Personalized Data Visualization for enhancing Shopping Experience

Final presentation

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Under the guidance of Prof. Venkatesh Rajamanickam

Why this project?

- High effort/less rewarding
 mechanism to input expenses
- Lack of a system that react positively and quickly to user's dynamic spending habits



Why this project?

- Spend money based on needs rather than following up a budget based on fixed assumptions like "how much money left and how many days left to survive"
- Help user spent money for his meaningful goals
- Enhance shopping experience



Project goals

- Build an expense tracker
- Visualization as a tool
- Help user derive insights about his expenditure
- Save money for meeting his meaningful goals

Structure

- Design process
- Data collection
- User studies
- State of art review
- Design brief
- Designs
- Final design
- Evaluation

DESIGN PROCESS









• How do I buy a product?









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Retailer

*Literature review









Information

Retailer











* "How Companies Learn Your Secrets" by Charles Duhigg, NYTimes, Feb 16, 2012







How habits are formed?

- 3 step loop:
 - Cue
 - It's a trigger that tells you which habit to choose
 - Go on automatic mode
 - Routine
 - Physical/mental/emotional routine
 - Reward
 - Helps brain figure out if this loop is worth remembering for future

* "<u>How Companies Learn Your Secrets</u>" by Charles Duhigg, NYTimes, Feb 16, 2012

How habits influence shopping?

- Once loop is established, habit emerges & brain stops fully participating in the decision making
 - Unless new cues and rewards are found, the existing pattern will be repeated automatically
 - Habits never disappear

After choice is made, what happens?

- The confidence that user have that he made the right choice
 ~ Post choice satisfaction (PCS)
- Consumer side
 - Satisfaction with the product
 - Satisfaction with information on which expectations were made
- Retailer side
 - Customer loyalty, recommends store and product to friends and relatives

Product evaluation

- Emotions that product evoke
 - Feeling that user gets from the purchase made
- Cognitive judgments* & effective reactions
 - PCS > if user is happy with product
 - Negative Post choice arousal > if user is dissatisfied

*That which comes to be known, as through perception, reasoning, or intuition; knowledge.

Why measure satisfaction?

- Satisfaction ~ influence shopping habits
- User satisfaction ~ enhance shopping experience
- How?
 - Transaction-specific perspective
 - Attention will be specifically paid to all recent purchases
 - Cumulative perspective
 - All purchase experiences will be measured, not just the recent ones

To summarize

- PCS can be used for?
 - Enhancing other's shopping experience > trusted source
- How to capture data?
- How to communicate the information to user?
 - Personalized data visualization

Personalization of data

- Using technology to accommodate the differences between two individuals ~
 Personalization
- Predictive personalization
 - Used to improve the overall user experience online
 - Used to predict user's behavior, needs or wants and for tailoring offers and communications precisely
 - Examples:





Personalized data visualization

- Approaching a person's data in a way consistent with their goals to transform the way people interact with their data
 - To make data more meaningful
 - Help user understand patterns in their life and accomplish their meaningful goals.
 - Examples

"Making Data Meaningful to a Person in the Context of Daily Life": by Nels Oscar, Shannon Mejia, IGERT, Oregon State University, May 20, 2013

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"Seeing the Bigger Picture with Daytum" by Chris Bowler, appstorm, Sept 3, 2009



"Daytum I love you but please join the web" by Tom Scott, derivadow, April 6, 2009



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Problems with existing trackers

- Categorization
 - Pre-defined categories
 - Single item with multiple categories
- Input
 - Too much effort
 - E.g. My fitness pal > 6 steps to input one item, 26 items to choose from

To summarize

- Study about user's shopping habits
 - User study > Affinity mapping
- Find how user data is being captured & communicated
 - State of art review
- Compare the findings
 - See what all problems exist, how they are solved, how can I solve the unsolved?



User studies

- User group
 - 5 users
 - Young adults
 - Age group: 20-30
 - Single
 - Not focusing on stock, currency exchange etc.



