



# Evaluations of BioPortal System

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Paul J. Hu

Accounting and Information Systems

David Eccles School of Business

University of Utah

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# Motivations

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- Investigate probable effects of the technology and the user's domain knowledge on task performance
- Gain preliminary understandings of the probable advantages and effectiveness of BioPortal system in terms analysis accuracy and efficiency, perceived system's usefulness, perceived system's ease of use, and user satisfaction
- Assess the usability of BioPortal
- System impacts

# Hypotheses

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- H1: Technology has a significant (main) effect on the **accuracy** of a person's task analysis.
- H1A: The analysis **accuracy** resulting from the use of BioPortal is **significantly greater** than that associated with a spreadsheet program.
- H1B: The increase in analysis accuracy resulting from the use of BioPortal compared with the benchmark spreadsheet program is positively associated with **task complexity**.
- H2: Technology has a significant effect on **the amount of time a person needs to complete an analysis task**.
- H2A: The amount of time a person needs to complete an analysis task is **significantly less** when he or she is supported by BioPortal than by a spreadsheet program.

# Hypotheses

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- H3: Technology has a significant effect on **user information satisfaction**.
- H3A: The user information satisfaction associated with the use of BioPortal is **significantly higher** than that observed with a spreadsheet program.
- H4: Technology has a significant effect on **end-user satisfaction**.
- H4A: The end-user satisfaction associated with the use of BioPortal is **significantly higher** than that observed with a spreadsheet program.

# Hypotheses

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- H5: Technology has a significant effect on **system usability** as perceived by individual users.
- H5A: Users are likely to consider BioPortal **more usable** than a spreadsheet program and assign higher usability scores for their overall reactions to the system, screen layout and sequence, terminology and system information, system learnability, and system capabilities.
- H6: Technology has a significant effect on **perceived usefulness**.
- H6A: The usefulness of BioPortal, as perceived by those using it, is **significantly higher** than that of a spreadsheet program.
- H7: Technology has a significant effect on **perceived ease of use**.
- H7A: The ease of use of BioPortal, as perceived by those using it, is **significantly higher** than that of a spreadsheet program.



# Research Design

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- Conducted a controlled experiment: a randomized two between-groups design
- A total of 33 subjects: 17 graduate business students and 16 graduate public health students
- Included a spreadsheet-based system for evaluation benchmark
- With the assistance of several domain experts (public health researchers and professionals), we created 6 scenarios common in public health and designed a total of 11 analysis tasks, ranging from a simple frequency count to a complex trend identification or pattern characterization

# Experimental Design

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		Technology	
		BioPortal	Benchmark Technology
Domain Knowledge	High	9 Subjects	7 Subjects
	Low	8 Subjects	9 Subjects

# Analysis Tasks - Examples

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- Scenario: Examine the correlation between Botulism and gender.
  - Task: In California, for year 2001, did more men or more women suffer from Botulism? (complexity = low)
  - Task: In California, for year 2002, did more men or more women suffer from Botulism? (complexity = low)
- Scenario: Determine the location of the most intensive outbreak of WNV during 1999 in New York.
  - Task: During 1999, which county in the New York State had the most occurrences of West Nile Virus (i.e., highest number of cases), and when? (complexity = medium)

# Analysis Tasks - Examples

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- Scenario: Determine correlations between the incidence of WNV and dead bird occurrences and mosquito pool counts.
  - Task: Using the technology assigned (BioPortal system or the spreadsheets) and the West Nile Virus disease data, can you determine whether there is a correlation between the dead bird occurrence and mosquito pool counts in 2002? (complexity = high)
  - Task: (Continued with Task 10) If so, what correlation do you observe? (complexity = high)

# Measurements

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- We examined **analysis accuracy** using a quasi “gold-standard” solutions generated by domain experts; we measured analysis accuracy using a 10-point scale on which 1 = completely incorrect and 10 = completely correct
- We used existing instruments to measure **user information satisfaction** (Ives et al. 1983) and **end-user satisfaction** (Doll and Torkzadeh 1988)
- We adopted QUIS instrument (Chin et al. 1988) to assess **system usability** – (1) the user’s overall reactions to a system, (2) assessment of the screen layout and sequence, (3) terminology and system information, (4) system learnability, and (5) system capabilities
- We used question items from Davis 1989) to measure **perceived usefulness** and **perceived ease of use**

