

## Social Navigation in Real World



“...without knowing much, we joined the longest existing queue formed for a sushi restaurant. looking at faces of people (both young and old) filled with expectations despite the long wait in the cold weather, we were sure that the food would be worth every minute of waiting time. well, it was”. (A comment on Flickr image, used in Rosta Farzan’s Thesis)

## Social Navigation in Real Life

What would you do...?

- Walking by the cinema you feel like watching a movie, but none of the movies seems familiar
- You missed a lecture and want to do your readings. You have a textbook and 100 assigned pages to read, but do not know what was most important in the lecture and what can be skipped
- You are hiking along a trail to a famous waterfall. You reached an unmarked road split and you have no map

## Social Navigation

- Natural tendency of people to follow each other
  - Making use of “direct” and “indirect cues about the activities of others
  - Following trails
    - Footsteps in sand or snow
    - Worn-out carpet
  - Using dogears and annotations
  - Giving direction or guidance
- Navigation that is conceptually understood as driven by the actions from one or more advice provider



## Social Navigation vs. General Navigation

Walking down a path in forest  
Walking down a road in a city

Reading a sign at the airport to find the baggage claim

Talking to a person at the airport help desk to find the baggage claim

## The Lost Interaction History

What is the difference between walking in a real world and browsing the Web?

- Footprints
- Worn-out carpet
- People presence

What is the difference between buying and borrowing a book?

- Notes in the margins
- Highlights & underlines
- Dog-eared pages
- Opens more easily to more used places

## Social Navigation in Information Space

### Synchronous

Communication in real time

### Asynchronous

Using the Interaction of past users

### Direct

Direct communication between people

### Indirect

Relying on user presence and traces of user behavior

### Synchronous

### Asynchronous

### Direct

Chats

Forums

### Indirect

Presence of other people

History-enriched environments

## Direct Asynchronous SN

Asynchronous discussion forums

Recommending information to friends and community

Directly asking questions for getting information

Sharing bookmarks with others

# Umtella: Direct Asynchronous SN

The screenshot shows the Umtella website interface. At the top, there is a navigation bar with links like 'Welcome', 'Select Community', 'Search', 'Create Community', 'Share Link', 'Share File', 'Discussion', and 'Community'. Below this, there is a search section with a 'Keyword' field, a 'Global Search' checkbox, and 'Start Time' and 'End Time' dropdown menus. The main content area displays a list of search results for 'The Social Web at Pitt'. Each result includes a resource name, the user who shared it, earned ratings, view times, reviews, and favorite status. A table summarizes these results.

Resource	Shared by	Earned Ratings	View Times	Reviews	Favorite?	Info
PHD Comics: Facebook	Hoyt	3	6	1	+	<a href="#">Detail</a> <a href="#">Remark</a>
Web 2.0 ... The Machine is Us/ing Us	John Harkins	3	6	1	+	<a href="#">Detail</a> <a href="#">Remark</a>
Chris Anderson discusses the long tail	Savinell	2	2	1	+	<a href="#">Detail</a> <a href="#">Remark</a>
Social Navigation	Hoyt	2	8	1	+	<a href="#">Detail</a> <a href="#">Remark</a>
Social Networking in Plain English	John Harkins	2	3	1	+	<a href="#">Detail</a> <a href="#">Remark</a>
Top Ten Second Life Tutorial Videos	Hoyt	2	3	1	+	<a href="#">Detail</a> <a href="#">Remark</a>
Teach Yourself Programming in Ten Years	Rosta	1	1	1	+	<a href="#">Detail</a> <a href="#">Remark</a>
Mashup on digg	Rosta	1	1	1	+	<a href="#">Detail</a> <a href="#">Remark</a>
100 Funnest Web 2.0 Words to Say (YouTube)	Peter	1	5		+	<a href="#">Detail</a> <a href="#">Remark</a>
Flickr: A Social Web Browser	Matthew Wood	1	5	1	+	<a href="#">Detail</a> <a href="#">Remark</a>
Page Rank Checker	Savinell	1	7		+	<a href="#">Detail</a> <a href="#">Remark</a>

# EDUCO: Synchronous, Indirect SN

The screenshot shows a Netscape browser window displaying the EDUCO website. The main content area features a paper titled "Course Sequencing for Static Courses? Applying ITS Techniques in Large-Scale Web-based Education" by Peter Brusilovskiy. The paper is from Carnegie Technology Education and HCI Institute, Carnegie Mellon University. The abstract discusses the application of intelligent tutoring systems (ITS) to course sequencing in large-scale web-based education. The page also includes a "1 Introduction" section and a "Comments" sidebar.

