Megaman Lighting Evaluation Study

Conducted by De Montfort University

February 2012

Contents

Final report for Megaman lighting study

1.0 Executive summary

The results of the Retail Lab trial suggest that the R9 Led lamp accentuated Yellow consistently across all tests, where as Metal Halide generally emphasised Red/Green. However, the R9 Led produced a much more consistent result than the Metal Halide, the first pick choice with the R9 Led was consistently Yellow throughout the trial and with Metal Halide it varied between Yellow and Red. Although a trend was evident, that there appears to be a difference in the way subjects selected objects based on colour between the two trial lamps. With this exercise designed to demonstrate proof of principle, the results would require further validation.

General: To evaluate the colour rendering of R9 LED lamps when compared to the industry standard of Metal Halide.

Aim: To compare both individual and group colour selection using two lighting scenarios.

Objectives: To create a controlled environment where individual subjects can select coloured objects under different lighting conditions emulating a retail environment. The choices made by the subjects will be recorded and their responses to colour choice under two controlled lighting scenarios collated. The trial will capture the similarities and differences in the subject's response to Metal Halide and R9 Led. This investigation is not intended to be a fully validated experiment rather it will provide an indication of trends proof of principle and/or the requirement for further investigation.
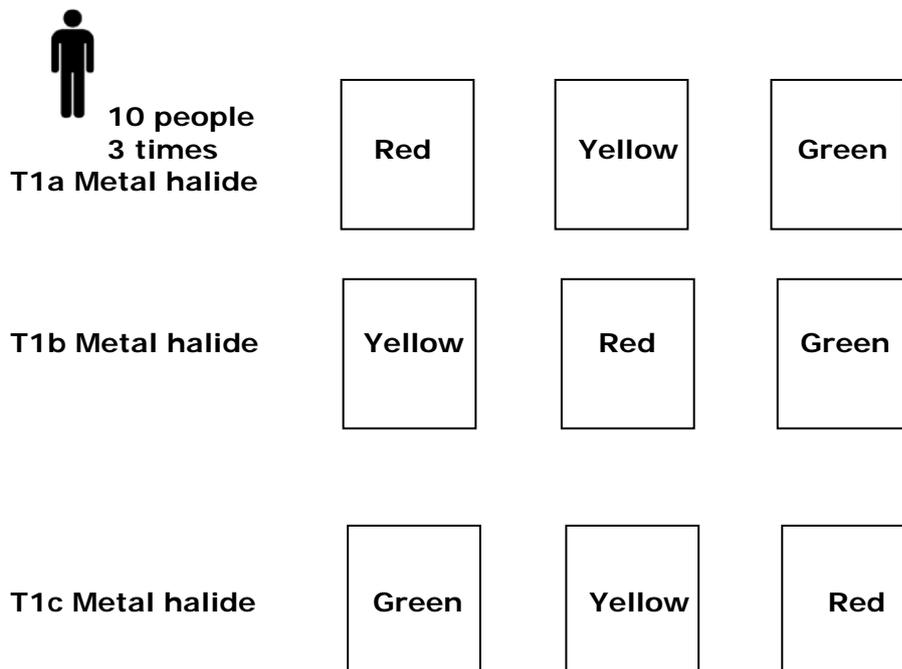
Methodology: Retail Lab (De Montfort University) will be used to emulate a supermarket vegetable display using a minimalist approach in order to reduce variables. Subjects will be asked to select coloured produce from a display and place them in a basket. On exiting the trial area their selection will be recorded by colour and number. A number of subjects will be followed up with a structured interview on their response to the event.

2.0 Results

2.1 Trial 1

Objective: to identify bias due to layout
- Using 10 subjects' over three activities, investigate the impact of layout on the selection choice of subjects.

- **Trial 1** will consider whether the layout has any noticeable influence on selection choice. The produce will be rearranged to identify bias in selection. Eg. Red, Yellow Green; Green, Red, Yellow; Yellow, Green, Red. One group of 10 randomly chosen subjects. The number of objects selected by each individual and the group will be recorded and compared in order to define any noticeable trend.

**10 people
3 times
T1a Metal halide**

Red	Yellow	Green

T1b Metal halide

Yellow	Red	Green

T1c Metal halide

Green	Yellow	Red

Results:
See appendix for data

Trial T1a (order Red Yellow Green) 15 Green 24 Red and 9 Yellow were selected Red was the predominant colour chosen.

