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ICT Innovation – Spring 2015

MSc in Computer Science and MEng Telecom. Engineering
EIT Masters ITA, S&P,SDE

Lecture 04 – Concept Development – Selection and Testing

Prof. Fabio Massacci

PD&D Process: Concept Development

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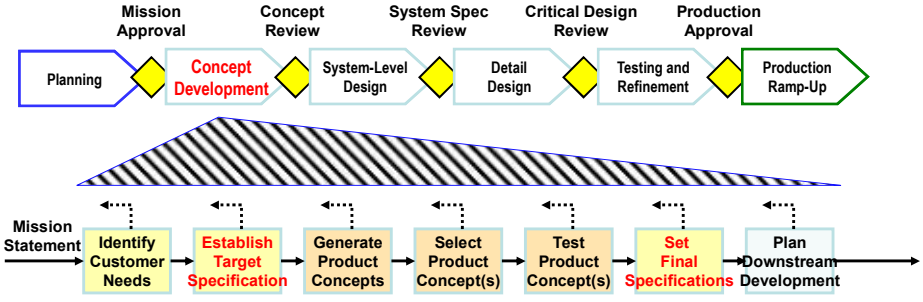
- **Design**
  - Concepts that are easy to produce
  - Concepts that have a potential market



Target Specs

Based on customer needs and benchmarking

Final Specs

Based on selected concept, feasibility, models, testing, and trade-offs

PD&D Process: Concept Development

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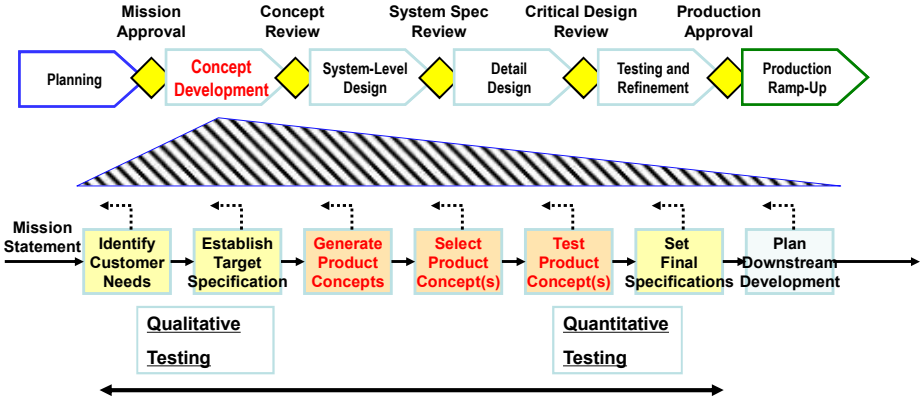
- **Eliminate**
  - Concepts that look unpromising (business-wise)
  - Concepts that are unwieldy to design



Concept Development Funnel

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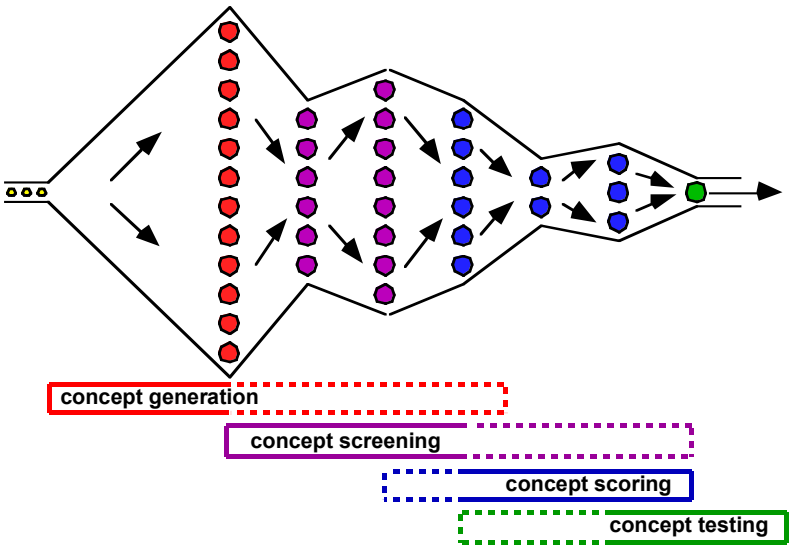

