

timised for giving best results with Euclidean metrics. It is therefore reasonable to assume that if the underlying colour space were optimised for the hyperbolic metric, even better results could be achieved. It is also worth noting that all the metrics perform better on the T50 data set than on the full RIT-DuPont data set. One possible explanation for this is that the underlying metrics have been optimised for the reduced data set. It should also be noted that the colour metric observational data is noisy, observer dependent, and time dependent, and that the databases used are relatively small. Thus, the detailed parameter values obtained in optimisations such as the current one, should not be taken too literally. With this as a background it is even more fascinating that the optimisations on the local noisy data still give relatively consistent results for the magnitude of the negative curvature of the chromatic plane, and that this curvature corresponds well with the globally observed hue super-importance phenomenon.

5. Conclusion

It is demonstrated that state-of-the-art Euclidean colour metrics can be statistically significantly improved by moving from Euclidean to hyperbolic geometry for the representation of the chromatic plane. It is also shown that one of the hyperbolic metrics derived from the existing Euclidean one can outperform even the state-of-the-art non-Euclidean metric CIEDE2000. Hyperbolic geometry also nicely models the hue super-importance effect observed in colour order systems. When the radius of curvature of the hyperbolic chromatic plane is optimised to give as good fit with colour metric data as possible, the magnitude of the resulting hue super-importance effect is on the order of what has been previously estimated for the purpose of colour order systems. This suggests that negatively curved colour spaces should be taken into consideration in the future development of colour metrics and colour spaces.

Acknowledgments

I would like to thank Profs. Roy Berns and Manuel Melgosa for sharing the RIT-DuPont data sets and the corresponding ellipsoid parameters in various formats, Ass. Prof. Bernt Tore Jensen for instructive discussion about hyperbolic geometry, and Prof. Jon Y. Hardeberg and the anonymous reviewer for constructive feedback on the manuscript. This research has been funded by the Research Council of Norway through project no. 221073 'HyPerCept – Colour and quality in higher dimensions'.