

# IM2 HMI - Human-Machine Interaction

## Major achievements

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Denis Lalanne (UniFr)  
IM2 Summer Institute  
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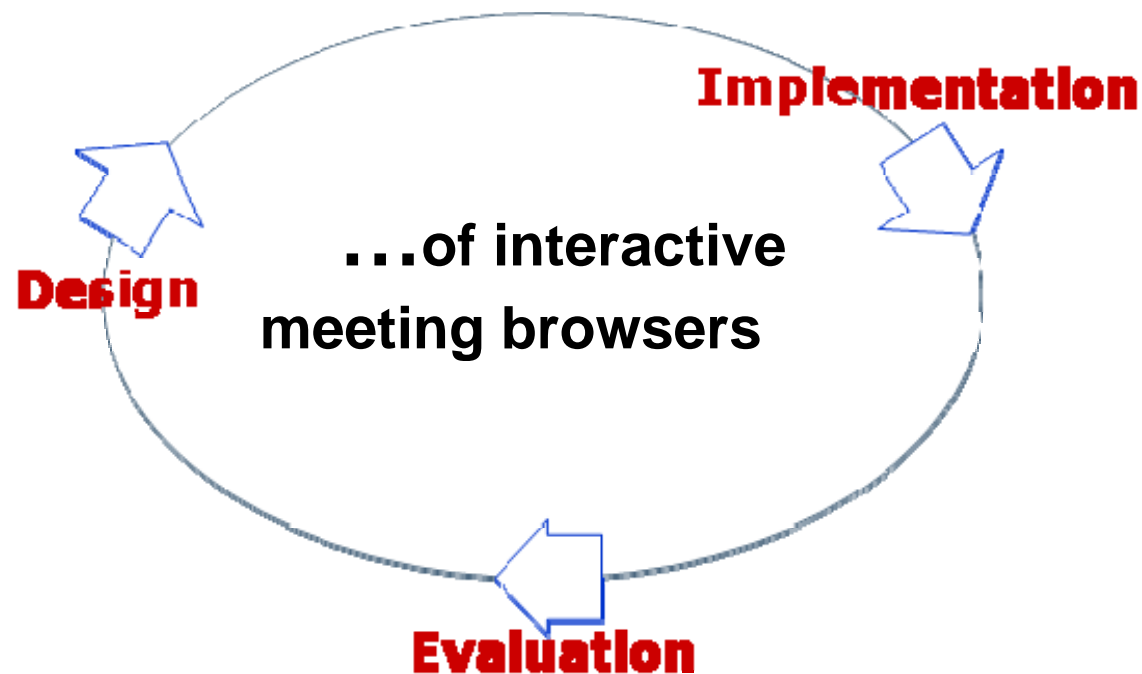
# Partners

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- Current and past Partners:
  - DIVA/UNIFR: Denis Lalanne, Maurizio Rigamonti, Florian Evequoz, Bruno Dumas
  - IDIAP: Andrei Popescu-Belis, Mike Flynn, Alexandre Nanchen, Quoc Anh LE, Majid Yazdani (Pierre Wellner, Alex Jaimes)
  - CGC/EPFL: Martin Rajman, Miroslav Melichar, Marita Ailomaa
  - ISSCO/UniGe: Pierrette Bouillon, Manny Rayner, Nikos Tsourakis, Maria Georgescu, Agnes Lisowska
- Completed PhD (3):
  - Maurizio Rigamonti (UniFr), Miroslav Melichar (EPFL), Agnes Lisowska (UniGe)
- Current PhD (4):
  - Florian Evequoz (UniFr, 3<sup>rd</sup> year), Bruno Dumas (UniFr, 3<sup>rd</sup> year), Majid Yazdani (IDIAP, 1st year), ), Marita Ailomaa (EPFL)

# Goals

- Design novel interactive meeting browsers
- Develop working prototypes, suitable for human testing.
- Evaluate the usability of these interactive prototypes with human subjects



