Shue Yan University
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Frontiers in Electronic Commerce and Internet Marketing Research

Ting-Peng Liang
National Sun Yat-Sen University
Kaohsiung, Taiwan

Outline

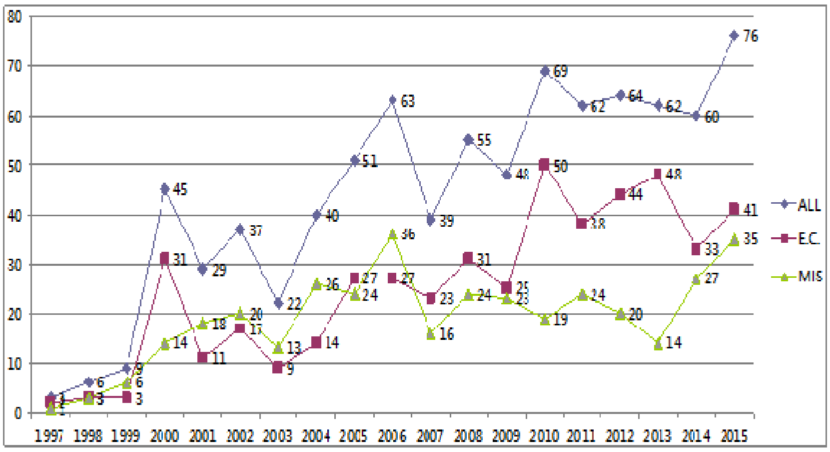
- Profile of e-commerce research
- New research trends
  - Big data analytics
  - Neuroscientific method: EEG and fMRI
- My recent projects
  - Helpfulness of e-WOM
  - Neuro-IS on Personalized services
- Q&A

Profile of E-commerce Research

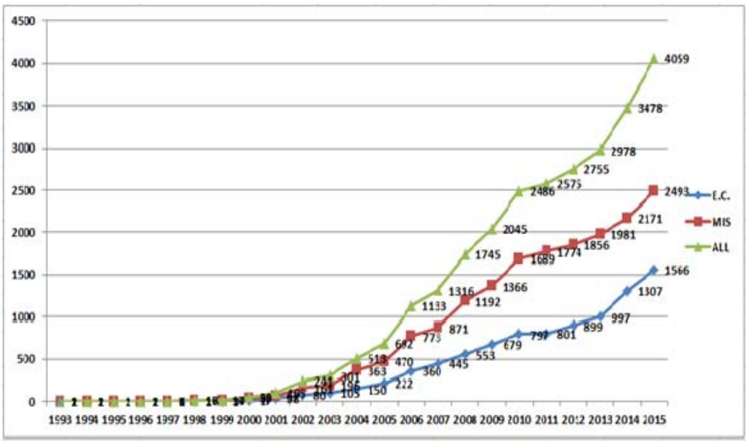
- A bibliometric research forthcoming in Pacific Asia Journal of AIS (Hsu and Chiang, 2017)
- Comparing EC papers published in EC and IS journals
- Bibliometric research: A quantitative tool for analyzing academic literature and showing the profile and trends of a particular research topic.

Journal Type	Journal	No. of publication	Citation No.	5 Year IF
E.C.	International Journal of Electronic Commerce(IJEC)	155	4012	3.091
	DECISION SUPPORT SYSTEMS (DSS)	137	3401	2.933
	ELECTRONIC COMMERCE RESEARCH AND Applications (ECRA)	115	1108	2.34
	JOURNAL OF ELECTRONIC COMMERCE RESEARCH (JOECR)	48	329	1.306
	ELECTRONIC COMMERCE RESEARCH (ECR)	46	248	2.02
MIS	INFORMATION & MANAGEMENT (I.M.)	144	3887	3.10
	JOURNAL MIS (JMIS)	121	2874	3.07
	INFORMATION SYSTEMS RESEARCH (ISR)	95	3618	3.75
	MANAGEMENT SCIENCE (M.S.)	89	2353	3.39
	MIS QUARTERLY (MISQ)	51	4226	8.49

Growth of EC Research



Growth of EC Paper Citations



Top 10 Countries in Publication

Ranking	Country	Total No.	IS	Ranking	EC	Ranking
1	USA	463	244	1	219	1
2	CHINA	147	54	2	93	2
3	TAIWAN	84	23	4	61	3
4	CANADA	65	42	3	23	6
5	SOUTH KOREA	55	19	6	36	4
6	SINGAPORE	38	21	5	17	9
7	GERMANY	34	8	5	26	5
8	AUSTRALIA	30	11	7	19	7
9	NETHERLANDS	26	8	8	18	8
10	SPAIN	20	8	8	12	10