Concept Selection Process

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- **Prepare the Matrix**
  - Criteria
  - Reference Concept
  - Weightings
- **Rate Concepts**
  - Scale (+ – 0) or (1–5)
  - Compare to Reference Concept or Values
- **Rank Concepts**
  - Sum Weighted Scores
- **Combine and Improve**
  - Remove Bad Features
  - Combine Good Qualities
- **Select Best Concept**
  - May Be More than One
  - Beware of Average Concepts
- **Reflect on the Process**
  - Continuous Improvement

Concept Selection Example:

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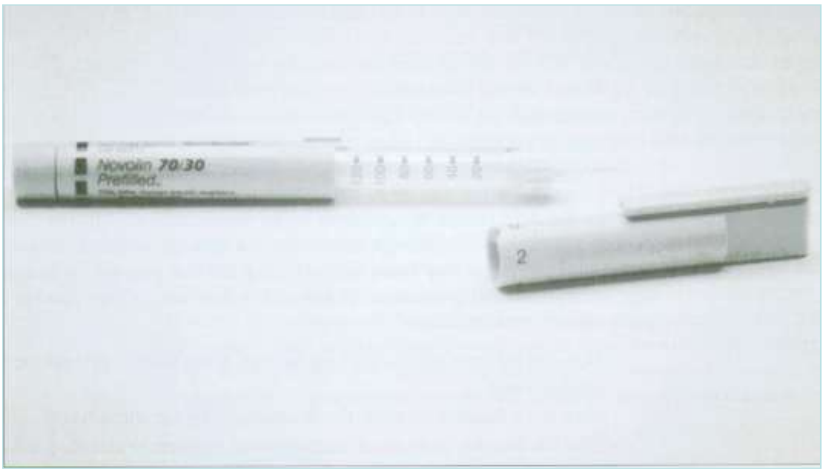

Example: Concept Screening

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	CONCEPT VARIANTS							
SELECTION CRITERIA	A	B	C	D	E	F	G	REF.
Ease of Handling	0	0	–	0	0	–	–	0
Ease of Use	0	–	–	0	0	+	0	0
Number Readability	0	0	+	0	+	0	+	0
Dose Metering	+	+	+	+	+	0	+	0
Load Handling	0	0	0	0	0	+	0	0
Manufacturing Ease	+	–	–	0	0	–	0	0
Portability	+	+	–	–	0	–	–	0
PLUSES	3	2	2	1	2	2	2	
SAMES	4	3	1	5	5	2	3	
MINUSES	0	2	4	1	0	3	2	
NET	3	0	–2	0	2	–1	0	
RANK	1	3	7	5	2	6	4	
CONTINUE?	Yes	Yes	No	No	Yes	No	Yes	

Example: Concept Scoring

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		Concepts							
		A (reference) Master Cylinder		**DF Lever Stop**		**E Swash Ring**		**G+ Dial Screw+**	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Ease of Handling	5%	**3**	0.15	3	0.15	4	0.2	4	0.2
Ease of Use	15%	**3**	0.45	4	0.6	4	0.6	3	0.45
Readability of Settings	10%	2	0.2	**3**	0.3	5	0.5	5	0.5
Dose Metering Accuracy	25%	**3**	0.75	3	0.75	2	0.5	3	0.75
Durability	15%	2	0.3	5	0.75	4	0.6	**3**	0.45
Ease of Manufacture	20%	**3**	0.6	3	0.6	2	0.4	2	0.4
Portability	10%	**3**	0.3	3	0.3	3	0.3	3	0.3
Total Score		2.75		3.45		3.10		3.05	
Rank		4		1		2		3	
Continue?		No		Develop		No		No	

Concept Selection Exercise: Mechanical Pencils

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Mechanical Pencils: Customer Needs

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Mechanical Pencils: Concept Selection Matrix

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Remember…

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- **The goal of concept selection is not to**
  - Select the best concept.
- **The goal of concept selection is to**
  - Develop the best concept.
- **So remember to combine and refine the concepts to develop better ones!**
- **But beware of the best "average" product.**
  - Perform concept selection for each different customer group and compare results.
  - Check sensitivity of selection to relative weightings and ratings

Usage Moel is key

- **Recall VHS vs Betamax main issue**
  - Betamax and VHS essentially based on similar technology
  - There is margin for improvement. Which feature to select?
- **Betamax intended usage → live videocamera recording**
  - Small size is best
    - you don't want to carry out heavy and unwieldy cameras
  - Duration not so important
    - you are not going to continuously record live stuff, can change easly tape
- **VHS intented usage → unattended TV recording**
  - Long duration is best
    - you don't want to go back home or wake up in middle of night to change tape
  - Size immaterial
    - recorder is laying together with TV set which is likely much bulkier
- **"Average" concept utterly useless**

