Overview

The PTAS project
Classifying interactions
Modelling and equivalence of interactions
Some non-functional issues
PTAS Project

‣ What social media and related tools are people using in the University to support their teaching?
‣ How are these being used?
‣ What are the common general issues?
‣ (How) are they being used to facilitate explicit types of interaction?

“How can I choose a tool, and find a mode of using it, which will satisfy my pedagogical aims?”

It can be difficult to identify an appropriate tool (or a mode of using such a tool) to meet specific pedagogic aims - sometimes the natural use of a particular tool is a good fit, and sometimes it needs creative abuse to make it fit.
Interactions

‧ Is it helpful to think about, and encourage specific interactions among students?

‧ Can we classify the interactions supported by different social media tools?

‧ If so, would this be useful in identifying different tools which may be helpful in particular situations?

‧ Are there some useful interaction models which are not well supported by any existing tools?
What Are People Using?

We interviewed 12 staff members from across the University, with a wide range of experience in online tool use

- Semi-structured interviews
- Loose identification of themes/trends
- Workshop to discuss results

What, how & why?

- What tools do people use & why & how?
- Do people have an explicit pedagogical aim for any of these uses?
- What kinds of interactions are involved?
- What works & what doesn’t? what are the problems?
- Is there anything people would like to do, which they haven’t been able to do?
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical tools</td>
<td>UG</td>
<td>UG</td>
<td>UG</td>
<td>PG</td>
<td>UG</td>
<td>UG</td>
<td>UG</td>
<td>PG</td>
<td>PG</td>
<td>PG</td>
<td>U-PG</td>
</tr>
<tr>
<td>Clickers</td>
<td>UG</td>
<td>UG</td>
<td>UG</td>
<td>UG</td>
<td>UG</td>
<td>UG</td>
<td>UG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VLE</td>
<td>PG</td>
<td>PG</td>
<td>U-PG</td>
<td>UG</td>
<td>U-PG</td>
<td>U-PG</td>
<td>UG</td>
<td>UG</td>
<td></td>
<td></td>
<td>U-PG</td>
</tr>
<tr>
<td>Blogging</td>
<td>PG</td>
<td>PG</td>
<td>UG</td>
<td>UG</td>
<td>U-PG</td>
<td>UG</td>
<td>UG</td>
<td></td>
<td></td>
<td></td>
<td>U-PG</td>
</tr>
<tr>
<td>Twitter</td>
<td>PG</td>
<td>PG</td>
<td>UG</td>
<td>UG</td>
<td>PG</td>
<td>UG</td>
<td>PG</td>
<td>PG</td>
<td>PG</td>
<td></td>
<td>U-PG</td>
</tr>
<tr>
<td>Facebook</td>
<td>PG</td>
<td>PG</td>
<td>UG</td>
<td>UG</td>
<td>U-PG</td>
<td>UG</td>
<td>UG</td>
<td>UG</td>
<td></td>
<td>UG</td>
<td>U-PG</td>
</tr>
<tr>
<td>LinkedIn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PG</td>
<td></td>
<td></td>
<td>PG</td>
</tr>
<tr>
<td>Skype</td>
<td>PG</td>
<td>PG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pre-entry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Googledocs/hangout/grp</td>
<td>PG</td>
<td>PG</td>
<td></td>
<td></td>
<td>PG</td>
<td>PG</td>
<td>UG</td>
<td></td>
<td></td>
<td></td>
<td>U-PG</td>
</tr>
<tr>
<td>Second life</td>
<td>PG</td>
<td>PG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>U-PG</td>
</tr>
<tr>
<td>Pinterest/wallwisher</td>
<td>PG</td>
<td>UG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>U-PG</td>
</tr>
<tr>
<td>Wikis</td>
<td>PG</td>
<td>PG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>U-PG</td>
</tr>
<tr>
<td>Online tests</td>
<td>U-PG</td>
<td>PG</td>
<td>UG</td>
<td></td>
<td>UG</td>
<td>UG</td>
<td></td>
<td>PG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own software</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>U-PG</td>
</tr>
</tbody>
</table>
We attempted a very simple classification the interactions described in the interviews