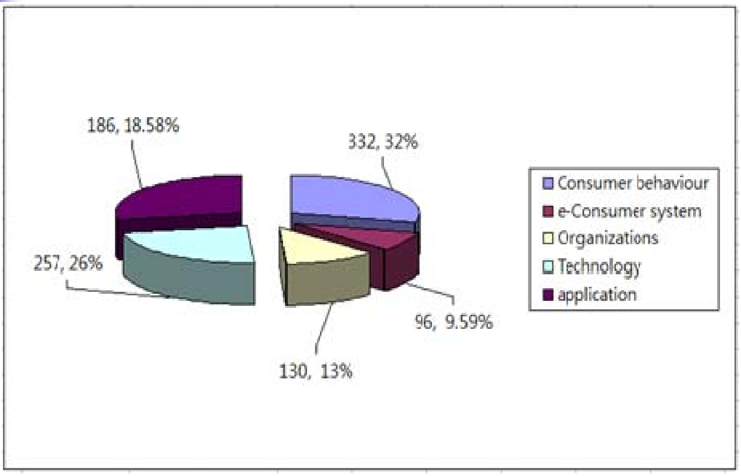
Top Theories Used

Rank	Theory	Total No.	EC		IS	
			No	Ranking	No	Ranking
1	Technology Acceptance Model (TAM)	290	146	1	144	1
2	Information Processing Model (IPM)	275	139	2	136	3
3	Consumer Decision Model (CDM)	274	137	3	137	2
4	Decision-Making Process (DMP)	259	133	4	126	4
5	IS Success Model (ISM)	147	130	5	17	5
6	Diffusion of Innovation (DoI)	30	19	7	11	7
7	Resource-based Theory (RBT)	29	16	6	13	6
8	Transaction Cost Economics(TCE)	18	12	9	6	8
9	Theory of Production (ToP)	17	14	8	3	9
10	Social Exchange Theory (SET)	14	12	9	2	10

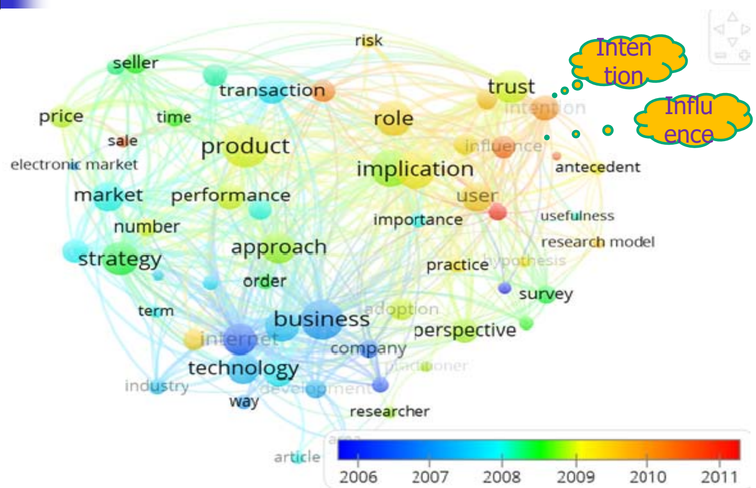
Top Ten Institutions

Rank	Institution	Total No.	EC	IS
1	CITY UNIVERSITY OF HONG KONG	42	13	29
2	ARIZONA STATE UNIVERSITY	29	21	8
3	NATIONAL UNIVERSITY OF SINGAPORE	23	7	16
4	UNIVERSITY OF TEXAS AUSTIN	21	8	13
5	UNIVERSITY OF HONG KONG	13	8	5
6	UNIVERSITY OF ILLINOIS CHICAGO	12	9	3
7	ERASMUS UNIVERSITY ROTTERDAM	11	11	0
8	UNIVERSITY OF ILLINOIS URBANA CHAMPAIGN	11	8	3
9	UNIVERSITY OF COLORADO BOULDER	10	10	0
10	NATIONAL SUN YAT SEN UNIVERSITY	9	9	0

