A Framework for Personalization:

When do you want to go *Where Everybody Knows Your Name* (and mailing address, and preferences, and last 50 web pages visited)?

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Delos-NSF Workshop: June 18-20, 2001
A Working Definition

- Outcome(t) = f(Action(t), PersonalHistory(t-n))

Examples,
- Relevance feedback
- Content-based filtering
- Collaborative filtering
- Caching, history lists, auto completion, MRU
- Implicit queries, Rememberance Agent, Watson, Kenjin
- MyYahoo!, MyAOL, MyMSN, MyLibrary, etc.
- AltaVista’s MySearch, iLOR
  ...

June 18, 2001  Delos-NSF Workshop
A Demonstration:
What do you see?
Many Kinds of Individual Differences

- Task – “info need”
  - Short-term, relevance feedback
  - Long-term, content-based filtering

- Preferences, e.g., CF

- Expertise, domain and application

- Cognitive aptitudes
  - Verbal, spatial, reasoning skills, etc.

- Demographics
  - Age, major, gender, location, etc.

- Cognitive styles, personality and affect
Individual Differences Are ...

- Large
- Systematic

Systems can often be modified to accommodate
  - E.g., robust systems
  - E.g., personalization
How Big Are Individual Diffs?

- E.g., Web searching (Chen & Dumais, CHI 2000)
  - 74 participants; Intermediate web/search experience
  - 30 search tasks (e.g., Home page for "Seattle Weekly")
  - Average RT (seconds) = 52.3 seconds

- Individual subjects’ average RT:
Characterizing Indiv Diffs

- Histogram

- Max:Min
  \[144, 22 = 6.5:1\]

- Q3:Q1
  \[66, 36 = 1.8:1\]

- SD/X
  \[.42\]
### Example Individual Differences

<table>
<thead>
<tr>
<th>Task</th>
<th>Max/Min</th>
<th>Q3/Q1</th>
<th>SD/X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grocery Cashiers</td>
<td>2:1</td>
<td>1.5:1</td>
<td></td>
</tr>
<tr>
<td>Text Editing</td>
<td>5:1</td>
<td>2:1</td>
<td>0.4</td>
</tr>
<tr>
<td>Information Retrieval</td>
<td>8:1</td>
<td>2.5:1</td>
<td>0.6</td>
</tr>
<tr>
<td>Computer Programming</td>
<td>20:1</td>
<td>3:1</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Individual Diffs Correlated w/ Performance in HCI/IR Tasks

- Experience – both application and domain
- Reasoning (Egan et al.; Card et al.; Greene et al.)
- Spatial abilities (Egan & Gomez; Vicente et al.; Stanney & Salvendy; Allen)
- Academic major (Borgman)
- Verbal fluency (Dumais & Schmitt)
- Reading comprehension (Greene et al.)
- Vocabulary (Vicente et al.)
- Age (Egan et al.; Greene et al.; Konvalina et al.)
- Personality and affect
- Gender
Framework for Identifying and Accommodating Indiv Diffs

- **Assay** – which user characteristics predict differences in performance; many studies stop here

- **Isolate** – isolate the source of variation to a specific sub-task or design component

- **Accommodate** – do something about it
  - Often harder than you think ...
    - E.g., Spatial ability and hierarchy navigation
    - E.g., Expertise
  - Evaluate!!!
Task: Find all employees who either work in the toy department or are managed by Grant, and also come from the city London.

SQL — fixed syntax, logical operators, parentheses
- E.g.,
  ```sql
  SELECT Name
  FROM Employee
  WHERE (Department = Toy OR Manager = Grant) AND City = London
  ```

TEBI — just need attribute names and values; recognize alternatives from system-generated table
- E.g., Name, Department = Toy, Manager = Grant, City = London
Greene et al. (Assay)

- Assessed individual characteristics:
  - Age, spatial memory, reasoning, integrative processing, reading comprehension & vocabulary

- Found large effects of:
  - Integrative processing (on accuracy, for SQL interface)
  - Age (on time, for SQL interface)
Figure 2. This modified partial residual plot shows percent correct as a function of integrative processing skill (a measure of reasoning ability), for two language conditions (TEBI Concrete and SQL Generation). The lines represent the predicted score holding the other individual difference variables at their means. The points represent individual subjects' scores minus the contribution of the other individual difference variables. The slopes of the lines indicate the importance of integrative processing to prediction of performance in the two language conditions. The difference between the points and the line is an indication of goodness of fit. Δ, TEBI; □, SQL.
Greene et al. (Isolate)