**Course Sequencing for Static Courses? Applying ITS Techniques in Large-Scale Web-based Education**  
 Peter Brusilovskiy  
 Carnegie Technology Education and HCI Institute, Carnegie Mellon University  
 4615 Forbes Avenue, Pittsburgh, PA 15215, USA  
 pbr@cs.cmu.edu

**Abstract.** We argue that traditional sequencing technology developed in the field of intelligent tutoring systems could find an immediate place in large-scale Web-based education as a core technology for concept-based course maintenance. This paper describes a concept-based course maintenance system that we have developed for Carnegie Technology Education. The system can check the consistency and quality of a course at any moment of its life and also assist course developers in some routine operations. The core of this system is a refined approach to indexing the course material and a set of "scripts" for performing different operations.

**1 Introduction**

Course sequencing is one of the oldest technology in the field of intelligent tutoring systems (ITS). The idea of course sequencing is to generate an individualized course for each student by dynamically selecting the most optimal teaching operation (presentation, example, question, or problem) at any moment of education. An ITS writes course sequencing represents knowledge about the subject as a network of concepts where each concept represents a small piece of subject knowledge. The learning material is stored in a database of teaching operations. Each teaching operation is indexed by concepts it deals with. The driving force behind any sequencing mechanism is a student model that is a weighted overlay of the domain model - for every domain model concept it reflects the current level of student knowledge about it. Using this model and some teaching strategy a sequencing engine can decide which one of the many teaching operations stored in the data base is the best for the student given his or her level of knowledge and educational goal.

Various approaches to sequencing were explored in numerous ITS projects. The majority of existing ITS can sequence only one kind of teaching operations. For example, a number of sequencing systems including the oldest sequencing systems [2, 14] and some others [8, 12, 15] can only manipulate the

## CoMeT: Indirect, Asynchronous

**CoMeT Collaborative Management of Talks**  
Bookmark Talks, Share with Friends, and We Recommend More!

Welcome peterB [Log out](#)

ALL  Search [Advanced Search](#) [Post New Talk](#)

Home **Calendar** Series Groups My Account

« Day **Week** Month »

Week 4 of March: March 18 - 24, 2012

**Monday, Mar 19**

- 1** bookmark **Crowd-Powered Systems** [Bookmark](#)  
By: **Michael Bernstein**, Computer Science and Artificial Intelligence Lab, Massachusetts Institute of Technology on: 10:00 AM - 11:00 AM  
Location: 6115 Gates and Hillman Centers  
Pushed to groups: [Human-Computer Interaction](#) [Social Web](#)  
Bookmarked by: [ghraya](#)
- 23** views **Common Sense, Uncommon Practice: A Socio-Structural View of Resistance to Interorganizational Collaboration** [Bookmark](#)  
By: **Stanley E. Fawcett**, Air Force Institute of Technology on: 10:30 AM - 12:00 PM  
Location: 115 Mervin Hall, Katz Graduate School of Business  
Series: [Supply Chain Management Seminar Series](#) [Subscribe](#)
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By: **Michael Farb**, Research Programmer, CyLab on: 12:00 PM - 1:00 PM  
Location: Distributed Education Center 1201 Lobby Level Collaborative Innovation Center  
Series: [CyLab Seminars](#) [Subscribe](#)
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Location: Hamburg Hall 1502
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By: **Aabid Shariff**, Joint Carnegie Mellon University, University of Pittsburgh Ph.D. Program, in Computational Biology on: 1:30 PM - 2:30 PM  
Location: Reddy Conference Room 4405 Gates and Hillman Centers
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By: **Robert L. Constable**, Professor, Department of Computer Science, Cornell University on: 2:00 PM - 3:00 PM  
Location: 3305 Newell-Simon Hall  
Series: [Computational Modeling and Analysis for Complex Systems Seminar \(CMACS\)](#) [Subscribe](#)