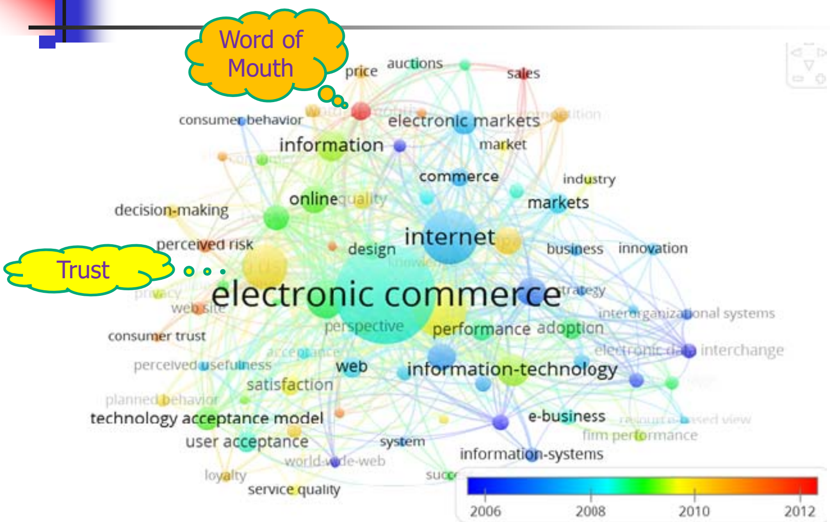
Distribution of Topics



Time Map of Topic Keywords



Time Map of Keywords By Citation



Top Authors in IS Journals

Author	Country	Institution	Total No.	First Author	Second Author	Single Author
BENBASAT, I	Canada	Univ British Columbia	23	0	18	0
PAVLOU, PA	USA	Temple Univ	11	5	3	1
WHINSTON, AB	USA	Univ Texas Austin	8	0	1	0
ZHU, K	USA	Univ Calif Irvine	7	6	1	1
GUPTA, A	USA	Univ Minnesota	7	2	1	0
GHOSE, A	USA	NYU	7	3	4	0
KAUFFMAN, RJ	USA	Univ Minnesota	6	1	3	0
GROVER, V	USA	Clemson Univ	6	0	1	0
VISWANATHAN, S	USA	Univ Maryland	5	1	2	1
OVERBY, E	USA	Georgia Tech	5	5	0	0
KRAEMER, KL	USA	Univ Calif Irvine	5	0	5	0
HU, Y	USA	Purdue Univ	5	0	5	0
GEFEN, D	USA	Drexel Univ	5	3	1	1
AGARWAL, R	USA	Univ Maryland	5	0	3	0

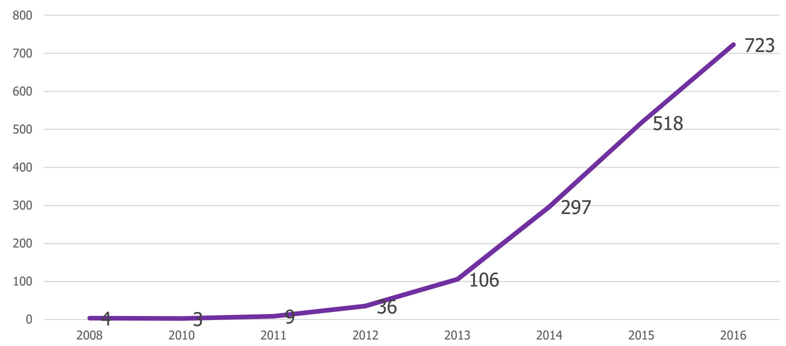
Top Authors in EC Journals

Author	Country	Institution	Total No.	First Author	Second Author	Single Author
KAUFFMAN, RJ	USA	Arizona State Univ	24	13	9	1
LIANG, TP	Taiwan	Natl Sun Yat-sen Univ	10	7	1	1
WESTLAND, JC	USA	Univ Illinois	8	1	1	1
TAN, YH	Netherlands	Free Univ	7	3	2	0
CHAU, PYK	Peoples R China	Univ Hong Kong	7	1	6	0
SHAW, MJ	USA	Univ Illinois	6	0	4	0
PAYNE, TR	England	Univ Liverpool	6	0	0	0
GUPTA, A	USA	Univ Minnesota	6	2	2	0
SU, BC	Taiwan	Natl Dong Hwa Univ	5	2	2	2
RAO, HR	USA	SUNY Buffalo	5	0	0	0
KIM, DJ	USA	Univ N Texas	5	4	1	1