- Examined two possible sources of difficulties
  - Interpreting the query
  - Specifying the query in a formal notation or query language
# Example TEBI Table

<table>
<thead>
<tr>
<th>Employee Name</th>
<th>Department</th>
<th>Manager</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jones</td>
<td>Toy</td>
<td>Grant</td>
<td>London</td>
</tr>
<tr>
<td>Allan</td>
<td>Toy</td>
<td>Grant</td>
<td>Athens</td>
</tr>
<tr>
<td>Doe</td>
<td>Toy</td>
<td>Buford</td>
<td>London</td>
</tr>
<tr>
<td>Smith</td>
<td>Toy</td>
<td>Buford</td>
<td>Athens</td>
</tr>
<tr>
<td>Price</td>
<td>Cosmetics</td>
<td>Grant</td>
<td>London</td>
</tr>
<tr>
<td>Hall</td>
<td>Cosmetics</td>
<td>Grant</td>
<td>Athens</td>
</tr>
<tr>
<td>Kelso</td>
<td>Cosmetics</td>
<td>Buford</td>
<td>London</td>
</tr>
<tr>
<td>Lee</td>
<td>Cosmetics</td>
<td>Buford</td>
<td>Athens</td>
</tr>
</tbody>
</table>
Figure 2. This modified partial residual plot shows percent correct as a function of integrative processing skill (a measure of reasoning ability), for two language conditions (TEBI Concrete and SQL Generation). The lines represent the predicted score holding the other individual difference variables at their means. The points represent individual subjects' scores minus the contribution of the other individual difference variables. The slopes of the lines indicate the importance of integrative processing to prediction of performance in the two language conditions. The difference between the points and the line is an indication of goodness of fit. Δ, TEBI; □, SQL.
Greene et al. (Accommodate)

- SQL – hard, especially for some users
- TEBI – new query specification language
  - Improved performance overall
  - Reduced many dependencies on reasoning skills and age
  - “Robust interface”
How to Accommodate?

- Robust interfaces: A new design improves the performance for all
  - E.g., Greene et al.’s TEBI interface
  - E.g., Dumais & Schmitt’s LikeThese interface

- Training:

- Personalization: Different interfaces/systems for different people
  - Group level - E.g., Grundy prototypes, I3R stereotypes, Expert/Novice
  - Individual level
  - Task (Info Need) level
Personalization Framework

- Characteristics for personalization
  - Expertise, Task, Preferences, Cog Aptitudes, Demographics, Cog Styles, Etc.

- Assay: How specified/modelled?
  - Implicit, Explicit, Interaction
  - Stability over time?
    - Long-term, short-term

- Accommodate: What to do about it?
  - Many ways of accommodating
  - Evaluation
    - Benefits of correct assessment and accommodation
    - Costs of mis-assessment
Content-Based Filtering

Match new content to standing info need

- Assay:
  - Explicit or Implicit profile specification?
    - Ongoing feedback?
  - How rapidly does profile it change?

- Accommodate:
  - Match profile against stream of new docs
    - Reduce number of docs to view
    - Return more relevant docs

- Benefits/Costs
ASI Examples

- Collaborative Filtering
- Implicit/Background Query
- Lumiere
- Temporal Query Patterns
Example: **MSRweb Recommender**<br>
<Breese, Heckerman, Kadie, UAI’98>

- Collaborative filtering algorithms
  - Bayesian network
  - Correlation+
  - Vector similarity
  - Bayesian clustering
  - Popularity

- Test collections
  - Each Movie
  - Nielsen
  - Microsoft.com

- Predicted
  - Individual scores
  - Ranked score
Example: **MSRweb Recommender**

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**Adaptive Systems & Interaction**

**Overview**

The Adaptive Systems & Interaction group (ASI) pursues research on automated reasoning, adaptation, and human-computer interaction. Interests of the group include principles and applications of decision making and learning, computation in the face of complexity, techniques for information management and search, and the development and evaluation of innovative designs for visualization and interaction.