Artifacts

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11	Mineral Water	40	Y	Y	Y	Y	Y	Y	Y	Y	Y	4.4444444444
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Affinity mapping

Apart from clothes, what about the other household stuff?	I don't use thampoo. I buy of and scop dati keep on shifting from brands. "If I'm doing a lot of budy activity this month, til prefer buying debid or If I know am not working much, then Fil prefer buying Cinthol"	INTA507
Anything else in expenses?	I buy Cigerettes that comes 150 rs per day. If I meet too many people per day, then it will become 300 per day.	INTASOB
So, tell me about ur special shopping, what triggers you to go and buy something	Ma shopping starts with a lack or need. If there is an event thas happening, i need format stuff that i don't have, and i have T shirt if and only if are running short of it. When it go for buying, if he more happy if its cheap. But apart from that, it should also be comfortable to wear.	INTAS09
So, you're telling me that you don't wish to buy or spent money on something that is perishable, that doesn't stay much?	Its not like that, I keep reusing it. I'll use it until ma mom throws it away.	INTAS10
You dont go for expensive brands?	I go for brands also, cor the stiching is better there. Most of the products that I buy in Dmargets spolled easily, the color pose off and sometimes. I'm even afraid of tright in the washing machine with the dothes.	INTAS11
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Tell me about the satisfaction you got after buying some product (or) tell me about one of your bad experiences	Thavent bought a wrom, remember of any. And Lo. happiness as flock only bary things when I buy a produc'	INTAS13
ts there any emotional attachment with the products you buy?, like its new! Am reeling happy or things like that?	If the product gets damage then I'll be sad. I feel that I made a more the	INTAS14

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A Behavior Model for Persuasive Design

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Key findings

- How to improve the shopping experience
 - Remind user about his needs
 - Checklist of requirements
 - Freedom to make right choices
 - Comparing multiple products based on requirements and budget
 - How to measure quality of a product?
 - "Online reviews and ratings can be trusted"- user(I don't think so)
 - "Word of mouth"
 - Reasons for dissatisfaction?
 - Product failure
 - Bad service
 - Information based on which expectations were built ~ online

Key findings

- How to capture the data with less effort?
 - Facts associated with a purchase
 - Product name, expense, locations etc.
 - How to categorize user expenses?
 - "No" to pre-defined categories
 - Unique ways > e.g. based on amount, shop name, fixed expense, future expense, debts**
 - Adding bills and artifacts
 - Tool to calculate/ adaptable with situations ~ currency conversion

STATE OF ART

State of art

- To validate user concerns, see how they're solved
 - 4 online shopping websites
 - 7 personal finance applications
 - Compare it with findings from user studies
- Evaluate the existing features based on user concerns

Categorizing an expense

- Kinds of expenses
 - Single product, single category
 - e.g. dinner at a restaurant
 - Multiple products, single category
 - e.g. shopping at supermarket
 - Single products, multiple categories
 - e.g. an unexpected travel > travel, unexpected travel

Visualizing the expenses

- Facts associated with a single purchase
 - Product name, description
 - Shopping location
 - **Categories** > a product may fall in multiple categories
 - Expense
- Reducing user's freedom to spend the money
 - Focus on need: money to meet needs, not "needs to meet money"

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Overall	\$5,193 of \$5,939		\$746 Left
Restaurants	\$598 of \$200		\$397 _{Over}
	HOME		
Lawn & Garden	\$90 of \$90		\$0 Left
Mortgage & Rent	\$2,168 of \$2,172		\$4 Left
Storage	\$147 of \$147		\$0 Left
	KIDS		
Babysitter & Daycare	\$400 of \$1,000		\$600 Left
	SHOPPING		
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Setting up a budget

- User concern:
 - "I make one budget for an year, then fill it > day wise, month wise > budget, actual"
 too much work
- Insight:
 - "...practices like leaving cash with friends for safekeeping and to reduce temptation to spend it"

- Input expenses with lesser effort
 - Motivated and disciplined to use the app
 - Existing input systems are not rewarding
 - User should manually make most of the decisions despite running the application on a "smart device"
 - Not flexible with users expenses
 - Money left: days left

- Freedom to make a right choice
 - Compare multiple products with **requirements** not with features



Design brief

- To build a smart phone based expense tracking application
- Capture user's expenses(habits)
- Use visualization as a tool to communicate personal data to user
- Help user derive insights about his expenditures
- Help user spend, save money for meeting his meaningful goals

Rohit Raj

- 26 year old engineer in Chennai. He lives 10 kilometers away from his office. He shares his rented flat with two others.
- Eats his lunch outside, cooks his breakfast and dinner. He doesn't own a refrigerator so he buys his grocery daily.
- He keeps changing his mobile phone every year. He always go for the best product available in the market.



