eMotion

Estimation of the User's Emotional State by Mouse Motions

<u>why give emotional abilities to machines? [Picard, 2003]</u>

* emulate living beings
* make machines more intelligent
* understand emotions by reproduction
* more fun and security to interact with machines

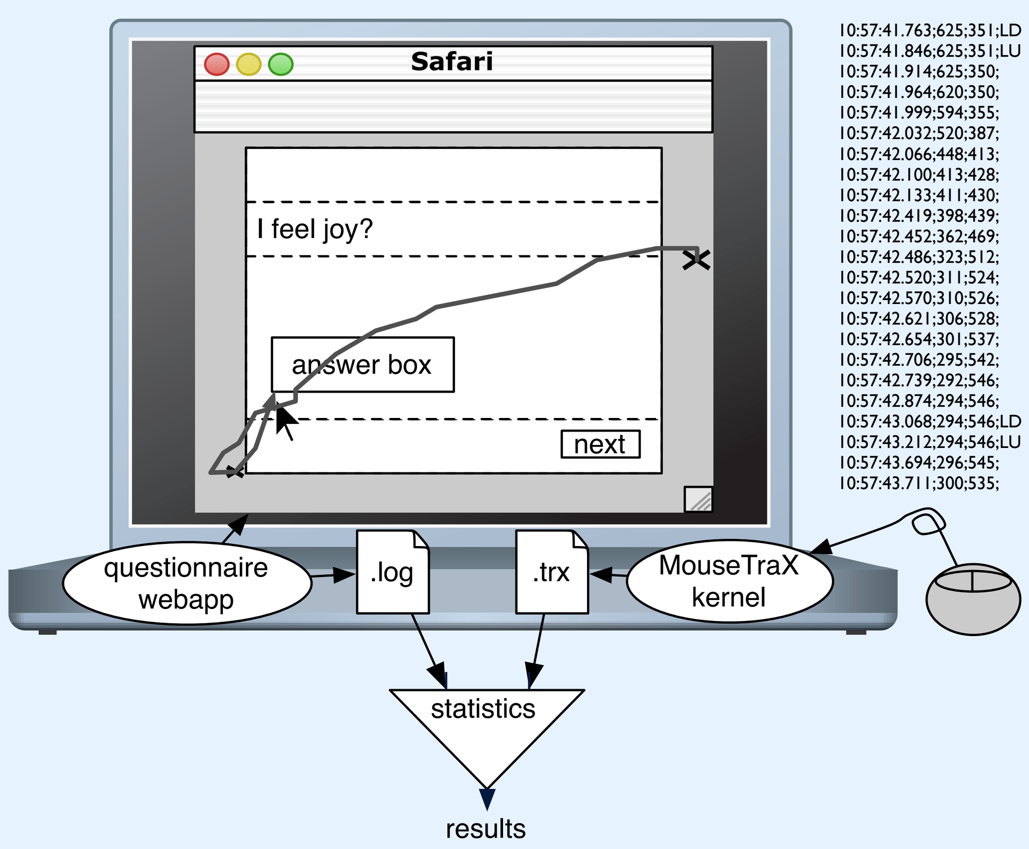
<u>why are affective machines more fun and lead to better work?</u>

* emotion is a part of our communication
  -> pets, plants, things have names, "talk to us"
* experiential emotional needs [Picard, 2002]
  -> we want the communication partner to feel with us
* matching emotional levels lead to less errors [Nass, 2005]
  -> communication requires less attention
  -> more attention on the task
* less frustration is better for our health
  -> affective machines could alleviate negative emotions

<u>what ways are there to measure emotion?</u>

* self-assessment: e.g. questionnaire
  + cheap, universally usable
  - subjective, user needs to take action
* physiological changes: e.g. heart rate, respiration
  + objective, precise, long experience
  - user is hooked-up, impeded
* facial expressions: e.g. distinct patterns captured by cam
  + non-intrusive, no user-actions required
  - ambient light problems
* voice intonation: e.g. changes in tone, emphasis
  + non-intrusive, no user-actions required
  - ambient noise problems, changes from sickness, etc.
* muscle movements: e.g. changes in speed, precision
  + non-intrusive when mouse is used, cheap, few error sources
  - in development, might become obsolete some day

