PeerJ*. The findings show striking similarities between the aesthetic score produced for random reef images and the health of the respective reef ecosystem as evaluated by reef scientists.



Images A-E are taken at the identical location on Carysfort reef, wider Caribbean, over a time span of 40 years. The aesthetic value generated for each picture shows a significant degradation of aesthetic appearance during this period (a lower score indicates a more aesthetic appearance). The historic images from 1975 suggests that the aesthetic appearance of this reef in the wider Caribbean was comparable to present day nearly untouched and healthy reefscapes which only can be found in remote places like the National Wildlife Refuge of the Palmyra atoll in the Central Pacific (F). Credit: The Authors

"Our results suggest that our perception of aesthetics is well-aligned with healthy, thriving ecosystems," said Andreas Haas, an SDSU postdoctoral scholar and primary researcher of the study.

The results of this unique and multidisciplinary endeavor demonstrate that human perception of aesthetic value is not purely subjective, but is influenced by inherent components of nature that indicate healthy or degraded states. Ecologists may be able to use this tool or ones like it as a quick and inexpensive approach to monitoring the status and health trajectories of coral reef communities.

"By quantifying aesthetic features of coral reef systems, this method provides a cost effective tool that also targets one of the most important socioeconomic values of [coral reefs](#)—their natural beauty," Haas said.



An example of a healthy reef. Kingman reef is a remote, uninhabited reef system located in the Central Pacific half way between the Hawaiian Islands and American Samoa. The image shows an example of a nearly pristine and healthy reef system with an aesthetic score of 5.40 (the smaller the number the more aesthetic the reefscape Credit: Jennifer E Smith

More information: Andreas F. Haas et al. Can we measure beauty? Computational evaluation of coral reef aesthetics, *PeerJ* (2015). [DOI: 10.7717/peerj.1390](https://doi.org/10.7717/peerj.1390)

Provided by PeerJ

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