Rohit: always opt for the best; price doesn't matter

Rohit Raj

- He doesn't miss his newspaper and a packet of cigarette before he boards the train.
- He has an account in the hotel where he eats his lunch, comes back home at 8 pm.
- He buys milk and other groceries on the way back.
- His weekends include a night out and the other days looking for the best restaurants around the city for lunch.



Rohit: always opt for the best; price doesn't matter

Financial Status

- Rohit is not financially stable. He misses his due dates for paying the rent and electricity bills.
- His latest purchase of an iPhone has claimed all his bank savings.
- Some of his friends asked him to write down his expenses, but he stopped doing as it didn't help him much.
- Rohit is now worried as he has no savings and his expenses are increasing



Rohit: always opt for the best; price doesn't matter

Deepak Soman

- Deepak is a 22 year old College Student; stays in college hostel with his friends at Christ College, Bengaluru and regularly travels to college located 2 kilometers away in his bike.
- He doesn't like hostel food so he prefers to have food outside in a local restaurant. Deepak is a fashion freak, spends his money on clothes and shoes.
- He leaves for college at 8 in the morning with breakfast on the way to college, lunch at college canteen and a late night dinner at his favorite diner.
- Weekends are fully occupied as he roams around the shopping malls and watching movies.



Deepak: fashionable and biker

Financial status

- Deepak hails from a Malayali family. He is the eldest of 3 and his parents are government employees.
- His only source of income is from his parents and sometimes he has to ask for extra money as he doesn't have control over his expenses.
- Deepak feels bad for taking extra money from his parents as his younger brothers are also studying and his parents can't afford to pay him.



Deepak: fashionable and biker

Radhika Krishnan

- Radhika is 26 year old HR Manager in Pune.
- She lives with her family in a small town that requires 1 hour commute to the office.
- She spends much of her time at home with parents and does all the shopping for the family.
- Her typical day starts at morning 5am; drives her bike to the bus stand where she boards the bus to workplace.
- On weekends, she goes out with her friends and prefers good restaurants to dine.



Radhika: Spends her money wisely

Financial status

- Radhika is the only earning member in her family and both her parents are retired.
- She takes care of the household expenses including monthly grocery. Her other expenses are on travelling and bike maintenance.
- She doesn't keep track of her expenses as her salary is not that big and she knows how much she is spending but she is always afraid to spent money.
- She keeps forgetting things to buy and is worried over her parent's wedding anniversary that is coming up after 2 months.



Radhika: Spends her money wisely


Design 1

Saving Money for future expenses

- Help user
 - Input expenses daily
 - Save money
 - Manage his expenses
 - Visualize his expenses



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- Advantages:
 - Saving money for expenses
- Disadvantages:
 - Setting up a budget is difficult. Even for once in a year
 - Conscious decision to do everything \sim too much effort

Design 2

Shopping planner

- Help user
 - Search
 - Find the best product
 - Find whether his requirements are satisfied or not
 - Checklist before user goes for shopping
 - "To think twice before he buy"











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Product		
Product 1		
Product 2		•
Product 3		
Product 4		
Product 5		
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- Advantages:
 - Work with/without a expense tracker
 - Checklist when user goes for shopping
 - Locate best product at its best price
- Disadvantages:
 - Focuses only on large scale shopping, not on small daily expenditures

Design 3

"Responsive Money Management"

- Help user
 - Capture his data with less effort
 - Track his expenses and derive a pattern of his spending habits
 - Make sense of it and use it for betterment
 - Predict his future expenses
 - Initiate habit of saving for future
 - Sets budget automatically, modes to prevent "I'm broke ⊗"

User concerns*

- "My expense wont be the same everyday"
- "I need freedom to spent my money"