The mouse motion characteristics of speed and precision show significant differences for different levels of arousal.



arousal (high vs. low) direct comparison								
name	M(low)	M(high)	var(low)	var(high)	df	t	sig	eff.size
CN	1.0663	1.1065	0.0042	0.0076	50.8825	-2.2028	0.0322*	-0.5411
MB	3.0325	2.3600	1.3231	0.6749	76.1451	3.0277	0.0034**	0.6500

arousal (high vs. low) relative per subject comparison								
name	M(low)	M(high)	var(low)	var(high)	df	t	sig	eff.size
dCN	1.0262	0.9954	0.0052	0.0033	72.6485	2.0836	0.0407*	0.4718
dMA	0.0049	-0.0020	0.0001	0.0003	65.3436	2.0638	0.0430*	0.4674
dMB	-0.4311	0.0896	1.2588	1.2297	75.9896	-2.0613	0.0427*	-0.4668
dMD	0.0009	-0.0001	< 0.0001	< 0.0001	57.0895	3.2651	0.0019**	0.7394
dMS	0.0283	0.0026	0.0007	0.0011	71.4186	3.7701	0.0003**	0.8538
dMT	0.9373	0.1494	2.8980	2.9775	75.9861	2.0299	0.0459*	0.4597
dMU	0.0356	0.0036	0.0008	0.0023	62.1245	3.6006	0.0006**	0.8154

<u>Legend:</u>
The first table shows the significant results of a direct comparison of the mouse characteristics. There we can also see the heterogeneity of the variance. In the second table we see the significant results when comparing the the changes of the mouse movements between the two levels of arousal. Hereby the recordings of the film with the average arousal were subtracted from the recordings of the film with highest and lowest arousal. Higher mean values stands for more difference and therefore lower values compared to the middle measurements.

CN (Click number) The number of clicks performed to achieve the wanted action. **MA** (Movement acceleration) The average acceleration of a mouse movement
in all the movement intervals. **MB** (Movement breaks) The number of movement breaks in a movement. **MD** (Movement deceleration) The average deceleration of a mouse movement in all the movement intervals. **MS** (Movement speed) The average speed of one mouse movement from click to click. **MT** (Movement targeting) The standard deviation from the average (ideal) movement. **MU** (Movement uniformity) The standard deviation of the speed in each movement interval.
d stands for personal difference compared to medium arousal [d = M(medium)-M(low) xor d = M(medium)-M(high)]. **f** stands for factor of change compared to medium arousal [d = M(medium)/M(low) xor d = M(medium)/M(high)].
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* $p < .05$ ** $p < .01$

Experiment:

* 39 persons ($N_{negativefirst}$ = 22, $N_{positivefirst}$ = 17)
* 3 videos (neutral, negative, positive) inducing emotions (IVs)
* self-assessment questionnaire after each video (IVs)
  -> valence, arousal, etc. scales
* logging of mouse movements
* calculation of movement characteristics (DVs)
  -> e.g. efficiency, average speed, clicking duration, etc.
* statistical analysis

Results and Conclusion:

* arousal activation of motions can be measured
  -> lower arousal results in significantly higher movement precision
  e.g. M(low)(CN) = 1.07, M(high)(CN) = 1.11, sig = 0.03222
  -> higher arousal results in significantly higher movement smoothness
  e.g. M(low)(MB) = 3.03, M(high)(MB) = 2.36, sig = 0.0034
  -> higher arousal results in significantly higher movement speed
  e.g. M(low)(dMS) = 0.02, M(high)(dMS) = 0.00, sig = 0.0003
  -> higher arousal results in significantly higher movement acceleration
  e.g. M(low)(dMD) = 0.0009, M(high)(dMD) = -0.0001, sig = 0.0019
* valence differences could not be measured
  -> may be Type II error
* strong variation of mouse motions between subjects
* videos performed not like expected

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written by **Wolfgang Maehr** (FH Vorarlberg)
supervised by **Guido Kempter** (FH Vorarlberg)
supervised by **Morten Fjeld** (Chalmers TH)

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