

Contextual Design and Innovations in Automotive HMI

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International Advanced School on Automotive Software Engineering Conference
“Software Engineering for Automotive Innovation”



General Motors Company



THE WORLD'S BEST VEHICLES

The Challenge...



Drive “innovation” into the HMI design of future infotainment and telematics systems



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Our Focus...



Gain a deeper understanding of how today's drivers entertain, communicate, navigate, and get information while traveling in their vehicles



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In addition...



Understand how people learn about the various features and functions in their vehicles



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Finally...



Learn about different driver populations and how we might tailor innovations to their unique needs and wants



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The Process...

Contextual Design (Phase 1)

Contextual Inquiry

Talk to specific users in the field

Interpretation Session

Interpret the data as a team to capture key issues

Work Models, Affinity Diagram, Personas

Consolidate data across users for a full population view

Visioning

Redesign people's work with new technology ideas

Requirements –
What matters to users and characterizing what they do

Solutions –
New ideas and directions



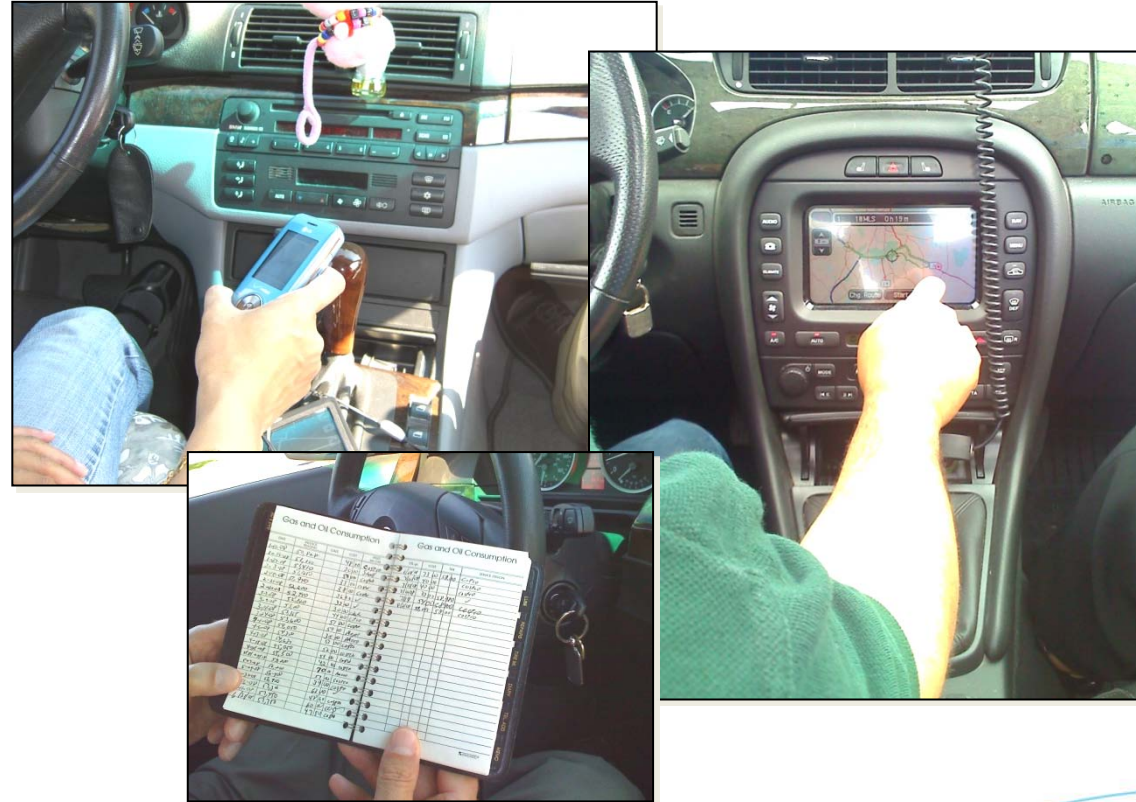
Contextual Design

Contextual Inquiry

Interpretation Session

Work Models, Affinity Diagram, Personas

Visioning



Provides reliable knowledge of what users actually do and what they really care about



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Visioning

She responds to his messages in the morning and the new mail for him at the home with him at night to sit at the terminal and r

It takes her from 2 to 3 hours secretary has helped, but she she is informed about what i

U3 13
She wants to understand what her boss is doing.