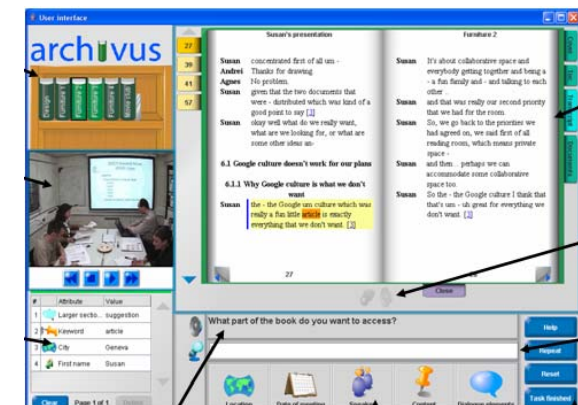
# Requirements elicitation: surveys

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- IM2 Internal: about 300 sample queries to meeting databases
  - October 2002: workshop at UniGe  
<http://www.issco.unige.ch/projects/im2/mdm/queries/list.html>
  - 2002-2003: Lalanne D., Sire, S., *Analysis of end-user requirements. Sample queries*, IM2.AP TR
- Multimodal interaction with meeting: ~ 500 sample queries
  - Lisowska A. *Multimodal Interface Design for the Multimodal Meeting Domain: Preliminary Indications from a Query Analysis Study*. IM2.MDM-11 TR 2003
  - Lisowska A., Popescu-Belis A. and Armstrong, S., “User query analysis for the specification and evaluation of a dialogue processing and retrieval system”, *LREC 2004*
- End-user oriented: 118 users
  - Bertini E. and Lalanne D., *Total Recall Survey*, TR UniFr 2007

# Wizard-of-Oz experiment

- Elicit user requirements by confronting users to a partially implemented meeting browser
  - controlled by two “wizards”
  - users unaware of them
- Recording
  - users: overall + face
  - input/output devices
  - wizards’ actions
- Analysis
  - user performance & errors + modalities used
- Some results
  - strong effect of training on modality preference
  - importance of spoken dialogue both for interacting and for indexing the recordings



Sources: (Lisowska, PhD 2007) and (Melichar, PhD 2008)

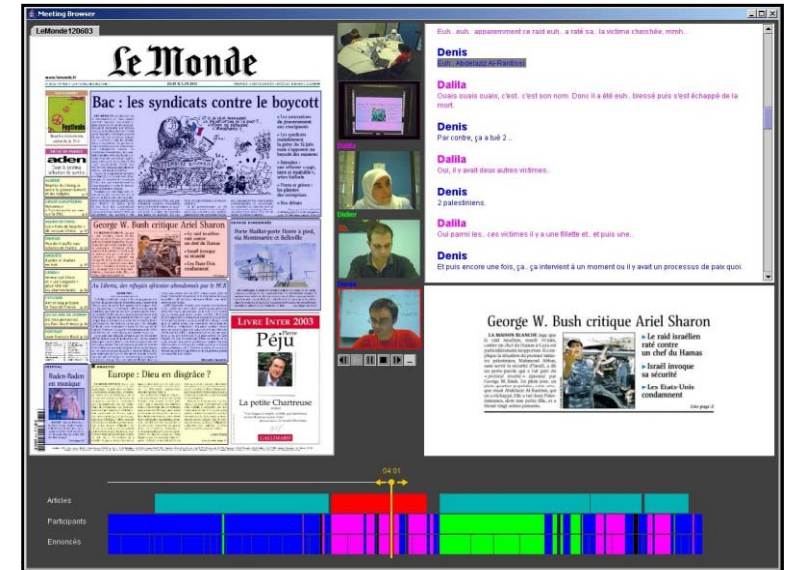
# Meeting browsers and their evaluation

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- Design of meeting browsers in IM2
  - fully automatic access to a database of processed meeting recordings (automatic or manual annotations)
  - voice-based, transcript/ASR-based, document-based, annotation-based, etc.
- Implementation toolkit: JFerret
- The BET: Browser Evaluation Test
  - Benchmark set of true/false “questions” for 3 meetings (AMI/IM2 Corpus)
  - 50-150 questions per meeting, good inter-observer agreement
  - Subjects answer questions using a meeting browser

# Example of tested browser: FriDoc (then JFriDoc in JFerret)

- Document-centric browser
    - document alignments with transcript & video
  - Compared **enabled vs. disabled** document-centric browsing, i.e. **with vs. without links** on documents
    - 8 users tested both options on different meetings
    - had to answer 12 questions each
- ➔ Browsing is more efficient when document alignment to media is available than when it is not



Results	all questions	
	#correct	avg time
without doc links	66%	2'16"
with doc links	76%	1'53"