March 2012  
S M T W T F S S  
26 27 28 29 30 31 W1  
4 5 6 7 8 9 10 W2  
11 12 13 14 15 16 17 W3  
18 19 20 21 22 23 24 W4  
25 26 27 28 29 30 31 W5  
1-5 6-10 11-20 21+

Feed  
[RSS](#) [iCal](#) [KAL](#) [+](#)

## SN in Information Space: The History

### History-enriched environments

- Edit Wear and Read Wear (1992)
- Social navigation systems
  - Footprints, Juggler, Kalas

### Collaborative filtering

- Manual push and pull
  - Tapestry, LN Recommender
- Modern automatic CF recommender systems

### Social bookmarking

- Collaborative tagging systems

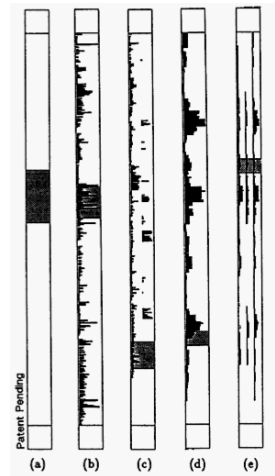
### Social Search

## Edit Wear and Read Wear (1992)

The pioneer idea of asynchronous indirect social navigation

Developed for collaborating writing and editing

Indicated read/edited places in a large document



## The Pioneers: *Footprints*

Wexelblat & Maes, 1997

Allowing users to create history-rich objects

Providing History-rich navigation in complex information space

Contextualizing Web pages

- Maps
- Path view
- Annotations
- Signposts

## Footprints: Maps

Showing the traffic through a website

Nodes

Documents

Links

Transition between them

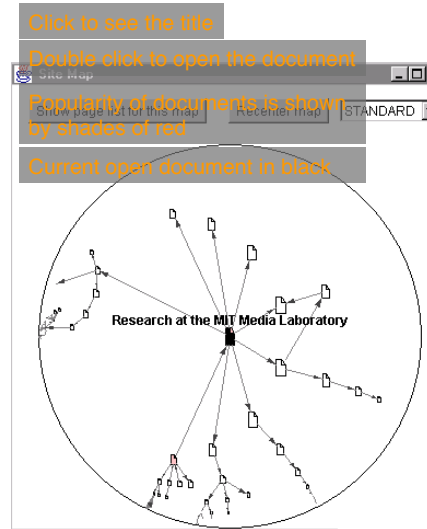
Tracking transition from all possible sources

Selecting a link

Typing a URL

Selecting a bookmark

Externalization of users' mental model



## Footprints: Annotations

Showing what percentage of users have followed each link

Link-centric social navigation approach

### Research Groups

- [Aesthetics and Computation](#) (8%)
- [Affective Computing](#)
- [Electronic Publishing](#)
- [Epistemology and Learning](#)
- [Explanation Architecture](#)
- [Gesture & Narrative Language](#)
- [Interactive Cinema](#)
- [Machine Listening](#)
- [Machine Understanding](#) (8%)
- [Micromedia](#)
- [Object-Based Media](#)
- [Opera of the Future](#)
- [Personal Information Architecture](#)
- [Physics and Media](#)
- [Sociable Media](#)
- [Software Agents](#)

Document: Done



## *Footprints: Signposts*

### Allowing users to enter feedback

- On pages

- On paths

  - “go this way for software agents; go that way for artificial life”

### Viewing comments left by other users

How we can classify this social navigation?