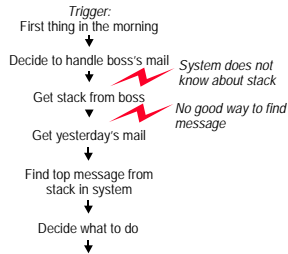
U3 14
Does she advise her boss on how to answer or manage his schedule?

U3 15
Can we design a better way for her to be informed?

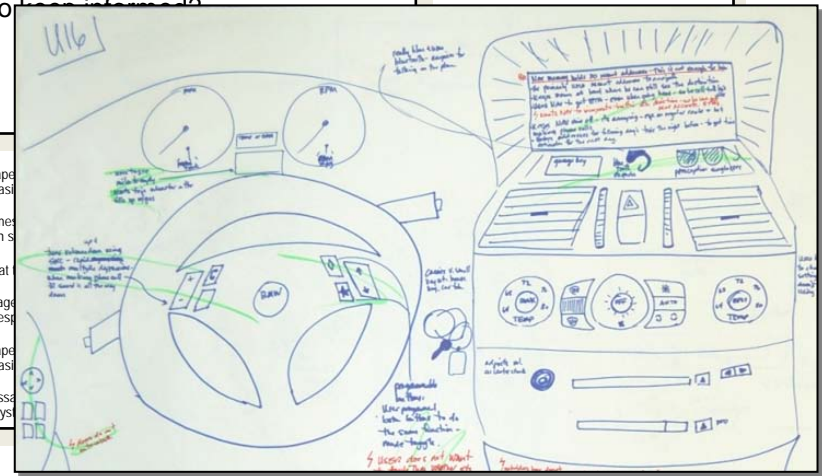
Insights
Secretary is making decisions on about when she has to the boss
refuses to use technology, is the burden on the
pattern is as old as bosses ries--they've just it to e-mail

U1 Sequence Model

Intent: Respond to mail with boss's comments



- Get clarification
- Type and s
- Check off paper and put asi
- Find next mes from stack in s
- Decide what
- Create message on cryptic resp
- Check off paper and put asi
- Find next messa stack in sys



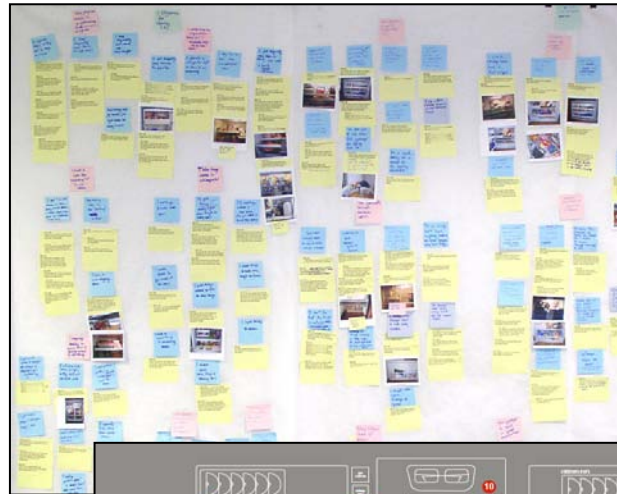
Creates a shared perspective of the data