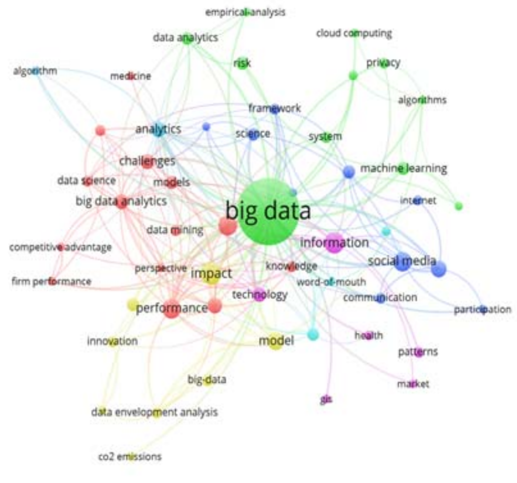
Two New Methodologies

- Big data analytics
  - Collect data from the real world and analyze with data mining and complicated data analytics
- Neuroscientific methods
  - Apply neuroscience instruments to collect physiological data as comparing with existing behavioral findings

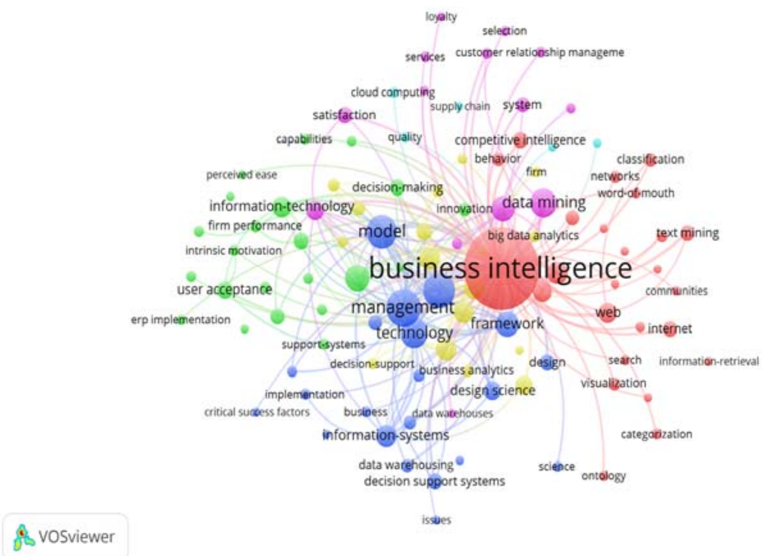
Growth of Bigdata Papers



Big Data Analytics Network



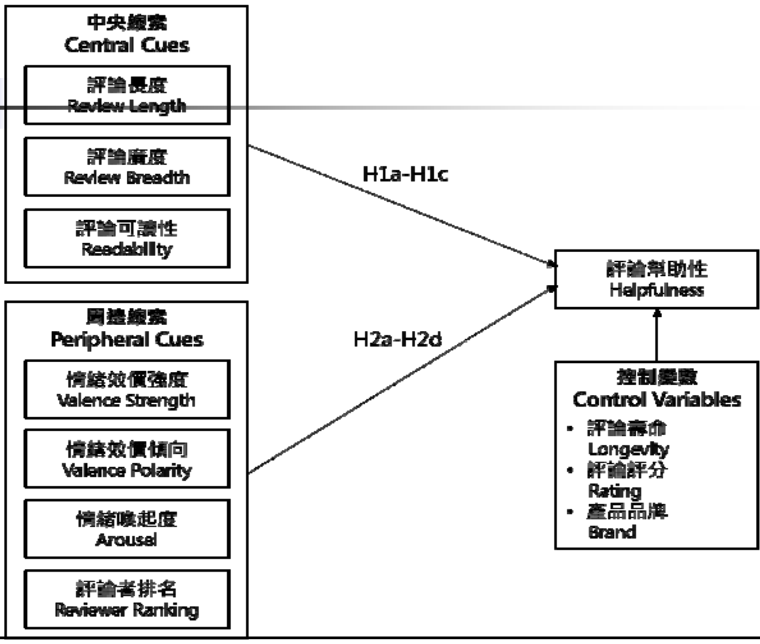
Business Intelligence



Sample Research: Factors Affecting Review Helpfulness

- Research Problems
  - Find factors that affect the helpfulness of online comments
- Theoretical Foundation
  - Elaboration Likelihood Theory: two paths that affect the effect of persuasion – central routes (thinking) and peripheral routes (intuition).

