

Critiquing-based Recommender Systems and User Experiences

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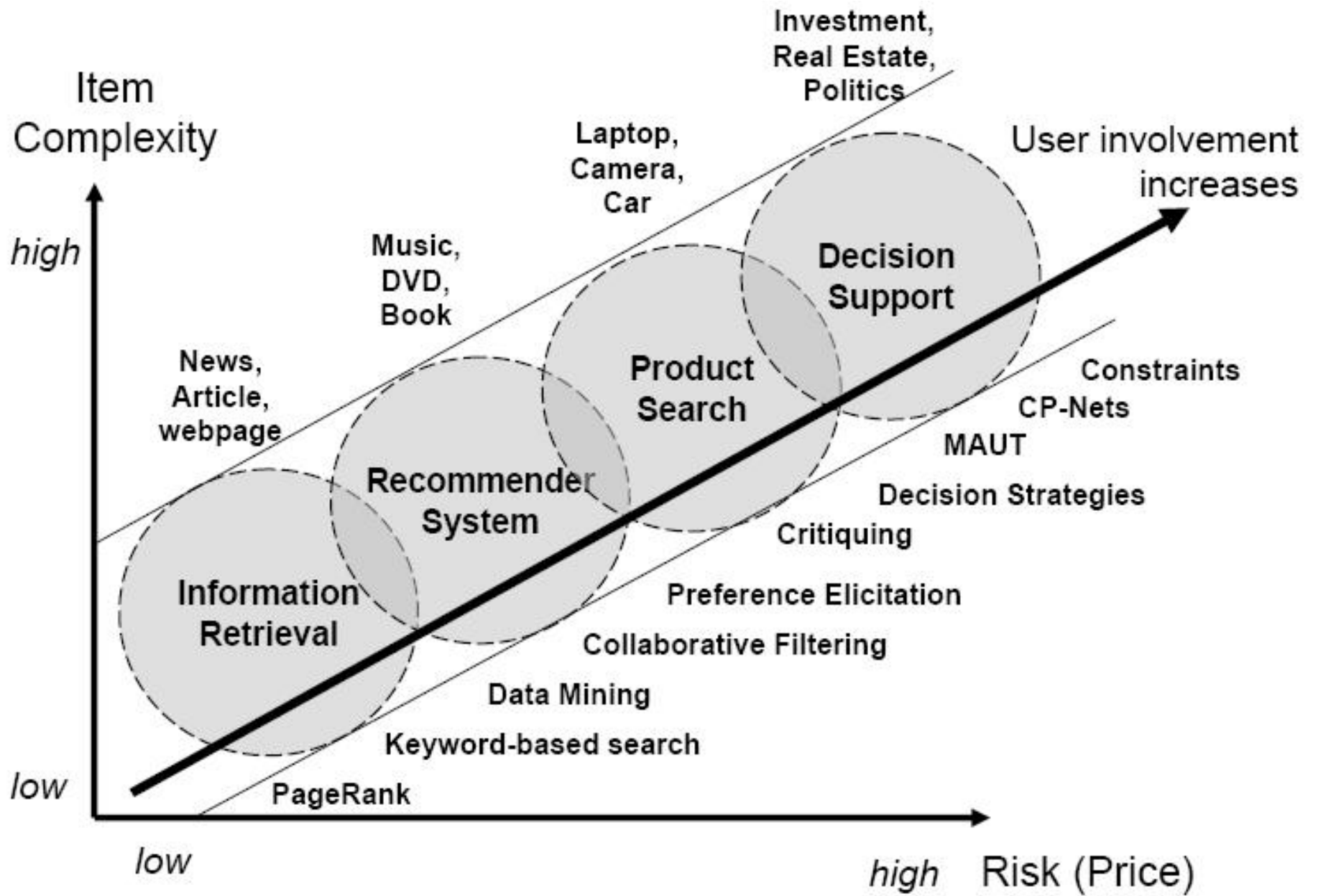
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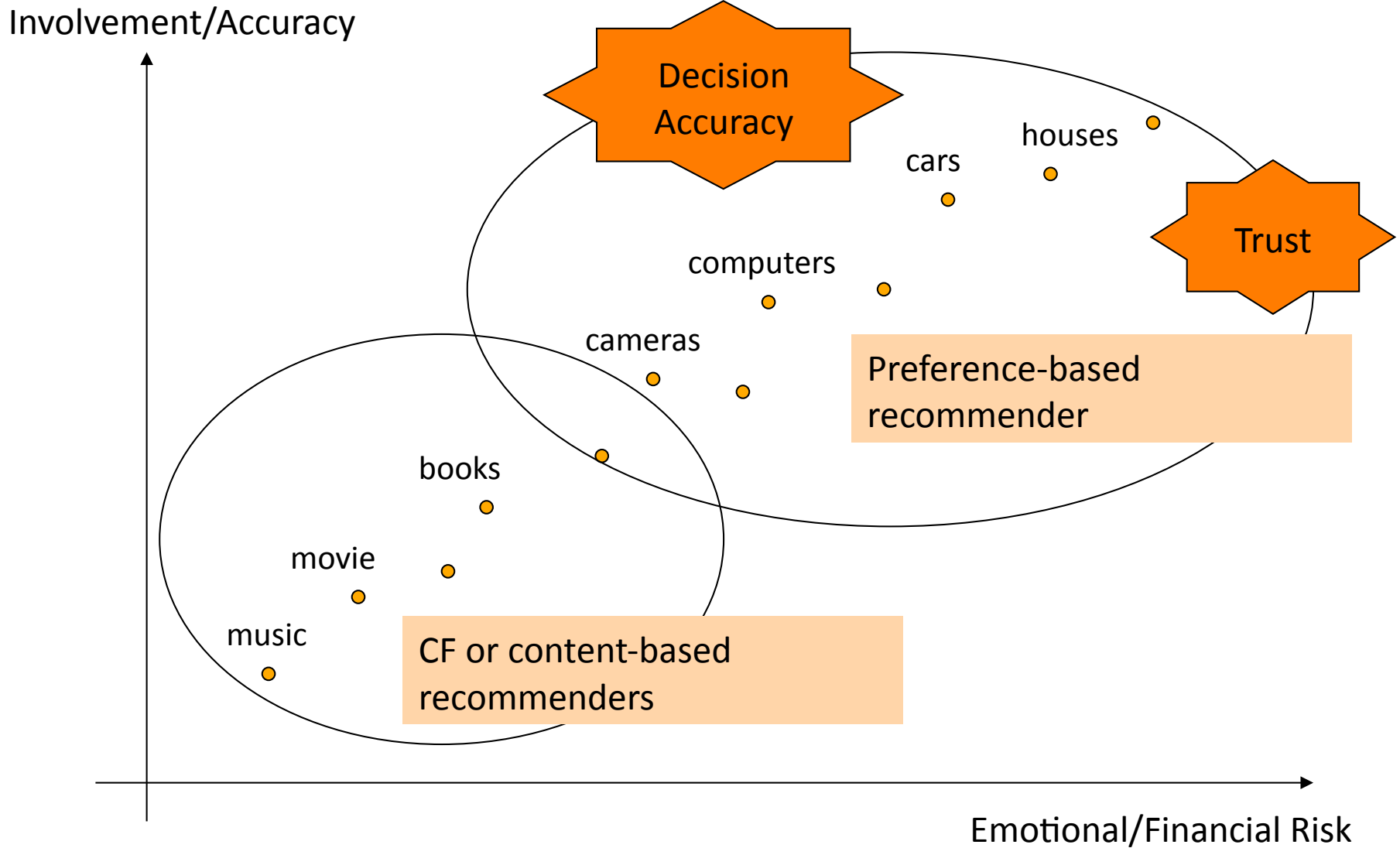
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Outline

- What is critiquing-based recommender system and Why?
- Development history
- User experiences
- Conclusion



For high-risk products



Challenge 1 – Adaptive decision maker

Unfamiliar product domain



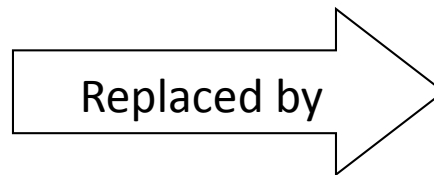
Complex decision environment with overwhelming information

How do people make decisions in unfamiliar and complex environment?

- Adaptive and constructive nature of user preferences (Payne *et al.*, 1993)
- Tend to use non-compensatory decision strategies (e.g., elimination-by-aspects)
- Tradeoff avoidance due to emotional and cognitive reasons (Hogarth, 1987; Payne *et al.*, 1999)
- Decision meta-goals: maximize the accuracy and minimize the effort (Bettman *et al.*, 1998)

<http://www.youtube.com/watch?v=CKM9u65kZHg>

Challenge 2 – Trust building in online environment

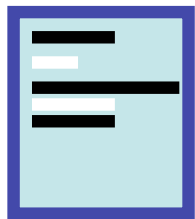


Trust is difficult to build and easy to lose

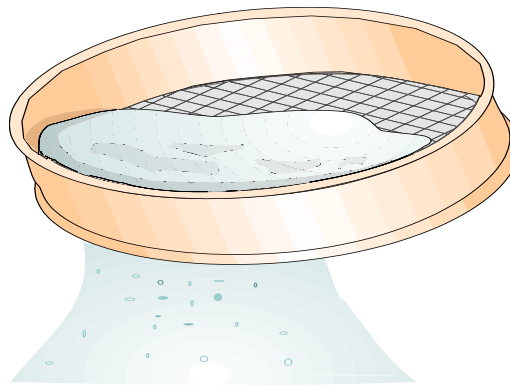
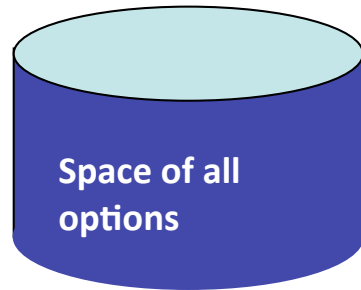
- Lack of face-to-face interaction in the online environment
- Impede customers from performing particular actions (like continue to transact, purchase, return, etc.) (Jarvenpaa *et al.*, 2000)
- Key factor to the success of e-commerce (Gefen, 2000)

Critiquing-based interaction: A **user-feedback** mechanism

Step 1: User states initial preferences



Preference Model



K items are displayed in the recommended set

Step 3:
User revises preferences
via critiquing

Help users

- Construct preferences
- Perform compensatory decision strategy
- Increase decision accuracy and save efforts
- Inspire trust

Step 2:
System recommends multiple examples

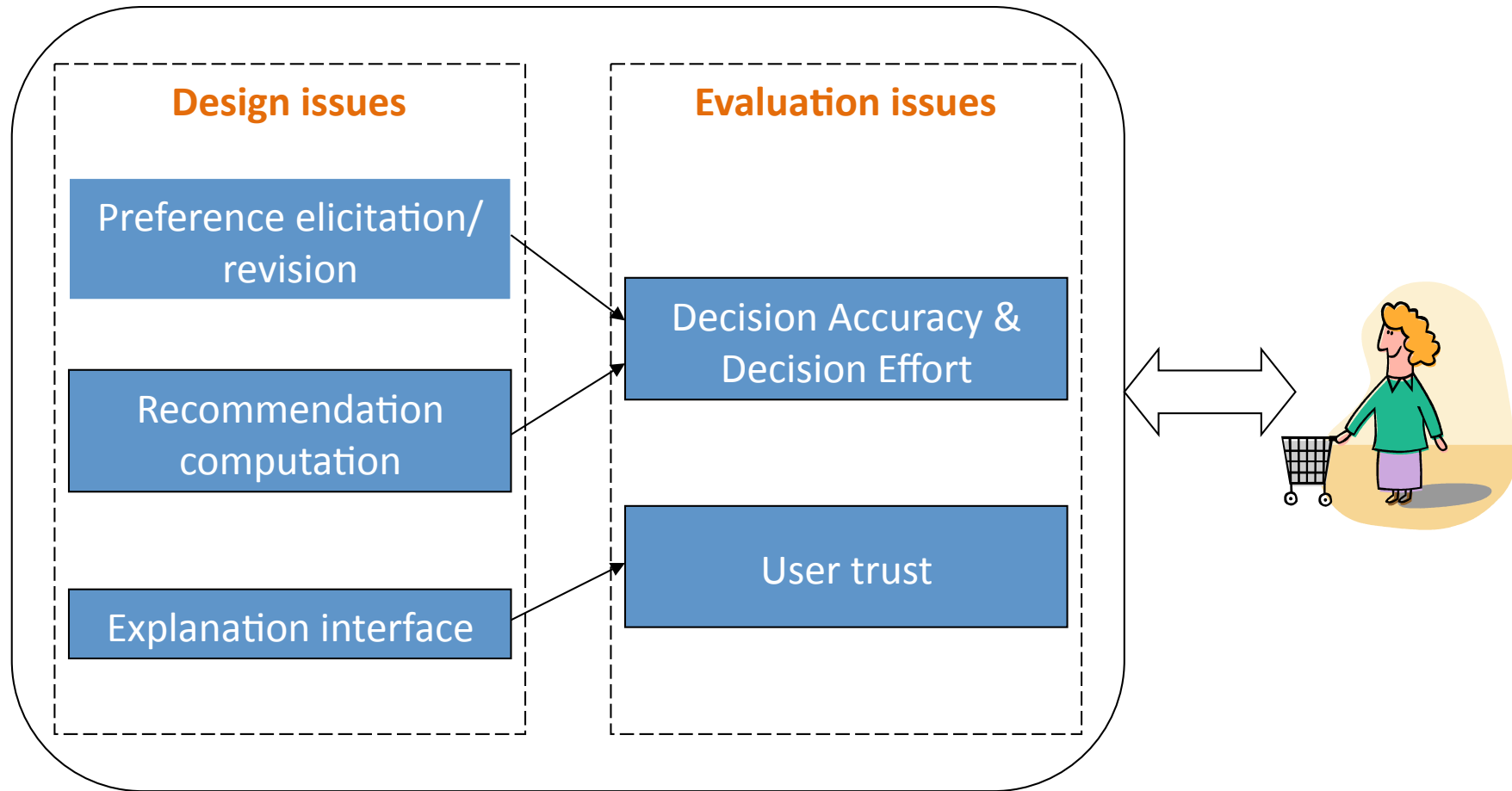
Step 4:
User picks the final choice



Why critiquing support?

- Particularly assist users in handling with two preference conditions
 - Preference incompleteness
 - Users are usually unable to accurately state their preferences up front (“*Adaptive decision maker*”, Payne et al. 1993)
 - **Solution**: to elicit users’ preferences on attributes via stimulating them to provide feedback (in form of critiques)
 - Preference conflict
 - No product satisfies all of the user’s stated preferences, e.g., “cheaper, faster and longer battery life”
 - **Solution**: to support users to make tradeoffs, i.e., obtaining the gains on important attributes while accepting the losses on less important ones
 - Making tradeoffs is a crucial aspect of high-quality, rational decision making (Frisch and Clemen, 1994) - **compensatory decision strategy**
 - Tradeoff making can **increase** users’ decision accuracy up to **57%** (Pu and Chen, EC’05)

Research Issues



Outline

- What is critiquing-based recommender system and Why?
- Development history (1997-2013)
- User experiences
- Conclusion

Representative Works

- Natural language dialog
- Graphical user interfaces
 - System-suggested critiques
 - User-initiated critiquing
 - Hybrid critiquing

1st type: Natural Language Dialog

- **ExpertClerk** (Shimazu, IJCAI'01)
- **Adaptive Place Advisor** (Thompson *et al.*, 2004)
- **Speech-based Critiquing** (Grasch et al., ACM RecSys'13)

ExpertClerk (Shimazu, IJCAI'01)

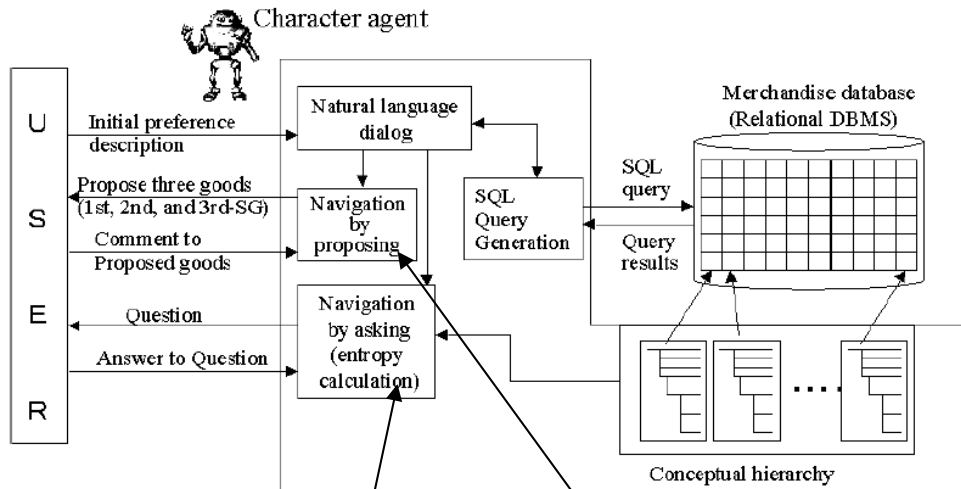


Figure 3: The ExpertClerk System

Switch between navigation by proposing and navigation by asking



Figure 4: The ExpertClerk screen image

Cont.