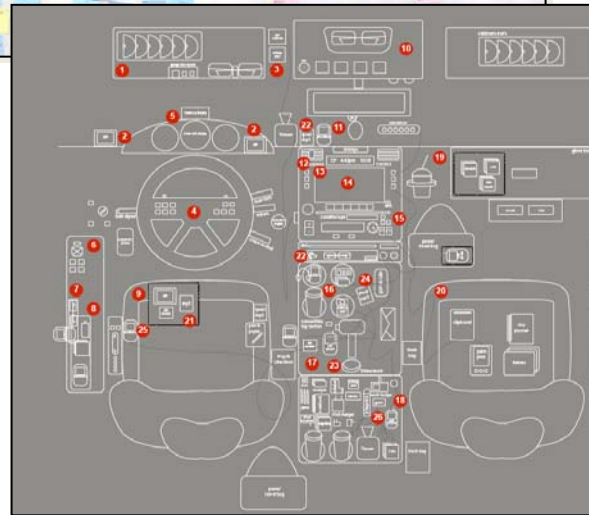
THE WORLD'S BEST VEHICLES

Contextual Design

Contextual Inquiry



Interpretation Session



Work Models, Affinity Diagram, Personas

Visioning

Spencer Green, Communications Extremist

"I'm a smartphone addict – my life literally runs off of my phone."

Spencer is a young sales professional who spends much of his time in the car during the day. He's hyper-connected to his work and social communities, emailing, calling, texting and filing while driving to sales calls. He's learned to run his life off of his new smartphone.

Spencer is an upwardly mobile young sales professional with an urban customer territory. He spends a lot of time in his 2002 Chevrolet Monte Carlo, but with his recent sales success he's planning to trade up for something a little more upscale. As a young, single person in a demanding job, Spencer is hyper-connected both at work and in his social life.

Six months ago, Spencer replaced his old Nokia with a new smartphone to help him manage his business life. Ambitious and technically savvy, Spencer quickly learned his way around the new phone, and has integrated it into his life in ways that have surprised even him. He knew it would sync with his enterprise Outlook server, so he wasn't surprised that he could access calendar and contacts in real time. But he was pleasantly surprised to discover that he could also access his Google calendar, Gmail and IM accounts. At this point, Spencer runs his life off of his new phone. "I'd be lost without it," he tells his friends. He religiously backs up his phone data on his PC to be safe.

Spencer is in the car most of the sales calls. While driving, he's email from his customers and personal email, IM and social media. He almost always has the and live – his Bluetooth device which calling without looking at Spencer has become adept at keep the most important audio balance his communications in. He almost always waits until he's ready to run about of social he jokes.

Although his new phone includes keep on it, figuring he could get reason he can't live without his locations with their contact into pointments online the day before traffic from the phone the need as possible. Time is money to graded navigation helps him in.

Spencer is shopping for a new sedan, ideally one that he can but he's not interested in paying using his smartphone for.

Goals

- Communicate and coordinate with work and social contacts via email, IM, phone and text with minimal effort.
- Get weather, traffic and news information in real time.
- Do a lot in the car – run my work and personal life.

Tasks

- Trapping email, IM, text and phone calls – prioritizing what needs to be done next.

Trigger

- A business card
- A magazine article
- An request from a sales

Overall intent make sure that we add the names and addresses and key information for the appropriate salesperson team that will drive per sales presence and reflect our customers.

Intent I need to find the right account to use

Does Account Lookup

Does Contact name lookup

Does recent history search

Enter name of account for search

Enter last name

Get result and choose account

View account detail

Review account detail

BY ACCOUNT SEARCH Help add a name for previous non-regular to manage contacts at the account

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Creates a single statement of work practice



Contextual Design

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A structured ideation process to imagine and develop new product concepts



Some details about our work...



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DESIGN



BUILD



SELL

THE WORLD'S BEST VEHICLES

Our initial CD project...

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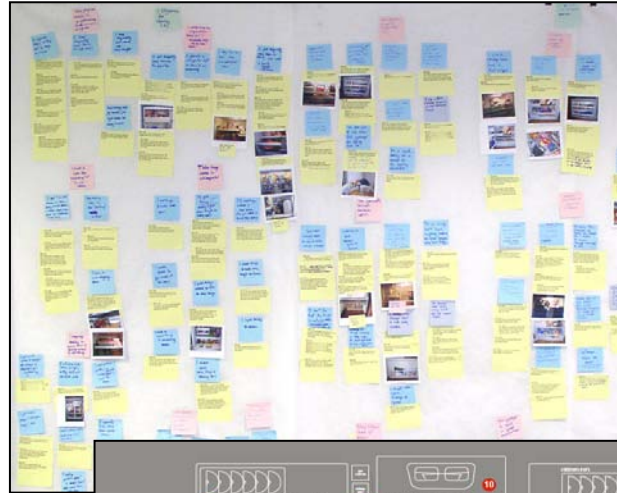


