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Comparing Judgements of Visual Clarity and Spatial Brightness

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In many studies evaluating the visual environment test participants are asked to make judgements of particular visual attributes such as brightness, clarity and pleasantness. When reporting the outcomes of such work it is clear that the experimenter assumes that the response gained from test participant is for the same attribute as was intended by the experimenter. This may be a dubious assumption, in particular because in the majority of studies it appears that the nature of visual attributes was not well defined.

Judgements of spatial brightness and visual clarity reported in past studies have been compared [1] to question whether these are similar or different judgements of the visual environment and this is done within the context of the effect of spectral power distribution (SPD) of the light source on visual perception. In addition to offering a better understanding of how naïve test participants respond to instructions, the outcomes of this review aid the interpretation and collation of results from past research, e.g. can the brightness evaluations from one study be grouped with the visual clarity judgements of another?

A review of definitions reported by lighting researchers provides a mixed opinion. Some studies imply a difference. For example, Vrabel et al [2] provided different written definitions for brightness and clarity, these definitions being used as anchors before a category rating task. Others have suggested that brightness and visual clarity have the same meaning [3]. Flynn et al [4] used factor analysis to group the results of sematic differential ratings and suggested that their perceptual clarity factor could also have been named spatial brightness since it seemed to relate to variations in illuminance: the factor included ratings of both brightness and clarity.

Further understanding may be gained through analysis of responses of naïve test participants when making judgements of brightness and clarity. Studies using a matching procedure to compare lighting of different SPD have used a range of visual criteria, including equal brightness and equal clarity. Results from a study carried out using a range of equality criteria did not suggest that different matching objectives would lead to different responses [5].

A review [1] was carried out of results from past brightness and clarity evaluations that were gained using a category rating procedure. Three different approaches were used according to the quality and quantity of data reported. Firstly, some studies reported a statistical analysis by which judgements were compared. Secondly, some studies reported mean ratings and standard deviations which permits simple post-hoc analysis using the t-test. Finally, some studies reported only the mean rating and these data were used to draw graphs to enable visual comparison.

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Figure 1 shows the mean ratings of brightness and clarity from the study by Flynn and Spencer [6] for five different lighting conditions. It can be seen that mean brightness and clarity ratings tend to be close and tend to follow the same relationship for different stimuli – a stimulus with a high mean brightness rating will tend also to have a high clarity rating. The same trend is apparent in the results of many studies.

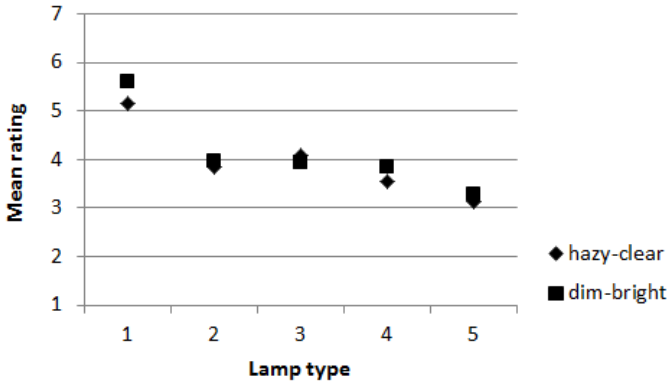

Figure 1. Mean brightness and clarity ratings from Flynn and Spencer [6]. A rating of 7 denotes the bright and clear ends of the scales. Lamps arranged in descending brightness order.

Table 1 summarises the methods of analysis and the conclusions drawn. In four studies, the data do not suggest that brightness and clarity ratings are different [6-9]. In the Rea [10] study the ratings are almost identical for half of the stimuli examined but similarity for the remainder cannot be determined. Data from the Boyce and Cuttle study [11] are inconclusive as to whether the ratings are different. In two peripheral studies [12, 13] ratings of brightness and clarity also appear to be similar. Thus results from the majority of studies indicate that ratings of brightness and clarity lead to similar judgements.

In only one study [2] are the ratings of brightness and clarity reported be significantly different, although further clarification is required as to the statistical basis for their decision. What is interesting about the Vrabel et al study is that they provided test participants with written definitions of brightness and clarity prior to trials. This gives rise to a possible explanation for the findings of the review [1]: when naïve test participants are provided with definitions of brightness and clarity then this encourages different judgements, but they do not discern a difference when these terms are undefined. Note however that a further study [7] also provided written and visual anchors yet still found similarity of brightness and clarity.

It was concluded [1] that when judgements of spatial brightness and visual clarity are sought from naïve test participants using a category rating procedure that they will lead to the same outcome when these phenomena are not well defined to the test participants. This raises the need to question the assumption that the quantity being assessed by the observer is actually what the researcher intends, or believes, it to be.

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Table 1. Past studies using category rating to evaluate both spatial brightness and visual clarity.

Study	**Method of comparison by study author(s)**	**Method of comparison by current authors**	**Agreement between brightness and clarity?**
Flynn & Spencer, [6]	Principal component factor analysis	Graph of mean ratings	Yes
Vrabel et al [2]	Correlation	Graph of mean ratings	Reported to be not similar but there is no justification for the threshold value of correlation used.
Rea [10]	Pearson product-moment correlation coefficient (r)	Graph of mean ratings	It is not known whether or not the reported correlations are statistically significant. The mean ratings are almost identical in 3 of the 6 cases.
Piper [8]	-	t-test applied to mean ratings	Yes
Vienot et al [9]	-	t-test applied to mean ratings	Yes (7 of 9 cases suggest similar ratings)
Fotios & Cheal [7]	-	Wilcoxon test applied to original data.	Yes
Boyce & Cuttle, [11]	-	Graph of mean ratings	Inconclusive