Additional observations were made on all the following trials with the first pick of the participant recorded.

Trial T1b (order Yellow Red Green) 19 Green 16 Red and 15 Yellow were selected the spread was more even when compared to the first trial, with the choice of Green being slightly more prominent. The majority of subjects selected Green as their first choice pick colour.
Trial T1c (order Green Yellow Red) 14 Green 19 Red 17 Yellow were selected the spread was much more even than on the first trial, with the choice of Red being slightly more prominent. The majority of subjects selected Red as their first choice pick colour.

Over all 48 Green 59 Red and 41 Yellow were selected under the metal halide lamps. This result correlates with the later studies where generally under these conditions Red was the predominant colour selected. The first pick selection of Red is also generally consistent under the metal halide lighting. The colours were reordered after each event and the selection suggests that there was no bias due to position.

Conclusion: This trial suggested that there was no noticeable bias due to the location and or order of the objects that although Red was selected marginally more often, the overall spread was relatively even at Green 48-32% Red 59-39% Yellow 41-26%. Red was also selected as the first pick choice more often than any other colour in this initial study.

Outcome: as there was no measurable preference based on position and order, the remaining study maintained an order of display that reflected the colour spectrum eg Red Yellow Green.

2.2 Trial 2

Objective: comparative evaluation between Metal Halide and R9 LED using 10 subjects two activities

- Using 10 subjects one activity, investigate the impact of Metal Halide lighting on the selection choice of the group.
- Using the same 10 subjects over one activity; investigate the impact of R9 LED lighting on the selection choice of the group.

**10 people
2 times
T2a Metal Halide**

Red	**Yellow**	**Green**

T2b R9 LED
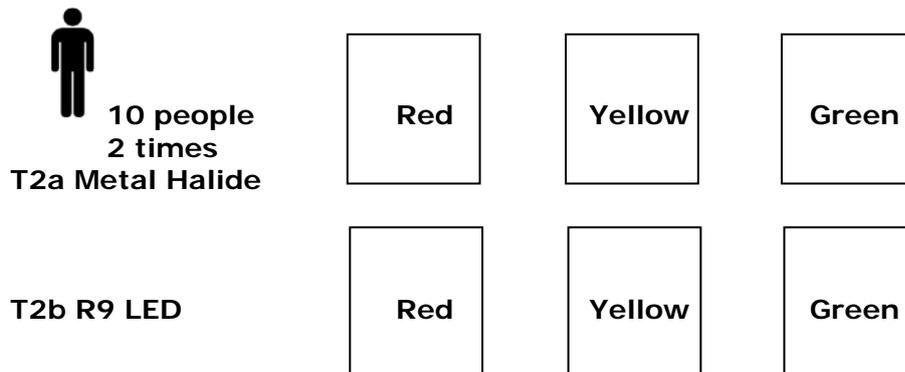
Red	**Yellow**	**Green**

Results:
See appendix for data
Trial T2a Metal Halide (order Red Yellow Green) 22 Green 15 Red and 18 Yellow were selected Green was the predominant colour chosen on T2a. The majority of subjects selected Yellow as their first choice pick colour.

Conclusion: the expectation would be that the result would be similar to T1a,c with the same lighting used. However, the result is counter intuitive with the predominant colour chosen being Green at 40% of the total as did trail T1.2b. This was followed by Yellow at 33% and Red at 18%. The first pick selection on this study was Yellow unlike trial 1 where it was Red.
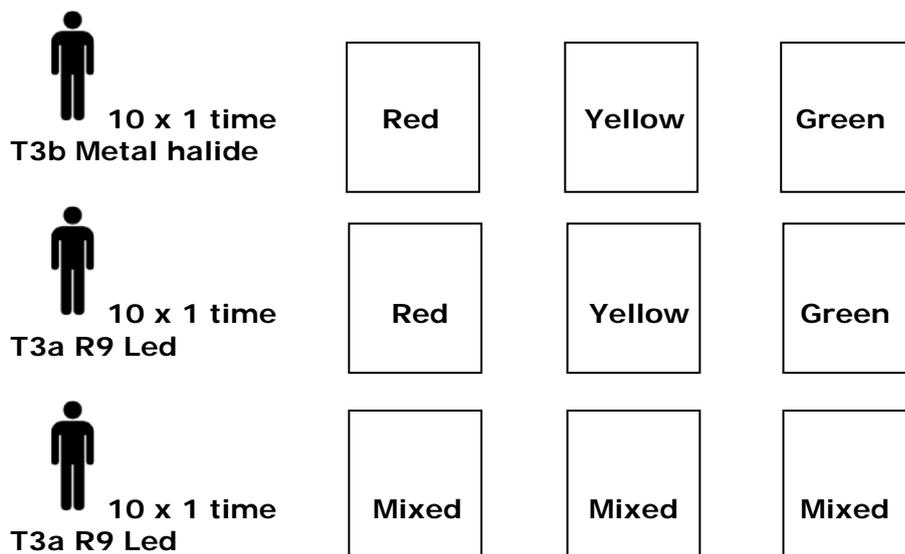
Trial T2b R9 LED (order Red Yellow Green) 18 Red 20 Yellow 17 Green. Yellow was selected more often than Red or Green at 36% followed by Green at 31% and Red at 33%. Five subjects selected Red and Yellow equally as their first choice pick colour.

