Yet further improvements to the ICC specification.

The ICC specification has recently undergone a major revision. The new version of the specification is designated ICC-1:2001.12 and is available for free download from the ICC website (www.color.org).

The previous specification has been widely adopted by the colour imaging community and proved very important in achieving and maintaining colour fidelity of images. However, despite its successful usage in many situations this widespread use has also identified ways in which it can be even further improved. That has been the main driving force behind this revision - in particular ways to improve interoperability. Certain ambiguities in the previous versions of the specification have occasionally permitted producers of profiles to misinterpret the reference colour space and also the information they need to provide in the profile. Thus profiles could be produced that were inconsistent with those produced by other vendors and when two such profiles are used together can give rise to unexpected results. Furthermore, these ambiguities permitted ICC compliant profiles to be produced that were interpreted slightly differently when used with different Colour Management Modules (CMMs). This meant that different CMMs could produce slightly different results to each other, even when using the same pair of profiles.

Although for many applications these problems were often small enough not to be an issue there are other situations where high levels of consistency are particularly important. It was therefore necessary for ICC to identify the major areas where ambiguities could permit poor interoperability and attempt to resolve those in the specification.

Before summarising the main amendments to the specification it is important to put these in context. The changes are designed to ensure that profile builders understand the reference colour space precisely, and exactly what is required of the profile. They also ensure that CMM producers are able to provide CMMs that ensure that any ICC compliant profile is interpreted unambiguously by any ICC compliant CMM, and that different CMMs processing the same pair of profiles to produce a colour transformation provide a similar transformation. This improvement has largely been attained by removing ambiguities from the specification, rather than by imposing specific additional requirements on profile building or CMM developers – though there are some additional mandatory requirements.

Thus this revision certainly does not mean that all profiles built for a specific device will be identical. There is still the need in many markets for profile building vendors to be able to differentiate their products and for users to select those products that best suit their needs. There is still no 'one size fits all' in colour reproduction and ICC has not attempted to impose one. However, what it does mean is that when a user's preferred profiles are used they should be produced in such a way that they are made to a common reference so that when combined with other profiles any results are predictable. It also means that when pairs of profiles are used they should always produce the same result – regardless of which CMM is used. There is still a small risk that different CMMs could produce small differences due to differing interpolation procedures but the more major errors of interpretation have been removed.

Thus users will still need to select and build profiles that suit their reproduction needs – and ensure that they process the individual images to give their preferred reproduction within the context of those profiles. How this is done will be workflow dependent. ICC is not proposing specific workflows and control procedures – that is the responsibility of the user and/or specific industry standardisation groups to recommend. What we do believe is that this version of the ICC specification provides users with the correct tools for communicating the colour rendering associated with devices to implement in their workflows.

This does not mean that ICC sees its work as complete. The subject of colour reproduction is not a trivial one and there are important issues still to address. Many users would like to see the ICC ensure conformance of profiles and CMMs to the specification. Others have workflow needs that cannot easily be met with the existing architecture. In order to address these issues ICC is working on developing recommended workflows to achieve desired results using ICC profiles conforming to the existing specification and following this will review the need for conformance testing. An Architecture working group is considering what fundamental changes are needed to a future specification to meet ever more complex workflows.

Thus we can summarise the state of the art with this new specification as ensuring improved consistency when using ICC profiles. The system still retains the flexibility to let users produce profiles that best suit their requirements – they can choose when to trade off ease of use when building profiles against their individual needs. They can achieve this either by evaluating the various profile building software packages available and selecting that which produces the best results for them, or by editing profiles to produce what they require. But because of the improved consistency, once a profile has been selected its performance in use should be highly predictable.

Summary of the main changes

- For perceptual rendering the dynamic range of the PCS, and the assumed level of illumination for viewing has been identified. These attributes were not identified in previous versions of the specification and this led to ambiguities when specifying gamut mapping that resulted in white and black being misinterpreted and tone reproduction 'errors'.
- Chromatic adaptation information is now required. When data is intended for viewing in illumination conditions other than those specified by ISO 3664 (i.e. D50) the transformation required for correction of the data must be specified. A procedure that specifies how the CMM should handle this transformation (depending on the chromatic adaptation condition assumed for the various profiles being processed) is now specified. This change is particularly important for colour monitor profiles (which rarely assume a D50 chromatic adaptation state) but can have applications elsewhere (e.g. where prints or transparencies are expected to be viewed in non-standard conditions).
- Where profiles involve more than the usual 4 (CMYK) colorants it is now required that the colour of the additional colorants be specified by their XYZ or L*a*b* co-ordinates. The sequence of printing may also be specified. This helps to avoid ambiguities when building profiles for such processes.
- New look up table (LUT) specifications have been provided that overcome some issues of invertibility of the previous LUTs – as well as offering some other benefits of profile management by having a similar structure for all types of profiles. Another specification enables a simpler specification of 1-d LUTs for typical display devices.
- Various clarifications have been introduced into the document covering such issues as rendering intents, the definition of the tags for three-component devices, the content and structure of monochrome profiles, the relationship between PCS XYZ and PCS L*a*b* and how to handle colours that can be represented in one and not the other.
- Various new procedures have been specified to avoid confusion when using profiles such as improved naming and dating procedures, and to permit profiles containing multiple rendering intents to be specified for input and display devices as they currently are for output profiles.