## *The Pioneers: Juggler*

Dieberger, 1998

Textual virtual environment (MOO)

History-enriched environment

- Showing access-counter for rooms

Recognizing URLs in the output of a communication tool

- Hiding it from user

- Popping out the page

- Integrating with social navigation

Supporting interaction between teachers and students

## Ideas for Social Navigation on WWW

### Awareness of presence of other users

- Discussion of an article
- Location attracting large crowds of users

### Relevant objects

- Links visited by similar users
- Items appreciated by similar users

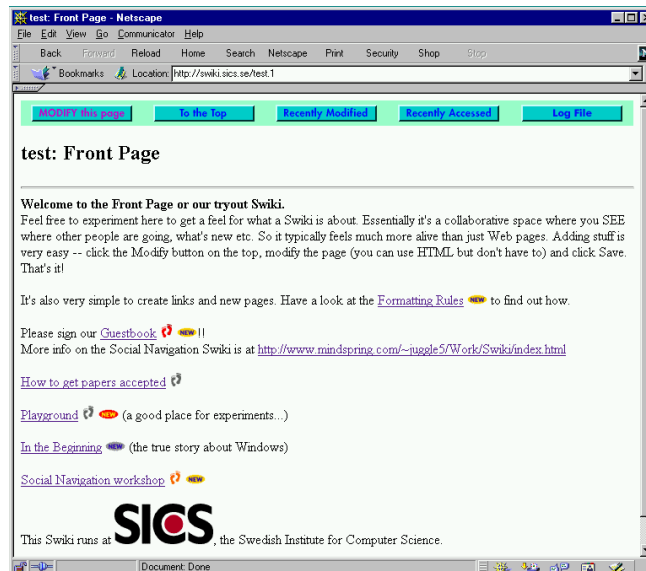
### Recency

- How long ago the page was created/visited

### Attitude

- What other users did/thought about an item

## Example: CoWeb



## Advancing SN: Beyond Click

Clicks are not reliable signs of interest!  
What other kinds of user activities can be tracked?

- Annotation
- Bookmarking
- Sending e-mail
- Solving a problem
- Downloading
- Purchasing
- Rating and liking

## Advancing SN: One Size Fits All?

Which users' actions are taken into account for social navigation?

- All users
- Coherent, like-minded group of users

Group-level social navigation

- KnowledgeSea II, Progressor – a class
- CourseAgent – users with similar goals
- CoFIND
- Facebook – social network
- Amazon - context

# Facebook: Propagation of Likes



# Amazon: Context-based SN

**Atlantis - The Lost Empire (2001)**  
 Starring: Michael J. Fox, Jim Varney Director: Gary T. Shore  
 Kirk Wise Rating: (R) Format: DVD  
 ★★★★★ (347 customer reviews)  
 List Price: \$19.99  
 Price: \$17.49 & eligible for FREE Super Saver Shipping on orders over \$25. Details  
 You Save: \$2.50 (13%)  
**In Stock.** Ships from and sold by Amazon.com. Gift-wrap available.  
 Want it delivered Thursday, January 14? Order it in the next 48 minutes, and choose One-Day Shipping at checkout.  
 \$1 new from \$9.92 \$5 used from \$2.74 collectible from \$14.99  
 Also Available In: List Price: Our Price: Other Offers:  
 VHS Disc 116 used & new from \$4.99

**Frequently Bought Together**  
 Customers buy this DVD with **Treasure Planet** DVD ~ Joseph Gordon-Levitt  
**Price For Both: \$30.98**  
 Add both to Cart Add both to Wish List  
 Show availability and shipping details

**What Do Customers Ultimately Buy After Viewing This Item?**

- 89% buy the item featured on this page: Atlantis - The Lost Empire ★★★★★ (347) \$17.49
- 4% buy Treasure Planet ★★★★★ (169) \$13.49
- 3% buy Up (Single Disc Widescreen) ★★★★★ (485) \$14.99
- 2% buy Mulan (Special Edition) ★★★★★ (493) \$14.99

**Customers Who Shopped for Atlantis - The Lost Empire Also Shopped For**

- Brother Bear (3-Disc Special Edition)**  
 DVD Joseph Gordon-Levitt  
 Price: \$20.00 \$18.49 ★★★★★ (230)  
 Used & new from \$2.98 [Add to Cart](#)
- Home on the Range**  
 DVD G.W. Bailey  
 Price: \$16.00 \$16.49 ★★★★★ (85)  
 Used & new from \$2.26 [Add to Cart](#)
- Tarzan (Special Edition)**  
 DVD Tony Goldwyn  
 Price: \$20.00 \$13.49 ★★★★★ (336)  
 Used & new from \$9.95 [Add to Cart](#)