- Method

- First ask a few questions to identify shopper's initial preference (buying points)
- **Navigate by proposing**
 - Show three contrasting samples with explanations of their selling point
 - e.g., "this is twice as expensive as those because it is made of silk and the other two made of polyester"
- Observe shopper's reactions on likes/dislikes and why
 - e.g., "this one is too dark for me compared with the other two"
- **Navigate by asking**
 - If too many matching goods, narrow down them by asking appropriate questions using entropy
- Pick new samples fit shopper's responses
- Repeat until shopper finds an appropriate good

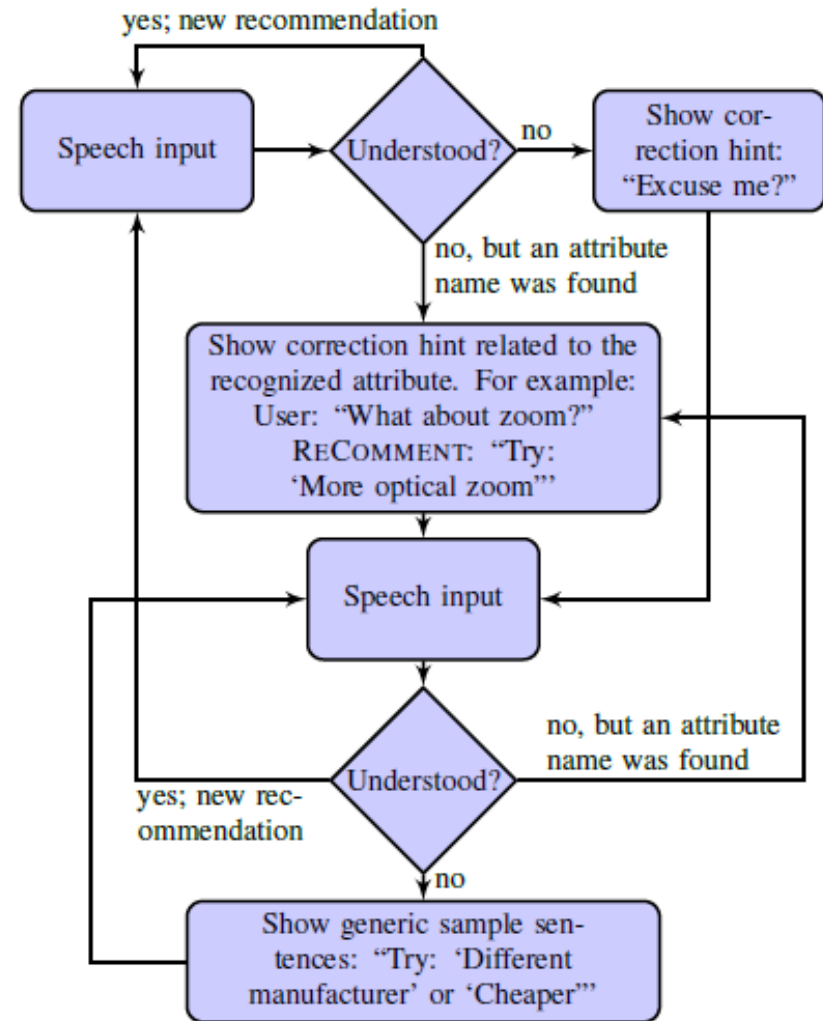
Adaptive Place Advisor (Thompson *et al.*, 2004)

1. Inquirer: Where do you think I should eat tonight?
2. Advisor: What type of food would you like?
3. Inquirer: What types are there?
4. Advisor: You can say things like Chinese, Indian, and Mediterranean.
5. Inquirer: Oh, maybe a cheap Indian place.
6. Advisor: What kind of parking would you like?
7. Inquirer: I don't care, as long as it's in Palo Alto.
8. Advisor: I'm sorry, I don't know of any restaurants like that, would you like to search for any price?
9. Inquirer: No, I think I'd like Chinese instead.
10. Advisor: I know three inexpensive Chinese restaurants in Palo Alto. One is Mandarin Gourmet on 420 Ramona. How does that sound?⁷
11. Inquirer: No, what else do you have?
12. Advisor: How about Jing-Jing Szechwan Hunan Gourmet on 443 Emerson Street?
13. Inquirer: Sure, that sounds fine.

Method

- A probabilistic representation of the user's preferences, i.e., the query, is expanded
- The system incrementally refines this query, based on the user's critiques to the attributes and items offered during a conversation

Speech-based Critiquing (Grasch et al., RecSys'13)



2nd type: System-Suggested Critiques

- **FindMe** (Burke *et al.*, 1997)
- **Dynamic Critiquing** (McCarthy *et al.*, IUI'05)
- **MAUT-based Compound Critiques** (Zhang *et al.*, AH'06)
- **Preference-based Organization** (Chen and Pu, UM'07)

FindMe (Burke *et al.*, 1997)

UKRAINIAN VILLAGE. TWO bedroom rehab garden apartment. Lr, Eurokitchen, hwfl, excellent security, forced air, lots of closets, laundry in building. Garage space included. Dogs OK. Available immediately. \$600/ mo. 312-489-1554./

Phone: 312-489-1554	2-bedrooms	\$600	60622 (West Town Bucktown)
---------------------	------------	-------	----------------------------

This apartment is OK, but make it...

bigger cheaper nicer safer

This neighborhood could be more...

convenient conservative dynamic

Figure 1: Tweaking an apartment in RENTME

These apartments have a cheaper rent.

UKRAINIAN VILLAGE SPECIAL. 2 bedroom. Hard wood floors, pocket doors, tin ceiling, pantry. Storage and parking included. Very sunny. \$520. Available immediately. 278-6064./

Phone: 278-6064	2-bedrooms	\$520	60622 (West Town Bucktown)
-----------------	------------	-------	----------------------------

These apartments are cheaper, but are in other neighborhoods.

VERY COZY ROGERS Park two bedroom (Jarvis/ Damen). Hard wood floors, miniblinds, completely remodeled kitchen, huge closets, updated bath, freshly painted, cable ready, small deck, 24 hour maintenance, laundry, storage. \$510 includes heat. Marion 312-338-0199 or Jill 708-679-5512./

Phone: 312-338-0199	2-bedrooms	\$510	60626 (Jarvis/Damen)
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Figure 2: The result of applying the "cheaper" tweak

Method

- The entry point is the user's initial query, e.g., [600<price<650,neighborhood = 'Bucktown', size=2]
- Each tweak is treated as a constraint with the highest priority
- A SQL query is passed to database
- If no enough entities return, drop lower priority constraint

Dynamic Critiquing (McCarthy *et al.*, IUI'05)

The screenshot shows the Quikshop.com website interface. At the top, there is a navigation bar with 'HOME', 'ABOUT THIS PROJECT', and 'CONTACT'. Below that, a search bar indicates 'Shop for: Digital Cameras, Holidays, PCs'. The main content area features a product image of a Canon EOS-300D camera on the left. To the right of the image is a 'Unit Critiques' section with the heading 'Adjust your preferences in product for you!'. This section contains a list of attributes with input fields and arrows for adjustment: Manufacturer (Canon), Model (EOS-300D), Price (\$), Format (SLR), Resolution (M Pixels), Optical Zoom (X), Digital Zoom (X), Weight (grams), Storage Type (Compact Flash), and Storage Included (MB). Below the 'Unit Critiques' section is a 'Compound Critiques' section with the heading 'We have more matching products with the following..'. It lists three critiques: 1. Less Optical Zoom & More Digital Zoom & A Different Storage Type (139), 2. A Lower Resolution & A Different Format & Cheaper (169), and 3. A Different Manufacturer & Less Optical Zoom & More Storage (167). Each critique has 'PICK' and 'EXPLAIN' buttons. A yellow arrow points from the 'Item Found: CASE2' section to the 'Compound Critiques' section. A grey box labeled 'Unit Critiques' is positioned above the attribute list, with arrows pointing to the 'Price (\$)', 'Format', and 'Storage Type' fields. A grey box labeled 'Compound Critiques' is positioned to the left of the critique list, with a dotted line pointing to the first critique.

Unit Critiques

Adjust your preferences in product for you!

Manufacturer	<input type="text" value="Canon"/>
Model	<input type="text" value="EOS-300D"/>
Price (\$)	<input type="text" value="871.0"/>
Format	<input type="text" value="SLR"/>
Resolution (M Pixels)	<input type="text" value="6.29"/>
Optical Zoom (X)	<input type="text" value="10.0"/>
Digital Zoom (X)	<input type="text" value="0.0"/>
Weight (grams)	<input type="text" value="645.0"/>
Storage Type	<input type="text" value="Compact Flash"/>
Storage Included (MB)	<input type="text" value="0.0"/>

Compound Critiques

We have more matching products with the following..

1. Less Optical Zoom & More Digital Zoom & A Different Storage Type (139)
2. A Lower Resolution & A Different Format & Cheaper (169)
3. A Different Manufacturer & Less Optical Zoom & More Storage (167)

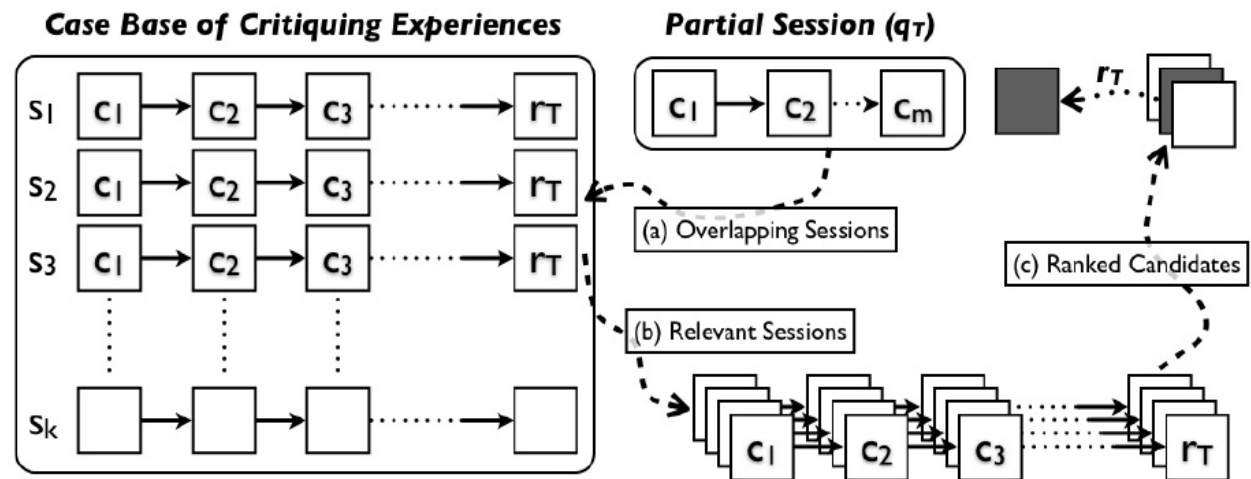
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Method

- Dynamically generate a set of compound critiques (each over multiple attributes) through frequent pattern mining
- The recommended item should satisfy the user picked critique as well as being most similar to the previous recommendation

Cont.: two extensions

- Incremental Critiquing (Reilly *et al.*, 2005)
 - The recommended item must be additionally compatible with the user's previously selected critiques
- Experience-based Critiquing (McCarthy *et al.*, ICCBR'10)



MAUT-based Compound Critiques (Zhang *et al.*, AH'06)

EasyShop Home Computers Apartment Electronics shopping cart | account | logout

Current reference product for you:

Sony VAIO R505TL Notebook
Configuration: 650MHz Intel Celeron, 384MB Memory, 15GB Harddisk, 12" TFT
Price: 959USD
[Add to cart](#)
[View all information about this product](#)

Your Preferences also provide products with the following Features:

Computer Type
[X] Laptop [v] [X]

Manufacturer
[X] Sony [v] [X]

Processor Type
[X] Intel Celeron [v] [X]

Processor Speed(MHz)
[v] 650 [u]

Monitor Size
[v] 12 inches [u]

Memory
[v] 384 MB [u]

Hard Disk
[v] 15 GB [u]

Price (\$)
[v] 959.0 [u]

1. **Same Brand with Lower Price**
(but slower CPU Speed, smaller screen, smaller memory, and smaller harddisk)
[see the detail product](#) [Select]

2. **Faster CPU, Bigger Screen Size, and Bigger Harddisk**
(but different brand, smaller memory, and more expensive)
[see the detail product](#) [Select]

3. **Better CPU, Bigger Screen Size and Lower Price**
(but different brand, smaller memory, and smaller harddisk)
[see the detail product](#) [Select]

4. **Bigger Screen Size and Lower Price**
(but different brand, different CPU Type, smaller harddisk)
[see the detail product](#) [Select]

5. **Better CPU and Bigger Screen Size**
(but different brand, smaller memory, and more expensive)
[see the detail product](#) [Select]

[See more products...](#)

[About Us](#) | [Help](#) | [Feedback](#)

Method

- Model the user's preferences based on the Multi-Attribute Utility Theory (MAUT)

$$U(\langle x_1, \dots, x_n \rangle) = \sum_{i=1}^n w_i V_i(x_i)$$

- Rank products according to their utilities and the top-k ones are presented as compound critiques (except the ranked first one)

Extension: visual critiquing (Zhang *et al.*, EC'08)

The screenshot displays a 'More Recommendations' section with a table of products. Each product row includes a brand logo, processor type, speed, screen size, memory, hard drive capacity, weight, battery life, and price. Visual critiques are shown as red boxes with arrows indicating negative changes and green boxes with arrows indicating positive changes. A legend in the top right explains the icons: a green arrow for 'positive', a red arrow for 'negative', an upward arrow for 'increase', a horizontal line for 'no change', and a downward arrow for 'decrease'. A 'Product Details (Drag to move)' window is open over the second product, showing a laptop image, the brand 'lenovo', and the model 'Lenovo ThinkPad X61'. Below the image, the 'Main Features' are listed: ProcessorType: Core 2 Duo, ProcessorSpeed(GHz): 2.0, ScreenSize(inches): 12.1, Memory(MB): 2048.0, HardDriveCapacity(GB): 160.0, Weight(lbs): 1.75, BatteryLife(hours): 7.8, and Price(\$): 1799.99. A 'Close this window' button is at the bottom of the details window.