Research Framework



Data Source

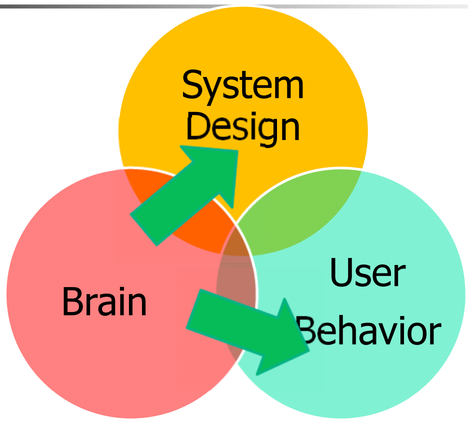
- Wang, Mai, and Chiang (2013) , Market Dynamics and User-Generated Content About Tablet Computers
- Original data: Amazon.com Tablet sales
- Period: 24 weeks from February 1, 2012
  - Market Dynamics of Products （2,163 ）
  - Product Characteristic Information （794 ）
  - Consumer-Generated Product Reviews （40,741 ）
  - Reviewer Information tables （39,278 ）

	Model 1	Model 2	Model 3	Model 4
β_1: log(Length)	0.595*** (0.008)	0.516*** (0.008)	0.537*** (0.008)	0.532*** (0.008)
β_2: Breadth	0.036*** (0.01)	0.034*** (0.01)	0.05*** (0.009)	0.049*** (0.009)
β_3: Readability	0.001** (0.00)	0.003*** (0.00)	0.003*** (0.00)	0.003*** (0.00)
γ_1: Valence Strength	-0.145 (0.089)	0.205* (0.086)	-0.14 (0.088)	-0.073 (0.089)
γ_2: Valence Polarity	-0.636*** (0.059)	-0.588*** (0.057)	-0.144* (0.061)	-0.175** (0.061)
γ_3: Arousal	-0.793*** (0.122)	-0.07 (0.118)	0.25* (0.12)	0.341** (0.123)
γ_4: log(Ranking)	-0.161*** (0.003)	-0.159*** (0.003)	-0.173*** (0.003)	-0.173*** (0.003)
δ_1: Longevity		0.003*** (0.00)	0.002*** (0.00)	0.003*** (0.00)
δ_2: Rating = 2			-0.425*** (0.027)	-0.42*** (0.027)
δ_3: Rating = 3			-0.511*** (0.026)	-0.5*** (0.026)
δ_4: Rating = 4			-0.681*** (0.022)	-0.671*** (0.022)
δ_5: Rating = 5			-0.439*** (0.02)	-0.431*** (0.02)
δ_6~δ_{24}: Brand				Included
AIC	191,050	187,047	186,058	185,756
Pseudo-R^2	0.316	0.382	0.398	0.404

Research Results

Path	Hypothesis	Support
Central	H1a：Length has positive effect on Helpfulness	Yes
	H1b：Depth has positive effect on helpfulness	Yes
	H1c：Readability is positive on helpfulness	Yes
Peripheral	H2a：Valence strength is positive on helpfulness	No
	H2b：Valence polarity is negative on helpfulness	Yes
	H2c：Arousal is positive on helpfulness	Yes
	H2d：Reviewer ranking is negative on helpfulness	Yes

Neuroscience and IS: A Triangular Relationships



Neuroscience adds a new dimension

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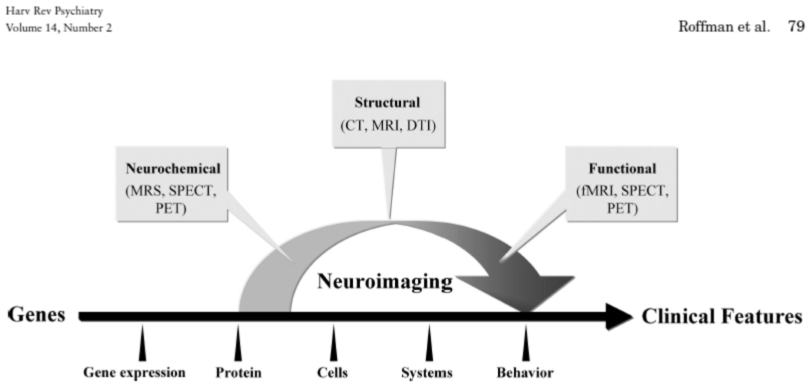
Level of Neuroscience Studies



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What Can Neuroscience do for ISR

- **Falsifying/enhancing existing theories**. New evidence can be used to examine existing theories that may be falsified or enhanced.
- **Developing new theories**. Adapting neurophysiological knowledge to IS research has the potential of developing new theories for interpreting IS design and/or usage behavior.
- **Facilitating system design**. Deeper knowledge of IS usage may lead to better design of future information systems. For example, knowing how a user views a website would lead to a better webpage design.
- **Evaluating system design**. Neurophysiological evidence may be used to evaluate the design of a system. For instance, the attractiveness of a user interface design may be assessed by the psychophysiological evidence of the experiment subject, instead of a survey questionnaire.
- **Better measurement of existing constructs**. Certain latent constructs measured by reflective indicators may be better assessed with neuroscience methods.

