

Online Appendix - Usability and Usefulness Evaluation

Methods:

We performed usability sessions with a sample of five epidemiologists from Utah's State and local health departments and five informatics program managers from the fields of epidemiology, psychology and public health. The participants were given a 10-15 minute introduction to the software, after which, they were allowed and encouraged to interact with the software, explore various time periods, control settings and tools available in the display. Following this session, the participants were asked to complete a survey about their experience. We developed our survey based on the Unified Theory of Acceptance and Use of Technology (UTAUT). [Venkatesh] The UTAUT model employs validated scales to measure three direct determinants of intention to use (performance expectancy, effort expectancy and social influence) and two direct determinants of usage behavior (use intent, facilitating conditions), as well as scales to measure anxiety and attitude towards using technology. UTUAT scales were adapted to capture the concept of an epidemiologist's utilization of EpiCanvas to perform public health surveillance. The survey consisted of 44 individual questions: 16 assessing general usability of the software and it's various features, and 28 questions assessing performance expectancy, effort expectancy, facilitating conditions, attitude toward using technology and anxiety associated with its use. The social influence determinant was not evaluated.

Results:

General software usability questions:

Table 1 shows the results of our 16 Yes/No survey questions addressing the general usability of the EpiCanvas software prototype.

#	Question	Respondent category										Total # of Responses	# Responding No	% Responding Yes
		Epidemiologist (MPH)	Epidemiologist (MPH)	Epidemiologist (MPH)	Epidemiologist (MPH)	Epidemiologist (MPH)	Informaticist (MPH/CPH)	Informaticist (MPH)	Informaticist (PhD)	Informaticist (MPH)	Informaticist			
1	Did the software run smoothly?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	8	0	100
2	Was the layout of the interface intuitive?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	8	0	100
3	Were you able to adjust the date range?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	8	0	100
4	Were the GIS map layer options intuitive?	Y	Y	Y	*	Y	Y	Y	Y	Y	*	7	0	100
5	Did you use the <i>Correlation lines options</i> on the left to control the lines?	Y	Y	Y	Y	Y	Y	N	N	Y	Y	6	2	75
6	Did you adjust the strength at which correlation lines appeared?	Y	Y	Y	Y	Y	Y	N	N	Y	N	6	2	75
7	Did the options under <i>Selected Cases</i> make sense?	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	7	1	88
8	Did you select (click) multiple tags ?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	8	0	100
9	Were the recent trends (bar graph to the right) for the selected tags helpful?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	8	0	100
10	Was the display of the number of cases associated with tags helpful?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	8	0	100
11	Was the dynamic rescaling of tags based on highlight and selection useful?	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	8	0	100
12	Was the choropleth map shading (coloring) intuitive?	Y	Y	Y	*	Y	Y	Y	Y	Y	*	7	0	100
13	Was the <i>Active Tag</i> panel useful?	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	8	0	100
14	Were the <i>Tag Groups</i> options helpful?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	8	0	100
15	Were the <i>Selected Tags</i> options helpful?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	8	0	100
16	Were the <i>Related Cases</i> line list & graph useful?	Y	Y	Y	Y	Y	Y	Y	-	Y	Y	7	0	100

* GIS Map service was not operational during these sessions

Table 1. Results of the survey questions addressing the general usability of the EpiCanvas software prototype.

Table 2. Comments from usability questions.

Question	Comments
Did the software run smoothly?	<i>"Until I used too many filters." "Did freeze once."</i>
Was the layout of the interface intuitive?	<i>"For the most part, I think the options section takes up too much real-estate for something that is not used often, may have the option show and hide when not needed."</i>
Were you able to adjust the date range?	<i>"A little confusing that you have to pick the last day in the 7 or 4 week range, maybe a start date – end date would make more sense."</i>
Were the GIS map layer options intuitive?	<i>None</i>
Did you use the <i>Correlation lines</i> options on the left to control the lines?	<i>"This is a nice function." "Worked as expected, might be easier to read if correlation lines grew with the tag as it's hard to tell where the lines are when the tags expand."</i>
Did you adjust the strength at which correlation lines appeared?	<i>"Unsure what the strength is, correlation."</i>
Did the options under <i>Selected Cases</i> make sense?	<i>"However I didn't know what the information represented." "I wasn't sure what "Show Selected Cases" did." "I can't understand the difference between all and any." "After training, not inherently."</i>
Did you select (click) multiple tags?	<i>"It froze after too many tags were selected." "Yes, that worked well."</i>
Were the recent trends (bar graph to the right) for the selected tags helpful?	<i>"Somewhat, the bar graph is hard to use and read."</i>
Was the display of the number of cases associated with tags helpful?	<i>"I really liked this feature." "Yes, although the tags would often be cut off on the right side, I'm only using a standard monitor so everything is tight."</i>
Was the dynamic rescaling of tags based on highlight and selection useful?	<i>"I recommend the tags associated with city names be displayed differently from symptom names perhaps with the map somehow." "Kind of, it is a little confusing because it's hard to tell which tags have the highest correlation; it looks like all the tags shrink to the same size. When I click on abdominal pain for 8/10/2007, infants shrinks to a smaller size than Preschool, even though preschool has no associated cases."</i>
Was the choropleth map shading (coloring) intuitive?	
Was the <i>Active Tag</i> panel useful?	<i>"is it just another way to select a tag? I can't turn off a specific tag, I guess it would be useful to select a tag that is hard to click on in the cloud, but that should be fixed in the cloud instead of using a workaround – also when I select some unrelated tags it grays out all the tags and I can't click on anything in the cloud and have to de-select the tags under selected tags."</i>
Were the <i>Tag Groups</i> options helpful?	<i>"Very useful to simplify EpiCanvas." "Yes, helps clean up the interface."</i>
Were the <i>Selected Tags</i> options helpful?	<i>"Needed to de-select tags when you can't see them in the cloud, helpful to see."</i>
Were the <i>Related Cases</i> line list & graph useful?	<i>"Yes, although hard to read in the limited space."</i>

Acceptance and Use of Technology results:

Table 2. Results of the Likert scale survey addressing Acceptance and Use. Items formatted with **red text** are negatively phrased.

