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Exploring the potential of 3D web mapping and analysis to support informed decision making in planning

Research Question

Can off-the-shelf web mapping tools be extended to enable the use of 3D within the planning process?

Urban planning supports growth of the built environment in the UK, geospatial data and software is often required for the process that underpins this modern workflow. While open web visualisation of 2D data is becoming increasingly common in planning, the use of GIS tools for 3D data is still in the realms of trained desktop based users.

In line with the development of GeoXphere's new cloud GIS (XMAP V2), this project examines the gap in current web GIS for 3D data visualisation and analysis tools, using Mapbox GL JS and Turf.js libraries.

Iterative development process

Three main development frameworks HTML5, CSS3 and JavaScript were used to create a prototype application. The iterative process consisted of 4 main stages:

Data Visualisation
- Local data loading
- Map tracking
- Map initialisation
- Layer creation and control

Graphing Capability
- Plot.ly plot framework
- X variable: Centre points
- Y variable: Building heights
- Width variable: Width of segment

1 — 2 — 3 — 4

Building Height Profile
- Drawing line segment
- Points of intersection
- Midpoints of intersect points
- Midpoints in polygon
- Visualising the buildings

Tools for further data analysis
- Querying buildings of equal height
- 'On-Click' 3D information

Application (Click Here)

Fits map panes to current layer extent.

Performs building height profile over the length of the drawn line, displayed in Figure 2.

Turns buildings of equal heights on, displayed in Figure 1.

Figure 1: 'Mouseover' buildings of equal height tool.

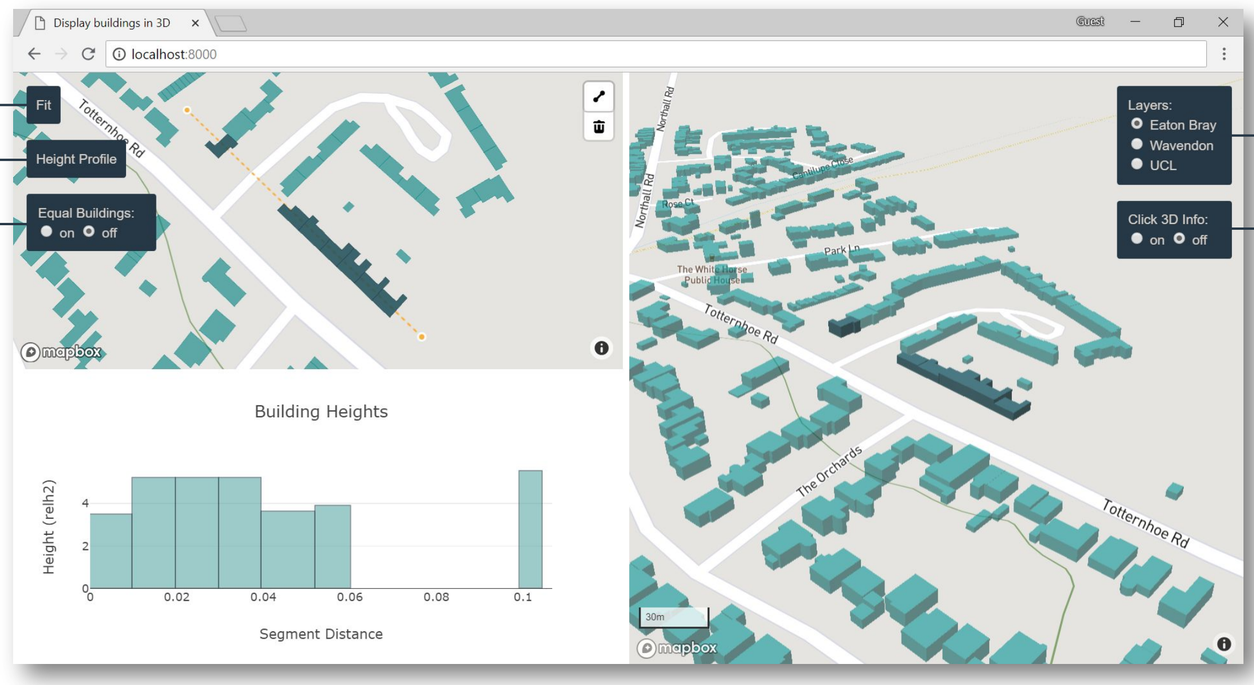

Figure 2: In browser working example of prototype with the buildings profile tool in use. Three datasets are sourced from the Ordinance Survey (2014).

Layer selection menu, zooms to extent of one of the three chosen layers.

Turns on 3D building information from a mouse click, displayed in Figure 3.

Figure 3: 'On-Click' 3D building information tool.