Concept Testing is Used for Several Purposes

- **Ok, you selected a concept**
- **What market to be in?**
  - Benchmarking
  - Forecasting demand
- **Which feature exactly?**
  - Selecting among alternative concepts
  - Confirming concept selection decision
  - Soliciting improvement ideas
- **Ready to launch?**
  - Go/no-go decisions

Concept Testing Process

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- **Define the test**
  - Define the purpose of the test
  - Choose a survey population
  - Choose a survey format
- **Execute test**
  - Communicate the concept
  - Measure customer response
- **Interpret the results**
  - Reflect on the results and the process

emPower Electric Scooter

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- **Purpose of concept test:**
  - What market to be in?
- **Sample population:**
  - College students who live 1-3 miles from campus
  - Factory transportation
- **Survey format:**
  - Face-to-face interviews

Communicating the Concept

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- Verbal description
- Sketch
- Photograph or rendering
- Storyboard
- Video
- Simulation
- Interactive multimedia
- Physical appearance model
- Working prototype

Verbal Description

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- What it is
  - The product is a lightweight electric scooter that can be easily folded and taken with you inside a building or on public transportation.
- How it works
  - The scooter weighs about 25 pounds. It travels at speeds of up to 15 miles per hour and can go about 12 miles on a single charge.
- Key feature
  - The scooter can be recharged in about two hours from a standard electric outlet.
- Key benefit
  - The scooter is easy to ride and has simple controls — just an accelerator button and a brake.

Various Presentational Formats

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Sketch

Rendering

Storyboard

3D CAD Model

Appearance Model

Working Prototype

Survey Format

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- **PART 1, Qualification**
  - How far do you live from campus?
    - <If not 1-3 miles, thank the customer and end interview.>
  - How do you currently get to campus from home?
  - How do you currently get around campus?
- **PART 2, Product Description**
  - <Present the concept description.>
- **PART 3, Purchase Intent**
  - If the product were priced according to your expectations, how likely would you be to purchase the scooter within the next year?

I would definitely not purchase the scooter.	I would probably not purchase the scooter.	I might or might not purchase the scooter.	I would probably purchase the scooter.	I would definitely purchase the scooter.
			↑	↑
			"second box"	"top box"

Survey Format

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- **PART 4, Comments**
  - What would you expect the price of the scooter to be?
    - Price point!
  - What concerns do you have about the product concept?
  - Can you make any suggestions for improving the product concept?
- **Thank you.**

Interpreting the Results: Forecasting Sales

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- **Q = N x A x P**
- **Q = sales (annual)**
- **N = number of (annual) purchases**
- **A = awareness x availability (fractions)**
- **P = probability of purchase (surveyed)**
- **= Cdef x Fdef + Cprob x Fprob**

Forecasting Example:

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- **Campus**
  - N = off-campus grad students (200,000)
  - A = 0.2 (realistic) to 0.8 (every bike shop)
  - P = 0.4 x top-box + 0.2 x second-box
  - Q = 200,000 x 0.2 x [0.4 x 0.3 + 0.2 x 02] = 6400 units/yr
  - Price point $795
- **Factories**
  - N = current bicycle and scooter sales to factories (150,000)
  - A = 0.25 (single distributor's share)
  - P = 0.4 x top-box + 0.2 x second-box
  - Q = 150,000 x 0.25 x [0.4 x 0.3 + 0.2 x 0.2] = 6000 units/yr
  - Price point $1500

emPower's Market Decision: Factory Transportation

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Sources of Forecast Error

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- **"Unsound" Surveys**
  - People may not tell true opinion
  - Statistically significant but practically insignificant
- **Network Effect**
  - Word-of-Mouth Effects
  - Competition
- **Quality of Concept Description**
- **Pricing**
- **Level/Type of Promotion**
  - "feel good" effect more than "actual" effect (but only for low cost item)
    - Nobody is going to spend 5.000€ for something that is nice but don't work
    - But between 13€ and 15€ you got a chance…

Who do you ask?

