



Concept Generation and Evaluation

MCHE 470 – Fall 2013

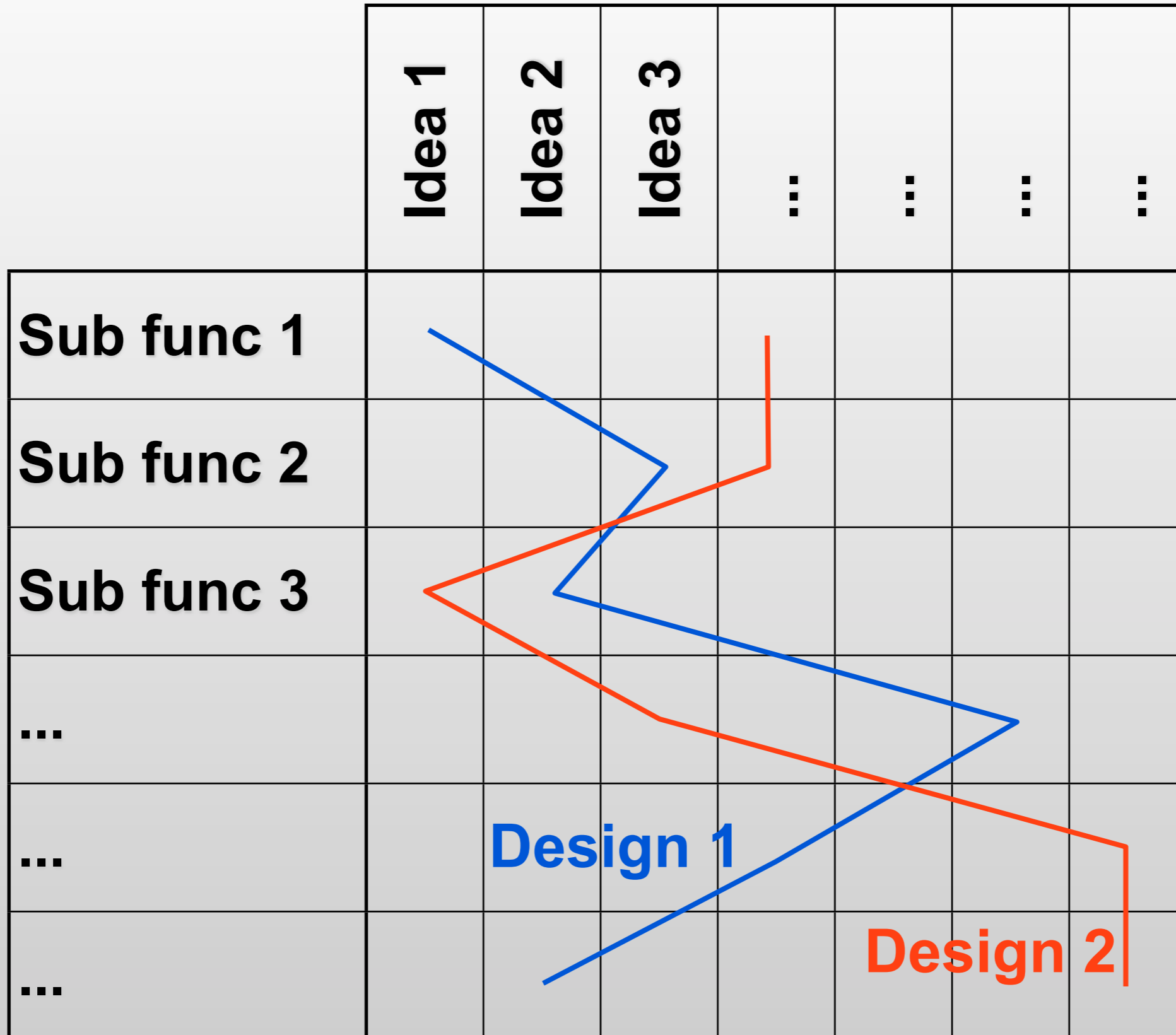
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Morphological Charts



Alternative Concepts



- All must satisfy same
 - Customer Req.
 - Specifications
 - Functions
- Want *5+ unique* designs that are all great
(Such that choosing the *final* one is difficult)

How should we choose?