Research goals include both the pursuit of basic science and the development of computing and communications applications that demonstrate new functionalities and flexibility. ASI is at the center of user modeling at Microsoft Research, focused on inferring the goals and needs of users from multiple sources of information about activity and interests.

The group is also home to research on information retrieval and management, including work in automated text classification and clustering. The ASI team continually attempts to identify new means for enriching the user experience through advances in automated reasoning and user interface design.

**Areas of focus:**

User Modeling and Intelligent User Interfaces. We pursue methods for enhancing human-
Example: **Background Query**

<Dumais et al., Horvitz et al.>

- Identify content at user’s focus of attention
- Formulate query, provide related information as part of normal work flow
- Background, implicit queries

Consider doc structure, basic scroll, dwell patterns
Data Mountain with Implicit Query results (highlighted pages to left of selected page)
Implicit Query Results

- Filing strategies

<table>
<thead>
<tr>
<th>IQ Condition</th>
<th>Filing Strategy</th>
<th>Semantic</th>
<th>Alphabet</th>
<th>No Org</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ0: No IQ</td>
<td></td>
<td>11</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>IQ1: Co-occur based</td>
<td></td>
<td>8</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>IQ2: Content-based</td>
<td></td>
<td>10</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

- Number of categories

<table>
<thead>
<tr>
<th>IQ Condition</th>
<th>Average Number of Categories (std error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ0: No IQ</td>
<td>10.0 (3.6)</td>
</tr>
<tr>
<td>IQ1: Co-occur based</td>
<td>15.8 (5.8)</td>
</tr>
<tr>
<td>IQ2: Content-based</td>
<td>13.6 (5.9)</td>
</tr>
</tbody>
</table>
Implicit Query Results

Web Page Retrieval Time

Average RT (seconds)

Implicit Query Condition

June 18, 2001
Delos-NSF Workshop
Implicit Query Results (Delayed Retrieval, 6 months)

- 17 subjects (9 IQ1, 8 IQ1&2)

![Bar chart showing RT Immediate vs Delayed]

RT Immediate vs Delayed

<table>
<thead>
<tr>
<th>RT (secs)</th>
<th>IQ0</th>
<th>IQ1&amp;2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Implicit Query Results

(Delayed Retrieval, 6 months)
Example: Lumiere

<Horvitz, et al.>

- Inferring user's goals under uncertainty

Pr(Goals, Needs)

- User query
- User activity
- User profile
- Data structures
Example: **Lumiere**

*Inference from words and actions*

- User’s query

- Sensed actions
Example: *Lumiere*

<Eve Event System>
Example: Web Queries

user = A1D6F19DB06BD694  date = 970916  excite log

150052  lion
152004  lions
152036  lions lion
152219  lion facts
153848  lions roaring
160232  africa lion
160642  lions, tigers, leopards and cheetahs
161042  lions, tigers, leopards and cheetahs cats
161144  wild cats of africa
161414  africa cat
161602  africa lions
161308  africa wild cats
161840  lion

161858  lion lions
163041  lion facts
163919  picher of lions
164040  lion picher
165002  lion pictures
165100  pictures of lions
165211  pictures of big cats
165311  lion photos
170013  video in lion
172131  pictureof a lioness
172207  picture of a lioness
172241  lion pictures
172334  lion pictures cat
172443  lions
172450  lions
Top 10 matches. [24867 hits. About Your Results]

66% Roaring Fork High School
URL: http://www.carbondale.com/schools/rfhs/index.htm
Summary: "A school is a place to be educated about the importance of an education . . . ". In a small Colorado town lies a small Colorado high school. Wait A Second, Where Am I ?!?!!. Roaring Fork Newsletter - Last updated ?????. Students of the month - Last updated January 19, 1996.
More Like This: Click here to perform a search for documents like this one.

64% Visit Morrison's Cove Home Retirement Living
URL: http://www.mchome.org/mchvisit.htm
Summary: At the Traffic Light in Martinsburg turn right onto Market Street (Route 866). At the Traffic Light in Martinsburg turn right onto Market Street (Route 866).
More Like This: Click here to perform a search for documents like this one.