•Compare with an Amazon review: “the remake of this movie is horrible, I recommend to watch the original version instead”

## Knowledge Sea II

Assisting students finding educational resources on the web

### Social Navigation

- Traffic based
  - Using intensity of colors to present footprints of other students
    - Distinguishing the most and the least visited pages
- Annotation based
  - Using visual cues to present students' annotation activity
    - magnitude of group annotation activity
    - presence of learners annotation
    - magnitude of individual annotation activity

## Knowledge Sea: Map

operator, loop, expression	operator, loop, expression	operator, expression, value	data, type, variable	data, type, variable	variable, data, type	variable, function, declaration	function, variable, declaration
L11	L14	L14	L8	L8	L8	L8	L8
loop, operator, statement	operator, expression, loop	language, operator, type	data, type, variable	data, variable, type	variable, declaration, function	function, variable, declaration	function, variable, declaration
L12 L15	L16	L16	L18	L18	L18	L18	L18 L23
loop, statement, operator	statement, loop, operator	language, statement, problem	language, problem, work	language, data, problem	memory, variable, structure	memory, function, pointer	function, memory, pointer
L12 L15	L16	L16	L18	L18	L18	L18	L18
statement, compiler, loop	language, statement, compiler	language, problem, run	language, problem, scanf	memory, scanf, language	memory, pointer, structure	pointer, memory, function	pointer, memory, function
L12 L15	L16	L16	L18	L18	L18	L18	L18
file, compiler, include	compiler, file, language	language, compiler, run	language, scanf, problem	scanf, language, memory	memory, pointer, scanf	pointer, memory, array	pointer, memory, array
L12 L15	L16	L16	L18	L18	L18	L18	L18
file, compiler, include	file, compiler, run	language, printf, scanf	scanf, string, printf	scanf, string, character	pointer, memory, string	pointer, memory, array	pointer, array, memory
L12 L15	L16	L16	L18	L18	L18	L18	L18
file, source, include	file, output, function	file, output, printf	string, character, printf	string, character, scanf	string, character, scanf	array, pointer, string	array, pointer, memory
L12 L15	L16	L16	L18	L18	L18	L18	L18
file, output, source	file, output, input	file, string, output	string, character, printf	string, character, printf	string, character, array	array, string, pointer	array, pointer, string
L12 L15	L16	L16	L18	L18	L18	L18	L17 L22

# Knowledge Sea: Cells & Pages

### Subsections

- [History of C](#)
- [Characteristics of C](#)
- [C Program Structure](#)
- [Variables](#)
  - [Defining Global Variables](#)
  - [Printing Out and Inputting Variables](#)
- [Constants](#)
- [Arithmetic Operations](#)
- [Comparison Operators](#)
- [Logical Operators](#)
- [Order of Precedence](#)
- [Exercises](#)

# Social Navigation in Progressor

The screenshot shows the Progressor application window. The main area is a circular navigation map with segments for different topics. A legend at the bottom left indicates that red segments are 'Pending' and green segments are 'Completed'. On the right side, there are several progress charts and a list of 'Top Progress (3)' and 'Rest Open (17)' items. The interface also includes a menu bar (File, Edit, View, History, Bookmarks, Window, Help) and a search bar at the top.