- Predict user's future expenses
- Alert user when there is a need (user's shopping pattern)
- Automatically sets budget
- Freedom to the user: **embrace user habits**, intervene only when needed

Experiment: predicting the list

Day 1		Day 2		Day 3		Day 4		Day 5	
Restaurant	400	Lunch	38	Brewberries	20	Cake	350	Attar	260
Brewberries	20	Brewberries	38	Lunch	44	Brewberries	20	Food	140
Cigarettes	20	Ice cream	35	Dinner	31	Camera	1500	Brewberries	42
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		Restaurant	400	Lunch	38	Brewberries	20	Brewberries	20
		Brewberries	20	Brewberries	20	Lunch	44	Lunch	44
		Cigarettes	20						

• E.g. P(Brewberries) = 1

Experiment: predicting the list & budget



- Average of (budget and actual) to predict next day's
- Based on frequency of occurrences, predictions are made

Mode switching(an example)

Day	Money left	Days left	Daily spending	Average for day	Mode
1	8000	30	800	200 per day (M3)	M1
			••	(based on user's pattern)	M1
					M1
					M1
10	4000	20	300		M2
					M2
					M2
					M2
20	2000	10	200	200 per day	M3
					M3
					M3
					M3
30	0	0	0	200 per day	M3

Mode 1



- No restrictions at this mode.
- User should always try to maintain Mode 1("safe zone")

Mode 2



- "Alert"
- User should start controlling his expenses to go back to Mode1

Mode 3



- "Warning"
- User has only enough money to support the remaining days



	•	
	Today's Lis	t > +
Grocery		3 items
Oats	1 kg 🔽	Rs 200 🔽
Milk	1 ltr 🔽	Rs 200 🔽
Eggs	1 dzn 🔽	Rs 200 🔽
Food		2 items
Autowala	n	4 items
Budget :	70 (O Actual : 0





	•
	This week 🔉 🕂
• •	• • • • •
Grocery	Rs <mark>1000</mark>
Food	Rs 200
Autowala	Rs 300
L Budget : 20	5000 00 Actual : 1500





		My	calen	der		
<	Ap	oril	>		Sta	tus
Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				
Expe	nses					+
Gro	cery				3 it	ems
Oat	S				Rs	200
Milk Rs 200						









Possible errors

- The list prediction is not accurate in the beginning, user should consider it as suggestions
- Takes time to learn & identify patterns
- Fails if user inputs expenses that are higher than income

Advantages

- Spent money freely
- "Stay green"
- Can predict accurately once it learns user
- Identifies how frequent a product & reminds
- Modes can be switched backwards: acts like a buffer
- Even in mode3, user can meet his daily needs
- "like a plan B"

Disadvantages

• Takes time to learn user's spending habits

FINAL DESIGN

Final design

"Responsive Money Management"

- Support input using prediction
- Prediction list can also be used like a checklist for shopping
- Save money (targets)
- Visualization
- Enhance shopping experience ~ personalized offers
- Record user satisfaction

Prediction





Input

	•	
	Daily expenses	
		×
Add a ne Expense	w item e name	
Amount		
Add cate	gories	
Trave	Food	
	• • •	
	Submit	

Input

•
Daily expenses
Add a new item
Amount
Add categories
Travel +
Travel
• • •
Submit
0

Daily expenses
Add a new item
Expense name
Amount
Add categories
Travel, food
Travel Food
• • •
Submit





•
Daily expenses
Add a new item
Expense name
Amount Add categories
Miscellaneous
Miscellaneous
• • •
Submit

Visualization

- Why progress bar for visualization?
- Why savings is given more preference?

	•	
	Daily expenses	
<	Today	>
Budget 474 Expense 375	Savings	
Food 5 items		
Groceries 1 item		



	•	
	Daily expenses	
<	Today	>
Budget 474 Expense 375	Savings	
Food 5 items		
Groceries		
Travel		
	Add new expense	





	•	
	Daily expenses	
<	Today	>
Budget 474 Expense 375	Savings	
Food 5 items		
Groceries 1 item		
Travel		
	Add new expense	



Saving money

• How to save money?