	Brand	Processor Type	Processor Speed	Screen Size	Memory	Hard Drive Capacity	Weight	Battery Life	Price	
1.	Apple Authorized Service Provider	intel Core 2 Duo	GHZ (negative)	(negative)	(negative)	(positive)	(positive)	(no change)	\$\$\$ (positive)	view detail <input type="button" value="I like this"/>
2.	lenovo	intel Core 2 Duo	GHZ (negative)	(negative)	(no change)	(positive)	(positive)	(positive)	\$\$\$ (positive)	view detail <input type="button" value="I like this"/>
3.	lenovo	intel Core 2 Duo	GHZ (no change)	(no change)	(no change)	(positive)	(no change)	(no change)	(no change)	view detail <input type="button" value="I like this"/>
4.	SONY	intel Core 2 Duo	GHZ (no change)	(negative)	(no change)	(positive)	(no change)	(no change)	(no change)	view detail <input type="button" value="I like this"/>
5.	SONY	intel Core 2 Duo	GHZ (no change)	(no change)	(no change)	(positive)	(no change)	(no change)	(no change)	view detail <input type="button" value="I like this"/>

Product Details (Drag to move)

 **lenovo**
Lenovo ThinkPad X61

Main Features:

- ProcessorType: Core 2 Duo
- ProcessorSpeed(GHz): 2.0
- ScreenSize(inches): 12.1
- Memory(MB): 2048.0
- HardDriveCapacity(GB): 160.0
- Weight(lbs): 1.75
- BatteryLife(hours): 7.8
- Price(\$): 1799.99

Text-only critiques are replaced with meaningful icons

Preference-based Organization (Chen and Pu, UM'07)

The top candidate according to your preferences									
Manufacturer	Price	MegaPixels	Optical zoom	Memory type	Flash memory	LCD screen size	Depth	Weight	
Canon	\$242.00	5.0 MP	3x	CompactFlash Card	32 MB	1.8 in	1.37 in	8.3 oz	choose
We have more products with the following they are cheaper and lighter, but have fewer megapixels									
Nikon	\$167.95	4 MP	3x	SD Memory Card	14 MB	1.8 in	1.4 in	4.6 oz	choose
Canon	\$230.00	4.1 MP	3x	CompactFlash Card	32 MB	1.5 in	1.09 in	6.53 oz	choose
Canon	\$180.00	2.2 MP	2x	SD Memory Card	16 MB	2 in	0.83 in	4.06 oz	choose
Canon	\$219.18	4.2 MP	4x	MultiMedia Card	16 MB	1.8 in	1.51 in	6.35 oz	choose
Canon	\$163.50	3.2 MP	4x	MultiMedia Card	16 MB	1.8 in	1.5 in	6.3 oz	choose
Canon	\$199.40	3.2 MP	2.2x	SD Memory Card	16 MB	1.5 in	1.4 in	5.8 oz	choose
they have more megapixels and bigger screens, but are more expensive									
Sony	\$365.00	7.2 MP	3x	Internal Memory	32 MB	2.5 in	1.5 in	6.9 oz	choose
Canon	\$439.99	7.1 MP	3x	SD Memory Card	32 MB	2 in	1.04 in	6 oz	choose
Fuji	\$253.00	6.3 MP	4x	XD-Picture Card	16 MB	2 in	1.4 in	7.1 oz	choose
Sony	\$336.00	7.2 MP	3x	Internal Memory	32 MB	2 in	1 in	5 oz	choose
Nikon	\$304.18	7.1 MP	3x	Internal Memory	13.5 MB	2 in	1.4 in	5.3 oz	choose
Olympus	\$334.00	7.4 MP	5x	XD-Picture Card	32 MB	2.0 in	1.7 in	7.1 oz	choose
they are lighter and thinner, but have less flash memory									
Pentax	\$238.99	5.3 MP	3x	Internal Memory	10 MB	1.8 in	0.8 in	3.7 oz	choose
Canon	\$273.18	4.0 MP	3x	SD Memory Card	16 MB	2 in	0.82 in	4.59 oz	choose
Nikon	\$329.95	5.1 MP	3x	Internal Memory	12 MB	2.5 in	0.8 in	4.2 oz	choose
Canon	\$316.18	5.3 MP	3x	SD Memory Card	16 MB	2 in	0.81 in	4.59 oz	choose
Casio	\$386.00	7.2 MP	3x	Internal Memory	8.3 MB	2.5 in	0.88 in	4.48 oz	choose
Fuji	\$309.18	6.3 MP	3x	XD-Picture Card	16 MB	2.5 in	1.1 in	5.5 oz	choose
they have more optical zoom with different memory type, but are thicker and heavier									
Panasonic	\$386.00	5.0 MP	12x	SD Memory Card	16 MB	1.8 in	3.34 in	11.52 oz	choose
Konica Minolta	\$349.99	5.0 MP	12x	SD Memory Card	16 MB	2 in	3.3 in	12 oz	choose
Fuji	\$259.18	4.23 MP	10x	XD-Picture Card	16 MB	1.5 in	3.1 in	11.9 oz	choose
Olympus	\$253.00	4.0 MP	10x	XD-Picture Card	16 MB	1.8 in	2.7 in	9.9 oz	choose
Olympus	\$284.99	4.0 MP	10x	XD-Picture Card	16 MB	1.8 in	2.7 in	10.6 oz	choose
Nikon	\$259.18	4.2 MP	8.3x	Internal Memory	13.5 MB	1.8 in	2.2 in	9 oz	choose

Critique suggestion

Satisfying items

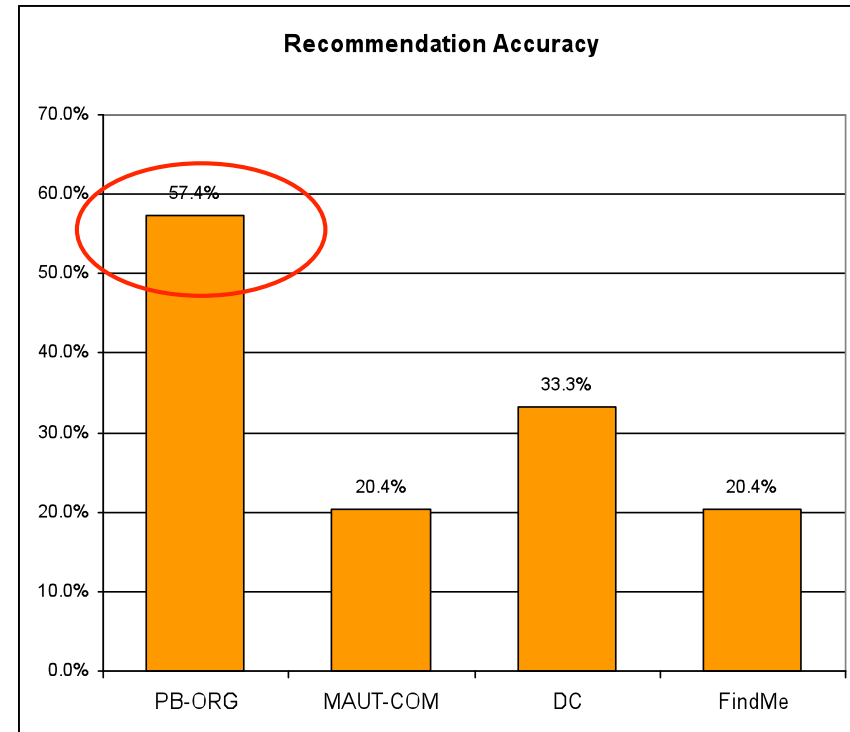
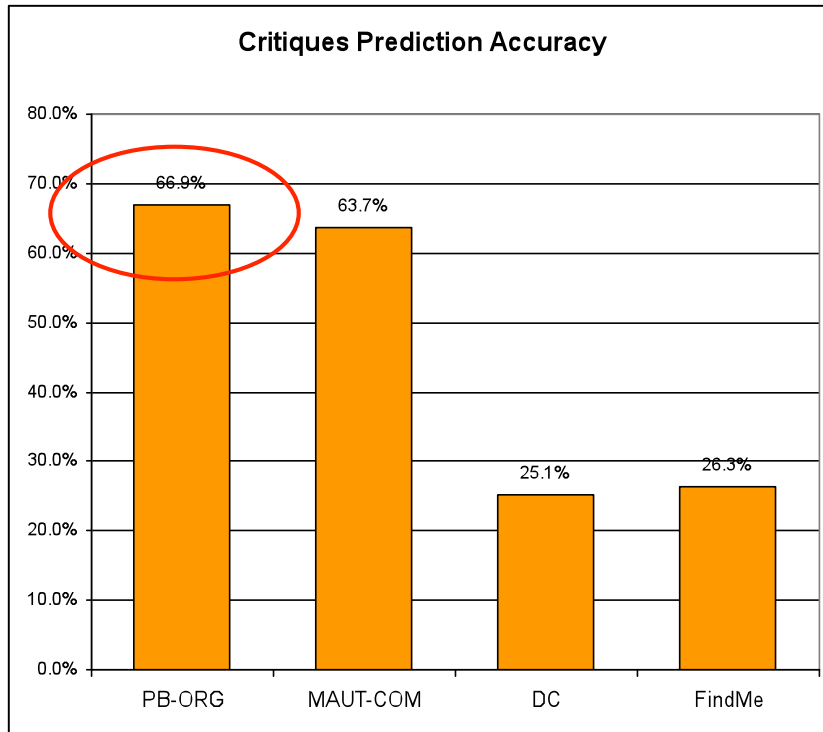
Interface design guidelines

1. Propose improvements and compromises (i.e., attributes tradeoff) in the critique
2. keep the number of attributes in the critique under five to avoid information overload
3. Include actual products (up to six) under each critique
4. Diversify the proposed critiques and their contained products

Comparison with others

	Dynamic critiques	Critiques typical of the remaining products	Critiques adaptive to user preferences	Diversity within critiques and their contained products
Preference-based organization	✓	✓	✓	✓
MAUT-based compound critiques	✓	×	✓	×
Dynamic critiquing	✓	✓	×	Partially (only critiques)
FindMe	×	×	×	Partially (only critiques)

Experiment

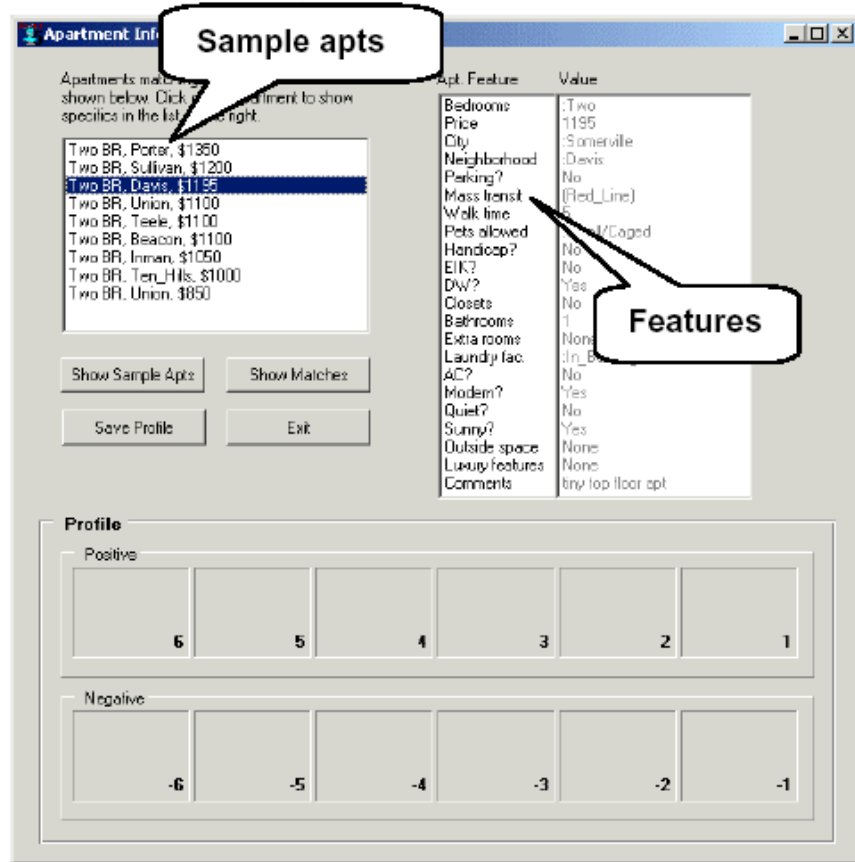


➔ The preference-based organization algorithm achieves **the highest accuracy** (significantly) in terms of both critique predication and recommendation computation

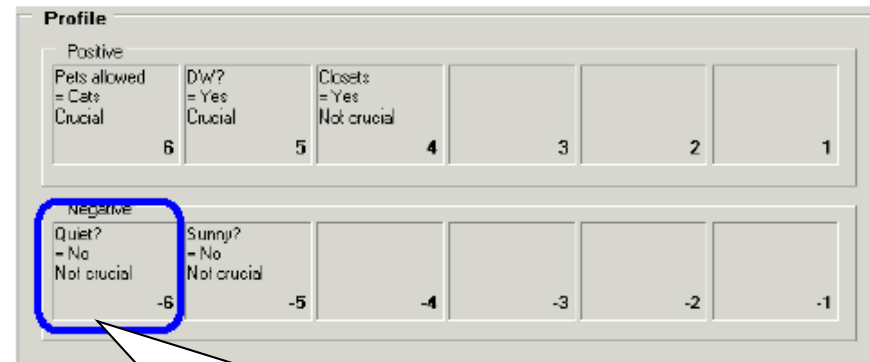
3rd type: User-Initiated Critiquing

- **Apt Decision** (Shearin and Lieberman, IUI'01)
- **Example Critiquing** (Pu and Chen, EC'05; Chen and Pu, AAAI'06)
- **Flat Finder** (Viappiani *et al.*, 2007)

Apt Decision (Shearin and Lieberman, IUI'01)



Drag features onto slots in the profile, which contains twelve weight slots: six positive weights (1 to 6) and six negative weights (-1 to -6)



For example, the leftmost negative slot indicates that the user feels very strongly about the fact that this selected apartment is not quiet

User profile: weighted feature vector, e.g., {(pets allowed, cats, 6(must have)), (closets, yes, 4(neutral)),...,}

Cont.

Sample Apartments

Decide which apartment you prefer, then press the button underneath the apartment.

Apt. Feature	Apartment A	Apartment B
Bedrooms	:Two	:Two
Price	1100	1050
City	:Somerville	:Somerville
Neighborhood	:Beacon	:Inman
Parking?	Yes	No
Mass transit	(Red_Line)	(Bus)
Walk time	10	
Pets allowed	:Cats	:Any
Handicap?	No	Yes
EIK?	Yes	No
DW?	Yes	Yes
Closets	Yes	No
Bathrooms	1	1
Extra rooms	None	None
Laundry fac.	:In_Unit	:In_Building
AC?	Yes	No
Modern?	Yes	Yes
Quiet?	No	No
Sunny?	Yes	Yes
Outside space	None	(Yard)
Luxury features	None	None
Comments		

Prefer A Prefer B

User chooses an apartment, and the features unique to the chosen apartment but not present in the profile will be added to the right side of the profile

Profile

Positive										Parking = Yes: Crucial	
Pets allowed = Cats: Crucial	6	DW? = Yes: Crucial	5	Closets = Yes: Not crucial	4		3		2		1

Negative											
Quiet? = No: Not crucial	-6	Sunny? = No: Not crucial	-5		-4		-3		-2		-1

Profile expansion: pairwise preference among pairs of sample apartments

Example Critiquing (Pu and Chen, EC'05)

The screenshot shows the 'Apartment Finder' application window with a 'Compare' dialog box overlaid. The 'Compare' dialog asks 'Would you like to compare' and lists the details of 'Apt 34'. It provides options to compare with other apartments based on various attributes, with 'Bigger Area' selected. Below, it shows attributes the user is willing to compromise on, with 'Kitchen' and 'Distance' selected.

Apartment Finder - Example Critiquing Interface

Search Panel

Type: room in a house | importance: least (selected) | most

Price Max: 600 | Fs: | Kitchen: private | Bathroom: private | Distance Max: 10

Search Results

ID	type	price	area(m2)	bathroom	...
34	room in a house	600	15	private	private
27	shared apartme...	550	20	private	not av
33	shared apartme...	600	18	shared	not av
35	room in a house	600	15	shared	private
38	room in a house	650	20	shared	share
42	shared apartme...	700	25	private	private
32	shared apartme...	600	12	shared	share

Basket

ID	type	price	area(m2)	bathroom	...
34	room in a house	600	15	private	private

Compare Dialog

Would you like to compare

Apt 34: room in a house, 600 frs, 15 square meters, private bathroom, private kitchen, 15 minutes to your work place

with other apartments for

- Better Type
- Cheaper Price
- Bigger Area
- Better Bathroom
- Better Kitchen
- Closer Distance

You are willing to compromise on the following attributes:

- Type of Apartment
- Price
- Area
- Bathroom
- Kitchen
- Distance

Buttons: Cancel, Show Results

Cont.