# CourseAgent

Adaptive community based course recommendation system

- Provides personalized access to course information
- Provides social recommendation about courses

Recommendation in the form of in-context adaptive annotation

Visual cues

- Expected course workload
- Expected relevance to students' career goals

Course Schedule

Course Catalog

# Course Schedule

Spring 2006 List

CourseAgent Adaptive Online Course Recommendation System

Schedule of spring 2006

CEN	Course No	Title	Day	Time	Location	Instructor	Workload	Relevance	Action
16092	ENSC12450	PARALLEL	Wed		102 CL	Robert Thompson	11	○ ○ ○ ○	Plan It
16094	ENSC12120	INFORMATION AND COORDING THEORY	Wed	9:00-4:50 P	102 CL	Paul Marco	11	○ ○ ○ ○	Plan It
16077	ENSC12130	DECISION ANALYSIS AND DECISION SUPPORT SYSTEMS	Wed	9:00-4:50	411 15	Marek Czumak	11	○ ○ ○ ○	Plan It
16098	IS 2104	ETHICS IN THE INFORMATION SOCIETY	Mon	9:00-5:50 P	409 15	Tom Carbo	11	○ ○ ○ ○	Plan It
16099	ENSC12200	HUMAN FACTORS IN SYSTEMS	Fri	9:00-5:50 P	411 15	Michael Lewis	11	○ ○ ○ ○	Register It
16096	ENSC12430	INTERACTIVE SYSTEM DESIGN	Wed	9:00-4:50 P	409 15	Peter Skalski	11	○ ○ ○ ○	Evaluate It
16079	ENSC12511	INFORMATION SYSTEMS ANALYSIS, DESIGN, AND EVALUATION	Thu	9:00-4:50 P	411 15	Silvio Baz	11	○ ○ ○ ○	Plan It
16011	ENSC12610	DATA STRUCTURES	Fri	9:00-5:50 P	501 15	Roger Firth	11	○ ○ ○ ○	Plan It
16119	ENSC12611	ALGORITHM DESIGN	Thu	9:00-5:50 P	409 15	Hassan Karam	11	○ ○ ○ ○	Plan It
16005	ENSC12720	GEOGRAPHIC	Thu	9:00-4:50 P	409 15	Hassan Karam	11	○ ○ ○ ○	Plan It

Difficulty level of the course: Low, Medium, High

Degree of relevance to students' career goal: Marginally relevant, Relevant, Very Relevant

Planned to take (can be registered)

Already taken (can be evaluated)

Click to see the schedule

# Course Catalog

Control Panel | Schedules | Career Scope | **Course Catalog** | Faculties | Register

---

Rosta's CourseAgent

**Course Catalog**

Please select one of the programs to view the course list:   **Select the program**

(Click on each "AREA" to see the list of related courses)

Taken Courses, 
 Planned Courses, 
 Currently Taken Courses, 
 Recommend by Advisor, 
 Degree of Relevance to Career Goals

**Cognitive Science Area** **Select the area of study**

Course No	Course Title	Workload	Relevance	Action
INFSCI 2300	HUMAN INFORMATION PROCESSING			<a href="#">View Feedback</a>
INFSCI 2330	FOUNDATIONS OF COGNITIVE SCIENCE			<a href="#">Plan It</a>
INFSCI 2350	HUMAN FACTORS IN SYSTEMS			

**-Cognitive Systems Area**

Course No	Course Title	Workload	Relevance	Action
INFSCI 2410	INTRODUCTION TO PARALLEL DISTRIBUTED PROCESSING			<a href="#">Plan It</a>
INFSCI 2420	NATURAL LANGUAGE PROCESSING			<a href="#">Plan It</a>
INFSCI 2440	ARTIFICIAL INTELLIGENCE			<a href="#">Plan It</a>
INFSCI 2450	ARTIFICIAL INTELLIGENCE PROGRAMMING TOOLS			<a href="#">Plan It</a>
INFSCI 2470	INTERACTIVE SYSTEM DESIGN			<a href="#">Leave Feedback</a>

**Plan the recommended course to take**

# Challenges

- Concept drift
- Snowball effects
- Bootstrapping



## Concept Drift

Old history information becomes less relevant

History decay

different for a very popular and a less popular information

Shift of Interest

## Snowball effect

Just one visit before the current visit can turn the page into 'hot'

The page could be useful or useless

Next users follow the same path

Snowball gets bigger and bigger



## Bootstrapping

### Social navigation works with many users

What if there are very few users?

How to match a new user against already populated system?

How to encourage users to leave their trails (commenting, ...)?

How to make the new information visible in already populated system?