Colour Management: Managing the Intuitive Issue, the Gamut Issue and the Engagement Issue.

Phil HENRY,[1] Stephen WESTLAND,[1]
[1] School of Design, University of Leeds

ABSTRACT

This research directly challenges the established and continued practice to implement colour-picker arrangements that are underpinned by colour science principles. Computer Aided Design software has evolved to empathetically resolve familiar real-world design challenges, whilst colour selection interfaces are predominantly governed by unfamiliar technical colour-spaces and additive colour behaviour (the intuitive issue). Importantly, the work confronts the current norm where colour-picker arrangements offer a user little insight into the potential colour difference between the various hardware components until hard copy proofs are produced (the *gamut* issue). Perhaps, more problematical still is the less obvious issue relating to an interface design strategy that allows users to *easily* select colour from the full monitor gamut (the *engagement* issue). The consequence of presenting exaggerated, yet easily accessed colour choice, in a technologically enhanced workflow can seemingly lead users to confidently select colours with little reflection on their tacit colour knowledge. This workflow can effectively negate inherent colour aptitudes which in the case of designers is likely based on paint and more naturally aligned to printer capabilities.

1. INTRODUCTION

The important concept that underpins this investigation is the hypothesis that creative digital colour users will benefit from a colour–picker interface that is designed to be consistent with their intuitive colour knowledge i.e. subtractive colour (Henry *et al.*, 2013; Henry, *2013*). This notion is seen to have particular significance for problematic digital colour tasks where the creative objective is to achieve an acceptable colour-match between the monitor display and colour printer. Such colour-sensitive objectives are often a creative requirement in the colour critical industries of fashion, textiles and graphic design. Hard copy proofs (colour-printouts) are regularly used as an integral part of the design development process, being central to effective in-house discussion, customer approval or in some cases as contractually binding manufacturing standards. Equally important is the understanding that this work doses not seek to invalidate technical colour management protocols but rather shares the views of other researchers in the observation that design communities working in colour critical environments often struggle to effectively apply ridged colour management workflows in a fluid and ever evolving design context (O'Neill *et al.*, 2008; Hirschler, 2010). A note worthy observation supported anecdotally in both industry and education contexts is the relationship between increased expectations in colour fidelity in direct relation to any increased investment in technical colour engagement. Subsequently, any disappointing results often lead to mistrust in the quality/capabilities of hardware, software or even user proficiency.

2. SUMMARY OF EXPERIMENTAL WORK

2.1 The Intuitive Issue

In the initial work the ability of users to predict colour mixtures in additive and subtractive systems was tested (the intuitive issue); it was shown that users can better predict the results from subtractive systems and it was assumed that experience with physical colorant system (e.g. paints) during childhood may be where the knowledge required is gained. This finding led to the hypothesis that a colour-picker tool based on subtractive colour mixing might be better, or more *intuitive,* than one based on RGB additive colour mixing. A series of experiments were conduced by which the accuracy of a colour match (where a participant tries to match or select a colour to match a given target) was assessed for a tool based on subtractive CMY primaries and compared with one based on additive RGB primaries. The subtractive CMY tool did, in fact, give better performance. However, most contemporary software presents a colour-selection environment rather than a colour-mixing environment; that is a colour map, for example, rather than RGB sliders. Therefore the new subtractive CMY tool was also tested against more contemporary solutions, (*Figure 1.*), and, in some circumstances, was shown to still give a better performance. The new subtractive tool works well when it has been explained to users (in terms of paint-mixing) whereas a similar explanation for the additive tool is unsuccessful.

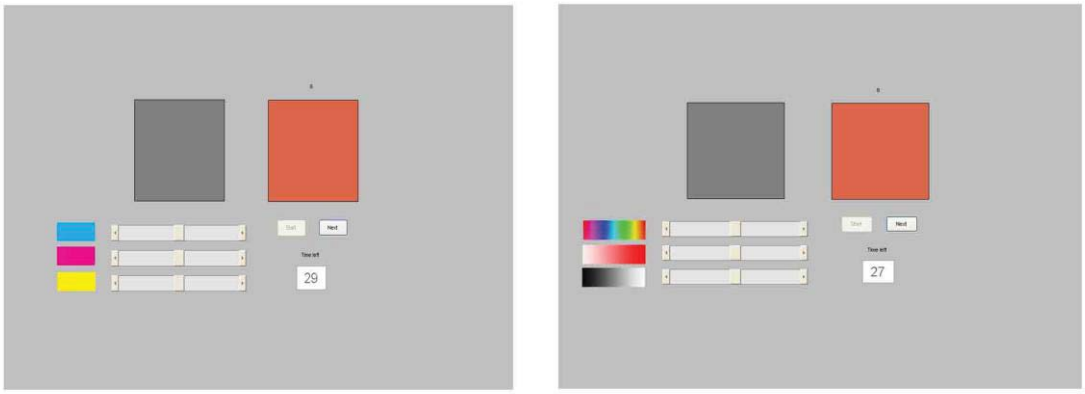

Figure 1: Examples of experimental colour-picker tools, a CMY slider bar (left) consistent with the experimental paradigm and an HCL arrangement (right) modelled on standard configurations.

2.2 The Gamut Issue

Further work explored more challenging cross-media colour matching scenarios questioning why users tend to select very bright and saturated colours on screen (i.e. *the gamut issue).* Several conclusions were arrived at: (1) firstly, users are drawn to saturated colour and if presented with these will tend to select them (without even thinking about the consequences); (2) secondly, users tend to remember colours as being brighter and more saturated than they were (*Figure 2.*); (3) thirdly, the way in which the interface is designed encourages functional-fixedness (Dunker, 1945) and does nothing to challenge the user to think about the differences in gamuts, for example, between display and print.