- Initial preference elicitation
 - Any preferences
 - Default preferences
- *How many examples to show?*
 - Multiple items for users to select the final choice or the one to be critiqued
 - For a moderate number of preferences, the amount falls between 5 and 20 (Faltings *et al.*, 2004)
- *What example to show?*
 - Combined strategy: Elimination-by-Aspect (EBA) (for hard constraints) plus Multi-Attribute Utility Theory (MAUT)
 - Show partial satisfaction set to help resolve preference conflicts








Cont.

- *How to support tradeoff making?*
 - Three types
 - Value tradeoff: change a particular attribute's preference value
 - Utility tradeoff: change the weight of a preference
 - Outcome tradeoff: add new preferences
 - Complexity of tradeoff task: (*optimize, compromise*)
 - Simple tradeoff: (1,1)
 - e.g., ({price}, {size of room})
 - Complex tradeoff: (m,n) (m or n > 1)
 - e.g., ({price}, {size of room, distance to work}) (three different ways to compromise two attributes in order to gain on one attribute)

Extension: Chen and Pu, AAAI'06


Multiple recommended items

Showing 7 products most matching your preferences

	Canon PowerShot S1 IS Digital Camera Add to saved list \$ 248.95 Canon, 3200000 pixels, 10 X optical zoom, 1.5 in screen size, 2.6 in thickness, 370.7 g weight. detail	Value Comparison
	Canon PowerShot S500 Digital Camera Add to saved list \$ 249.95 Canon, 5000000 pixels, 3 X optical zoom, 1.5 in screen size, 1.1 in thickness, 184 g weight. detail	Value Comparison
	Canon PowerShot S2 IS Digital Camera Add to saved list \$ 424.15 Canon, 5300000 pixels, 12 X optical zoom, 16 MB memory, 1.8 in screen size, 2.97 in thickness, 404.7 g weight. detail	Value Comparison
	Canon PowerShot G6 Digital Camera Add to saved list \$ 469.99 Canon, 7400000 pixels, 4 X optical zoom, 2 in screen size, 2.9 in thickness, 379.2 g weight. detail	Value Comparison
	Canon PowerShot SD200 Digital Camera Add to saved list \$ 209 Canon, 3300000 pixels, 16 MB memory, 2 in screen size, 0.83 in thickness, 114.9 g weight. detail	Value Comparison
	Canon PowerShot Pro1 Digital Camera Add to saved list \$ 489.18 Canon, 8000000 pixels, 7 X optical zoom, 2 in screen size, 3.6 in thickness, 1052.8 g weight. detail	Value Comparison
	Canon Powershot S60 Digital Camera Add to saved list \$ 299 Canon, 5000000 pixels, 3.6 X optical zoom, 32 MB memory, 1.8 in screen size, 1.53 in thickness, 229.5 g weight. detail	Value Comparison

The product chosen to be critiqued

To find similar products with better values than this one

 **Canon PowerShot S2 IS Digital Camera** [Add to saved list](#)
 \$424.15
 Canon, 5.3 M pixels, 12x optical zoom, 16 MB memory, 1.8 in screen size, 2.97 in thickness, 404.7 g weight. [detail](#)

would you like to improve some values?

	Keep	Improve	Take any suggestion
Manufacturer	<input checked="" type="radio"/> Canon	<input type="radio"/> Sony <input type="text" value="v"/>	<input type="radio"/>
Price	<input type="radio"/> \$424.15	<input checked="" type="radio"/> less expensive <input type="text" value="v"/> less expensive \$100 cheaper \$200 cheaper \$300 cheaper	<input type="radio"/>
Resolution	<input checked="" type="radio"/> 5.3 M pixels	<input type="radio"/>	<input type="radio"/>
Optical Zoom	<input checked="" type="radio"/> 12x	<input type="radio"/>	<input type="radio"/>
Removable Flash Memory	<input checked="" type="radio"/> 16 MB	<input type="radio"/> more memory <input type="text" value="v"/>	<input type="radio"/>
LCD Screen Size	<input checked="" type="radio"/> 1.8 in	<input type="radio"/> larger <input type="text" value="v"/>	<input type="radio"/>
Thickness	<input checked="" type="radio"/> 2.97 in	<input type="radio"/> thinner <input type="text" value="v"/>	<input type="radio"/>
Weight	<input checked="" type="radio"/> 404.7 g	<input type="radio"/> lighter <input type="text" value="v"/>	<input type="radio"/>

[Show Results](#) [Reset](#)

User-initiated critiquing facility

Flat Finder (Viappiani *et al.*, 2007)

Preferences

Price ? 450 Remove Bathroom ? private Remove

Search according to these preferences:

Add preferences

Results

There are a total of **187** options, of which **8** fully match your preferences.

These are the best solutions that match your query.

ID	Type	Price	Rooms	Furnished	Smoking	Bathroom	Kitchen	Transportation	Distance to Uni	Distance to Centre	Choose
8142	room in a house	300	1.0	true	non smoking	private	shared	bus	10	12	<input checked="" type="radio"/>
7849	room in a house	400	1.0	true	either	private	shared	none	18	16	<input type="radio"/>
8080	room in a house	410	1.0	true	either	private	not available	bus	19	19	<input type="radio"/>


In the dataset you can also find..

ID	Type	Price	Rooms	Furnished	Smoking	Bathroom	Kitchen	Transportation	Distance to Uni	Distance to Centre
8122	studio	420	1.0	false	either	private	private	bus	7	5
8046	shared apartment	450	1.0	true	either	shared	shared	bus	9	8
8027	shared apartment	400	1.0	true	either	shared	shared	metro	12	6

Look at the solutions displayed. If you realize that you did not stated some of your preferences you can do it now.

State an additional preference

My Basket

 Here you can store entries for comparison. When you choose one of them, you can proceed to checkout

No element in that set

Look-ahead principle: stimulate the user to express more preferences (outcome tradeoff) with the predictive recommendations


Representative Works

- Natural language dialog
- Graphical user interfaces
 - System-suggested critiques
 - User-initiated critiquing
 - **Hybrid critiquing**

4th type: Hybrid Critiquing

Hybrid of system-suggested critiques and user-initiated critiquing
(Chen and Pu, IUI'07)

To find similar products with better values than this one



Canon PowerShot S2 IS Digital Camera
\$424.15
Canon, 5.3 M pixels, 12x optical zoom, 16 MB memory, 1.8 in screen size, 2.97 in thickness, 404.7 g weight. [detail](#)

We have the following

1. Less Optical Zoom and Thinner and Lighter Weight
2. Different Manufacturer and Lower Resolution and Cheaper
3. Larger Screen Size and More Memory and Heavier

OR would you like to improve some value(s) by yourself?

	Keep	Improve	Take any suggestion
Manufacturer	<input checked="" type="radio"/> Canon	<input type="radio"/> Sony <input type="button" value="v"/>	<input type="radio"/>
Price	<input checked="" type="radio"/> \$424.15	<input type="radio"/> less expensive <input type="button" value="v"/>	<input type="radio"/>
Resolution	<input checked="" type="radio"/> 5.3 M pixels	<input type="radio"/> higher <input type="button" value="v"/>	<input type="radio"/>
Optical Zoom	<input checked="" type="radio"/> 12x	<input type="radio"/> more zoom <input type="button" value="v"/>	<input type="radio"/>
Removable Flash Memory	<input checked="" type="radio"/> 16 MB	<input type="radio"/> more memory <input type="button" value="v"/>	<input type="radio"/>
LCD Screen Size	<input checked="" type="radio"/> 1.8 in	<input type="radio"/> larger <input type="button" value="v"/>	<input type="radio"/>
Thickness	<input checked="" type="radio"/> 2.97 in	<input type="radio"/> thinner <input type="button" value="v"/>	<input type="radio"/>
Weight	<input checked="" type="radio"/> 404.7 g	<input type="radio"/> lighter <input type="button" value="v"/>	<input type="radio"/>

System-suggested critiques

User-initiated critiquing

Extension: Chen and Pu, RecSys'07

Preference-based organization



The product best matching your preferences

Toshiba Portege M200 Tablet PC [Add to saved list](#)
 \$ 2649 (USD)
 Toshiba, Microsoft Windows XP Tablet PC, 4.34 hours battery, 12.1 in display size, 80 GB HD, 1500 MB memory, Intel Pentium M Processor (Centrino), 2 GHz processor speed, 2.07 kg weight. [detail](#)

[Specify your own criteria for "Better Features"](#)



We also recommend the following products with some Better Features

These products have **Cheaper Price and Longer Battery Life**, although they have slightly Lower Processor Speed

	Panasonic Toughbook 18 Tablet PC - Touchscreen PC Version Add to saved list \$ 2599.99 (USD) Panasonic, Microsoft Windows XP Pro, 8.5 hours battery, 10.4 in display size, 40 GB HD, 256 MB memory, Intel Pentium M Processor (Centrino), 1.1 GHz processor speed, 2.03 kg weight. detail	Better Features
	Acer TravelMate C302XCI-SP2 Tablet PC Add to saved list \$ 1299 (USD) Acer, Microsoft Windows XP Tablet PC, 5.5 hours battery, 14.1 in display size, 60 GB HD, 512 MB memory, Intel Pentium M Processor (Centrino), 1.6 GHz processor speed, 2.79 kg weight. detail	Better Features



6 products [Show All](#)

These products have **Larger Display Size**, although they have slightly Shorter Battery Life and Heavier Weight

	Acer TravelMate C314XMI Tablet PC Add to saved list \$ 1776.49 (USD) Acer, Microsoft Windows XP Tablet PC, 4 hours battery, 14.1 in display size, 100 GB HD, 1024 MB memory, Intel Pentium M Processor (Centrino), 2 GHz processor speed, 2.88 kg weight. detail	Better Features
	Toshiba Satellite R10 Tablet PC Add to saved list \$ 1439 (USD) Toshiba, Microsoft Windows XP Tablet PC, 4 hours battery, 14 in display size, 40 GB HD, 512 MB memory, Intel Pentium M Processor, 1.6 GHz processor speed, 2.93 kg weight. detail	Better Features



6 products [Show All](#)

These products have **Lighter Weight and Different Processor Class**, although they have slightly Smaller Display Size

	ElectroVaya Scribbler SC-500 Tablet PC Add to saved list \$ 2499 (USD) ElectroVaya, Microsoft Windows XP Tablet PC, 8 hours battery, 10.4 in display size, 30 GB HD, 512 MB memory, Intel Pentium III Processor with SpeedStep, 0.866 GHz processor speed, 1.76 kg weight. detail	Better Features
	Acer TMC104TI Tablet PC Add to saved list \$ 1059 (USD) Acer, Microsoft Windows XP Tablet PC, 3.5 hours battery, 10.4 in display size, 30 GB HD, 256 MB memory, Intel Pentium M Processor, 0.99 GHz processor speed, 1.4 kg weight. detail	Better Features

6 products [Show All](#)

These products have **Cheaper Price and Larger Display Size**, although they have slightly Heavier Weight

	Acer TravelMate C314XMI Tablet PC Add to saved list \$ 1776.49 (USD) Acer, Microsoft Windows XP Tablet PC, 4 hours battery, 14.1 in display size, 100 GB HD, 1024 MB memory, Intel Pentium M Processor (Centrino), 2 GHz processor speed, 2.88 kg weight. detail	Better Features
	Acer TravelMate C302XCI-SP2 Tablet PC Add to saved list \$ 1299 (USD) Acer, Microsoft Windows XP Tablet PC, 5.5 hours battery, 14.1 in display size, 60 GB HD, 512 MB memory, Intel Pentium M Processor (Centrino), 1.6 GHz processor speed, 2.79 kg weight. detail	Better Features

6 products [Show All](#)

User-initiated critiquing support

To find products with better features than this one

Toshiba Portege M200 Tablet PC
 \$ 2649 (USD)
 Toshiba, Microsoft Windows XP Tablet PC, 4.34 hours battery, 12.1 in display size, 80 GB HD, 1500 MB memory, Intel Pentium M Processor (Centrino), 2 GHz processor speed, 2.07 kg weight

would you like to improve some values by yourself?

	What you have chosen	Improve	Take any suggestion
Manufacturer	<input checked="" type="radio"/> Toshiba	<input type="radio"/> Acer	<input type="radio"/>
Price	<input type="radio"/> \$ 2649 (USD)	<input checked="" type="radio"/> < \$ 2649 (USD) <input type="radio"/> < \$ 2649 (USD) <input type="radio"/> <= \$ 2500 (USD) <input checked="" type="radio"/> <= \$ 2000 (USD) <input type="radio"/> <= \$ 1500 (USD)	<input type="radio"/>
Operating System	<input checked="" type="radio"/> Microsoft Windows XP Tablet PC	<input type="radio"/> P Pro	<input type="radio"/>
Battery Life	<input checked="" type="radio"/> 4.34 hours	<input type="radio"/>	<input type="radio"/>
Display Size	<input checked="" type="radio"/> 12.1 in	<input type="radio"/> > 12.1 in	<input type="radio"/>
Hard Drive Capacity	<input checked="" type="radio"/> 80 GB	<input type="radio"/> >= 80 GB	<input type="radio"/>
Installed Memory	<input checked="" type="radio"/> 1500 MB	Not Available	<input type="radio"/>
Processor Class	<input checked="" type="radio"/> Intel Pentium M Processor (Centrino)	<input type="radio"/> Intel Mobile Celeron Processor	<input type="radio"/>
Processor Speed	<input checked="" type="radio"/> 2 GHz	<input type="radio"/> >= 2 GHz	<input type="radio"/>
Weight	<input checked="" type="radio"/> 2.07 kg	<input type="radio"/> < 2.07 kg	<input type="radio"/>