The Problem Understanding Form



●	Strong = 9
■	Medium = 3
△	Weak = 1

Engineering Characteristics

<div style="border: 2px solid orange; border-radius: 50%; padding: 20px; width: fit-content; margin: 0 auto;"> Customer Requirements </div>	5	●		■	△	
	6		●	■		■
	9	●	■		△	
	2	■	△			■
	1		●	△	●	△
Absolute Importance	132	92	34	23	73	
Relative Importance	0.37	0.26	0.10	0.06	0.21	


1st-Level Evaluation Matrix



	<p>Alternative Concepts</p>
<p>Customer Requirements</p>	<p>Evaluation of Concept Against Cust. Req.</p>

1st-Level Eval Matrix - Desert








					
Customer Requirements					
	DATUM				

- Choose a “benchmark” product as your datum

1st-Level Eval Matrix - Desert








					
Customer Requirements		↓ S			
	DATUM				

- Fill in your concepts and compare to datum
- + = better, - = worse, S = same

1st-Level Eval Matrix - Desert








						
Customer Requirements		S	S			
	DATUM					

- Fill in your concepts and compare to datum
- + = better, - = worse, S = same

1st-Level Eval Matrix - Desert








						
Customer Requirements	DATUM		S	S	-	

- Fill in your concepts and compare to datum
- + = better, - = worse, S = same

1st-Level Eval Matrix - Desert








					
Customer Requirements		S	S	-	-
	DATUM				

- Fill in your concepts and compare to datum
- + = better, - = worse, S = same

1st-Level Eval Matrix - Desert








					
		\$	S	-	-
		+			
Customer Requirements	DATUM				

- Fill in your concepts and compare to datum
- + = better, - = worse, S = same

1st-Level Eval Matrix - Desert








					
Customer Requirements	DATUM	S	S	-	-
		+	+	+	S
		-	-	+	S
		S	S	+	+
		-	+	S	-

- Fill in your concepts and compare to datum
- + = better, - = worse, S = same

1st-Level Eval Matrix - Desert



					
Customer Requirements		S	S	-	-
	DATUM	+	+	+	S
		-	-	+	S
		S	S	+	+
		-	+	S	-
$\sum +$		1	2	3	1
$\sum -$		2	1	1	2
$\sum S$		2	2	1	2






1st-Level Eval Matrix Weaknesses?