Feedback

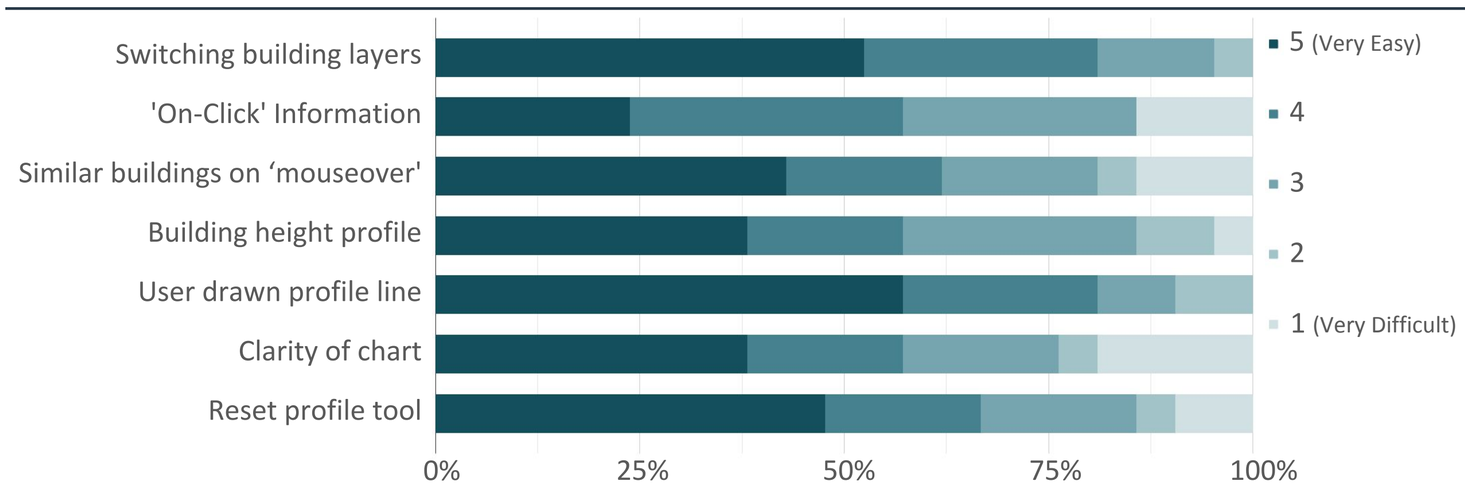

Figure 4: Chart representing user percentage against ease of use question topics, the legend represents user rating.

- Overall 57% to 81% of users found every interactive tool of the application easy to find and use, rating it a score of 4 or 5.
- User found drawing the profile line easiest.
- 43% of users rated the 'On-Click' and profile tools a score of 3 or lower.
- Ease of use testing was only suggested for the Eaton Bray and Wavendon layers, due to the loading limitation of free Heroku deployment and larger GeoJSON.

- Overall 79% of users found overall the application was moderately fast to fast.
- The map navigation and tool results performed fastest.
- Initial loading speed performed worst with a third of users rating speed at average or lower.
- When privately testing layer performance file size and feature count were a major controlling factor on application and tool speeds. This was the main limitation of the UCL layer.

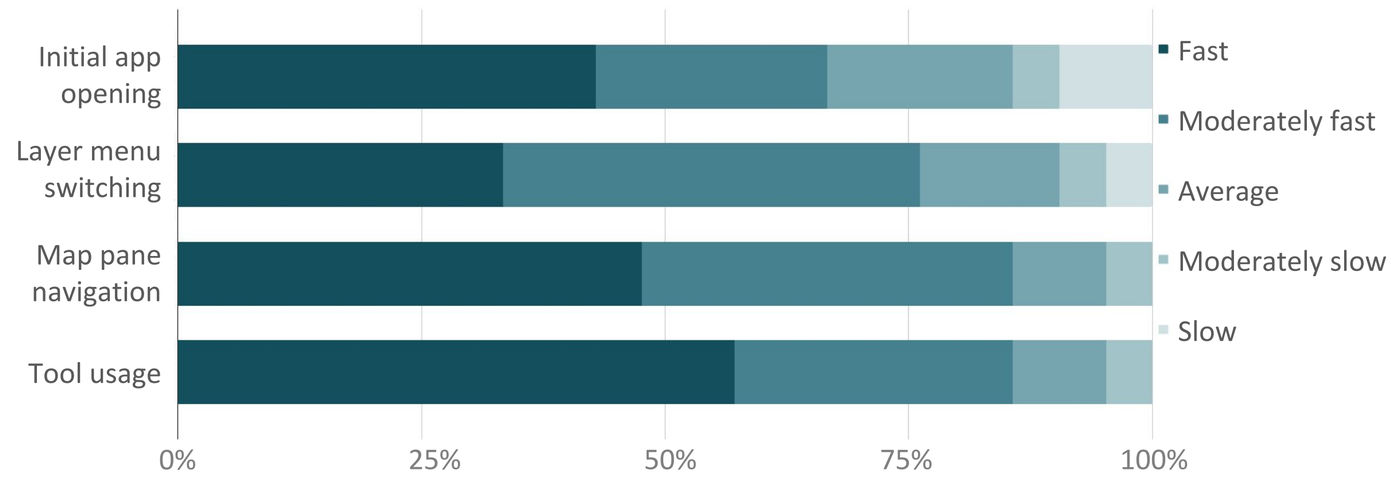

Figure 5: Chart representing user percentage against performance aspects, the legend represents speed.

Conclusions

- User feedback was promising, 100% of users agreed this application could aid the planning process with further development and bug fixing.
- How a tool is used and when it is in operation must be obvious; pop-ups are successful but were not implemented across the whole application. Intuitive styling and user guides could also complement and support the application toolset.
- Mapbox basic functionality is able to support the development of a useable application, which can create an open platform for inspecting 3D spatial data. It can also be extended to perform GIS analysis with integration of other JavaScript libraries, further benefiting the urban planning process.

References

Ordinance Survey. (2014). *OS MASTERMAP TOPOGRAPHY LAYER User Guide*. Ordinance Survey. Retrieved from https://www.ordnancesurvey.co.uk/docs/user-guides/os-mastermap-topography-layer-user-guide.pdf

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