Usability inspection of a transit application through the lens of Bret Victor's user interface theory

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Abstract

City dwellers rely on the quality of transit app user interfaces for seamless travel planning. Bret Victor's innovative UI theory serves as a benchmark for this evaluation of Berlin's official transit app, BVG. Victor's proposed principles – such as minimising unnecessary user interaction, displaying extensive contextual information and deliberate application of graphic design practices – are extracted into concrete criteria. The inspection based on these criteria uncovers numerous shortcomings and unfulfilled potential in BVG's UI. The identified deficiencies provide valuable insights for the future development of transit apps, aiming to provide passengers with more helpful and intuitive interfaces.

1. Introduction

A popular method of assessing the usability of software is through usability inspection, which itself can take many different forms, such as in the heuristic evaluation, where UI specialists inspect the software at hand. The utility of reliance on fewer but more specialised perspectives for usability inspection could be infused with specific theories and ideas on user interfaces. Software engineer and researcher Bret Victor developed one such theory in his article "Magic Ink" [Vic06].

Victor's main points are that "information software", meaning software with the primary purpose to deliver information, fails at providing adequate usability to its users by relying on redundant interaction and neglecting to design bespoke graphical interface elements. Besides drawing upon graphic design, user interfaces should predict the user's concerns by utilizing contextual information such as the user's past queries, geographical location, the current time. Victor summarizes the purpose of software design as "context-sensitive information graphics". Victor himself developed a transit app widget (Figure 1) for the US Bay Area which he discussed in-depth in Magic Ink. This widget won the "Best Mac OS X Dashboard Widget" Apple Design Award in 2007 and lends itself as object of comparison for the inspection of the transit app.

Using Victor's theory as an inspection lens examines two questions: for one, whether Victor's ideas have been actualized since the formation of these ideas in 2006. And furthermore, whether the inspection's subject has usability problems.

The BVG route planner is a mobile application providing real time information for the public transit system in Berlin and the surrounding area [Ber]. Bian, et al. mention an improved image of public transit and reduced wait time for transit app users [BLZ*22]. The tangible impact of transit app usability emphasizes the importance of good software design.

By using Victor's theory on information software as a lens for inspection, fundamental usability problems are revealed that would otherwise be hidden by habituation.

The contributions of this paper are

- theoretical contribution: an evaluation framework for applying Bret Victor's theory of "information software" on transit apps.
- opinion contribution: the BVG app and by extent similar apps fail to provide usability to their fullest potential
- Methodological contributions: a lens-based usability inspection that extracts criteria from a theoretical proposition.

2. Related Work

Jeffries, Robin, et al. determined that "heuristic evaluation" of a user interface uncovers more usability problems than the other evaluation methods. In heuristic evaluation, UI specialists conduct an in-depth analysis of the user interface. Their personal experience is essential to the advantages to heuristic evaluation. [JMWU91]

Zhang, Basili, and Shneiderman propose "perspective-based inspection" where each inspector focuses on taking a specific perspective on the interface. They proposed "novice", "expert" and "error" perspectives. The detection of usability problems increased using perspective-based inspection compared to the usage of heuristic evaluation. [ZBS98]

Kell examined software engineering principles through the lens of Ivan Illich's concept of "conviviality". His approach is relevant by way of applying theoretical and philosophy-adjacent ideas to a field that is predominantly viewed through purely technical terms. [Kel20]

Figure 1: *Bret Victor's transit widget for the Bay Area*

Figure 2: *The trip results of the BVG app are simpy presented as a list.*

3. Lens-based usability inspection

To systematically evaluate the chosen software, Victor's theory on information software needs to be extracted into a list of principles. These are chosen from Victor's more general arguments for information software as well as from the design decisions of his own developed transit planner widget. The usability of the app is then analyzed according to those criteria. For each criterion a summarizing verdict is reached.

3.1. Results

3.1.1. Alternative trips are presented in a timeline

[Vic06, Demonstration: Showing the data]

The proposed trips as seen in Figure 2 are presented as a list in chronological order.

Verdict: A timeline graph is nonexistent.

3.1.2. The user's geographical location is the baseline for navigating the space domain

[Vic06, Inferring context from the environment]

The start position can simply be set as the user's current geographical location by tapping a button next to the form. Also, when entering only the destination, the departure form is automatically filled with the user's current location.

The current geographical location is displayed on a map as seen in Figure 3. A button tap re-centers the map to the user's location.

Verdict: The current location as default for navigation through space is fully provided.

3.1.3. Last-value predictors are provided as default configuration

[Vic06, Inferring context from history]

The previously entered trip configuration is set in the trip stop forms by default.

Verdict: Last-value predictors are sufficiently provided.

3.1.4. Learning predictors based on time, history, and geographical location are presented to the user

[Vic06, Inferring context from history]

The home screen shows current departure times of lines near the user's geographical location. Previously entered stops predictors are available when filling the trip stops form. This is limited to individual stops and no complete trips (pair of departure and destination). No patterns from daytime-specific trips are provided as predictors.