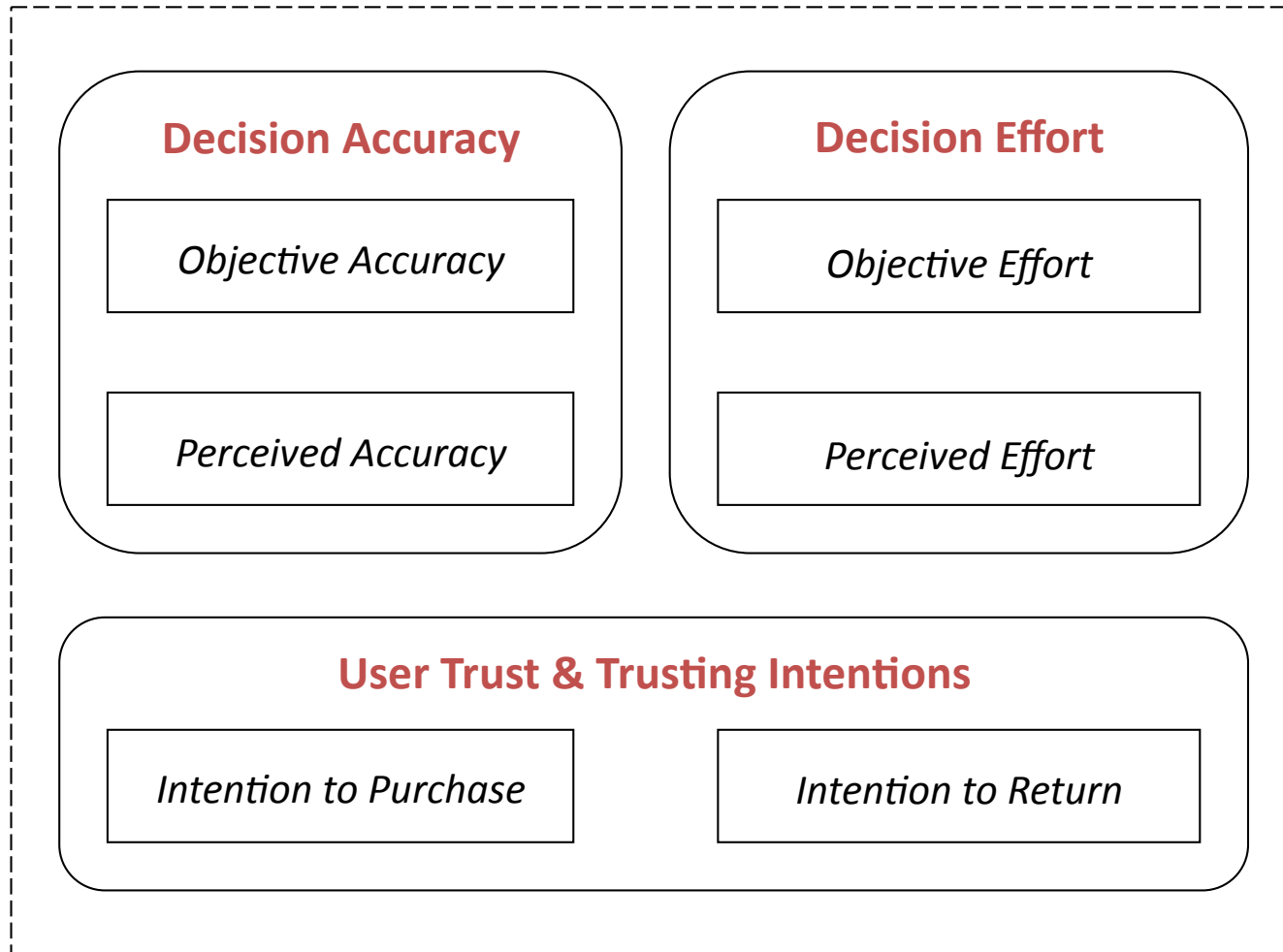
[Show Results](#) [Reset](#)

If suggested critiques and products do not interest the user in the organization interface, she could switch to make the self-initiated critiquing

Outline

- What is critiquing-based recommender system and Why?
- Development history
- User experiences
- Conclusion

User Evaluation Framework



Experiments

1. Example critiquing vs. non-critiquing based system (EC'05)
2. Example critiquing vs. dynamic critiquing (AAAI'06)
3. Organization interface vs. ranked list (IUI'06, UMAP'10)
4. Evaluation of hybrid critiquing (IUI'07, RecSys'08)

Example Critiquing (Pu and Chen, EC'05)

The screenshot shows the 'Apartment Finder' application window with a search panel, search results table, and a 'Compare' dialog box overlaid on top.

Apartment Finder - Example Critiquing Interface

Search Panel

Type: room in a house | importance: least (selected) | most

Price Max: 600 | Fs: | Kitchen: private | Bathroom: private | Distance Max: 10

Search Results

ID	type	price	area(m2)	bathroom	...
34	room in a house	600	15	private	private
27	shared apartme...	550	20	private	not av
33	shared apartme...	600	18	shared	not av
35	room in a house	600	15	shared	private
38	room in a house	650	20	shared	share
42	shared apartme...	700	25	private	private
32	shared apartme...	600	12	shared	share

Basket

ID	type	price	area(m2)	bathroom	...
34	room in a house	600	15	private	private

Compare Dialog

Would you like to compare

Apt 34: room in a house, 600 frs, 15 square meters, private bathroom, private kitchen, 15 minutes to your work place

with other apartments for

Better Type Cheaper Price Bigger Area

Better Bathroom Better Kitchen Closer Distance

You are willing to compromise on the following attributes:

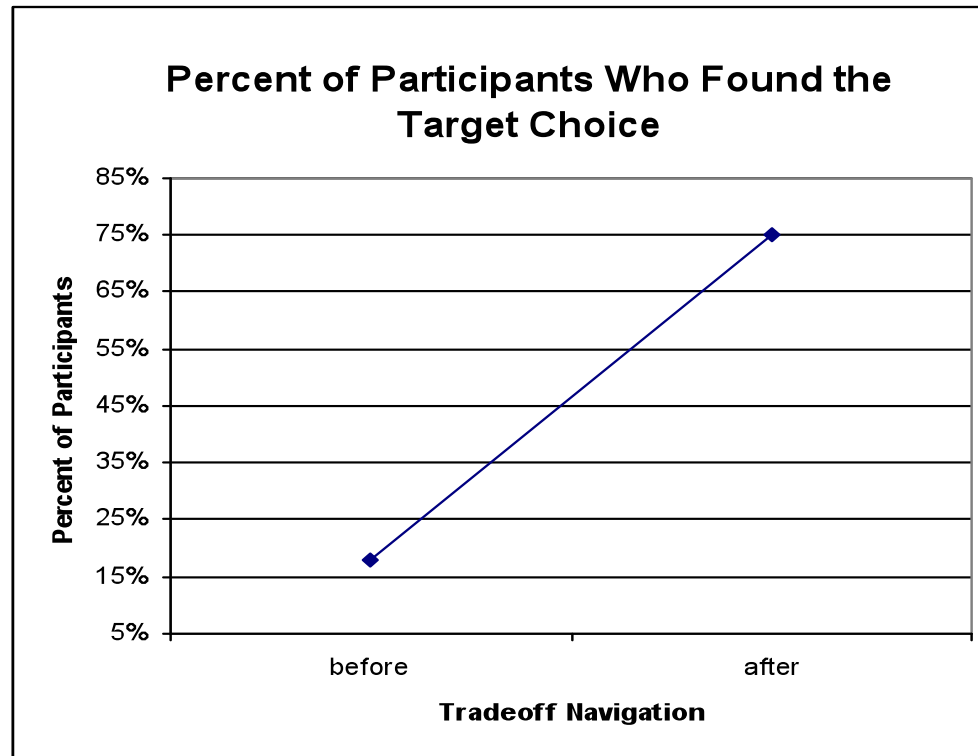
Type of Apartment Price Area

Bathroom Kitchen Distance

Buttons: Cancel, Show Results

Experiment 1: Example critiquing vs. non-critiquing based system (EC'05)

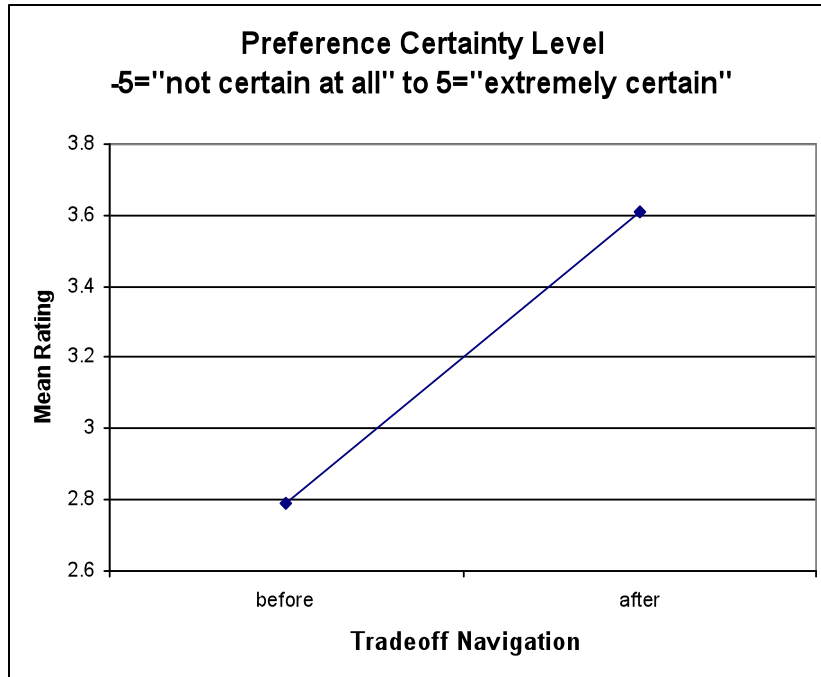
Participants: 28; Material: Apartment Finder



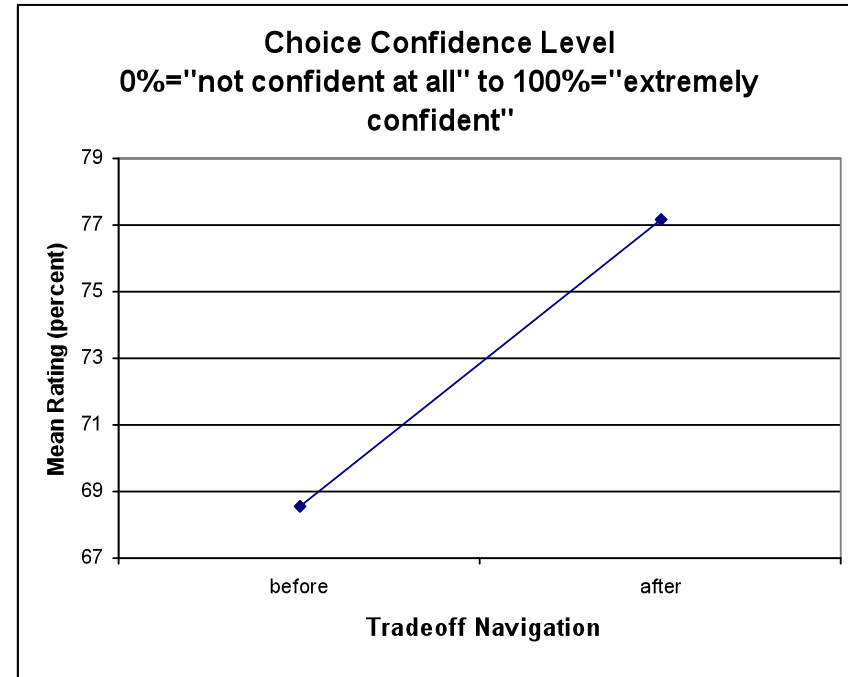
Effect of example critiquing on improving **decision accuracy**

➔ Tradeoff navigation process with the support of example-critiquing can significantly improve users' decision accuracy by **up to 57%**

Preference certainty



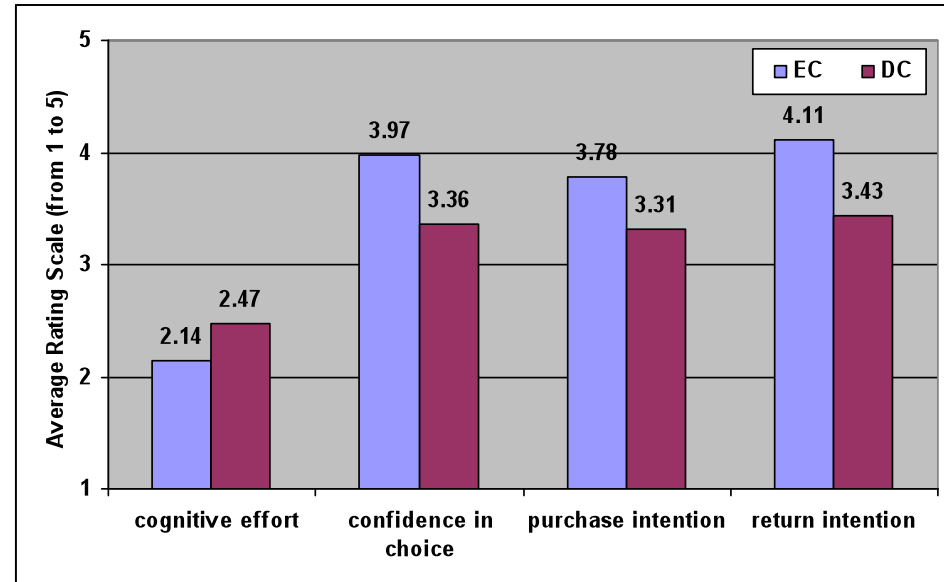
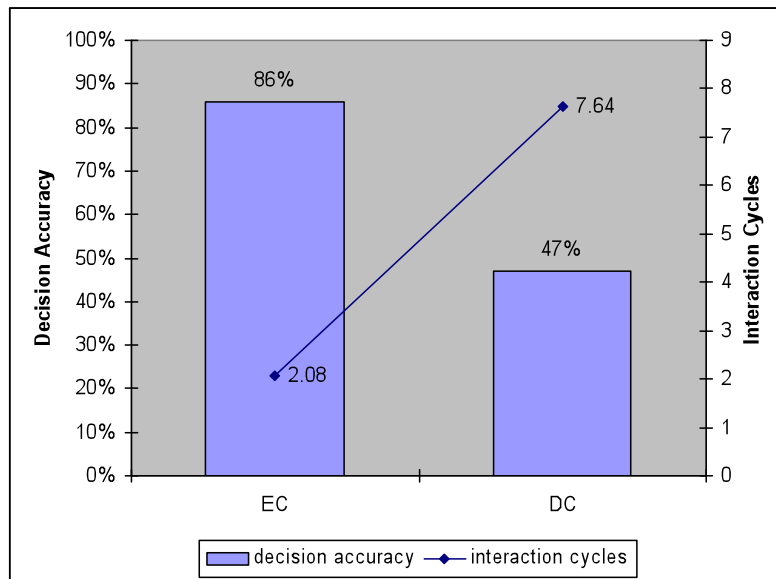
Decision confidence



➔ Tradeoff navigation process with the support of example-critiquing can significantly improve users' preference certainty and decision confidence

Experiment 2: Example critiquing vs. dynamic critiquing (AAAI'06)

Participants: 36; Material: Online product finder; Procedure: within-subjects



➔ Example critiquing significantly outperforms dynamic critiquing regarding **objective/subjective accuracy, objective interaction effort** and **perceived effort, purchase and return intentions**

Dynamic Critiquing (McCarthy *et al.*, IUI'05)

QWIKSHOP.COM HOME · ABOUT THIS PROJECT · CONTACT

Shop for: Digital Cameras, Holidays, PCs

Digital Cameras

Unit Critiques

Adjust your preferences in product for you!

Manufacturer	<input checked="" type="checkbox"/>	Canon	<input checked="" type="checkbox"/>
Model	<input checked="" type="checkbox"/>	EOS-300D	<input checked="" type="checkbox"/>
Price (\$)	<input type="checkbox"/>	871.0	<input type="checkbox"/>
Format	<input checked="" type="checkbox"/>	SLR	<input checked="" type="checkbox"/>
Resolution (M Pixels)	<input type="checkbox"/>	6.29	<input type="checkbox"/>
Optical Zoom (X)	<input type="checkbox"/>	10.0	<input type="checkbox"/>
Digital Zoom (X)	<input type="checkbox"/>	0.0	<input type="checkbox"/>
Weight (grams)	<input type="checkbox"/>	645.0	<input type="checkbox"/>
Storage Type	<input checked="" type="checkbox"/>	Compact Flash	<input checked="" type="checkbox"/>
Storage Included (MB)	<input type="checkbox"/>	0.0	<input type="checkbox"/>

Item Found:
Specifications
6.3 Megapixel CMOS sensor
7-point wide-area AF
High-performance DIGIC processor
100-1600 ISO speed range
Compatible with all Canon EF lenses and EX Speedlites
PictBridge, Canon Direct Print and Bubble Jet Direct compatible – no PC required

Compound Critiques

We have more matching products with the following...

