BIG DATA AS INNOVATIVE APPROACH FOR USABILITY EVALUATIONS OF BUILDINGS

- Nils Olsson, NTNU
- Heidi Bull-Berg, SINTEF
- Anje Junghans, NTNU
What is Big Data?

- Big Data is datasets that are so large that they are not suitable to collect, store, process or analyse using traditional database tools
- “The three Vs“ volume, velocity, variety
- We may be interested in “small” og “medium” as well, but principles form Big Data are interesting anyway
"If you are a large company and you are not involved in analytics, you are not a large company for very much longer."

Big data developments

- Large quantities of data become available, including data from the internet and data based on sensor and tracking technology.
- Increased pressure for making data available.
- Access to storage and analysis capabilities at low cost.
- Access to IT platforms to put data into context, such as digital maps for presentation of position data, or building information models (BIM).
Data categories

- Internet traffic, including activity on social media and data from search engines
- Movement-related data, including GPS, RFID
- Physical environment, typically from different types of sensors
- Commercial activity, the use of payment services and consumption patterns

In addition, there are growing numbers of organisational internal data in IT systems, which is of interest even though the volume does not yet qualify as Big Data.
Possible problematic issues related to Big Data

- availability
- applicability
- relevance
- Privacy
Hey! What about my privacy??

They say that people who worry about their privacy have something to hide ...
Possible problematic issues related to Big Data

- availability
- applicability
- relevance
- privacy
- ownership
- Competence
Possible problematic issues related to Big Data

- availability
- applicability
- relevance
- privacy
- ownership
- competence

None of the challenges need to hinder use of Big Data, provided that the issues are properly managed.
New types of data that may be relevant to the evaluation of buildings

- Internet activity: Examples include how the current buildings are discussed on the Internet, Facebook, Twitter etc, how many Google searches are made on the building?
- Location data: how many are in an area in or near the building, time of day/week, where they come from and where they go. Can be based on GPS, mobile phones, access control systems, video cameras, or else.
- Sensors: Logging temperature in the building, the use of different automation systems (lighting, climate, energy), sensors that count the number of passages (into a room, for example)
- Behaviour: What do people do, such as which websites accessed from wireless networks in the building. Login on computers can be used to log the utilization of office jobs.
- Economic activity: Registrations with credit card - when, how people use money
<table>
<thead>
<tr>
<th>Category</th>
<th>Effect</th>
<th>Indicator</th>
<th>Data source</th>
<th>Availability</th>
<th>Applicability and relevance</th>
<th>Privacy and property rights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet activity</td>
<td>Usability</td>
<td>The experience of the building</td>
<td>Mention of the building on the Internet</td>
<td>No access</td>
<td>Relevance of high-profile buildings like the Opera</td>
<td>Not Personal Data</td>
</tr>
<tr>
<td>Efficiency in operations</td>
<td>Type of Use</td>
<td>Websites that sought from the local network</td>
<td>Could be logged. Administrator for wifi system has access</td>
<td>Displays the type of internet activity to building users</td>
<td>Can not be linked to the device (PC, phone, etc.) used</td>
<td></td>
</tr>
<tr>
<td>Movements</td>
<td>Efficiency in business, usability</td>
<td>Where people are, their retention</td>
<td>Login at the local wifi network</td>
<td>Could be logged. Administrator for wifi system has access</td>
<td>Showing equipment using wifi / internet</td>
<td>Must be anonymised and / or aggregated</td>
</tr>
<tr>
<td>Efficiency in business, usability</td>
<td>Movements, retention</td>
<td>Access cards</td>
<td>Not a tradition of handing out</td>
<td>Only applicable for areas with access control</td>
<td>Must be anonymised and / or aggregated</td>
<td></td>
</tr>
<tr>
<td>Efficiency in business, usability</td>
<td>Where people are, movements</td>
<td>Video camera</td>
<td>Requires analysis of video</td>
<td>Showing activity where there is a camera</td>
<td>Depending on type of analysis</td>
<td></td>
</tr>
<tr>
<td>Physical Environment</td>
<td>Efficiency in business, usability</td>
<td>Use of the building</td>
<td>Light switches, motion sensors in rooms</td>
<td>Not a tradition of storing or handing out</td>
<td>Depends on the type and location of sensors</td>
<td>No personal data for public premises</td>
</tr>
<tr>
<td>Operating Cost</td>
<td>Energy</td>
<td>Energy Management Systems</td>
<td>Store in part for mapping energy</td>
<td>Important cost</td>
<td>No personal data for public premises</td>
<td></td>
</tr>
<tr>
<td>Efficiency in business, usability</td>
<td>Use of the building</td>
<td>Energy Management Systems</td>
<td>Store partially</td>
<td>The focus on energy consumption, but also illustrates the use</td>
<td>No personal data for public premises</td>
<td></td>
</tr>
<tr>
<td>Usability</td>
<td>Indoor air</td>
<td>Air conditioning, CO measuring</td>
<td>Part of usability</td>
<td>No personal data for public premises</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial activity</td>
<td>Efficiency in operations</td>
<td>Number of users, type of use, revenue</td>
<td>Use of payment cards</td>
<td>Not a tradition of handing out</td>
<td>Important information for commercial premises</td>
<td>Privacy</td>
</tr>
<tr>
<td>Internal records / data</td>
<td>Operating Cost</td>
<td>Maintenance Activity</td>
<td>Operating and maintenance systems</td>
<td>Related info with the building manager</td>
<td>Shows the level of usage and kindness in technical solutions</td>
<td>Not Personal Data</td>
</tr>
<tr>
<td></td>
<td>Operating Cost</td>
<td>Cost of operation and maintenance</td>
<td>Accounting system</td>
<td>Facilities manager may have this</td>
<td>Displaying cost, life cycle cost</td>
<td>Not Personal Data</td>
</tr>
<tr>
<td></td>
<td>Operating Cost</td>
<td>Scope of modification</td>
<td>Area registry and accounting</td>
<td>Facilities manager may have this</td>
<td>Showing adaptability</td>
<td>Not Personal Data</td>
</tr>
</tbody>
</table>
Possible use of Big Data in FM research

- Support triangulation and quality assurance of data
- Complement and enhance existing evaluation parameters
- Provide new evaluation parameters
- Provide quantitative data on the conditions previously been based on qualitative assessments
- Illustrate effects that have not been possible to visualize previously
Reflections

- It published a lot on the topic in general, and both practitioners and academics see opportunities.
- It seems to be great opportunities for using new (large) data in FM research.
- Methods can be used on not so big data.
- We recommend pilot studies.
- It is likely that FM researchers need assistance related to data acquisition and analytics.
We do not want to be the last to notice Big Data
But we shall not be naïve, either