Verdict: Learning predictors are sufficiently provided.

3.1.5. "Submit" buttons are avoided in favor of immediate feedback of user actions

[Vic06, Reducing interaction]

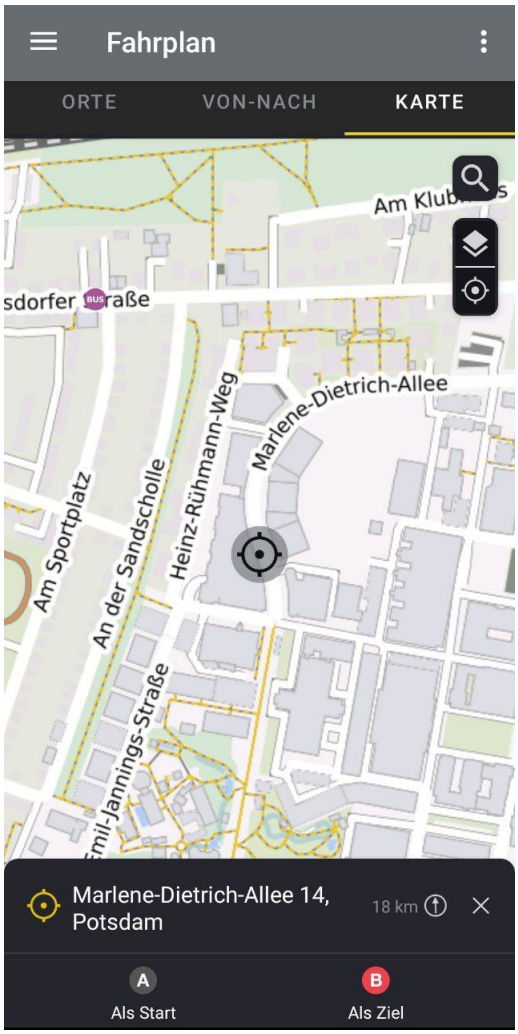

Figure 3: *The BVG app includes a map interface with which a trips start and end stop can be set.*

Searching for trips requires tapping a button after filling out trip stop forms instead of immediate feedback after filling all forms. Otherwise, no interaction requires a subsequent button tap.

Verdict: "Submit" buttons are sufficiently avoided.

3.1.6. Departure time, arrival time, and duration of alternative trips are visually comparable through their graphical layout

[Vic06, Showing the data]

The duration of alternative trips is visually comparable by representing individual trips as "bars" as seen in Figure 4. Longer trips have a larger width than shorter trips. The bar is further subdivided into intermediate stops which provides visually readable way of communicating the length of intermediate trips. Departure and arrival times are simply represented as numbers and thus not graphically comparable.

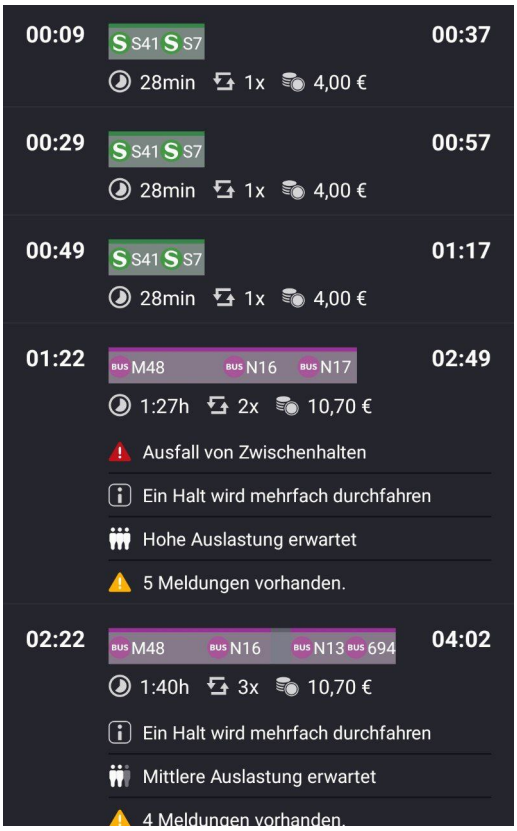

Figure 4: *In the BVG App the length of alternative trips for the same route is graphically encoded through the length of the bar element that represents an individual trip.*

Verdict: Visual comparability is insufficiently provided.

3.1.7. The current time is the baseline for navigating through the time domain

[Vic06, Navigating through time]

The default configuration for the time of the trip form is "now". The graphical interface for configuring the departure or arrival time is in relative terms to "now" as seen in Figure 6.

Verdict: The current time as a baseline for time domain navigation is fully provided.

3.1.8. Temporal information is set in relation to the current time and synced automatically

[Vic06, Navigating through time]

The progress of individual vehicles on their respective path is represented by a progress bar that is in sync with the current time as seen in Figure 5. No other information such as departure and arrival time automatically set in relation to "now".