- No consideration of importance
- No indication of *magnitude* of better/worse

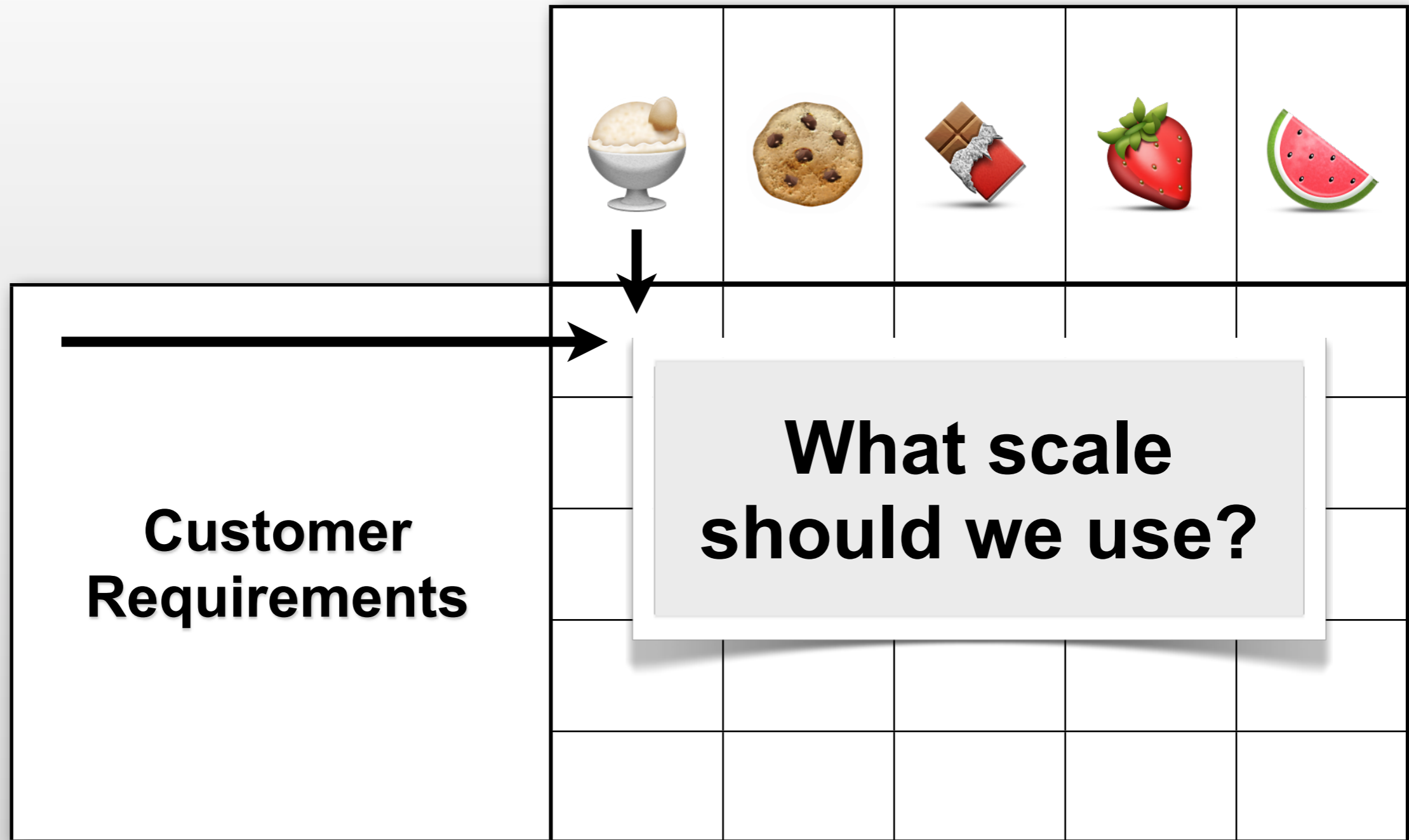
2nd-Level Evaluation Matrix



					
Customer Requirements					

- Give numerical value to how well a Customer Req. is satisfied

2nd-Level Evaluation Matrix



- Give numerical value to how well a Customer Req. is satisfied

Evaluation Scales








Pts	Meaning
0	Unsatisfactory
1	Just Tolerable
2	Adequate
3	Good
4	Very Good (Ideal)

Pts	Meaning
0	Unsatisfactory
1	Inadequate
2	Weak
3	Tolerable
4	Adequate
5	Satisfactory
6	Good, but drawbacks
7	Good
8	Very Good
9	Exceeds Req.
10	Ideal Solution





2nd-Level Evaluation Matrix



					
Customer Requirements	3				






2nd-Level Evaluation Matrix



					
Customer Requirements	3	3	4	2	2
	0	3	4	2	1
	1	1	1	4	3
	2	2	2	3	4
	2	4	1	0	1






2nd-Level Evaluation Matrix



					
Customer Requirements	3	3	4	2	2
	0	3	4	2	1
	1	1	1	4	3
	2	2	2	3	4
	2	4	1	0	1
Absolute Total	8	13	12	11	11

2nd-Level Evaluation Matrix








					
Customer Rec	3	3	4	2	2
	0	3	4	2	1
Absolute Total	8	13	12	11	11

$$\text{Relative Total} = \frac{\text{Absolute Total}}{\text{Max. Possible}}$$

2nd-Level Evaluation Matrix



					
Customer Requirements	3	3	4	2	2
	0	3	4	2	1
	1	1	1	4	3
	2	2	2	3	4
	2	4	1	0	1
Absolute Total	8	13	12	11	11
Relative Total	0.40	0.65	0.60	0.55	0.55






2nd-Level Eval Matrix Weaknesses?



- No consideration of importance

3rd-Level Evaluation Matrix



						
Customer Requirements	5					
	6					
	9					
	2					
	1					

What scale should we use?

Evaluation Scales








Pts	Meaning
0	Unsatisfactory
1	Just Tolerable
2	Adequate
3	Good
4	Very Good (Ideal)

Pts	Meaning
0	Unsatisfactory
1	Inadequate
2	Weak
3	Tolerable
4	Adequate
5	Satisfactory
6	Good, but drawbacks
7	Good
8	Very Good
9	Exceeds Req.
10	Ideal Solution

3rd-Level Evaluation Matrix



						
Customer Requirements	5	7				
	6					
	9					
	2					
	1					

Design “Scores”



- Absolute Total






$$\text{Absolute Total} = \sum_{\text{col}} (\text{Design Performance} \times \text{Customer Importance})$$

- Relative Total

$$\text{Relative Total} = \frac{\text{Absolute Total}}{\text{Max. Possible}}$$






3rd-Level Evaluation Matrix



						
Customer Requirements	5	7	6	9	5	4
	6	0	7	10	5	2
	9	3	2	3	10	8
	2	5	6	5	8	0
	1	6	9	2	0	3
Absolute Total		78	111	134	161	107

3rd-Level Evaluation Matrix



						
Customer Requirements	5	7	6	9	5	4
	6	0	7	10	5	2
	9	3	2	3	10	8
	2	5	6	5	8	0
	1	6	9	2	0	3
Absolute Total		78	111	134	161	107
Relative Total		0.34	0.48	0.58	0.70	0.47

Remember that...



- Much of the utility of these is in having to think objectively about the designs to rate them
- A design is the not the best because it got the highest score. It got the highest score because it's the best.
- Like all the tools, these are “living” documents
 - Can identify weaknesses in otherwise good designs
 - Promotes “cross pollination” of ideas
 - *ITERATE!*