64% ROARING - Ring Of Australian RoleplayING
 Queries are not independent

Consider:
- Search goals (e.g., current events, weather)
- Refinement actions (e.g., specialize, new)
- Temporal dynamics

Bayes net to predict next action, or next search goal

Hand-tagged sample of Excite log
Temporal dynamics results

![Diagram showing temporal dynamics results with different classes and time intervals.]
Real-World Examples

- Implicit storage of history of interaction
  - Caching
  - History
  - Auto Completion
  - Dynamic Menus

- Explicit storage
  - Favorites
  - MySearch, iLOR

- Recommendations

MyBlah ...
When do you want to go “where everybody knows your name” (and mailing address, and preferences, and last 50 web pages visited)?: A framework for personalization

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Abstract

Over the years, I have been involved in developing several information personalization prototypes (e.g., content-based filtering, collaborative filtering, implicit queries and visualization). Sometimes personalization works pretty well, and other times it never catches on or participation falls off after an initial spurt of interest. I think it is instructive to reflect on an even wider range of personalization efforts to begin to develop a framework (or at least articulate a set of considerations) for better understanding and developing personalized digital library services.

As a working definition, I consider a personalized system to be one that responds differently to two people who issue the same proximal request, depending on their previous history of interaction with the system. Examples of such systems include content-based and collaborative filtering as well as caching, history lists, dynamic menus, automatic completion, customized content selection, and implicit queries. These systems vary in many respects – e.g., the characteristics that are used for personalization (e.g., keywords, information context) and how personalization is specified.
Ballantine Books; ISBN: 0345400690; Dimensions (in inches): 0.83 x 6.87 x 4.20

Other Editions: Audio Cassette

Amazon.com Sales Rank: 57,009

Average Customer Rating: ★★★★★ Based on 8 reviews. Write a review.
Rate this item to get personal recommendations.

Customers who bought this book also bought:

- The Million-Dollar Tattoo (Thomas Black Series, No 9) by Earl W. Emerson
- The Vanishing Smile by Earl W. Emerson
- Poverty Bay by Earl W. Emerson
- Catfish Cafe by Earl W. Emerson

Editorial Reviews
From Kirkus Reviews
What dire secret could make Lainie Smith, Seattle's well- heeled answer to Mother Teresa, vulnerable to blackmail? Whatever it is, it's something she's been paying $2,000 a week to keep quiet--and something she doesn't want to share with her lawyer, Kathy Birchfield, or Kathy's husband, private eye Thomas Black (The Million-Dollar Tattoo, 1996, etc.). Thomas doesn't insist on knowing Lainie's secret, but as he gets deeper into the case--trailing the two men who pick up the latest two grand, searching the lair he's tracked one of them to, dispensing his trademark similes (one craven suspect has "an alibi prepared like a frozen dinner in the freezer")--he can hardly help finding out what it is. And it's dynamite, something it's no wonder Lainie didn't want him to know. Seventeen years ago she was present with recently executed Charlie Groth when four Stockton machine shop workers were killed. Writing, I don't know. Writing? Lainie had more important things to do...
Most popular matches for "earl emerson"

- **The Dead Horse Paint Company** -- by Earl W. Emerson; Mass Market Paperback
  - **Our Price: $5.39** -- Or [buy used] from $1.35
- **Undercurrents** -- by Ridley Pearson; Mass Market Paperback
  - **Our Price: $6.29** -- Or [buy used] from $4.40
- **First Avenue** -- by Lowen Clausen; Mass Market Paperback
  - **Our Price: $6.29** -- Or [buy used] from $1.50

All 38 matches for "earl emerson"
Personalization Success

- Effectively Assay and Accommodate:
  - Easy to specify relevant information
    - Explicitly: profile changes slowly
    - Implicitly: capture automatically, esp short time
  - We know what to do about it
    - Algorithmic and application levels
    - And, the user can see the benefit
    - And, there are few big failures
Personalization Opportunities

- Geo-coding
- Query history
- Query plus usage context
- Keeping found things found
Open Issues

- Evaluation ... difficult for personalized systems
  - Components, easier
  - End-to-end applications, harder
    - Questionnaires
    - Pre-Post assessment
    - Algorithmic issues in situ
- Privacy, security ...
The End …