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- **Selling male condoms (growing market even in time of crisis)**
  - Survey is most frequently used method → Thousands of surveyed people!
- **General Social Survey**
  - US Men in the right age bracket
  - Frequency of Sex (Variable sexfreq): Women 15-44 yrss
  - Sex without Condoms (variable SXQ251): Male-Female 18-59
- **Market estimation**
  - Estimated = (1-SXQ251) * sexfreq x US men
- **Who do we target for "requirements" & "customer needs"?**

Estimating our market

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- **Frequency of Sex (Variable sexfreq): Women 15-44 Years - Average 51 times/yr**
  - 1-2 a year: 7.8%
  - Once a month: 10.3%
  - 2-3 times month: 15.9%
  - Weekly: 17.7%
  - 2-3 per week: 21,20%
  - 4+times a week: 6.3%
- **Sex without Condoms (variable SXQ251): Males-Fem 18-59 yrs – approx 42% use condoms**
  - Never 27,2%
  - Less than half the times 13,4%
  - About half 6,9%
  - Not always but more than half 8.3%
  - Always 43.8%
- **Market estimation**
  - Estimated: 1.325M/year = 42% condoms x 51 times x 61.2M men

Who do we ask?

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- **Men's female partners over lifetime**
  - None 11.4%
  - One 15.0%
  - Two 7.6%
  - 3 to 6 26.5%
  - 7 to 15 18.1%
  - 15+ plus 21.4%
- **"Men are hunters" etc. etc.**
- **Most promising market?**
  - According to a Durex survey (2° largest player)
  - Man with several partners
- **Women's male partners over lifetime**
  - None 11.3%
  - One 22.2%
  - Two 10.7%
  - 3 to 6 31.6%
  - 7 to 15 16.0%
  - 15+ plus 8.3%
- **"Women prefer stable relationships" etc. etc.**

Recapping the numbers

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- **General Social Survey (2006-2009)**
  - Frequency of Sex (Variable sexfreq): Women 15-44 Years
    - Average 51 times a year
  - Sex without Condoms (variable SXQ251): Males-Females 18-59 years
    - Using at some point 42%
    - Never wtthout 27,2%
- **Market estimation for 2009**
  - Estimate = 1.325M/year = 42% using condoms x 51 times x 61.2M men
  - Conservative = 851M/year = 27% never without x 51 times x 61.2M men
- **Actual Numbers**
  - Condoms sold in 2009 according to Nielsen: 437M
    - Of those city of NY alone bought 41.7M condoms to give away in some program, Washington DC bought 3.5M….
- **Where are the billion of potentially saleable condoms gone?**

Is survey data reliable?

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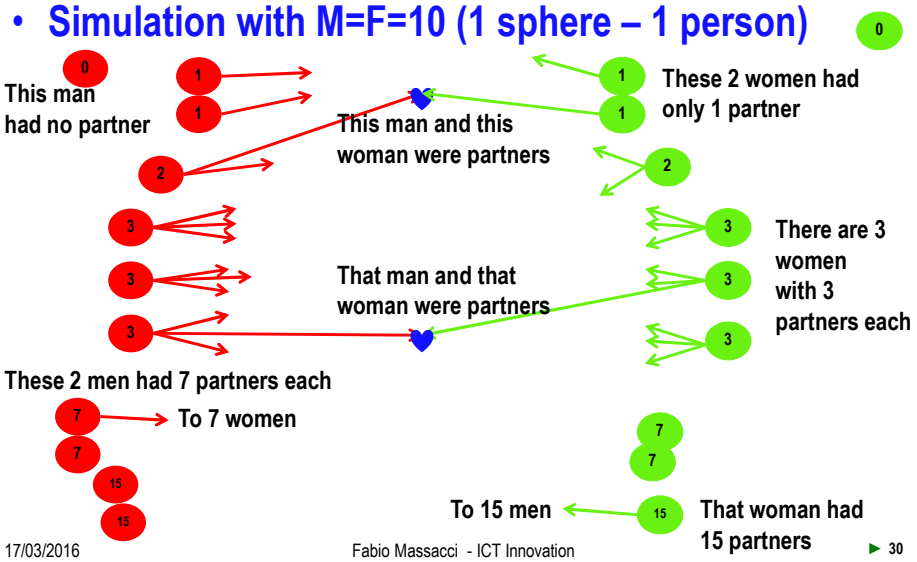
- **Simulation with M=F=10 (1 sphere – 1 person)**