Provide reliable knowledge of what users actually do and what they really care about

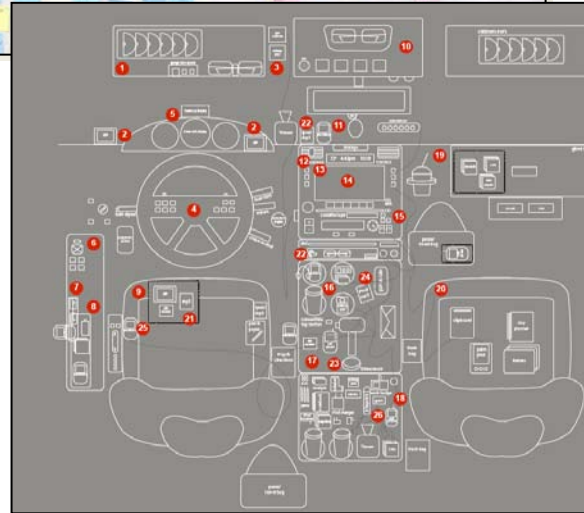


Our initial CD project...

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Create a single statement of work practice

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Enter name of account for search

Enter last name

Get result and choose account

View account detail

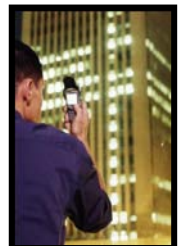
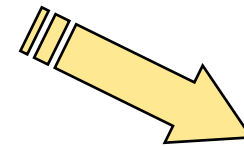
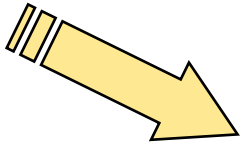
Review account detail

BY ACCOUNT SEARCH Help add a name for getting more similar to manage contacts at the account

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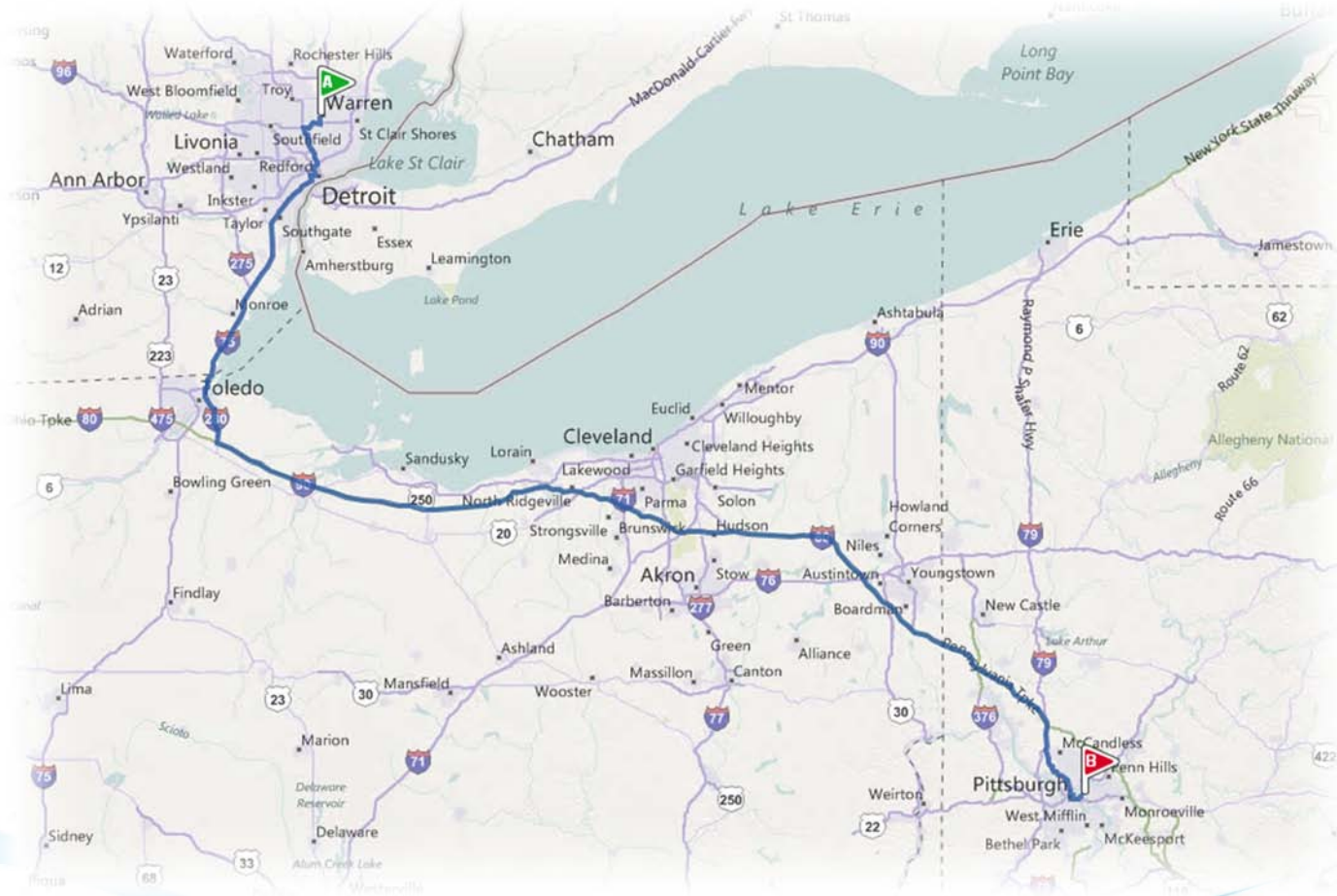


