Bike Lab

Homework

Your Name: (first and last)

_____

Your Pod: (circle)

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Part 1: Profile of an Ideal Trip

Review the data on an "ideal trip" for each persona, calculate speed (3), wheel rotations (4) and rear wheel RPM (5).

	Ideal Trip from Case Study		Calculate			From Case Study	
Persona	Distance kilometers	Time minutes	Speed k/h	Rear Wheel Total Rev.	Rear Wheel RPM	Ideal Pedal RPM	Min Comfort Mech Adv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tourist	10	90				40	0.40
Shopper	8	40				55	0.25
Commuter	12	30				70	0.15

Hint: Wheel diameter is 660mm (.66 meters); π = 3.14159

Part 2: Analyze the Drive Train Options

Calculate speed ratio (12), pedal RPM for an ideal trip (13-15) and mechanical advantage (16) for each drive train option.

Speed Ratio - Equation 1

$$Speed\ Ratio = \frac{\omega_{out}}{\omega_{in}} = \left(\frac{N_{chainring}}{N_{cassette}}\right)$$

Mechanical Advantage - Equation 2

$$M.A. = \frac{F_{out}}{F_{in}} = \left(\frac{L_{crank}}{R_{wheel}}\right)\left(\frac{N_{cassette}}{N_{chainring}}\right)$$

Hint #1: Pedal RPM is the rear wheel RPM divided by the speed ratio.
Hint #2: This is a good use for a spreadsheet!

	From Case Study				Calculate – Ideal Trip				
Option	Manufacturer Brand	Chainring teeth	Cassette teeth	Crank Length mm	Speed Ratio Equ 1	Tourist Pedal RPM	Commuter Pedal RPM	Shopper Pedal RPM	Mech Advantage Equ 2
	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1	Shimano	30	28	170					
	Traveler	30	24	170					
		30	22	170					
2	Campagnolo	48	34	170					
	Trieste	48	28	170					
		48	24	170					
3	SRAM	52	24	160					
	Cardinal	52	20	160					
		52	16	160					
4	Shimano	52	32	170					
	Blue	52	24	170					
		52	18	170					
5	Bontrager	44	-15%	170					
	Rolhoff	44	26	170					
	(Internal)	44	+15%	170					

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Part 3: Putting It All Together

Decide on your design persona (17), then recall the ideal pedal RPM (18)(6) and minimum comfort mechanical advantage (19)(7) for this persona. Review your data from Part II, then select a manufacturer and brand (20) that is best for your design persona. Record the ideal trip RPM (21) for this drive train choice (Part II, 13-15) and calculate the difference (22) from the Ideal RPM (21-18). Finally, record the mechanical advantage (23) for this drive train choice (Part II, 16) and calculate the difference (24) from the design persona minimum comfort mechanical advantage (24-19).

Design Persona			Your Drive Train Choice				
What persona are you designing for?	Ideal Pedal RPM	Min Comfort Mech Advantage	Manufacturer/ Brand	Ideal Trip Pedal RPM	Difference vs Ideal RPM	Mechanical Advantage	Difference vs Min Comfort Mech Advantage
(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)

Part 4: Making it Real

Designers often sketch or draw a representation of the customer of their design. This is a way for your brain to integrate thoughts that are often hard to express in words.

Try it! Draw a picture (right) of the type of customer you think should be the target of this design – Tourist, Shopper or Commuter. Add notes on the persona that you think are important and should be considered as part of the final design.

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Part 5: Enrolling Your Team

Empathy Maps (right and next page) can be used to bring team members together around a vision of the design customer. Matt will need to enroll his team on the drive train decision and will use an empathy map.

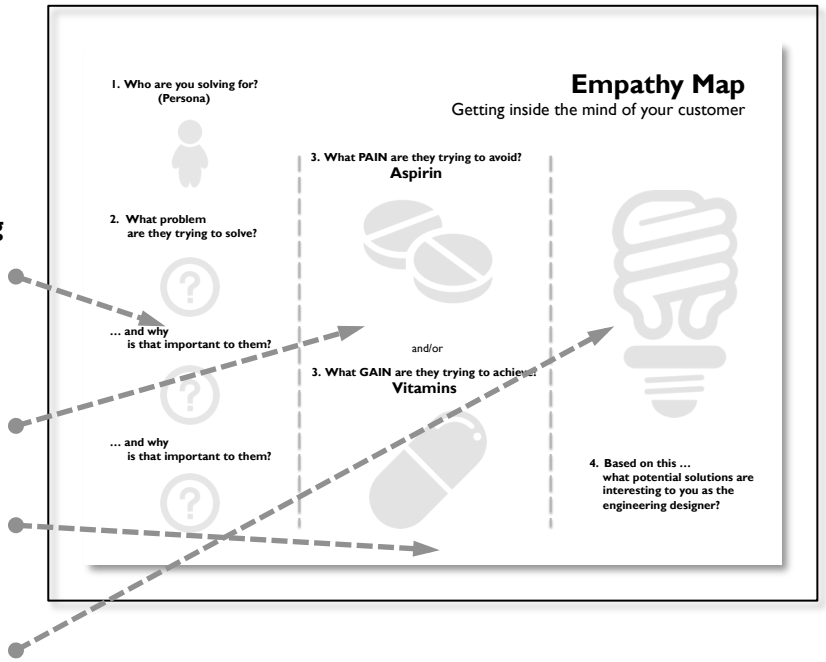
What problem is your persona trying to solve with B-cycle?

Why is that important to your persona?

What PAIN are they trying to avoid by using a B-cycle?

What GAIN are they trying to achieve with B-cycle?

Based on this, are there any design characteristics that are critical to make B-cycle the best solution for your design persona?



Now, try working with an Empathy Map to capture your ideas. On the following page is a full-size Empathy Map. Write or sketch your thoughts – *who are you solving for? What problem are they trying to solve? What PAIN are they avoiding or GAIN they are achieving?* and *what are the potential solutions that most interest you as a designer?* Now imagine how Matt might use this to talk about his design decision with the broader product development team at Trek.

Empathy Map

Getting inside the mind of your customer

1. Who are you solving for? (Persona)

2. What problem are they trying to solve?

… and why is that important to them?

… and why is that important to them?

3. What PAIN are they trying to avoid?
Aspirin

and/or

3. What GAIN are they trying to achieve?
Vitamins

4. Based on this … what potential solutions are interesting to you as the engineering designer?