1. Less Optical Zoom & More Digital Zoom & A Different Storage Type (139)
2. A Lower Resolution & A Different Format & Cheaper (169)
3. A Different Manufacturer & Less Optical Zoom & More Storage (167)

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Method

- Dynamically generate a set of compound critiques (each over multiple attributes) through association rule mining
- The recommended item should satisfy the user picked critique as well as being most similar to the previous recommendation

Experiment 3: Organization interface vs. ranked list (IUI'06)

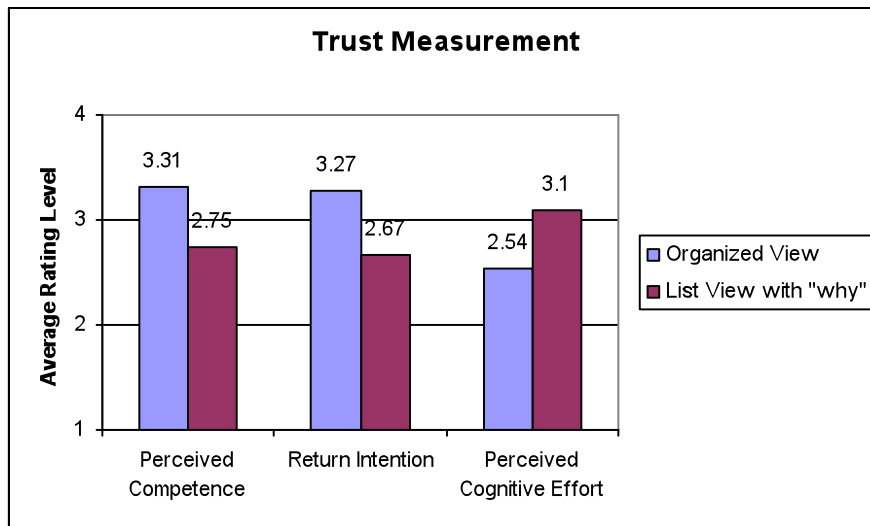
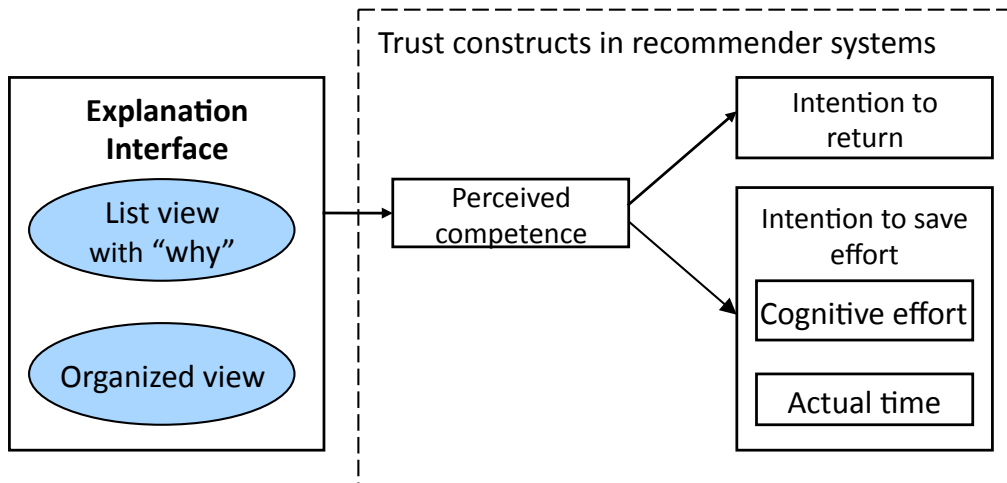
The most popular product								
Manufacturer	Price	Processor speed	Battery life	Installed memory	Hard drive capacity	Display size	Weight	
Ⓞ	—	\$2'095.00	1.67 GHz	4.5 hour(s)	512 MB	80 GB	38.6 cm	2.54 kg
We also recommend the following products because they are cheaper and lighter, but have lower processor speed								
Manufacturer	Price	Processor speed	Battery life	Installed memory	Hard drive capacity	Display size	Weight	
Ⓞ	—	\$1'499.00	1.5 GHz	5 hour(s)	512 MB	80 GB	33.8 cm	1.91 kg
Ⓞ	—	\$1'739.99	1.5 GHz	4.5 hour(s)	512 MB	80 GB	38.6 cm	2.49 kg
Ⓞ	—	\$1'625.99	1.5 GHz	5 hour(s)	512 MB	80 GB	30.7 cm	2.09 kg
Ⓞ	—	\$1'426.99	1.5 GHz	5 hour(s)	512 MB	60 GB	30.7 cm	2.09 kg
Ⓞ	—	\$1'929.00	1.2 GHz	4 hour(s)	512 MB	60 GB	26.9 cm	1.41 kg
Ⓞ	—	\$1'595.00	1 GHz	5.5 hour(s)	512 MB	40 GB	26.9 cm	1.41 kg
they have higher processor speed and bigger hard drive capacity, but are heavier								
Manufacturer	Price	Processor speed	Battery life	Installed memory	Hard drive capacity	Display size	Weight	
Ⓞ	—	\$1'220.49	1.8 GHz	5 hour(s)	1 GB	100 GB	38.1 cm	2.95 kg
Ⓞ	—	\$2'148.99	2 GHz	4 hour(s)	1 GB	100 GB	39.1 cm	2.9 kg
Ⓞ	—	\$1'379.00	3.3 GHz	2 hour(s)	512 MB	100 GB	43.2 cm	4.31 kg
Ⓞ	—	\$2'235.00	1.8 GHz	2.5 hour(s)	1 GB	100 GB	43.2 cm	3.99 kg
Ⓞ	—	\$2'319.00	1.7 GHz	4.5 hour(s)	512 MB	100 GB	43.2 cm	3.13 kg
Ⓞ	—	\$2'075.00	1.8 GHz	1.67 hour(s)	512 MB	100 GB	43.2 cm	4.4 kg
they have longer battery life and lighter weight, but smaller display size								
Manufacturer	Price	Processor speed	Battery life	Installed memory	Hard drive capacity	Display size	Weight	
Ⓞ	—	\$1'529.00	1.7 GHz	6.5 hour(s)	512 MB	80 GB	33.8 cm	1.77 kg
Ⓞ	—	\$1'599.00	1.7 GHz	6.5 hour(s)	512 MB	80 GB	33.8 cm	1.91 kg
Ⓞ	—	\$1'125.00	1.5 GHz	6 hour(s)	512 MB	80 GB	30.7 cm	2 kg
Ⓞ	—	\$2'099.99	1.2 GHz	9 hour(s)	512 MB	60 GB	26.9 cm	1.41 kg
Ⓞ	—	\$1'649.00	1.1 GHz	8.5 hour(s)	512 MB	40 GB	26.9 cm	1.36 kg
Ⓞ	—	\$969.00	1.2 GHz	6 hour(s)	256 MB	39 GB	30.7 cm	2.22 kg
they are cheaper, but heavier								
Manufacturer	Price	Processor speed	Battery life	Installed memory	Hard drive capacity	Display size	Weight	
Ⓞ	—	\$1'179.00	3.2 GHz	2 hour(s)	512 MB	80 GB	39.1 cm	3.62 kg
Ⓞ	—	\$1'425.00	1.6 GHz	5.5 hour(s)	512 MB	80 GB	39.1 cm	2.86 kg
Ⓞ	—	\$1'190.00	3.2 GHz	1 hour(s)	512 MB	80 GB	39.1 cm	3.72 kg
Ⓞ	—	\$1'629.00	1.8 GHz	5.8 hour(s)	512 MB	60 GB	38.1 cm	2.81 kg
Ⓞ	—	\$627.10	1.6 GHz	1.5 hour(s)	256 MB	40 GB	38.1 cm	2.81 kg
Ⓞ	—	\$520.00	1.13 GHz	3.5 hour(s)	128 MB	30 GB	35.8 cm	2.59 kg

Organization interface

The most popular product									
Manufacturer	Price	Processor speed	Battery life	Installed memory	Hard drive capacity	Display size	Weight		
Ⓞ	—	\$2'095.00	1.67 GHz	4.5 hours	512 MB	80 GB	38.6 cm	2.54 kg	
We also recommend the following products									
Manufacturer	Price	Processor speed	Battery life	Installed memory	Hard drive capacity	Display size	Weight		
Ⓞ	Why?	—	\$1'220.49	1.8 GHz	5 hours	1 GB	100 GB	38.1 cm	2.95 kg
Ⓞ	Why?	—	\$2'148.99	2.0 GHz	4 hours	1 GB	100 GB	39.1 cm	2.90 kg
Ⓞ	Why?	—	\$1'379.00	3.3 GHz	2 hours	512 MB	100 GB	43.2 cm	4.31 kg
Ⓞ	Why?	—	\$1'179.00	3.2 GHz	2 hours	512 MB	80 GB	39.1 cm	3.62 kg
Ⓞ	Why?	—	\$1'529.00	1.7 GHz	6.5 hours	512 MB	80 GB	33.8 cm	1.77 kg
Ⓞ	Why?	—	\$1'599.00	1.7 GHz	6.5 hours	512 MB	80 GB	33.8 cm	1.91 kg
Ⓞ	Why?	—	\$1'425.00	1.6 GHz	5.5 hours	512 MB	80 GB	39.1 cm	2.86 kg
Ⓞ	Why?	—	\$2'235.00	1.8 GHz	2.5 hours	1 GB	100 GB	43.2 cm	3.99 kg
Ⓞ	Why?	—	\$1'190.00	3.2 GHz	1 hours	512 MB	80 GB	39.1 cm	3.72 kg
Ⓞ	Why?	—	\$1'125.00	1.5 GHz	6 hours	512 MB	80 GB	30.7 cm	2 kg
Ⓞ	Why?	—	\$2'319.00	1.67 GHz	4.5 hours	512 MB	100 GB	43.2 cm	3.13 kg
Ⓞ	Why?	—	\$1'499.00	1.5 GHz	5 hours	512 MB	80 GB	33.8 cm	1.91 kg
Ⓞ	Why?	—	\$1'739.99	1.5 GHz	4.5 hours	512 MB	80 GB	38.6 cm	2.49 kg
Ⓞ	Why?	—	\$1'629.00	1.8 GHz	5.8 hours	512 MB	60 GB	38.1 cm	2.81 kg
Ⓞ	Why?	—	\$1'625.99	1.5 GHz	5 hours	512 MB	80 GB	30.7 cm	2.09 kg
Ⓞ	Why?	—	\$1'426.99	1.5 GHz	5 hours	512 MB	60 GB	30.7 cm	2.09 kg
Ⓞ	Why?	—	\$2'099.99	1.2 GHz	9 hours	512 MB	60 GB	26.9 cm	1.41 kg
Ⓞ	Why?	—	\$2'075.00	1.8 GHz	1.67 hours	512 MB	100 GB	43.2 cm	4.4 kg
Ⓞ	Why?	—	\$1'649.00	1.1 GHz	8.5 hours	512 MB	40 GB	26.9 cm	1.36 kg
Ⓞ	Why?	—	\$627.10	1.6 GHz	1.5 hours	256 MB	40 GB	38.1 cm	2.81 kg
Ⓞ	Why?	—	\$969.00	1.2 GHz	6 hours	256 MB	39 GB	30.7 cm	2.22 kg
Ⓞ	Why?	—	\$520.00	1.13 GHz	3.5 hours	128 MB	30 GB	35.8 cm	2.59 kg
Ⓞ	Why?	—	\$1'929.00	1.2 GHz	4 hours	512 MB	60 GB	26.9 cm	1.41 kg
Ⓞ	Why?	—	\$1'595.00	1.0 GHz	5.5 hours	512 MB	40 GB	26.9 cm	1.41 kg

Ranked list

Results



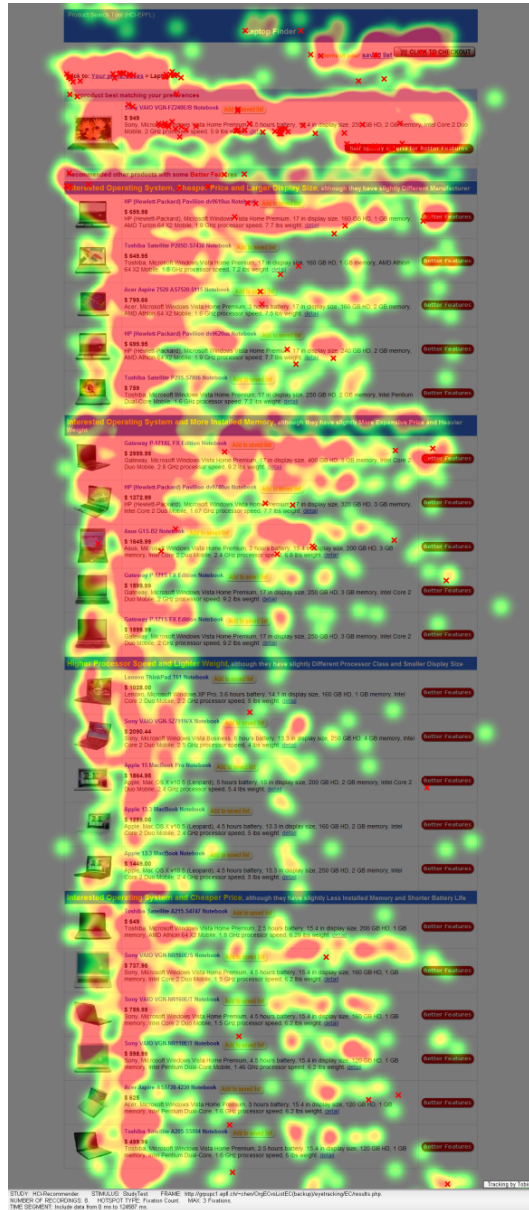
Participants: 72; Material: online product finder; Procedure: within-subjects

Items in the Perceived Competence construct	Mean	
	Organized view	List view with "why"
I felt comfortable using the interface;	3.24	2.78
This interface enabled me to compare different products very efficiently.	3.38	2.72
Cronbach's alpha = 0.84		

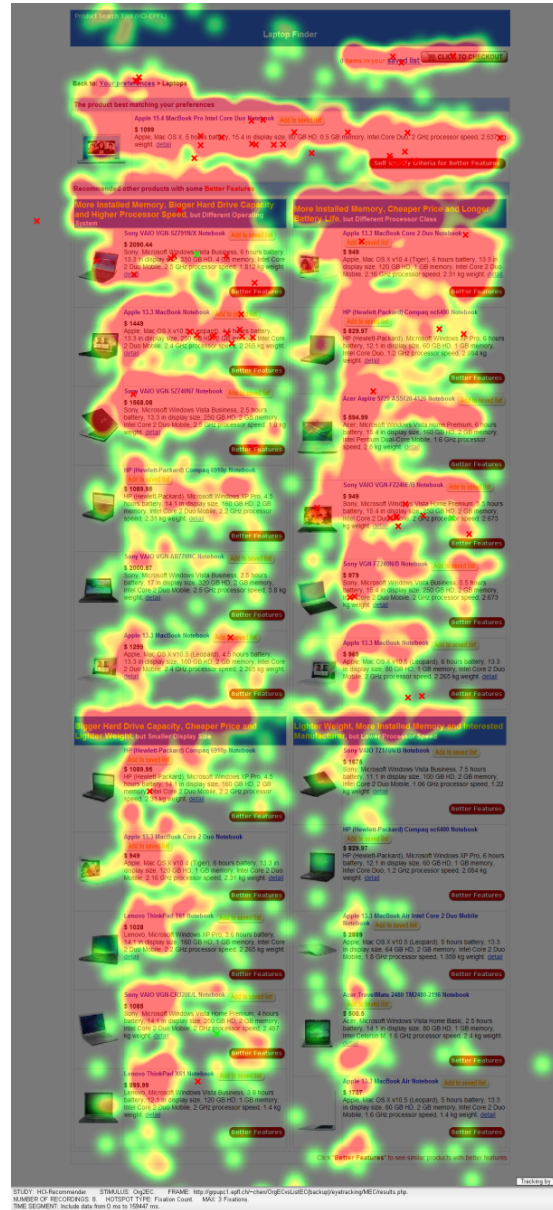
Items in the Intention to Return construct	Mean	
	Organized view	List view with "why"
If I had to buy a product online in the future and an interface such as this was available, I would be very likely to use it;	3.11	2.56
I don't like this interface, so I would not use it again (<i>reverse scale</i>).	3.40	2.79
Cronbach's alpha = 0.91		

Items in the Cognitive Effort construct	Mean	
	Organized view	List view with "why"
I easily found the information I was looking for (<i>reverse scale</i>);	2.47	3.07
Selecting a product using this interface required too much effort.	2.61	3.14
Cronbach's alpha = 0.73		