What we learned...



I take my life context into the car

An HMI “i”nnovation example...



The navigation system doesn't know what I know...



A second CD project...

Contextual Inquiry

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Provide reliable knowledge of what users actually do and what they really care about



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Robert, Visual-Tactile Learner

"Hearing it, seeing it, touching it, doing it is way better than just reading it."

Robert learns best from multiple kinds of information and experiences. He gets an overview of his car by skimming the manual or talking to someone, then does it himself, following along with and referring to manual if he gets stuck. He doesn't memorize a lot, instead remembering where to go to get more information when he needs it. He is a visual learner, and is responds strongly to visual patterns, groupings and inconsistencies.

Robert's dealer gave him a complete walk-through of his new vehicle when he picked it up. He listened to and watched the whole orientation, and although he knew he couldn't take it all in, he made mental notes on important features that he wanted to go back to later when he got home.

The next day, after delivery, Robert sits in his vehicle and skims through the manual, playing with new features that he was shown the day before. He considers himself a visual person, and he pages through the manual, stopping at pictures and diagrams that can serve as cues for what the dealer showed him. He goes through the manual, remembering key parts of the dealer walkthrough, setting the trip odometer and adding voice name tags. As he scans the HURC section, he's confused by a button that he doesn't recognize. He compares the picture to his HURC and the buttons do not match. He's confused because the manual describes two different controls and has pictures for all the vehicle variants, not just for his specific vehicle.

A couple days later, he tries the remote start feature, but nothing happens. He pulls out the quick reference guide and finds the remote start section by finding a picture of the key fob. Before reading the section, he

Goals

- Get overview of what is in new car so he can use as later mental "bookmarks" to go back to later.
- Use lots of kinds of information to learn: visual, tactile, reading, human help.
- Plan and prioritize what he wants to get proficient at.

Tasks

- Sit with manual and quick reference guide in new car and learn the important features.
- Use the pictures in the manual and quick reference guide as memory cues to recall the dealer training or previous learning.

Find Contact

Trigger:
- A business event
- A magazine article
- An account from sales

Overall intent: make sure that we add the names and accounts and key responses information for the appropriate salesperson/team that will drive our sales process and reflect our customers.