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Social Neuroscience Techniques

- **Psychophysical measurement**: Measurement of psychophysiological indicators like heart rate, blood pressure, galvanic skin response (GSR, sweating in the palms), and pupil dilation (pupils dilate in response to arousal) to detect a subject's reaction to a stimulus
  - Eye tracking
- **Brain activity:** Measurement of brain activities such as brain waves and areas of activation when a particular task is performed by the subject and interpret the association between brain activation and the stimulus.
  - EEG – measuring revealed electrical signals on the scalp
  - Imaging – measuring blood flow in the brain.

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Commonly Used Tools

Table 1. Description and Focus of Measurement of Commonly Used Neurophysiological Tools

Neurophysiological Tools	Focus of Measurement
Psychophysiological Tools	
Eye Tracking	Eye pupil location ("gaze") and movement
Skin Conductance Response (SCR)	Sweat in eccrine glands of the palms or feet
Facial Electromyography (fEMG)	Electrical impulses caused by muscle fibers
Electrocardiogram (EKG)	Electrical activity of the heart on the skin
Brain Imaging Tools	
Functional Magnetic Resonance Imaging (fMRI)	Neural activity by changes in blood flow
Positron Emission Tomography (PET)	Metabolic activity by radioactive isotopes
Electroencephalography (EEG)	Electrical brain activity on the scalp
Magnetoencephalography (MEG)	Changes in magnetic fields by brain activity

Source: Dimoka, et al. (2012)

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Electro-encephalogram (EEG)

- EEG uses electrodes attached to the scalp to measure electrical activity (brain waves) synchronized to stimulus events or behavioral responses (known as Event Related Potentials or ERPs)
- One-point sensor detects frontal brainwaves to measure attention and relaxation

Source: Wikipedia.com

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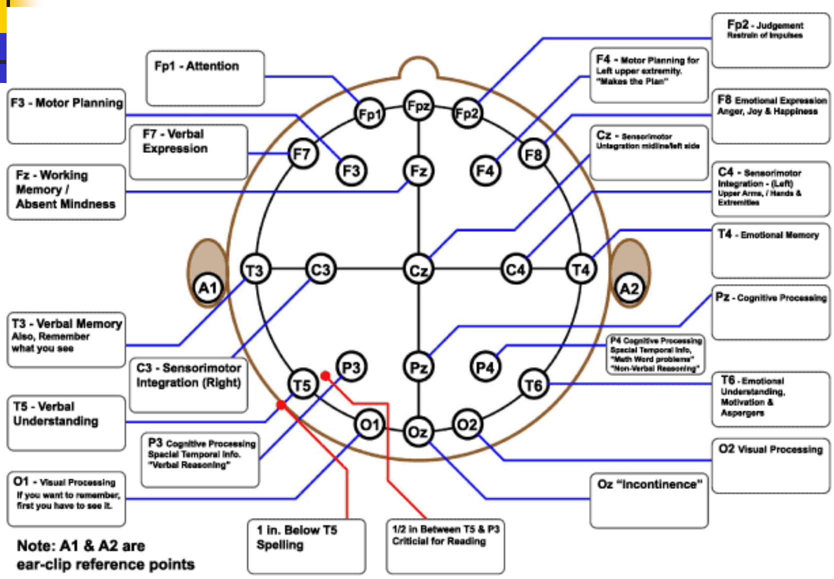
Possible Locational Function



Basics of EEG

- EEG reflects the summation of the synchronous activity of many neurons with similar spatial orientations
- Cortical pyramidal neurons produce most of the EEG signal
- Deep sources (subcortical areas) are much more difficult to detect than currents near the skull
- EEG signals are featured by response time (in milliseconds) and relative strength.
- EEG is time sensitive but not good in location determination