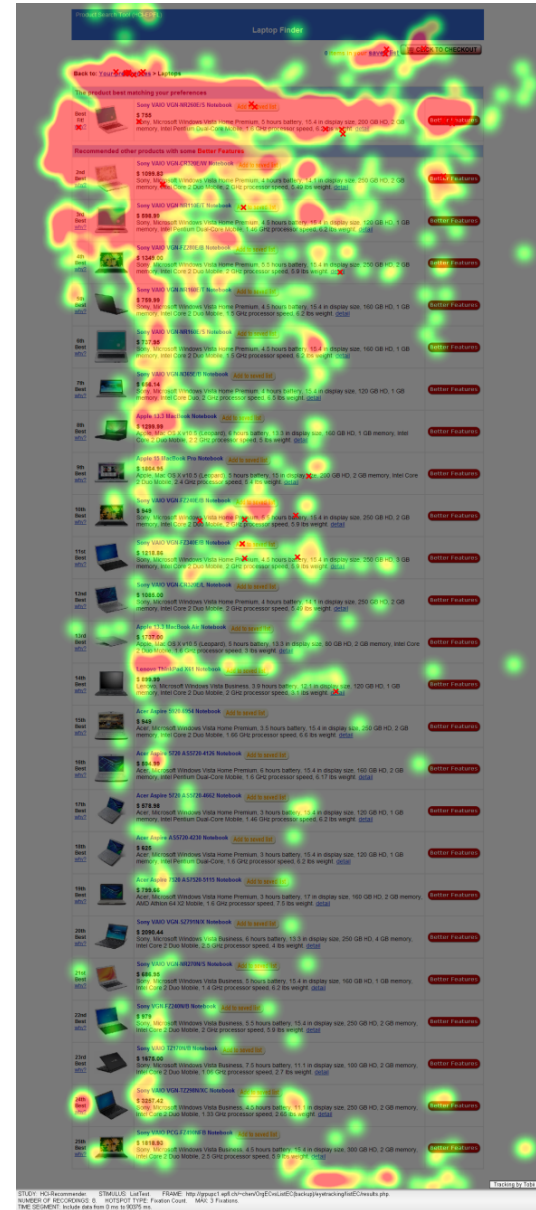
Hotspot plot



ORG1



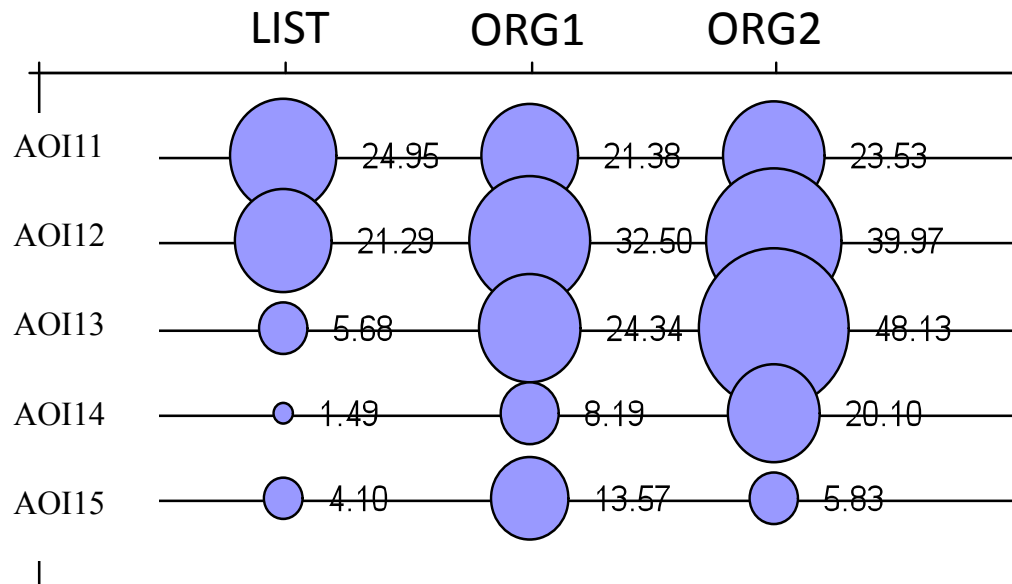
ORG2



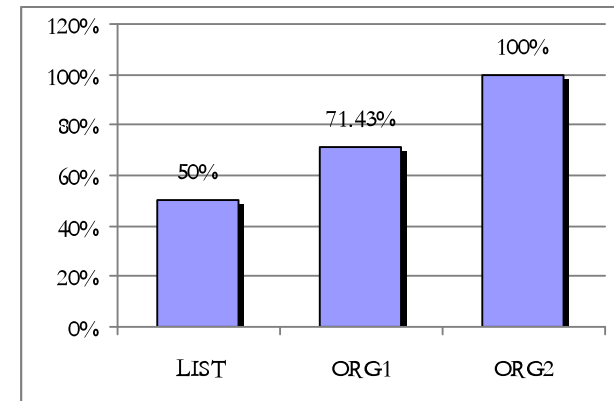
LIST

AOI analysis & decision quality

Fixation duration on each AOI



Percent of users who have finally made product choice



Distribution of users' choices among AOIs

	Average selections	Top item (AOI1)	AOI2	AOI3	AOI4	AOI5
LIST	1.33	25%	75%			
ORG1	1.86	23%	31%	15%	8%	23%
ORG2	3.2	12.5%	37.5%	37.5%	12.5%	

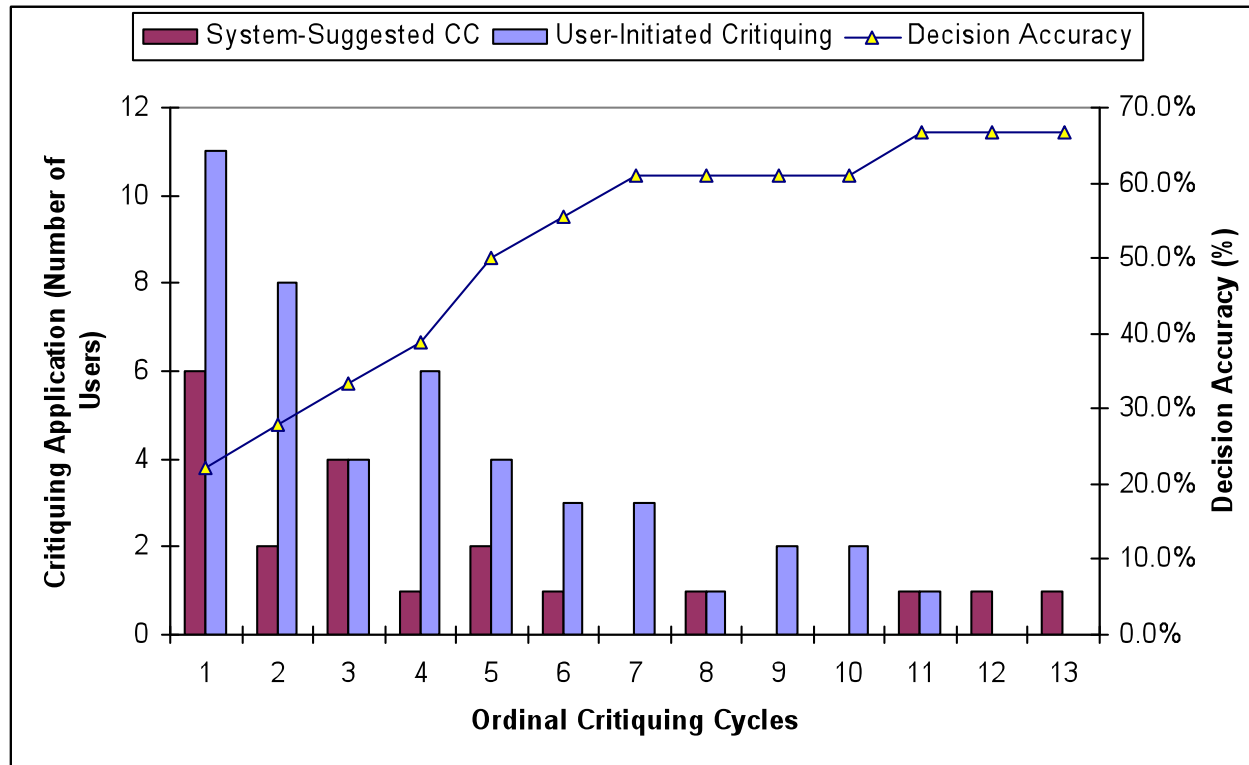
Cross-Cultural Study (Chen and Pu, RecSys'08)

	<i>Oriental Culture (60)</i>	<i>Western Culture (60)</i>
Nation	China (60)	Switzerland (41); Other European countries (19)
Gender	Female (23); Male (37)	Female (15); Male (45)
Average age	21~30 (57); >30 (3)	<21 (14); 21~30 (44); >30 (2)
Major/ job domain	Computer, mathematics, environment, electronics, architecture, etc.	Computer, education, mechanics, electronics, architecture, etc.
Computer knowledge	4.34 (advanced)	4.08 (advanced)
Internet usage	4.83 (almost daily)	4.98 (almost daily)
e-commerce site visits	3.69 (1-3 times a month)	3.36 (a few times every 3 months)
e-shopping experiences	3.25 (a few times every 3 months)	2.92 (a few times every 3 months)

- People from different cultural backgrounds basically performed similar regarding both objective performance and subjective perceptions
- Significant favor of ORG against LIST
- Stronger among Chinese participants

Experiment 4: Evaluation of hybrid critiquing (IUI'07)

Participants: 18




➔ Users behaved more active in creating their own criteria with the self-initiated critiquing aid, relative to their application of the system-suggested critiques

4th type: Hybrid Critiquing

Hybrid of system-suggested critiques and user-initiated critiquing
(Chen and Pu, IUI'07)

To find similar products with better values than this one



Canon PowerShot S2 IS Digital Camera
\$424.15
Canon, 5.3 M pixels, 12x optical zoom, 16 MB memory, 1.8 in screen size, 2.97 in thickness, 404.7 g weight. [detail](#)

We have the following

1. Less Optical Zoom and Thinner and Lighter Weight
2. Different Manufacturer and Lower Resolution and Cheaper
3. Larger Screen Size and More Memory and Heavier

OR would you like to improve some value(s) by yourself?

	Keep	Improve	Take any suggestion
Manufacturer	<input checked="" type="radio"/> Canon	<input type="radio"/> Sony <input type="button" value="v"/>	<input type="radio"/>
Price	<input checked="" type="radio"/> \$424.15	<input type="radio"/> less expensive <input type="button" value="v"/>	<input type="radio"/>
Resolution	<input checked="" type="radio"/> 5.3 M pixels	<input type="radio"/> higher <input type="button" value="v"/>	<input type="radio"/>
Optical Zoom	<input checked="" type="radio"/> 12x	<input type="radio"/> more zoom <input type="button" value="v"/>	<input type="radio"/>
Removable Flash Memory	<input checked="" type="radio"/> 16 MB	<input type="radio"/> more memory <input type="button" value="v"/>	<input type="radio"/>
LCD Screen Size	<input checked="" type="radio"/> 1.8 in	<input type="radio"/> larger <input type="button" value="v"/>	<input type="radio"/>
Thickness	<input checked="" type="radio"/> 2.97 in	<input type="radio"/> thinner <input type="button" value="v"/>	<input type="radio"/>
Weight	<input checked="" type="radio"/> 404.7 g	<input type="radio"/> lighter <input type="button" value="v"/>	<input type="radio"/>

System-suggested critiques

User-initiated critiquing

Extension: Chen and Pu, RecSys'07

Preference-based organization



The product best matching your preferences

Toshiba Portege M200 Tablet PC [Add to saved list](#)
 \$ 2649 (USD)
 Toshiba, Microsoft Windows XP Tablet PC, 4.34 hours battery, 12.1 in display size, 80 GB HD, 1500 MB memory, Intel Pentium M Processor (Centrino), 2 GHz processor speed, 2.07 kg weight. [detail](#)

[Specify your own criteria for "Better Features"](#)



We also recommend the following products with some Better Features

These products have **Cheaper Price and Longer Battery Life**, although they have slightly Lower Processor Speed

	Panasonic Toughbook 18 Tablet PC - Touchscreen PC Version Add to saved list \$ 2599.99 (USD) Panasonic, Microsoft Windows XP Pro, 8.5 hours battery, 10.4 in display size, 40 GB HD, 256 MB memory, Intel Pentium M Processor (Centrino), 1.1 GHz processor speed, 2.03 kg weight. detail	Better Features
	Acer TravelMate C302XCI-SP2 Tablet PC Add to saved list \$ 1299 (USD) Acer, Microsoft Windows XP Tablet PC, 5.5 hours battery, 14.1 in display size, 60 GB HD, 512 MB memory, Intel Pentium M Processor (Centrino), 1.6 GHz processor speed, 2.79 kg weight. detail	Better Features



6 products [Show All](#)

These products have **Larger Display Size**, although they have slightly Shorter Battery Life and Heavier Weight

	Acer TravelMate C314XMI Tablet PC Add to saved list \$ 1776.49 (USD) Acer, Microsoft Windows XP Tablet PC, 4 hours battery, 14.1 in display size, 100 GB HD, 1024 MB memory, Intel Pentium M Processor (Centrino), 2 GHz processor speed, 2.88 kg weight. detail	Better Features
	Toshiba Satellite R10 Tablet PC Add to saved list \$ 1439 (USD) Toshiba, Microsoft Windows XP Tablet PC, 4 hours battery, 14 in display size, 40 GB HD, 512 MB memory, Intel Pentium M Processor, 1.6 GHz processor speed, 2.93 kg weight. detail	Better Features



6 products [Show All](#)

These products have **Lighter Weight and Different Processor Class**, although they have slightly Smaller Display Size

	ElectroVaya Scribbler SC-500 Tablet PC Add to saved list \$ 2499 (USD) ElectroVaya, Microsoft Windows XP Tablet PC, 8 hours battery, 10.4 in display size, 30 GB HD, 512 MB memory, Intel Pentium III Processor with SpeedStep, 0.866 GHz processor speed, 1.76 kg weight. detail	Better Features
	Acer TMC104TI Tablet PC Add to saved list \$ 1059 (USD) Acer, Microsoft Windows XP Tablet PC, 3.5 hours battery, 10.4 in display size, 30 GB HD, 256 MB memory, Intel Pentium M Processor, 0.99 GHz processor speed, 1.4 kg weight. detail	Better Features

6 products [Show All](#)

These products have **Cheaper Price and Larger Display Size**, although they have slightly Heavier Weight

	Acer TravelMate C314XMI Tablet PC Add to saved list \$ 1776.49 (USD) Acer, Microsoft Windows XP Tablet PC, 4 hours battery, 14.1 in display size, 100 GB HD, 1024 MB memory, Intel Pentium M Processor (Centrino), 2 GHz processor speed, 2.88 kg weight. detail	Better Features
	Acer TravelMate C302XCI-SP2 Tablet PC Add to saved list \$ 1299 (USD) Acer, Microsoft Windows XP Tablet PC, 5.5 hours battery, 14.1 in display size, 60 GB HD, 512 MB memory, Intel Pentium M Processor (Centrino), 1.6 GHz processor speed, 2.79 kg weight. detail	Better Features

6 products [Show All](#)

User-initiated critiquing support

To find products with better features than this one

Toshiba Portege M200 Tablet PC
 \$ 2649 (USD)
 Toshiba, Microsoft Windows XP Tablet PC, 4.34 hours battery, 12.1 in display size, 80 GB HD, 1500 MB memory, Intel Pentium M Processor (Centrino), 2 GHz processor speed, 2.07 kg weight