Intent: I need to find the right account to use

Does Account Lookup | Does Contact name lookup | Does recent history search

Enter name of account for search | Enter last name

Get needs and disclose account | View account detail | Review account detail

In account search field, add a name bar person responsible to manage contacts at this account

Work Model Diagram

The diagram shows a central steering wheel and dashboard area with various controls and labels. It includes a gear shift, a handbrake, and a steering wheel with multiple buttons. The labels describe the functions of these controls, such as "Power windows", "Power mirrors", "Power locks", "Power windows", "Power mirrors", "Power locks", "Power windows", "Power mirrors", "Power locks".

Create a single statement of work practice



What we also learned...

Past experience / User expectation

My old car worked like this...



Other things work like this...

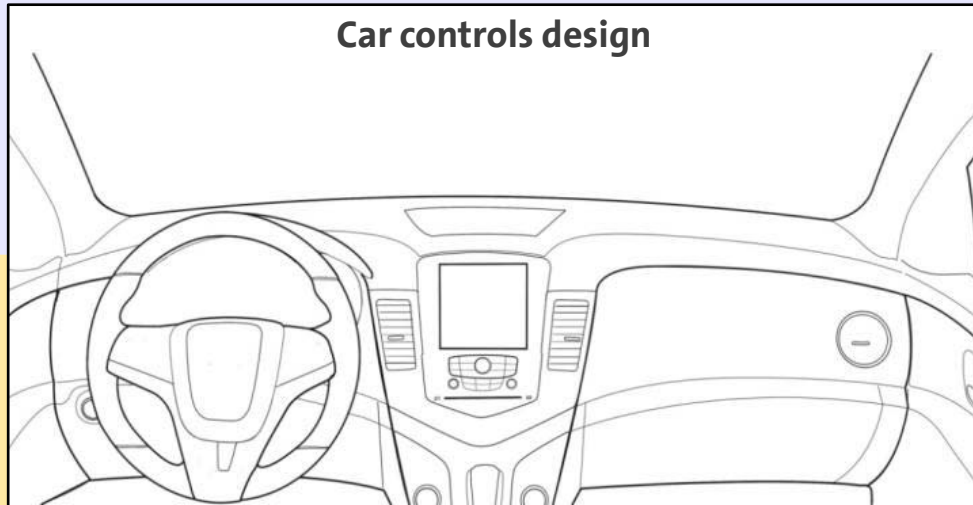


Customer



Customer

Car controls design



Show me



Play/feedback

Owner's manual



Study/search

Different learning styles

I can be overwhelmed by the new car learning task

Another “i”nnovation example...



How did you learn to operate an iPhone or iPad?



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DESIGN



BUILD



SELL

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A third CD project...

Contextual Inquiry

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Provide reliable knowledge of what users actually do and what they really care about



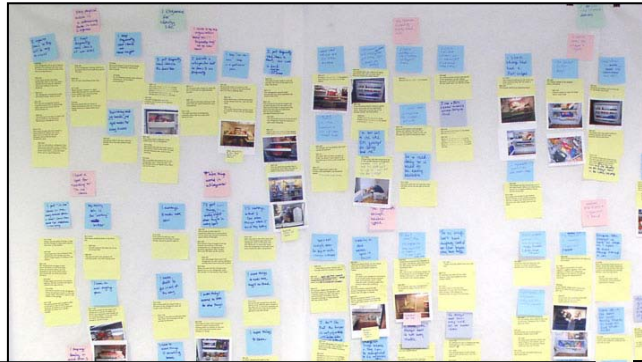
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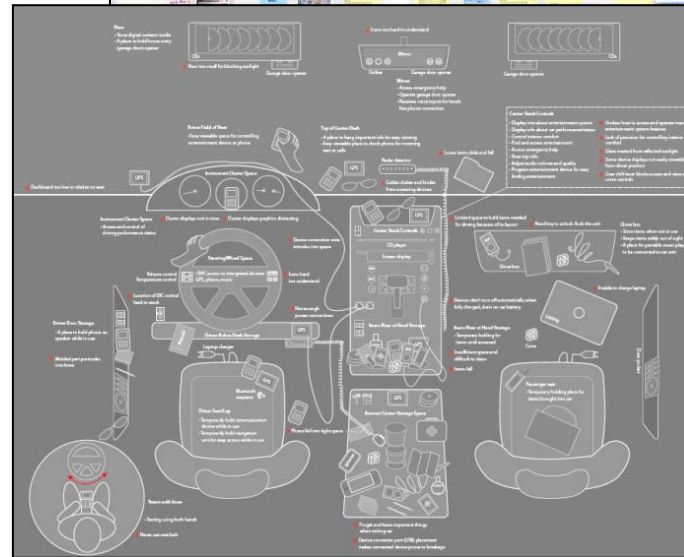
A third CD project...