Is survey data reliable? Keep going

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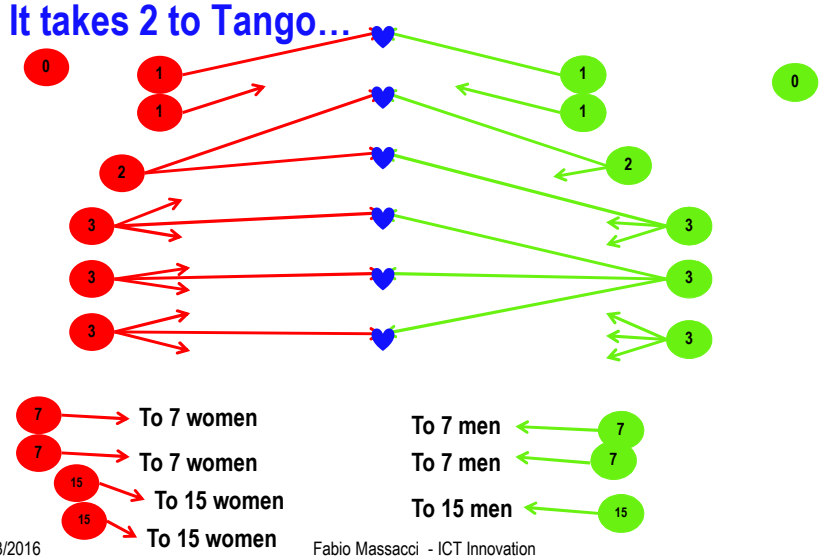
- It takes 2 to Tango…



Is survey data reliable? Ooops

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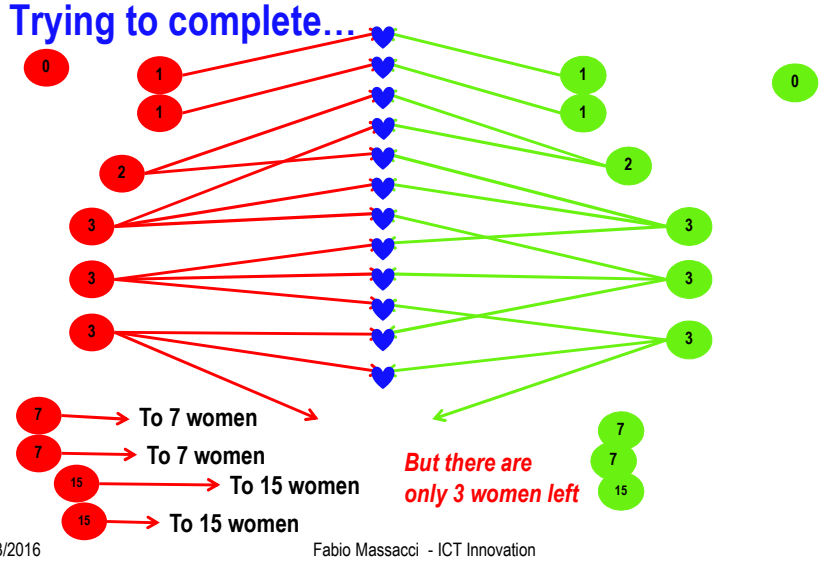
- Trying to complete…



Should you target men or women? (contd)

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- **Men's female partners over lifetime**
  - None 11.4%
  - 1 partner 15.0%
  - 2 partners 7.6%
  - 3 to 6 26.5%
  - 7 to 15 18.1%
  - 15+ plus 21.4%
- **339M relationships =**
  - 61.2M * (15%+2*7.6%+…)
- **There are 100M relationships missing…**
  - Unsurprisingly not many condoms are sold to the men boasting 7+ relationships in the surveys…
- **Women's male partners over lifetime**
  - None 11.3%
  - 1 partner 22.2%
  - 2 partners 10.7%
  - 3 to 6 31.6%
  - 7 to 15 16.0%
  - 15+ plus 8.3%
- **233M relationships**
  - 61.9M * (22.2%+2*10.7%+…)
- **What's wrong?**
  - Men lie or women lie or both lie
  - or count "partners" differently
  - or just don't remember and put down a "feels right" number

Who do you ask? (continued)

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- **General Social Survey → Now we ask women**
  - Frequency of Sex (Variable sexfreq): Avg 51 times a year
  - Frequency of Usage of Contraceptives – Women 15-44 Years
    - No Contraceptives 19,0%
    - Using Condoms 10,0%
    - Other Contraceptives 51,8%
- **Market estimation**
  - Estimate = 316M/year = 10% condoms x 51 times x 61.9 M women
  - Condom sold in 2009 according to Nielsen: 437M
- **Same "data" but asking different people and different questions**
  - Customers are not obliged to tell you the truth
    - They often do it or don't do it out of kindness to the interviewees or for shame etc. etc.
    - # "no/lousy contraceptives" * "frequency of sex" is also inconsistent with # "pregnancies"
  - Surveys may have "statistical significance" → but no "practical significance"
    - Ok for a socio-rant in the NYTimes on national sexual behavior, not so good for planning to produce half billion condoms
  - Look for answers from different perspectives and "evidence" of behavior

Can we exploit the bias?