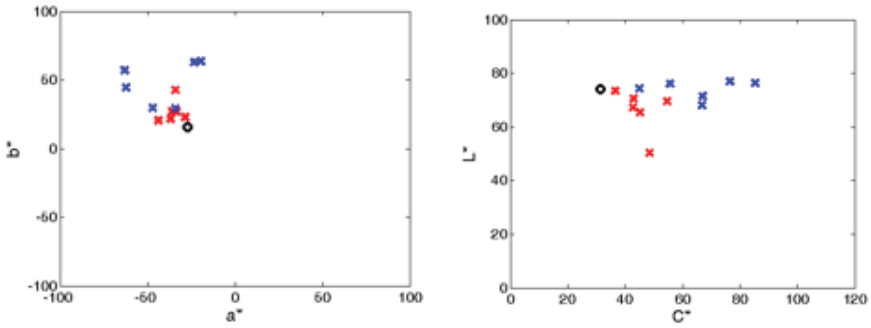

Figure 2: CIELAB coordinates (a and b*) (L* and C*) of one of the six targets (black circle) and the matches made by the observers on-screen (blue X) and in print (red X)*

2.3 The Engagement Issue

Previous studies of user colour-interface experience focuses their assessments on ease-of-use; how easily the participants could excel in basic colour-matching tasks when using different colour-picker arrangements. However, more current HCI (Human Computer Interaction) thinking has identified reservations with regards to interface strategies centred on ease-of-use preferring interfaces that exhibit aspects of possibilities-in-action. An underpinning and distinguishing quality of our colour-picker tool is the opportunity for a user to engage-in-use and connect with their existing colour knowledge, as well as gain an improved understanding regarding the nature of the digital colour challenges they are dealing with and use their skills and knowledge to make well-informed decisions. This new strategy is counter to existing colour selection strategies that seemingly encourage poor colour choice by presenting colour options that are not compatible with printing and only provide users with a relatively passive role in accepting colour outcomes governed by often concealed colour management infrastructures (i.e. the engagement issue).

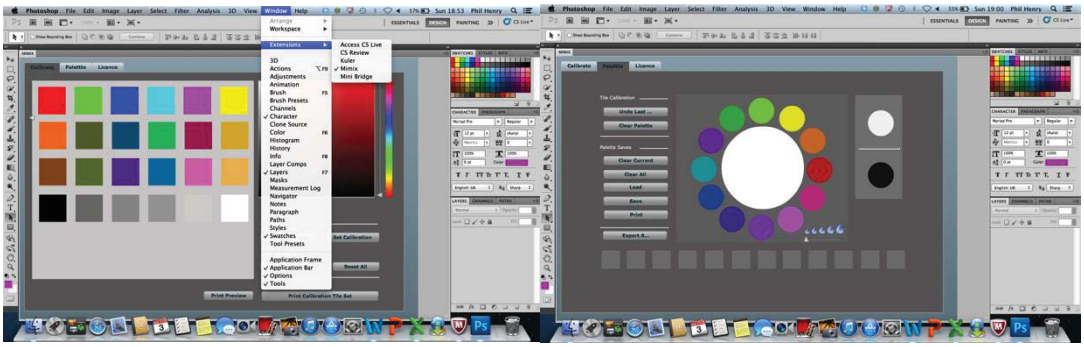

Figure 3: Illustrates views of the initial characterisation/colour matching exercise which introduces user to the gamut issue and the colour mixing interface which mimics subtractive/paint mixing

4. DISCUSSION

The results of this work challenge the established colour science convention suggesting that colour management methods are the most viable answer to tackling colour fidelity issues prevalent in many design industries, notably Textiles, Fashion and Graphics. Unquestionably, existing colour management does offer effective solutions providing the technical structures are correctly implemented and the practical constraints understood. However, a key criticism highlighted on all existing workflows is a procedure that allows users to make contextually poor colour decisions based on the colour information and options presented by the majority of colour-picker arrangements. Why, in the first instance, mislead the design expert with exaggerated colour options, then expect that any required compromises in creativity will be adequately resolved by colour science proficiency?

CONCLUSIONS

The final outcome of this research project is fully functional colour-creation software ColourMimix; it is developed as colouring tool for designers providing the means to create original palettes reproducible within the colour-space of a selected printer, ink set and substrate combination. This is achieved without the need for expensive and complicated colour management hardware or software; as an alternative the designer is in control from the outset using their colour judgment to set up the colour-picker tool to display only printable colour selections on the monitor screen. The software incorporates a unique intuitive interface and provides an alternative user-centred approach to managing digital colour. More detailed information regarding the software can be found at www.ColourMimix.co.uk and https://creative.adobe.com/addons.

REFERENCES

Duncker, K., 1945. *On Problem-Solving, Chapter in Dashiell J., F., ed., Psychological Monographs 58, No. 5.*

Henry P., Westland S. & Cheung V., 2013. *Colour selection strategies in colour design, Proceedings of the 12th Congress of the International Color Association, 1157-1160, Gateshead, UK.*

Henry P., 2013. *The design of a new colour-picker tool, Proceedings of the NIP, 98-101 Seattle, USA.*

Hirschler, R., 2010. *Electronic Communication in the Textile and Apparel Industry, REDIGE - V1 N1*

O'Neill,J., *Martin, D., Colombino, T., Roulland, F. and Willamowski, J., 2008. Colour Management is a Socio-technical Problem. Proceedings of CSCW 08.*

Address: Dr Phil HENRY, , School of Design, University of Leeds, Centre For Colour Design Technology, Leeds, LS2 9JT, ENGLAND

E-mails: p.m.henry@leeds.ac.uk, s.w.westland@leeds.ac.uk,