Conclusion: the trial suggested that there was a slight predominance in the selection of Yellow under the R9 LED lamps. This result is consistent with the overall results of the study see below.

2.3 Trial 3

Objective: using two groups of ten randomly selected subjects
- Using 10 subjects over one activity, investigate the impact of Metal Halide lighting on the selection choice of the group.
- Using a different group of 10 subjects over one activity; investigate the impact of R9 Led lighting on the selection choice of the group.

**10 x 1 time
T3b Metal halide**

| Red | Yellow | Green |

**10 x 1 time
T3a R9 Led**

| Red | Yellow | Green |

**10 x 1 time
T3a R9 Led**

| Mixed | Mixed | Mixed |

Results:
See appendix for data
Trial T3a metal Halide (order Red Yellow Green) 22 Red and 17 Yellow 21 Green were selected with Red 36% being marginally the predominant colour followed by Yellow 42% and Green 35%. The majority of subjects selected Red as their first choice pick colour.

Conclusion: the results are consistent with T1a,c where under metal halide Red was selected as a preferential colour this is also consistent with generally Red being the first pick choice under metal halide.

Trial T3b R9 LED (order Red Yellow Green) 18 Red 23 Yellow 13 Green were selected with Yellow 42% being the predominant colour followed by Red 33% and Green 24%. The majority of subjects selected Yellow as their first choice pick colour which is consistent with the first pick choice under R9 LED above.

Conclusion: the results are consistent with trial T2b where Yellow was selected most often under the R9 LED lamps.

Trial T3c R9 LED (mixed colours equal numbers of each) 15 Red 28 Yellow 12 Green were selected with Yellow 51% being the predominant colour selected followed by Red 27% and Green 22%. The majority of subjects selected Yellow as their first choice pick colour which is consistent with the other R9 LED trials above.

However some of this data was collected after the event via video. In a mixed colour situation the colour choice would appear more to be more significant, with Yellow be 100% of subjects first choice, this consistent the other LED trials above.

Conclusion: the results are consistent in trial T2b, T3b,c with Yellow as first pick and overall selected quantity when using the R9 LED lamps. This result however is particularly interesting with the mixed colours balanced between the boxes. Overall The R9 LED lamp consistently produced Yellow as the predominant colour.

3.0 Overall results conclusions

Whilst acknowledging the limitations of this study and that the variables have not been eliminated. As a proof of principle, there does seem to be a number of identifiable trends developing from the initial analysis.

R9 LED:
- Yellow is consistently chosen as the highest number of selected objects under all R9 LED Trials.
- Yellow is consistently the first pick selection under all R9 Led lamps.
- The colour perception when using R9 LED is possibly more consistent than when using Metal Halide. Eg selection is always Yellow Red Green by number.
- Red is consistently the second choice selection of objects under the R9 LED conditions.
- The order and quantity of selection choice is consistent under R9 Led as 1st Yellow 2nd Red 3rd Green.

Metal Halide
- The highest selected colours under metal Halide are not consistent and vary between Red and Green.
- The colour perception under metal halide maybe inconsistent in comparison to the R9 Led.
- The first pick selection under metal halide varies from trial to trial and covers all three colours.
- Selected choice order under metal halide is not consistent.