Contextual Inquiry



Interpretation Session

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Visioning

Sara Pearson, Social Butterfly

"My car is where we all hang out to gossip, text and jam the tunes."

Socializing and music are key aspects of Sara's life. Her car is the main gathering place for her and her friends to hang out together and have a good time talking and sharing music. She likes to have a large collection of music on hand to help keep the tunes going.

Sara wants to hang out with her friends in the car. She likes driving her friends around town and providing a space for them to share music. Their listening motto tends to be "don't bore us, get to the chorus" as they listen only to the best parts of a song and move on to the next one. A shared listening experience where each of her friends can DJ in the car is a vital part of their music connection.

Music plays an integral role in Sara's driving experience. Having quick and easy access to lots of music enhances the experience. She prefers simple and intuitive radio controls in her vehicle so that it's easy to use like her iPod. Sara and her friends shuffle each other's iPods and CD's into the playback cycle constantly while driving around the city. They would prefer to select their music by simply saying a song name out loud and having the system start playing back their selection. They think that would be a "cool" feature.

For her, music needs to stay fresh and set the right vibe, so she con-

Goals

- Provide a fun space to hang out with friends in car
- Share music in the car with friends
- Stay connected to her social group in the car
- Be able to access music quickly while driving

Tasks

- Attend classes at school
- Drive friends around the city
- Organize music for trips or setting a mood
- Select and share music with

Find Contact

Trigger: A business card, a magazine article, an industry "buzz table."

Overall intent: make sure that we add the names and addresses and key informant information for the appropriate salesperson team that will drive our sales process and reflect our customers.

Intent: I need to find the right contact to use

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    graph TD
      A[Intent: I need to find the right contact to use] --> B[Done Account Lookup]
      A --> C[Done Contact name lookup]
      A --> D[Done recent history search]
      B --> E[Enter name of account for search]
      C --> F[Enter last name]
      D --> G[Get result and choose account]
      E --> G
      F --> G
      G --> H[View account detail]
      H --> I[Review account detail]
      I --> J[In account search field, add a name for person responsible to message contacts at this account]
  