	LIKERT SCALE (1 = SRONGLY DISAGREE, 5 = STRONGLY AGREE)	Respondent category										Mode	Median	# Agree or Strongly Agree	% Agree	% Agree or Strongly Agree	% Disagree or Strongly Disagree	Category
		Epidemiologist (MPH)	Epidemiologist (MPH)	Epidemiologist (MPH)	Epidemiologist (MPH)	Epidemiologist (MPH)	Informaticist (MPH/CPH)	Informaticist (MPH)	Informaticist (PhD)	Informaticist (MPH)	Informaticist							
17	Using tool like EpiCanvas is a bad idea.	1	1	1	1	1	1	2	1	2	1	1	1	0	0	0	100	Attitude
18	EpiCanvas could make my work more interesting.	5	5	5	5	4	5	4	5	4	5	5	5	10	100	70	0	Attitude
19	I liked working with EpiCanvas.	5	5	5	5	5	4	5	5	4	5	5	5	10	100	80	0	Attitude
20	I found the layout of the EpiCanvas user interface confusing.	2	2	3	2	2	2	2	4	2	2	2	2	1	10	0	80	Anxiety
21	My interaction with EpiCanvas was clear and understandable.	4	4	4	4	4	4	5	4	4	5	4	4	10	100	20	0	Effort expectancy
22	It would be easy for me to become skillful at using EpiCanvas.	5	4	4	5	5	5	4	5	4	5	5	5	10	100	60	0	Effort expectancy
23	Learning to operate EpiCanvas was easy for me.	4	4	4	4	5	4	4	5	4	5	4	4	10	100	30	0	Effort expectancy
24	The data types being displayed and their provenance were clear to me.	5	4	4	4	4	4	4	4	4	5	4	4	10	100	20	0	Other
25	The number of tags displayed is overwhelming, making the display useless.	2	2	2	2	2	3	1	4	2	1	2	2	1	10	0	80	Other
26	I have the knowledge of infectious diseases necessary to use EpiCanvas.	4	5	4	3	5	5	5	3	4	5	5	4.5	8	80	50	0	Facilitating conditions
27	The EpiCanvas approach is compatible with the other systems I use.	4	4	4	4	5	3	4	5	3	4	4	4	8	80	20	0	Facilitating conditions
28	The data required to use EpiCanvas is available in existing systems.	4	5	2	4	5	4	5	5	3	4	4	4	8	80	40	10	Facilitating conditions
29	I would find EpiCanvas useful for performing disease outbreak surveillance.	5	5	5	5	4	5	5	4	5	4	5	5	10	100	70	0	Performance expectancy

Usability/Usefulness evaluation:

Performance expectancy: 100% of respondents agreed that they would find EpiCanvas 1) useful for performing disease outbreak surveillance and 2) investigating outbreaks of specific infectious diseases in certain groups, such as infants, or in specific cities. A lesser majority agreed that EpiCanvas would enable them to accomplish surveillance tasks more quickly (90%) and allow them to spend less time on routine surveillance activities (80%).

Effort expectancy: 100% of respondents agreed that 1) they understand how EpiCanvas could be applied to public health surveillance, 2) their interaction with EpiCanvas was clear and understandable, 3) learning to operate EpiCanvas was easy for them and 4) that it would be easy for them to become skillful at using EpiCanvas. 60% strongly agreed with the latter statement.

Facilitating conditions: 80% of respondents agreed that 1) they have the knowledge of infectious disease necessary to use EpiCanvas, 2) the EpiCanvas approach is compatible with the other systems they use and 3) that the data required to use EpiCanvas is available in existing systems. 100% agreed that they would expect EpiCanvas to make it easier to collaborate with other epidemiologists in their own and other public health agencies.

Anxiety: 100% of respondents DID NOT agree that 1) they felt apprehensive about using EpiCanvas and 2) that EpiCanvas is somewhat intimidating to them. A lesser majority DID NOT agree that 1) they were worried they might draw incorrect conclusions by using EpiCanvas (90%), 2) that the number of tags is overwhelming, making the display useless (80%), and 3) found the layout of the EpiCanvas user interface confusing (80%).

Attitude toward using technology: 100% of respondents agreed that 1) EpiCanvas could make my work more interesting and 2) they liked working with EpiCanvas. 100% DID NOT agree that using EpiCanvas was a bad idea.

Specific features: 100% of respondents agreed that 1) they found the interaction with the tag cloud, including highlighting and selecting of various tags, was intuitive and 2) the ability to query the data by dynamically selecting and unselecting tags would be useful. A lesser majority agreed that they found the correlation lines helpful for understanding the relationships between items (90%) and 2) they found the dynamically updated map useful (88%).

Reference:

Venkatesh V, Morris MG, Davis FD. User Acceptance of Information Technology: Toward a Unified View. MIS Quarterly. 2003 Sep;27(3):425–78