Findings from SPSS analysis:
Although the initial project was not designed with SPSS in mind the package was used in order to determine whether there were any 'hidden correlations'.

There were no statically relevant findings based on the SPSS analysis undertaken on the results. There were a number of reasons for this outcome
- The study was not designed from concept to run SPSS in future this should be considered at the development stage.
- The sample size was too small to generate clear statistical correlations
However there was a slight link between the use of metal halide lighting and selection of RED in the first test.

Qualitative feedback from participants.
Review of the participants comments collected after the even do not show any consistent themes. However they do support the studies conclusions that the Red and Yellow where more attractive. Participants mentioned explicitly the Red and Yellow more often than the green. Red and Yellow received positive feedback throughout the comments. The participants also identified some of the weaknesses in the study where they said 'squeezed them to find the best, shinny ones looked best, did not like shinny ones. Red ones were poorer quality, like to eat yellow ones!' This study was unable to eliminate

the bias die to personal opinion and preference. A further study would require bigger sample sizes in order to begin toe eliminate there personal idiosyncrasies.

Observations:
The high contrast, intensity of saturation and relative hue between the Green and Red peppers may have over emphasised the perceived 'brightness of the Yellow'. This is potentially most noticeable in the final trial where the colours were mixed up thus emphasising this difference. This may have been perceived by the subjects as Yellow being the brighter colour. There is some evidence to support this in the feedback statements from the participants see appendix 2
Where Yellow was selected under the R9 Led lamps the objects were centrally placed, and may have been more prominent contrasted against the Red and Green at either side. However, this was not the case on the final mixed trial were Yellow was clearly a dominant choice. In this context, although the illumination levels were relatively consistent was there a technical feature (beam angle etc) of the R9 that may have influenced the trials?
The selection quantity choice under the Metal Halide lamps varied across the colour spectrum from Red 3 times –Green 2 times.
The event suggests that the metal halide lamps generally emphasise the Red spectrum whilst the R9 LED lamps emphasise the Yellow spectrum. With both lamp types in the order of 4000-4200K lamps of warmer colour intensity may have balanced the results more towards the Red end for both.

Recommendations:

- A further study designed to eliminate the variables identified during this activity. Eg handedness, shadowing.
- Additional studies could be undertaken developing out of this proof of principle evaluation, to consider colour rendering in isolation eg Red only under a selection of lamp types. This might utilise a standard sized sphere (100mm dia.) coloured in specific pantone referenced colours. This may eliminate bias due to object preference.
- Additionally a controlled 'instore study' may provide a more 'realistic' trial environment.
- A follow up activity using warmer lamp colours may confirm colour rendering.

Author Richard Chipps April 30 2012

4.0 Appendices:

Appendicx 1

Percentage of selected objects

		Red	Yellow	Green	Comments
T1abc	Trial 1 MH number % 148 total	59 40%	41 27%	48 32%	Order of selection hierarchy Red Green Yellow
T2a	Trial 2 MH Number % 55 total	15 27%	18 33%	22 40%	Order of selection hierarchy Green Yellow Red Unexpected result with green as main choice
T2b	Trial 2 LED Number % 55 total	18 33%	20 36%	17 31%	**Order of selection hierarchy Yellow red green**
T3a	Trial 3 MH Number % 60 total	22 36%	17 28%	21 35%	Order of selection hierarchy Red Green yellow
T3b	Trial 3 LED Number % 55total	18 33%	23 42%	13 24%	**Order of selection hierarchy Yellow red green** The yellow remains reasonably consisting from trial 2 at the expense of green and red
T3c	Trial 3 LED Number % 55 total	15 27%	28 51%	12 22%	**Order of selection hierarchy Yellow Red Green** There is greater contract in this case with the yellow and red juxtaposed against the green

Megaman lighting study   Tally sheet.   Metal Halide
No 1 of 3   Trial 1
 order Red Yellow Green   **illumination** R= lux Yellow lux G lux   @25 deg C

Gender	Green number	Red number	Yellow number	Time in Secs	Comments
1 Female		3		45 secs timed out	Took time to review and consider
2 Female	1	2	2	20.36	
3 Female	2	2	1	45 secs timed out	
4 Male	2	3		45 secs timed out	Cast shadow over produce
5 Male	2	2	1	44.26	Cast shadow over produce
6 Male	2	2	1	32.00	
7 Female	1	3	1	34.11	
8 Female	1	2	2	26.00	
9 Female	2	3*		25.03	
10 Female	2	2	1*	45 secs timed out	Took time to review and consider
10	15	24	9	50 total	