# Statistics and Construct Reliability

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Construct	BioPortal			Spreadsheet Program		
	Mean	S.D.	Alpha	Mean	S.D.	Alpha
User information satisfaction (10 items)	2.34	1.02	0.94	3.67	1.23	0.88
End-user satisfaction (9 items)	2.76	1.10	0.92	3.52	1.16	0.84
Perceived usefulness (7 items)	2.13	1.06	0.92	3.47	1.88	0.97
Perceived ease of use (7 items)	2.31	1.06	0.90	3.24	0.88	0.71
System usability						
- Overall reactions to systems (6 items)	3.54	1.19	0.86	5.55	1.84	0.90
- Screen layout and sequence of system (4 items)	3.50	1.69	0.77	3.64	1.53	0.80
- Terminology and system information (5 items)	2.80	1.40	0.88	3.62	1.67	0.83
- Learning to use the system (6 items)	3.27	1.51	0.91	4.22	1.51	0.78
- Capabilities of the system (5 items)	3.10	1.42	0.80	4.28	1.49	0.68

# Evaluation Results

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## Analysis Accuracy

Source	DF	Type III SS	Mean Square	F-Value	P-Value
Background	1	1165.4298	1165.4298	3.12	0.09
<b>Technology</b>	1	3173.1221	3173.1221	8.51	<b>0.01</b>
Background x Technology	1	28.5427	28.5427	0.08	0.78

## Task Complete Rate

Source	DF	Type III SS	Mean Square	F-Value	P-Value
Background	1	4.5426	4.5426	3.06	0.09
<b>Technology</b>	1	33.6924	33.6924	22.73	<b>0.00</b>
Background x Technology	1	4.5426	4.5426	3.06	0.09

# Evaluation Results

## Time Requirements for Task Completion

Source	DF	Type III SS	Mean Square	F-Value	P-Value
Background	1	673239.589	673239.589	2.43	0.13
<b>Technology</b>	1	4395727.04	4395727.039	15.84	<b>0.00</b>
Background x Technology	1	344002.342	344002.342	1.24	0.27

## End-User Satisfaction

Source	DF	Type III SS	Mean Square	F-Value	P-Value
Domain knowledge	1	1.57	1.57	1.42	0.24
Technology	1	4.33	4.33	3.92	0.06
<b>Domain knowledge x Technology</b>	1	6.48	6.48	5.86	<b>0.02</b>

## User Information Satisfaction

Source	DF	Type I SS	Mean Square	F-Value	P-Value
Domain knowledge	1	1.34	1.34	1.15	0.29
<b>Technology</b>	1	14.00	14.00	12.01	<b>0.00</b>
<b>Domain knowledge x Technology</b>	1	5.08	5.08	4.36	<b>0.05</b>

# Evaluation Results

## Perceived Usefulness

Source	DF	Type III SS	Mean Square	F-Value	P-Value
Background	1	3.4398	3.4398	1.61	0.22
<b>Technology</b>	1	13.7857	13.7857	6.45	<b>0.02</b>
Background x Technology	1	6.5916	6.5916	3.09	0.09

## Perceived Ease of Use

Source	DF	Type III SS	Mean Square	F-Value	P-Value
Background	1	0.0704	0.0704	0.07	0.79
<b>Technology</b>	1	7.0611	7.0611	7.01	<b>0.01</b>
Background x Technology	1	0.4382	0.4382	0.44	0.51



# Evaluation Plan for 2006 - 2008

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- Field and lab-based experimental investigations that involve public health professionals and real-world analysis tasks/scenarios
- Cognitive processing and load as well as problem solving strategies associated with the use of BioPortal
- Visualization evaluations; e.g., by user group or task
- Impacts analysis at individual or community level
- Suggestions??