- who is communicating with who, in what order?
- no analysis of message content
- email
- private blogs viewed by tutor
- assignment submissions
- lectures
- online videos
- student presentations
- web pages, Learn
- twitter
- e-portfolio
- reflective blog
› individual tutorial
› email exchange
» individual feedback
(to or from the student)
 › online polls
 › MOOC multiple choices
 › email feedback to web pages
- face-to-face group discussion
- skype, second life
- collaborate
- clickers
- twitter
Compound Interactions

There were quite a few cases of more complex procedures

- These are usually sequential compositions of individual interactions

For example ...
- A group of students collaborate to create (closed) Wiki pages
- The Wiki pages are then opened up to a wider student group
- The other students comment on the Wiki pages
- The original students revise their pages
- The Wiki is presented for marking
- The staff return marks and comments
Modelling and Equivalence

How can we represent interactions so that we can reason about them?

- How do we represent the sequences of actions?
- How much is the message content significant, compared to the sequencing of the individual actions?

When are two interactions “the same”?

- Tools supporting “the same” kind of interaction should be suitable for similar purposes
- Are there multiple notions of “equivalence”?
Reactive Systems

Reactive systems ...

- Have “state”
- React to stimuli from their environment
  - e.g. by changing their state
- Influence the environment

Process Algebras ...

- Are prototype specification languages for reactive systems
- These allow us to write down descriptions of interactions and reason about them
From the work of Robin Milner (Edinburgh), around 1980

A process is a “black box” with inputs and outputs

Communication is an exchange of information between a “matching” input and output

Following a communication, a process evolves into a different process

For example: $P' = a.P$

- $P$ is a process which can accept the message $a$
- After it has accepted $a$, it evolves to a new process $P'$
- $P'$ is (potentially) different from $P$
  - for example, it may no longer be able to accept $a$
- $\emptyset$ is the “null” process (stopped - end of interaction)
CCS Example (1)

Student = \texttt{assignment} . 0
Lecturer = \texttt{assignment} . 0

- \texttt{assignment} is an “output"
  - this should be an “overbar”, but my slides don’t support it!
- \texttt{assignment} is a matching “input”
- The student stops after submitting the assignment
- The lecturer stops after receiving the assignment
After showing, the video returns to the same process as it started with (recursion) an "output":

- this is sequential here, not simultaneous

Each student watches it only once and then stops

The order is indeterminate
Demonstrator = question . answer . Demonstrator
Student1 = question . answer . Student1
Student2 = question . answer . Student2

- After accepting a question, the demonstrator must respond with an answer before returning to the initial state
- Each student may keep asking questions
  - but they must wait for an answer before asking the next one
Demonstrator = $q(X) \cdot a(X) \cdot \text{Demonstrator}$

Student1 = $q(X) \cdot a(X) \cdot \text{Student1}$

Student2 = $q(X) \cdot a(X) \cdot \text{Student2}$

- The communications usually involve some kind of information
- We need to represent message content
- For example..
  - If the student asks a question ($X$)..
  - He/she would like to receive an answer to the same question ($X$)
    Not a completely different question!
The \( + \) symbol represents a choice of actions

- This unreliable demonstrator may choose to answer the question \( (a) \)
- Or to ignore it and return to waiting for the next question! \( (b) \)

Note that in both cases, the question must be received first
The symbol indicates a composition of processes ...

The class contains a video and a demonstrator and two students

The video can be watched repeatedly

The demonstrator continually responds to questions

Each student can either give up (0)

  - ask a question (and continue after the answer)
  - watch the video (and continue)
CCS Example (7)

\[
\text{OpenWiki} = ( \text{view}(x) \cdot \text{OpenWiki} ) \\
\quad + ( \text{close} \cdot \text{ClosedWiki} )
\]

\[
\text{ClosedWiki} = ( \text{update}(x) \cdot \text{ClosedWiki} ) \\
\quad + ( \text{open} \cdot \text{OpenWiki} )
\]

\[
\text{Lecturer} = ( \text{open} + \text{close} ) \cdot \text{Lecturer}
\]

\[
\text{Group} = \text{update}(x) \cdot \text{Group}
\]