Megaman lighting study   Tally sheet.   Metal Halide
No 2 of 3   Trial 1
 order Yellow Red Green   **illumination** Red= lux Yellow lux Green lux @25 deg C

Gender	Green number	Red number	Yellow number	Time in Secs	Comments
1 Female	3	1	1*	37.31	
2 Female		3*	2	27.20	Reactive rather than considered
3 Female	1	2*	2	39.89	
4 Male	2	1	2*	38.39	
5 Male	3	1	1*	43.56	
6 Male	4*	1		26.71	
7 Female	1	2	2*	35.48	Selected and considered
8 Female	1*	2	2	33.00	
9 Female	2	2	1*	18.45	
10 Female	2*	1	2	39.94	
10	19	16	15	50 total	

Megaman lighting study   Tally sheet.   Metal Halide
No 3 of 3   Trial 1
 order Green Yellow Red   **illumination** Red= lux Yellow lux Green lux @25 deg C

Gender	Green number	Red number	Yellow number	Time in Secs	Comments
1 Female	4*	1		20.21	
2 Female			5*	16.31	
3 Female	2	2	1*	35.06	
4 Male	1	3	1	39.63	
5 Male	1*	2	2	38.29	
6 Male	1	2*	2	28.44	
7 Female	1	2	2*	30.82	Took time to review and consider
8 Female	1	2*	2	18.96	
9 Female	1	2	2*	18.71	
10 Female	2	3	1*	26.53	
10	14 2*	19 2*	17 5*	50 total	

Megaman lighting study   Tally sheet.   Metal Halide
No 1 of 2   Trial 2
 order Red yellow Green   **illumination** R=1458 lux Yellow 1374 lux G 1384 lux   @25 deg C

Gender	Green number	Red number	Yellow number	Time in Secs	Comments
11 Female	2	1	2*	28.59	Took time to review and consider
12 Female	3*	1	1	45 timed out	
13 Male	2*	1	2	38.78	
14 Male	1	2	2*	44.98	
15 Female	*0*	*1*	*1**	*37.81*	*Eliminate due to failure to conform to requirements*
16 Female	3	1*	1	40.66	Wheel chair user
17 Female	2*	2	1	22.41	Selected and then rejected choices
18 Female	3	1*	1	33.00	
19 Female	2	1*	2	31.24	
20 Male	2	1	2*	39.94	Cast shadow over produce
21 Female	1	2	2*	36.98	LH
22 Female	1	2	2*		
11	22 7*	15 3*	18 10*	55 total	

Megaman lighting study   Tally sheet.   R9 LED
No 2 of 2   Trial 2
 order Red Yellow Green   **illumination** R=1238 lux Yellow 1379 lux G 1250 lux   @25 deg C

Gender	Green number	Red number	Yellow number	Time in Secs	Comments
11 Female	1	1	3*	36.10	
12 Female	2	1*	2	44.20	Took time to review and consider
13 Male	2	2	1*	30.10	
14 Male	1	1	3*	32.12	Selected on quality reviewed
15 Female	*0*	*1*	*1**	*45 secs timed out*	*Eliminate due to failure to conform to requirements*
16 Female	3*	1		43.15	Wheel chair user
17 Female	3*	1	1	17.78	Selected and then rejected choices
18 Female	1	2*	2	29.35	
19 Female		2	3*	27.66	
20 Male	1	2*	2	38.72	Cast shadow over produce
21 Female	2	2*	1	38.53	LH
22 Female	1	2*	2	38.88	
11	17 2*	17 5*	20 5*	55 total	

Megaman lighting study   Tally sheet.   Metal Halide
No 1 of 3   Trial 3
 order Red yellow Green   **illumination** R=1358 lux Yellow 1313 lux G 1370 lux   @25 deg C