Enhancing shopping experience

- Facebook, foursquare
- Filters offers based on how many friends used it
- Reviews based on user experience
- Difference between giving a rating when user buy a product and after using a product







Scenario 1: Scenario describing how a user uses prediction mechanism to input his daily expenses.





what all things he has to buy



Rohit takes out his new mobile application and reads out today's predicted list for category "grocery". He also enters the expenses meantime



Rohit can see how much did he spend today. Now rohit doesnt have to spend extra time in writing down his shopping list or calculating his daily budget

Scenario 2: Scenario showing how the application can enhance user's shopping experience









Scenario 3: How the application can help user save money for her future expenses.





< This Month

Finally the due date is reached, now she has enough money to celebrate and buy loads of gifts for her parents

Radhika daily makes sure that she saves enough money for the next two months

EVALUATION





6 users

124

Ħ	#18/4 File Edit View Insert	Format Data Tools	Add-ons Help	All changes saved in Drive				Comments	Jaison Jacob 👻
		% .0 _↓ .0 <u>0</u> 123 - Arial	· 10 ·	B I 5 <u>A</u> - ♦	- ⊞ - BE - <u>↓</u> -		Υ - Σ -		
f×									
	А	В	С	D	E	F	G	Н	I
1			Day 2 (18/4/14)					
2	Pre	dicted expense		Use	r's original expense		Money left	Daysleft	
3	Budg	et for Day 2: Rs. 157		Actual expense	e(total expense) for Day 2	2: Rs 791	(for this month)	(for this month)	
4	Category of expense	Name of expense	Amount spent	Category of expense	Name of expense	Amount spent			
5	Food	Теа	30	Food	Lunch	47			
6	Food		77	Groceries	Munchies, stationary, etc.	424			
7	Dinner	Canteen	50	Travel	Auto to and fro	56			
8				Food	Coffee, muffin	264			
9									
10									
11									
12									
13									
14									
15									
10									
18									
19									
20									
21									
									4 1

What went wrong?

- Average (budget & actual) for predicting next day's expense
 - Used mean of all previous actual expenses to make the prediction instead
- Maximum probability of an expense to occur
 - Habits disappeared quickly but prediction did not
 - Followed 7 day rotating cycle to predict possible daily expenses instead





Results

- Why users left the process?
 - "no reminder"
 - Work pressure, couldn't find time to fill the form
 - "I know I wont spend beyond my salary limit"
 - It wasn't rewarding, lacked motivation
 - "If it was on my phone, It would have been easier to input"

User feedbacks

- How will I know the status of my targets?
- What if I've a sudden expense and I want to know whether it fits my budget?
- "I want to know my actual expense.. This is different"

Target status



Input check



•	
My targets	
Create a target	
Target name	
600	
Target due date	
Add categories	
+	
Grocery Food	
• • •	
Set target	

My targets	
Create a target	×
Target name	
6000	
Target due date	
/ /	
Add categories	
	+
Grocery Food	
• • •	
Set target	

	•	
≡	My targets	
Create	a target	
Target	name	
60000		
Target o	due date	
/	/	
Add cat	tegories	
		+
Groo	ery Food	
	• • •	
	Set target	

Summary



What did I learn

- Budget prediction is responsive but takes time to adapt
- Habits evolve quickly
 - Strong(Typical user): stay over a long period
 - Easy to capture
 - Weak(Atypical user): appear & disappear quickly
 - Hard to capture



How it works?





Budget and List generating engine

Mode switching engine











<u> </u>
Monthly expenses
This month
Budget Savings 5832 3342 Expense 2490
Food & Beverage
Savings: 1287
Transportation
Savings: 324
Communication
Savings: 675
Personal care
Add a new target










			0				
		N					
<		June 2014				>	
Sun	Mon 2	Tue 2	Wed	Thu	Fri	Sat	
-	2	3	4	12	12	1.4	
8	9	10	111	12	13	14	
15	16	17	18	19	20	21	
22	23	24	25	26	27	28	
29	30						
Ladakh trip							
Status: need more time							



	•	
	My purchase ratings	
<	April 2014	>
Buffet (**** 18/4/201	@ Renaissance 14	
Ra	/rite your review te your satisfaction ☆☆☆☆☆☆☆	
Buffet (**** 18/4/201	@ Renaissance 14	