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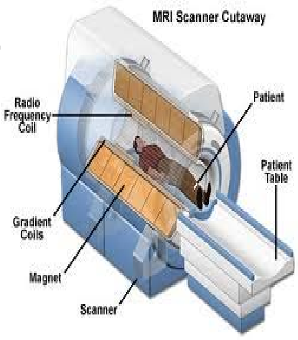
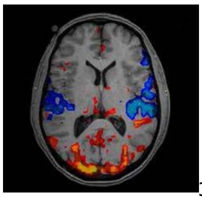
Brain imaging - PET and fMRI

- **Positron emission topography (PET)** measures blood flow in the brain as a proxy for neural activity;
- **Functional magnetic resonance imaging (fMRI)** tracks blood flow in the brain using changes in magnetic properties due to blood oxygenation (the "BOLD signal"). This is a new and popular method for the time being.





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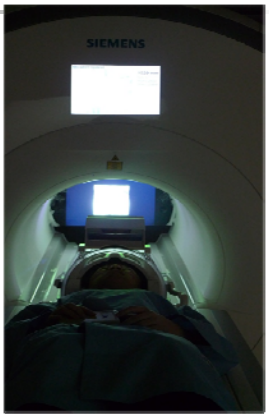
fMRI Experiment for IS Research



Equipment: Siemens MAGNETOM skyra 3T

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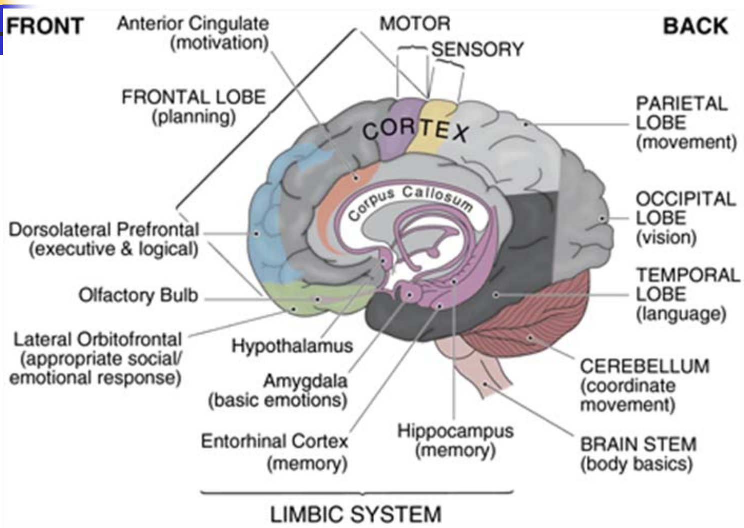
Basic Brain Functions



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Neuroscience Applications

- Neuroeconomics
- Neural decision making
- Neuro-marketing
- Neuro-information systems
- Neuro-finance
- Neuro-management

fMRI Research Sample

- THE NEURAL BASIS OF PERSONALIZATION EFFECTS: AN FMRI INVESTIGATION OF PRODUCT RECOMMENDATIONS AND ANTHROPOMORPHIZED AVATARS

(Authors: Liang, T.P., Yen, N.S., Li, Y.W., Hsu, S.M., and Banker, S.)

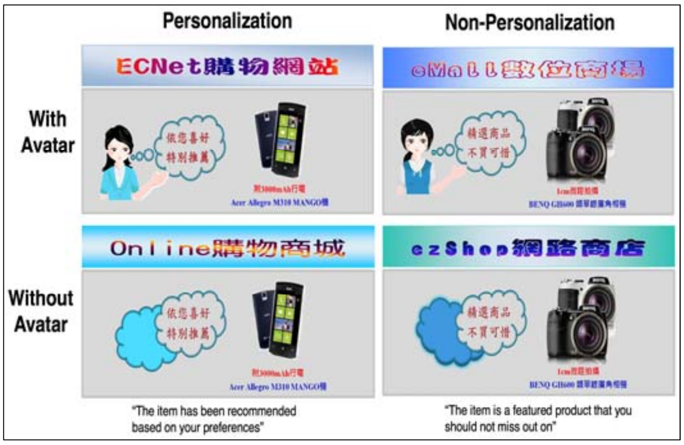
Research Background

- Previous behavioral findings have suggested that personalized recommendation agents are effective because they (1) increase perceived closeness through self-reference, (2) reduce cognitive effort, (3) increase social presence, and (4) increase perceived enjoyment.
- Purpose: Evaluate different theories related to the effect of online personalization with neurobiological evidence