Gender	Green number	Red number	Yellow number	Time in Secs	Comments
23 Female	2	2*	1	44.62	Do I have to pick green?
24 Male	2*	1	2	43.60	
25 Male	1	2*	2	40.14	
26 Male	2	2*	1	22.64	
27 Female	2	2*	1	26.75	
28 Male	2*	1*	2	45 secs timed out	Analysed the produce
29 Female	1	3*	1	16.28	
30 Female	2	3*		36.80	Put basket down on table
31 Female	1	2	2*	19.44	
32 Male	2	1*	2	26.45	
33 Male	2*	1	2	23.87	
34 Female	2	2*	1	24.50	
12	21 3*	22 9*	17 1*	60 total	

Megaman lighting study   Tally sheet.   R9 LED

No 2 of 3   Trial 3

order Red Yellow Green   **illumination** R=1204 lux Yellow 1398 lux G 1353 lux   @25 deg C

Gender	Green number	Red number	Yellow number	Time in Secs	Comments
35 Female	1	3*	1	27.67	Do I have to pick green?
36 Female	2	1	2*	25.44	
37 Female	2	2	1*	19.72	
38 Female	2	2*	1	19.44	
39 Female	1	1	2*	18.91	Selected only 4
40 Female			5*	19.33	
41 Female	2	2*	1	19.46	
42 Female		2	3*	23.92	
43 Male	1	2*	2	37.40	Made selection changed mind
44 Female	2	2*	1	22.58	
45 Female		1	4*	24.09	
11	13 0*	18 5*	23 6*	55 total	

Megaman lighting study   Tally sheet.   R9 LED
No 3 of 3   Trial 3
 Order Mixed up colours   **illumination** R=1224 lux Yellow 1416 lux G 1299 lux   @25 deg C

Gender	Green number	Red number	Yellow number	Time in Secs	Comments
35 Female	3	2		34.80	First choice selection middle
36 Female	1	1	3* RHS	24.74	First choice selection RHS video evidence
37 Female	2	1	2* LHS	18.49	First choice selection RHS video evidence
38 Female	1*	2*	2	17.15	First choice selection LHS
39 Female	2*	1	2	18.65	First choice selection LHS
40 Female			5*LHS	17.53	First choice selection LHS Note this is the same subject that picked five on test 2
41 Female		3	2*LHS	15.66	First choice selection LHS
42 Female	1	1	3*LHS	26.14	First choice selection LHS
43 Male	1	2	2*LHS	38.38	First choice selection LHS
44 Female	1	2	2*LHS	22.88	First choice selection LHS
45 Female			5*middle	42.58	First choice selection middle
11	12	15	28	55 total	

First pick chart

T1a MH	**Red** na	**Yellow** na	**Green** na	Comments
T1b MH	**Green** X5	**Red** X3	**Yellow** X2	Note: red is first choice pick under metal halide
T1c MH	**Yellow** X5	**Green** X2	**Red** X2	
T2a MH	**Red** X3	**Yellow** X5	**Green** X3	
T2b LED	**Red** X5	**Yellow** X5	**Green** X2	Note: Yellow is first choice pick under LED
T3a MH	**Red** X9	**Yellow** X1	**Green** X3	Note: red is first choice pick under metal halide
T3b LED	**Red** X5	**Yellow** X6	**Green** X0	Note: Yellow is first choice pick under LED
T3c LED	**Mixed** X0	**Mixed** X10?	**Mixed** X0	Note: all yellow were first pick on the mixed boxes
				Yellow 33 O/A first pick Red 27 O/A fist pick Green 15 O/A first pick

Appendix 2 SPSS Data

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NEW FILE.
DATASET NAME DataSet2 WINDOW=FRONT.
DATASET ACTIVATE DataSet1.
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Crosstabs

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Crosstabs

Notes		
Output Created		29-Mar-2012 11:29:10
Comments		
Input	Data	D:\My Documents\peppers test data trial3 .sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	20
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each table are based on all the cases with valid data in the specified range(s) for all variables in each table.
Syntax		CROSSTABS /TABLES=lighting BY firstpick /FORMAT=AVALUE TABLES /STATISTICS=CHISQ CORR /CELLS=COUNT /COUNT ROUND CELL.
Resources	Processor Time	00 00:00:00.016
	Elapsed Time	00 00:00:00.014
	Dimensions Requested	2
	Cells Available	174762

[DataSet1] D:\My Documents\peppers test data trial3 .sav

```
CROSSTABS
  /TABLES=lighting BY firstpick BY nored noyell nogrn
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT
  /COUNT ROUND CELL.
```