# Browser evaluation at a glance

Browser	Condition	Nb. of subjects	Time per question (s)	Stdev*	Precision	Stdev*
Audio-based browsers	Speedup	12	99	26*	0.78	0.06*
	Overlap	15	88	23*	0.73	0.08*
JFerret sample	BET set (pilot)	10	100	43	0.68	0.22
	Gisting (5 questions)	5	max. 180	0	0.45	0.34
	Factual (5 questions)	5	max. 180	0	0.76	0.25
Transcript-based browser (TQB)	1 <sup>st</sup> meeting	28	228	129*	0.80	0.09*
	2 <sup>nd</sup> meeting	28	92	16*	0.85	0.06*
	Average on both meetings	28	160	66*	0.82	0.06*
Document-based (FriDoc)	With speech/document links	8	113	n/a	0.76	n/a
	Without links	8	136	n/a	0.66	n/a
Archivus multimodal	T/F questions	80	127	36	0.87	0.12
	Open questions	80	==	==	0.65	0.22

- Average performance (now state of the art):
  - 70-80% precision, 0.5-1.0 questions per minute
- BET confirmed as a good indicator of human + browser performance on the information extraction task

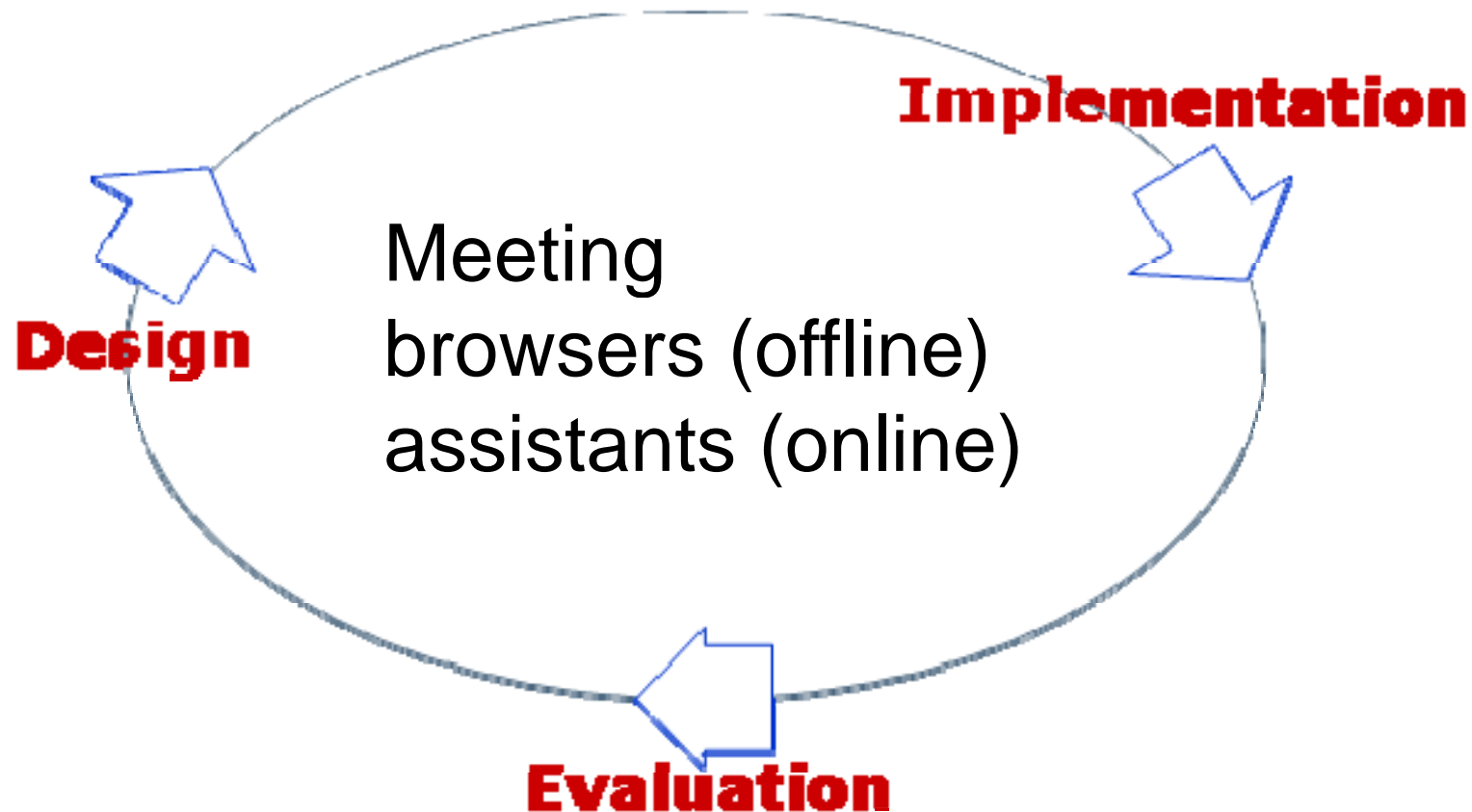


# Synthesis

Stages in software lifecycle	Interviews and questionnaires to focus groups <i>(requirements elicitation)</i>	Wizard-of-Oz studies	Research prototypes of meeting browsers and assistants	End-user products (e.g. commercial)
Achievements	Databases of queries to meeting archives, and sets of other meeting browsing tasks	Archivus	FaericWorld JFerret demo JFriDoc TQB VICoDE Speech-based browsers Idiap	Klewel SMAC
Assessment or evaluation methods	Statistical analysis (to infer user requirements)	Performance measures, behaviour analysis	BET (task-based) and other efficiency/ usability metrics	Customer satisfaction

# Extended objectives

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# Off-line Meeting browsers/assistants

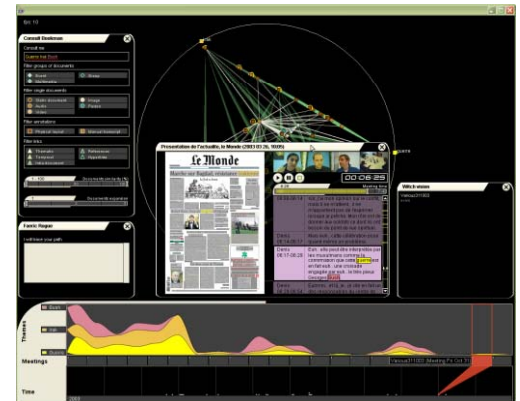
- **Extended JFerret & the Hub**

- To ease development of online meeting browsers and assistants (through the Hub client-server architecture for real-time exchange of annotations)