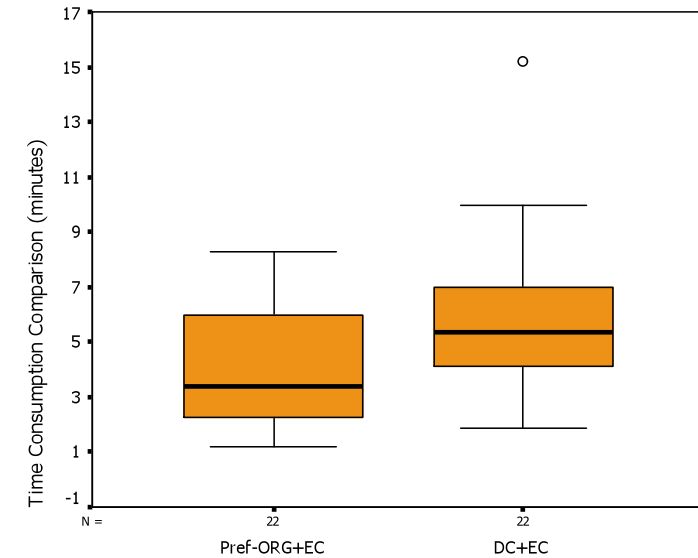
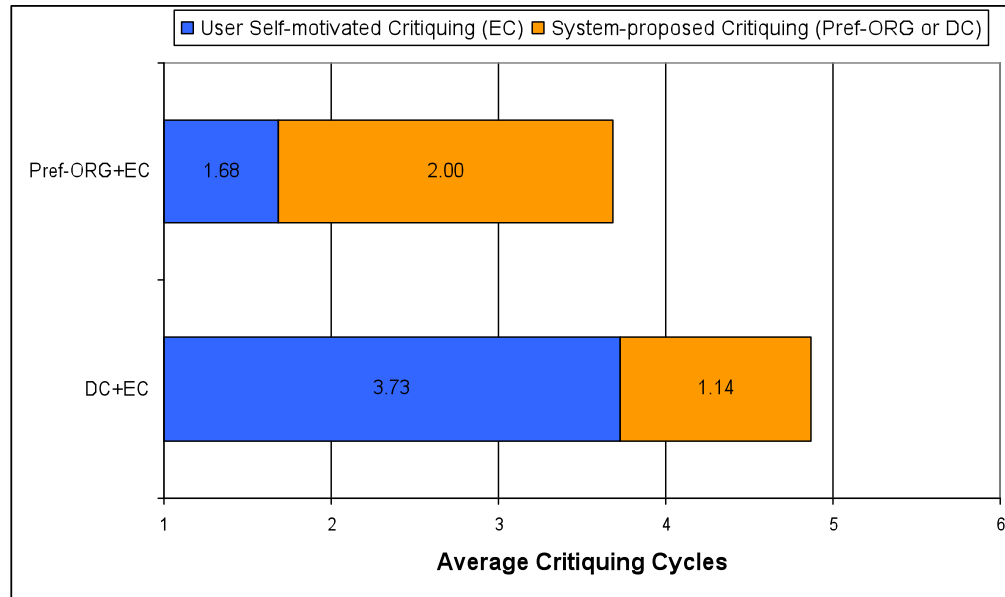
would you like to improve some values by yourself?

	What you have chosen	Improve	Take any suggestion
Manufacturer	<input checked="" type="radio"/> Toshiba	<input type="radio"/> Acer	<input type="radio"/>
Price	<input type="radio"/> \$ 2649 (USD)	<input checked="" type="radio"/> < \$ 2649 (USD) <input type="radio"/> < \$ 2649 (USD) <input type="radio"/> <= \$ 2500 (USD) <input checked="" type="radio"/> <= \$ 2000 (USD) <input type="radio"/> <= \$ 1500 (USD)	<input type="radio"/>
Operating System	<input checked="" type="radio"/> Microsoft Windows XP Tablet PC	<input type="radio"/> P Pro	<input type="radio"/>
Battery Life	<input checked="" type="radio"/> 4.34 hours	<input type="radio"/>	<input type="radio"/>
Display Size	<input checked="" type="radio"/> 12.1 in	<input type="radio"/> > 12.1 in	<input type="radio"/>
Hard Drive Capacity	<input checked="" type="radio"/> 80 GB	<input type="radio"/> >= 80 GB	<input type="radio"/>
Installed Memory	<input checked="" type="radio"/> 1500 MB	Not Available	<input type="radio"/>
Processor Class	<input checked="" type="radio"/> Intel Pentium M Processor (Centrino)	<input type="radio"/> Intel Mobile Celeron Processor	<input type="radio"/>
Processor Speed	<input checked="" type="radio"/> 2 GHz	<input type="radio"/> >= 2 GHz	<input type="radio"/>
Weight	<input checked="" type="radio"/> 2.07 kg	<input type="radio"/> < 2.07 kg	<input type="radio"/>

[Show Results](#) [Reset](#)

If suggested critiques and products do not interest the user in the organization interface, she could switch to make the self-initiated critiquing by clicking the button

Participants: 44; between-group experiment procedure



➔ The integration of the preference-based recommendation organization in hybrid critiquing can effectively help **increase the suggested critiques' application frequency** and significantly contribute **to saving users' task time and interaction effort**

Outline

- What is critiquing-based recommender system and Why?
- Development history
- User experiences
- Conclusion

What can be concluded?

- Design guidelines
 - Li Chen and Pearl Pu. Interaction Design Guidelines on Critiquing-based Recommender Systems. *User Modeling and User-Adapted Interaction Journal (UMUAI)*, vol. 19 (3), pages 167-206, 2009.
 - Li Chen and Pearl Pu. Critiquing-based Recommenders: Survey and Emerging Trends. *User Modeling and User-Adapted Interaction Journal (UMUAI)*, vol. 22(1), pages 125-150, 2012.
- User-centric evaluation framework for RS
 - Pearl Pu, Li Chen and Rong Hu. A User-Centric Evaluation Framework for Recommender Systems. In *Proceedings of the 5th ACM Conference on Recommender Systems (RecSys'11)*, pages 157-164, Chicago, IL, USA, October 23-27, 2011.

Critiquing in MovieLens (Vig et al., IUI'11)

The screenshot shows the MovieLens website for the movie *Toy Story 3* (2010). The page includes movie information, a community tag section, and a "Movie Tuner" section. The "Movie Tuner" section is highlighted with a red circle and contains a slider interface for adjusting preferences for various movie qualities. Below the slider is a list of similar movies, with the first one, *Shawshank Redemption, The* (1994), selected. The "What I want" section has a "lock" button next to the "children" slider.

Movie Information (edit info) (flag)

Starring: Tom Hanks, Tim Allen, Joan Cusack, Ned Beatty, Don Rickles, Michael Keaton, Wallace Shawn, John Ratzenberger, Estelle Harris, John Morris, Jodi Benson, Emily Hahn, Laurie Metcalf, Blake Clark, Teddy Newton, Bud Luckey, Beatrice Miller, Javier Fernandez Pena, Timothy Dalton, Lori Alan, Charlie Bright, Kristen Schaal, Jeff Garlin, Bonnie Hunt, John Cygan, Jeff Pidgeon, Whoopi Goldberg, Jack Angel, R. Lee Erney, Jan Rabson, Richard Kind, Erik von Detten

Directed By: Lee Unkrich

Genres: Adventure, Animation, Children, Comedy, Fantasy, IMAX

Languages: English Spanish

Average rating: ★★★★★ (4.22 stars)

Your Prediction: ★★★ (2.5 stars)

Rated by: 263 users

Links: [IMDb](#), [Rotten Tomatoes](#)

Movie Tags (more about tags)
Add and edit tags here or [update all of your tags](#)

Community Tags (2) Tags represent how MovieLens users feel about this movie

Trash

My tags for this movie (2)

What I like about movie	I'm neutral about	What I dislike about movie
<input type="text"/>	<input type="text"/>	<input type="text"/>
Edit	Edit	Edit

Movie Tuner (2) **New!**
Find similar movies with less or more of particular qualities. The movie list below will update as you indicate your preferences.

What I want

This movie	less	ok	more
animation	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
pixar	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
adventure	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
children	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
bittersweet	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Enter selection...	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[reset all](#)

Similar to Toy Story 3, but less children:

- [Shawshank Redemption, The](#) (1994)
- [Lord of the Rings: The Return of the King, The](#) (2003)
- [Curious Case of Benjamin Button, The](#) (2008)
- [Raiders of the Lost Ark \(Indiana Jones and the Raiders of the Lost Ark\)](#) (1981)
- [Cinema Paradiso \(Nuovo cinema Paradiso\)](#) (1989)
- [Stand by Me](#) (1986)

(Click to flag movies that do not belong)


MovieLens Q&A
There are no posts that mention Toy Story 3 (2010)

[Ask a question about Toy Story 3 \(2010\)](#)

[About MovieLens](#) | [Published Research](#) | [Privacy Policy](#) | [Acceptable Use](#) | [Contact Us](#)

Editorial Picked Critiques (Pu *et al.*, RecSys'09)

Miracle So Magicl by Lancome for Women 3.4 oz Eau de Parfum Spray



LANCOME
Miracle So Magicl by Lancome for Women 3.4 oz Eau de Parfum Spray 100ml

Price : Around **\$47.98**

Features:
Quantity: 100 ml
Category: Eau de Parfum
Gender: Women
Bestselling rate: 9.5
Average user rate: 0
Source: Amazon


Add to shopping list ▶

A fresh, floral and vibrant fragrance. A daring association of fresh clover leaf with flowery heart notes of wild rose and narcissus, to create a truly vibrant fragrance.

User Rating: ☆☆☆☆☆ / 0
Uninteresting ○ ○ ○ ○ ○ I love it (Rate)


You may also like...

More popular and cheaper (1/1)




[Kai Perfume Kai Perfume Oil](#)
\$ 45
An intoxicating blend of tropical gardenia and white exotic flowers. Preciously packed in a roll-on vial,...

Same brand and cheaper (1/6)




[Attraction by Lancome for Women 1.7 oz Eau de Parfum Spray](#)
\$ 34.99
It begins with light, the inexplicable flash between a man and a woman. A look. A touch. A passionate emb...

Just as popular, but cheaper (1/6)




[Green Tea Scent by Elizabeth Arden for Women 1.7 oz Eau Perfumes Natural Spray](#)
\$ 13.99
Evoke feelings of pure serenity. Clean and refreshing, with peaceful notes of Green Tea accord...

Same price range, just as popular (1/6)



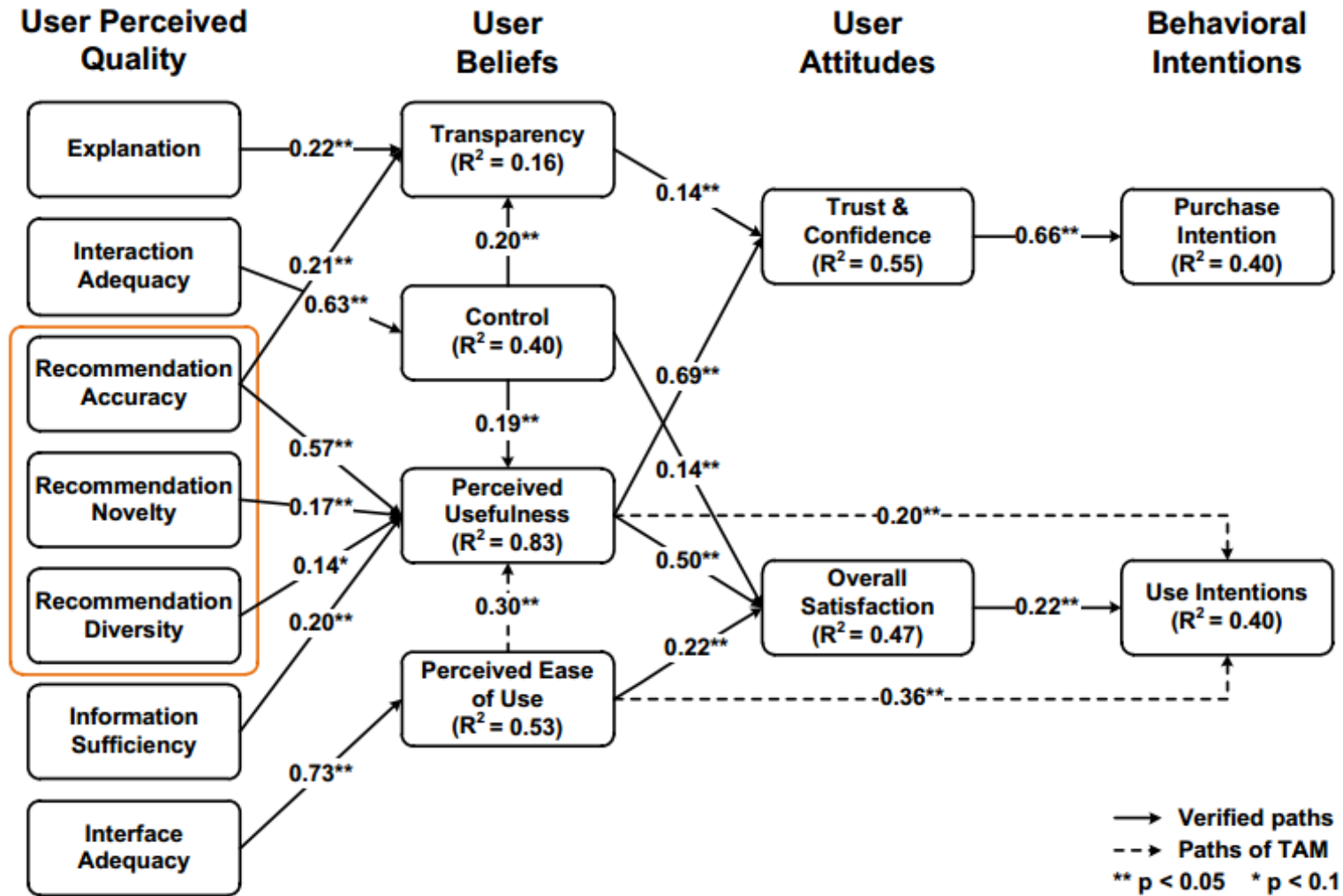
[Kai Perfume Kai Perfume Oil](#)
\$ 45
An intoxicating blend of tropical gardenia and white exotic flowers. Preciously packed in a roll-on vial,...

People who like this may also like (1/6)



[Versace Signature by Gianni Versace for Women 3.4 oz Eau de Parfum Spray](#)
\$ 47.99
NULL...

ResQue: Recommender systems' Quality of user experience



32 questions and 15 constructs

1. Recommendation Accuracy

The items recommended to me matched my interests.

2. Recommendation Novelty

The items recommended to me are novel.

The recommender system helped me discover new products.

3. Recommendation Diversity

The items recommended to me are diverse.

4. Interface Adequacy

The labels of the recommender interface are clear.

The labels of the recommender interface are adequate.

The layout of the recommender interface is attractive.

The layout of the recommender interface is adequate.

5. Explanation

The recommender explains why the products are recommended to me.

6. Information Sufficiency

The information provided for the recommended items is sufficient for me to make a purchase/download decision.

7. Interaction Adequacy

The recommender allows me to tell what I like/dislike.

I found it easy to tell the system what I like/dislike.

I found it easy to inform the system if I dislike/like the recommended item.

8. Perceived Ease of Use

I became familiar with the recommender system very quickly.

I easily found the recommended items.

9. Control

I feel in control of modifying my taste profile.

The recommender allows me to modify my taste profile.

I found it easy to modify my taste profile in the recommender.

10. Transparency

I understood why the items were recommended to me.

11. Perceived Usefulness

The recommender helped me find the ideal item.

Using the recommender to find what I like is easy.

The recommender gave me good suggestions.

12. Overall Satisfaction

Overall, I am satisfied with the recommender.

13. Confidence & Trust

I am convinced of the items recommended to me.

I am confident I will like the items recommended to me.

The recommender made me more confident about my selection/decision.

The recommender can be trusted.

14. Use Intentions

I will use this recommender again.

I will use this recommender frequently.

I will tell my friends about this recommender.

15. Purchase Intention

I would buy the items recommended, given the opportunity.

End of my talk

- Thanks!
- Q&A



- Call For Papers
 - 2014 5th International Workshop on Social Recommender System (in WWW'14) (<http://users.soe.ucsc.edu/~jwang30/srs2014/>)
 - 2014 ACM Conference on Recommender System (<http://recsys.acm.org/recsys14/>)