Crosstabs

Notes		
Output Created		29-Mar-2012 10:45:57
Comments		
Input	Data	D:\My Documents\peppers test data trial2 set 1.sav
	Active Dataset	DataSet1
	Filter	<none>
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	N of Rows in Working Data File	20
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each table are based on all the cases with valid data in the specified range(s) for all variables in each table.
Syntax		CROSSTABS /TABLES=lighting BY firstpick BY nored noyell nogrn /FORMAT=AVALUE TABLES /STATISTICS=CHISQ /CELLS=COUNT /COUNT ROUND CELL.
Resources	Processor Time	00 00:00:00.000
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[DataSet1] D:\My Documents\peppers test data trial2 set 1.sav

Appendix 3 Participants comments

DMU Study Interview Notes
Lighting Methodology
Lighting suspended on truss 2.8m height in retail Lab.
GE brand CMH 25w lamps 4200k installed in Antares black track spots with global 3 circuit track adaptors.
Megaman R9 20w Par 38 LED lamps 4000k installed in illuma Topspot track spots with G3 Global adaptors.
Lighting Lux levels taken with ETi1301 Light meter (ref no 06049000).
Temperature at start in retail Lab 22 ^{o} C
Measurements taken at fixed point in centre of box (same depth, height). Results shown in table below and re-tested before each new experiment (to ensure daylight factor did not increase overall illuminance).

T1 Metal Halide	1246 R	1287 Y	1361 G
T1 LED	1156 R	1183 Y	1260 G
T2 MH	1458 R	1374 Y	1384 G
T2 LED	1238 R	1379 Y	1250 G
T3 MH	1353 R	1313 Y	1370 G 25 oc
T3 LED	1204 R	1398 Y	1353 G
T4 LED mixed	1224 Left	1416 Middle	1299 Right

What attracted you to a particular colour?
Were any more vibrant than others?
Did you change your mind?

T1
1 – Red , Yes often
2 – Yellow, Red / yellow more attractive to buy last time. Did change mind.
3 – No, Red Shinny, No
4 – Less Yellow, less attractive, didn't change mind.
5 – Red Shinny, yellow not see as participant quite tall so blocked light a bit. Not changed mind.
6 – Not exactly, Green and Red more attractive.
7 – Yellow was shinny, red ok, then green. Not change mind.
8 – Red attractive, Seemed brighter, changed mind yes.
9 – Based choice of glare of object and usually picked the brightest.
10 – Red liked best, chose as if would eat them.

T2
What colours were most appealing, what was different to the first time?
11 – yellow best colour, no change in brightness.
12 – Green better, less shinny. If over shinny makes it less attractive.
13 – Green more appealing, yellow looked better than Red. Red quite dark compared to others.
14 – Yellow more vibrant red looked pure.
15 – Y/R – chose lower down the box than the top 2nd pass through.
16 – green ones better, chose more Red 2nd time.
17 – red ones brighter, thinks choices similar both times through.
18 – more yellow 2nd pass, 1st time more Red, straight choice no change of mind or hesitation.
19 – Yellow brighter – more fresh, red better second time. (LH applicant)
20 – Yellow, squeezed to find the right ones, pretended as if they were in a shop.
21 – Red more attractive but not pick it, longer to pick 2nd time and red/green better.
22 – Yellow favourite, chose same both times, I Green each time. Chose based on shape , look and feel, felt a difference in lighting.
T3
23 – Green, well lit, Yellow looked transparent.
26 – higher placed ones shone more in box.
27 – Red was brighter, very shinny.
28 – Yellow stronger colour, red was eye catching.
29 – chose more based on appeal and Red was best.
30 – Chose Red first.
31 – Red stood out more than others.
32 – Green shinny and appealing, red peppers looked poor quality.
33 – yellow brighter.

T4 LED only
35 – Red 1st choice, went through colours and back to Red again.
36 – Yellow chose 3 from this group.
37 – Red best.
38 – Red and Yellow favourite with best ambience.
39 – Yellow brightest, not change mind at all.
40 – Yellow was brightest.
41 – Chose at random, brightest at top.
42 – Yellow peppers appeared to have an Orange feel to them.
43 – Red brighter, others similar intensity.
44 – Red best then Green.
45 – Yellow best based visually, likes to eat Yellow ones.
T5 mixed boxes no comments taken.