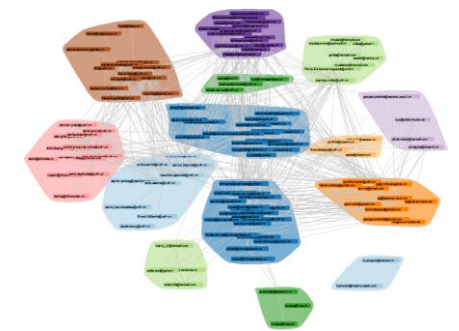
- **Mobile meeting browsing**

- The Multilingual Multi-Modal Application (M3C)



- **Cross-meeting browsing**

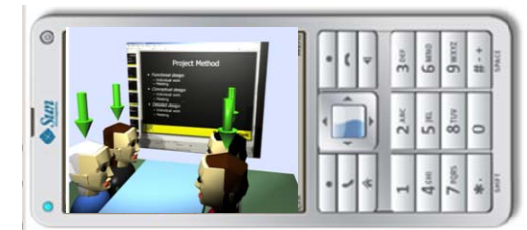
- E.g. FaericWorld
  - Complete end-to-end system (data to users)
  - Full AMI/IM2 + UniFr Corpus (193 meetings)



- **Personal Access to Meetings**

# Online meeting browsers/assistants

- **Online meeting assistants**
  - E.g.:
    - Live content linking between meeting documents and live ASR (through the Hub)
    - Turn taking assistant
    - Live interaction with physical documents
- **Remote & mobile meeting assistants**
  - MMA Mobile meeting assistant (through the Hub)
- **Frameworks**
  - Jferret & Hub, HephaisTK



# User evaluations of meeting assistants & browsers

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- Automatic BET answering
- Field study of Automatic Content Linking Device in two meeting rooms
- Naturalistic study with 12 users of Personal Information Management strategies
- Evaluation of technology impact over stress (120 job interviews recorded in SMR)
- Evaluation of Mobile meeting Assistants (MMA & M3C)
- Evaluation of TableMind with 16 users
- Special session on user evaluation of meeting browsers organized at MLMI 2008
- Synthesis of HMI activities in a journal article

# Wrap up

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- Both user-based vs. technology-based useful to make progress, many connection points
- Dissemination
  - 1 conference chaired (UIST 2008 by P. Wellner)
  - 2 workshops & special session (MLMI 2008)
  - 1 demo session (ICMI-MLMI 2009)
  - 1 book
  - 10 journal articles
  - 60 conference articles (peer reviewed)
- Future
  - Continuation of research activities on online meeting assistants in IM2 phase III (IP1 and IP2)
  - HMI Institute in Fribourg (Human-IST)