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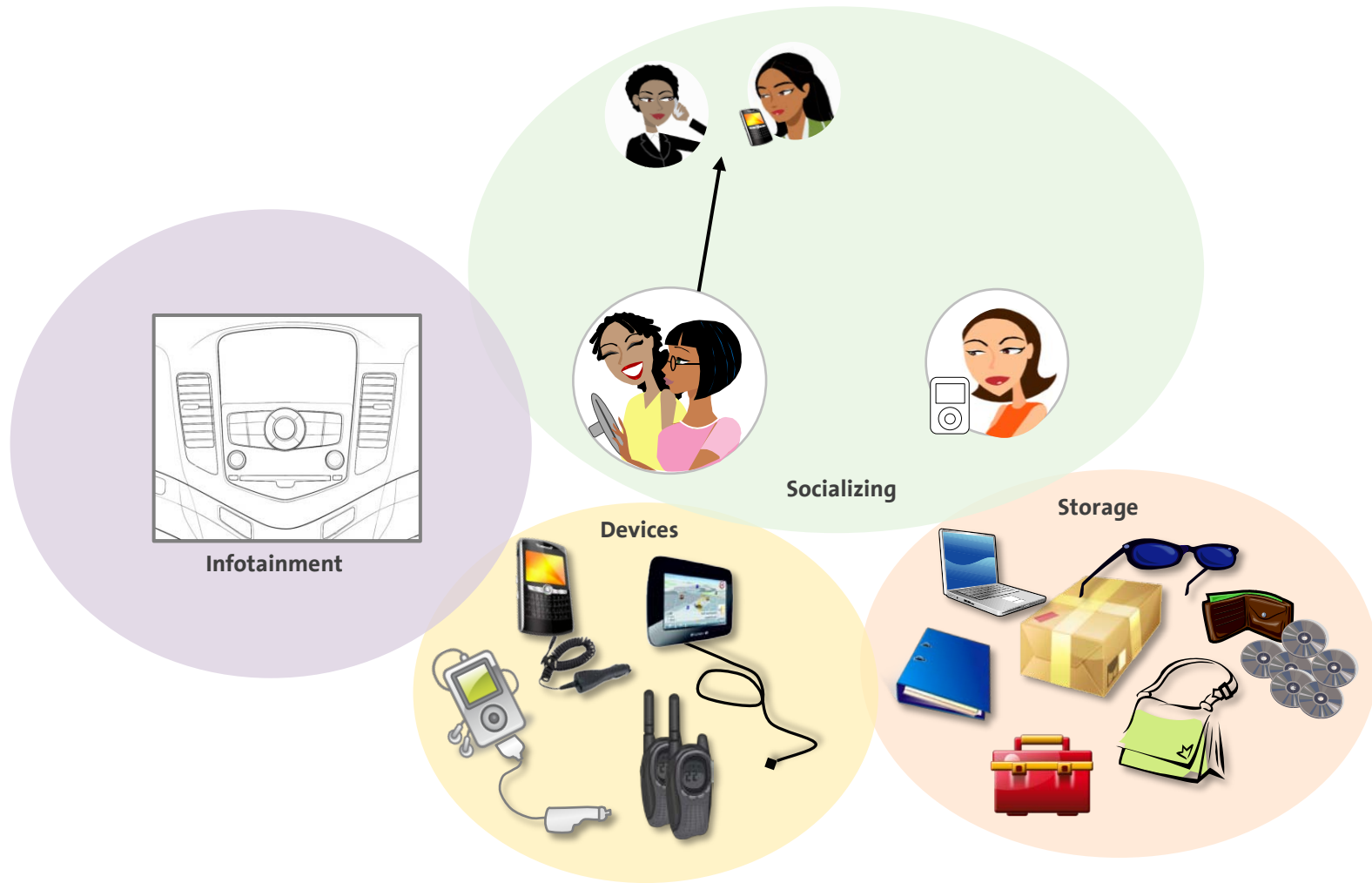
Confirm: Worked, Delivered

Create a single statement of work practice



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What more we learned...



Keep me safely connected to my world when I am in the car

A final HMI example...



Help me to stay connected... but I want my messages to be kept private



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In Conclusion...



- Adapted Contextual Design methods for driving environments
- Learned how people interact with technologies that would have been impossible in a driving simulator or naturalistic driving study
- Netted over 300 design ideas, 48 patent ideas, 12 patent submissions, and 5 defensive publications
- Revolutionized GM's design process for innovation in infotainment, telematics, and active safety systems



For your reference...

Automotive UI 2010 Paper

- Gellatly, A.W., Hansen, C., Highstrom, M., and Weiss J.P. (2010). [Journey: General Motors' Move to Incorporate Contextual Design Into Its Next Generation of Automotive HMI Designs.](#) In Proceedings of the Second International Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI 2010), November 11-12, 2010, Pittsburgh, Pennsylvania. Association for Computing Machinery.

Contextual Design References

- Beyer, H. and Holtzblatt, K. (1997). Contextual Design: Defining Customer-Centered Systems. Morgan Kaufmann, San Francisco, CA.
- Holtzblatt, K., Wendell, J.B., and Wood, S. (2004). Rapid Contextual Design: A How-to Guide to Key Techniques for User-Centered Design. Morgan Kaufmann, San Francisco, CA.

Contact Information

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