\[
\text{Class} = \text{view}(x) \cdot \text{Class}
\]
Internal Reasoning

The process calculus models only the “externally visible” interactions

- It does not model the internal decision process of any of the agents
- For example: we have no knowledge of when, or why a student may choose to watch a video, rather than ask a question
- If we are interested only (for example) in deciding whether two tools offer a similar pattern of interaction, then this is not usually significant
- The Lightweight Communication Calculus is an executable language based on CSS which allows us to specify the internal processes, as well as the interactions
  - This is less useful for equivalence checking (for example)
  - But it could be used, for example, to create simulations
a(buyer, B) ::
  ask(X) => a(shopkeeper, S) then
  price(X, P) <= a(shopkeeper, S) then
  buy(X, P) => a(shopkeeper, S)
      ← afford(X, P) then
  sold(X, P) <= a(shopkeeper, S)

a(shopkeeper, S) ::
  ask(X) <= a(buyer, B) then
  price(X, P) => a(buyer, B)
      ← in_stock(X, P) then
  buy(X, P) <= a(buyer, B) then
  sold(X, P) => a(buyer, B)
Equivalence

CCS allows us to demonstrate equivalence (or not) of two different interaction models

- CCS has a notion of process equivalence called “Bisimulation”
- Informally: the two processes are capable of following the same sequences of actions
- The “names” of the processes and messages are not significant, so this equivalence is based on the abstract pattern of the interactions
- There are some technicalities involving non-termination

The “Edinburgh Concurrency Workbench”

- is an automated tool which can check the equivalence of two processes
- Also, check various properties and run simulations
We have not created sufficiently realistic models to be able to judge whether automated equivalence checking may be useful in practice

- How significant are the roles?
  - Does a tool which supports an interaction between the teacher and student also support the same interaction when the roles are reversed?

- Which actions are significant?

- How significant is the message content? Can we classify this?

- Could we engineer the models to expose the learning outcomes in a way which would be significant?

**Modelling issues**

- CCS does not support “broadcast”
- Some situations are not very natural to model
Is This A Useful Perspective?

There were very few cases where someone articulated a clear vision of an interaction which they explicitly wanted to initiate.

- This makes it difficult to evaluate how useful this perspective is in designing interactions to meet a particular objective.

**But …**

- Feedback suggests that this can be a helpful way of thinking about tool use.
- Other tools which perform a similar interaction may be useful alternatives.

_is it worth a deeper analysis_?

- I think so …
Non-functional Aspects

**Synchronous?**
- Does everyone need to be present at the same time?

**Persistent?**
- Do the contents remain visible indefinitely? (snapchat)

**Anonymous?**
- Is the poster anonymous?

**Fluent?**
- Is there a significant latency?
Other Issues

Time & Effort

› Is it worth the time to investigate/learn/develop? for both staff and students?

› Learning multiple, constantly changing tools is not efficient tools can change quickly, requiring significant effort to keep up

Cultural or personal attitudes/preferences

› Some people have a natural tendency to share things (or not)

Privacy, Anonymity & Data Protection …

Internal vs External Systems …
Privacy & Anonymity

Students prefer to keep separate personal & work spaces
- eg. on Facebook
- This may lead to “exclusion” and other issues

Anonymity is an important consideration
- Can encourage people to participate (Peerwise? Wordpress aliases?)
- But can also be abused (Twitter?)

Accidental bleed between public & private spaces
- Lack of clarity about (eg.) staff membership of Facebook groups
- Postings on private Wordpress site then discussed in public Facebook

Tools are often deployed without a very explicit consideration of these issues
- Google hangouts posting discussions to uTube
**Internal vs External Systems**

**Internal systems are good ...**
- Access is restricted and students (and staff!) are not so exposed
- They provide data protection, and protection of ideas (copyright)
- We have some control over the availability and stability

**Internal systems are not so good ...**
- The privacy is unclear because staff have access and control
- Access is unavailable after students graduate
- It may not be easy to provide access for (eg.) external examiners, or job interviewers
- The need for stability and the lack of effort means that services usually lag behind those available externally
Final Thoughts …

The project state …
- Interviews are still being coded - lots of interesting data here
- But no further explicit work planned on the interactions

What we would do with more time/resources …
- Attempt to model some realistic examples more fully
  - Including the types of messages
- Experiment with (automated) equivalence checking
- Look more at related fields, such as the use of process calculi for modelling business processes (s_BPM)
  - And process calculi supporting broadcast

Is this interesting ?
- (How) does it relate to “group knowledge” ?
Orchestrating the Student Experience with Social Media Tools


Paul Anderson, Kirsty Hughes, Hamish Macleod, Jessie Paterson

A PTAS funded project - http://edin.ac/14wOyMP