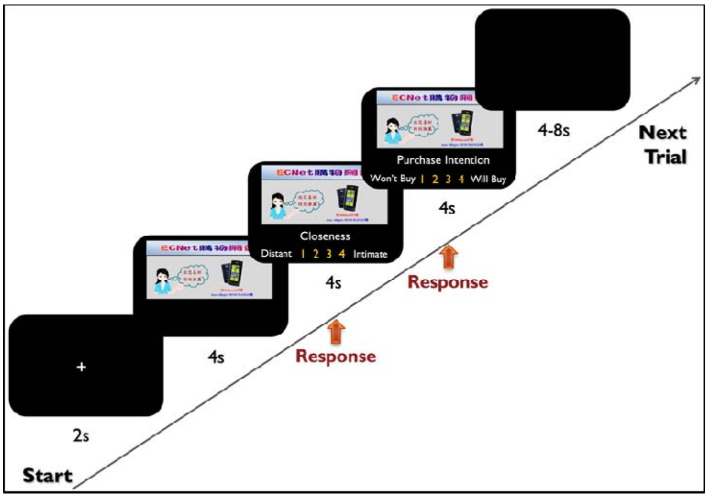
Our findings

- Supported
  - self-referencing theories through increased activity in brain networks linked to self-referential processing,
  - social presence accounts by eliciting increased activation in brain networks associated with social imitation, and
- partially supported accounts of perceived enjoyment by generating greater reward-related activation
- Not supported the commonly accepted cognitive load reduction perspective in revealing no modulation of neural activity within brain networks related to the deployment of cognitive effort.

Experimental Settings



Experimental Procedure



Behavior Results

Table 2. ANOVA results for perceived closeness.

Source	F Statistic	Sig.
Avatar	134.768	.000
Personalization	232.877	.000
Avatar × Personalization	2.817	.093

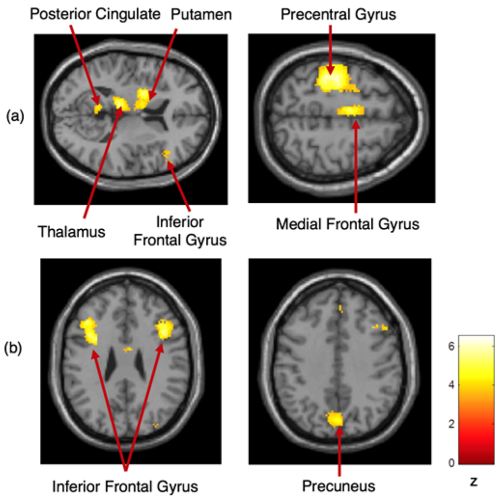
Table 3. ANOVA results for purchase intention.

Source	F Statistic	Sig.
Avatar	1.058	.304
Personalization	991.353	.000
Avatar × Personalization	0.003	.955

Brain Activation - Closeness Assessment

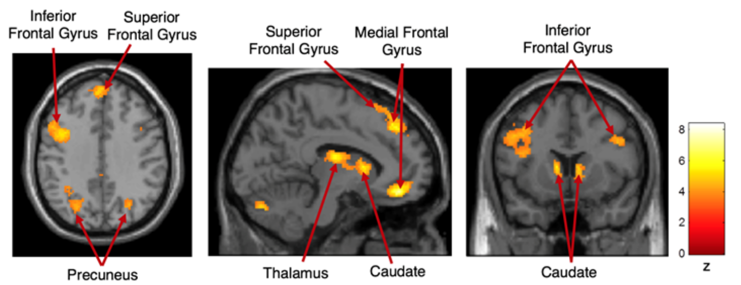
(a) personalization vs. non-personalization contrast,

(b) with avatar vs. without avatar contrast



Brain Activation – Purchase Intention

- No Avatar effect was found
- personalization vs. non-personalization contrast below:



Summary of Findings

Table 6. Summary of Findings

	Theoretical Lens	Neural correlates	Perceived closeness		Purchase intention	
			Pers. Rec.	Avatar	Pers. Rec.	Avatar
H1	Self-referencing	Self-referential network (midline cortical structure)	**Yes**	Yes	**Yes**	No
H2	Cognitive overload	Cognitive control network (dlPFC and dACC)	**No**	No	**No**	No
H3	Social presence	Social imitation network (IFG)	Yes	**Yes**	Yes	**No**
H4	Content-relevance and social presence	Reward network (striatum)	**Yes**	**Yes**	**No**	**No**

Questions and Comments