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- **If customers have a systematic bias, can transform this "bug" into a "feature"… to sell them things?**
  - Can we exploit tendency of men to boast "sexual prowess"?
- **Trojan, condom manufacturer, already did:**
  - "Magnum" Condom (from Latin – Big) – 18.8% Market share
- **Advertising campaigns**
  - "Live Large", "Live to the gold standard"
- **Compare two product descriptions**
  - "ENZ™ is our classic trusted condom" → 12.6$/11.1€
  - "The Gold Standard™ in comfort and protection" → 14.5$/12.8€

Advertising & Pricing vs Reality

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- **Advertised Difference**
  - MAGNUM lettering is twice larger than ENZ
  - Gold Lettering over Black

JA Bellizzi and RE Hite. "Environmental color, consumer feelings, and purchase likelihood." *Psychology & marketing* 9(5): 347-363, 1992.

PA Bottomley and JR. Doyle. The interactive effects of colors and products on perceptions of brand logo appropriateness *Marketing Theory* 6:63-83, 2006.

Advertising & Pricing vs Reality

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- **Advertised Difference**
  - MAGNUM lettering is twice larger than ENZ
  - Gold Lettering over Black

- **Actual difference**
  - In size: +3mm
  - In length: 19cm vs 20.5cm
  - mean lenght of men: 13cm, sd. 2.7cm

JA Bellizzi and RE Hite. "Environmental color, consumer feelings, and purchase likelihood." *Psychology & marketing* 9(5): 347-363, 1992.

PA Bottomley and JR. Doyle. The interactive effects of colors and products on perceptions of brand logo appropriateness *Marketing Theory* 6:63-83, 2006.

R. Bresler. "Why Are So Many Men Suddenly Buying Magnum Condoms?". *The DateReport*, 26 March, 2013

K Promodu, K V Shanmughadas, S Bhat and K R Nair. Penile length and circumference. *International Journal of Impotence Research* 19:558–563, 2007

What does it mean?

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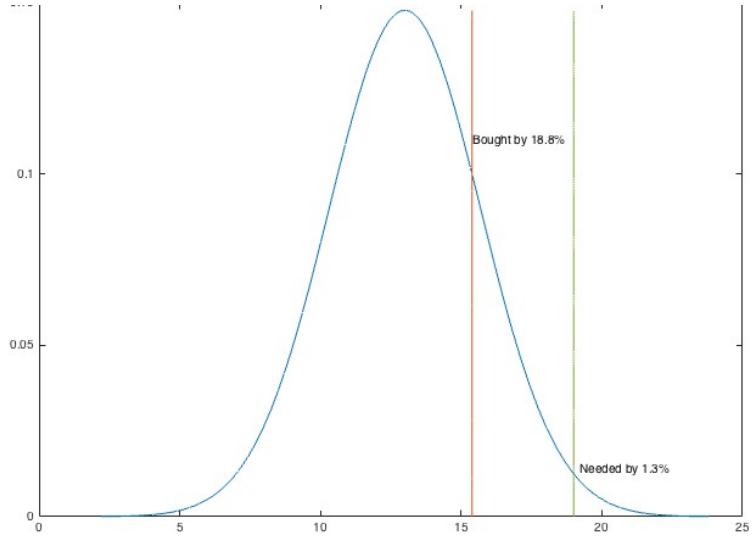

Discussion

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- **Why do respondents typically overestimate purchase intent?**
  - Might they underestimate intent?
- **How to use price in surveys?**
- **How much does the way the concept is communicated matter?**
  - When shouldn't a prototype model be shown?
- **How do you increase sales, Q?**
- **How does early (qualitative) concept testing differ from later (quantitative) testing?**

Textbook

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Product Design and Development
Karl T. Ulrich and Steven D. Eppinger
5th edition, Irwin McGraw-Hill, 2012

1. Introduction
2. Development Processes and Organizations
3. Opportunity Identification
4. Product Planning
5. Identifying Customer Needs
6. Product Specifications
7. **Concept Generation**
8. **Concept Selection**
9. **Concept Testing**
10. Product Architecture
11. Industrial Design
12. Design for Environment
13. Design for Manufacturing
14. Prototyping
15. Robust Design
16. Patents and Intellectual Property
17. Product Development Economics
18. Managing Projects