Verdict: The relation of "now" to temporal information is insufficiently provided.

Figure 5: *The BVG app graphically displays how far the current vehicle of the trip has progressed.*

3.1.9. Configured route is reversible / switchable

[Vic06, Navigating through space]

Configured routes are reversible through a button tap.

Verdict: The ability to reverse routes is fully provided.

3.1.10. The trip stops can be configured through selecting positions on a 2D map interface

[Vic06, Navigating through space]

The map interface (Figure 3) can be used as an alternative to the text forms to enter the departure and arrival stop. The selected locations are not displayed as markers on the map.

Verdict: A 2D map interface to select trip stops is sufficiently provided.

3.1.11. Navigating through time and space requires little interaction

[Vic06, Comparison]

The map(Figure3) is navigated by dragging. The time domain cannot be navigated beyond the configuration interface.

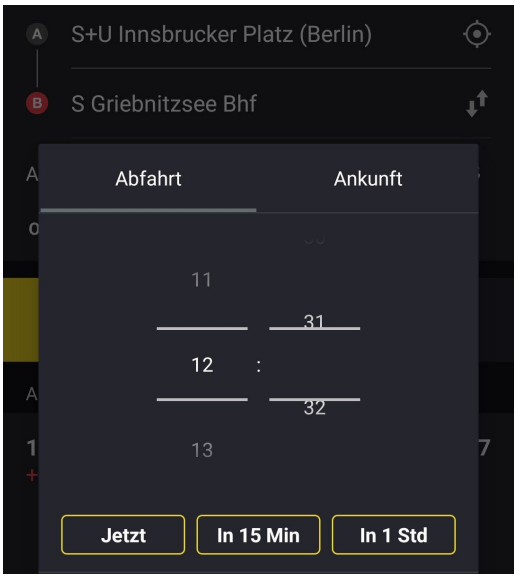

Figure 6: *The BVG interface element to change the selected time.*

Verdict: Interaction-sparse navigation through time and space is insufficiently provided.

3.1.12. The presentation of notification configuration is directly editable (Bonus: sentence interface)

[Vic06, Configuring notifications]

Notifications can only be set for specific trips and are not editable after the fact.

Verdict: Editable presentations of notification configurations are nonexistent.

3.1.13. UI elements like checkboxes, dropdowns, and texts are kept to a minimum, instead users manipulate through bespoke graphics interfaces

[Vic06, Conclusion, Reducing interaction]

Text form is the common UI element through which the user manipulates information. The map and daytime widget are the sole bespoke graphical elements.

Verdict: Bespoke graphical interfaces are insufficiently provided.

3.2. Evaluation

Six out of thirteen examined UI features are either insufficiently implemented or nonexistent. While some core tenets of Victor's approach, such as extensive use of the "map interface", are implemented, others, like the graphical encoding of temporal information in a unified timeline is completely missing. Through the lens of Bret Victor's ideas on software and UI, the BVG app has fundamental deficiencies in its graphical presentation.

3.3. Discussion

Victor's Magic Ink was published one year before the release of the first iPhone and thus the advent of ubiquitous smartphone usage. While this doesn't rule out the relevance of his theory in context of mobile apps, there are some factors that call for an update to the theory.

For once, Victor's argument for the graphic design in opposition to interaction in software does not take into account the available screen space of different devices. Information software on smartphones can accommodate much less information on a single screen compared to information software on desktop machines. The effortless touch controls of smartphones might change the argument against extensive interaction in information software as well.

Compared to Victor's route planner prototype, BVG contains a much denser and more complex transit system. Besides rapid transit, BVG provides information for Berlin's subway, tram and bus system.

3.4. Future Work

To further determine whether this lens-based inspection reveals instructive insights, a comparison of this inspection approach to the established usability inspection methods could be conducted.

In order to support the generalised conclusions from this usability inspection, multiple theory-based inspections of different transit apps could be compared with each other to discern whether the usability problem in transit apps is widespread or even fundamental.

A prototype based on Victors theory could be developed, which then subject of a classic usability inspection. In parallel, one or multiple transit apps are inspected as well. The results of these inspections are then compared to discern whether an implementation of Victor's theory has a measurable higher usability compared to existing transit apps.

In a parallel investigation, we compare the outcomes of usability inspections conducted on two distinct groups: one exposed to Victor's principles and the other unexposed. This comparative analysis aims to elucidate the potential impact of familiarity with Victor's ideas on the results of usability inspections.

Another approach to determine how valuable Victor's theory is for usability inspections could be to compare the usability inspection conducted by two groups. One group is exposed to Victor's theory while the other group has no knowledge of his theory. The difference of these two usability inspections might provide insights to the utility of the information software theory.

4. Conclusion

Applying Bret Victor's theory on information software 17 years after its publication uncovers deep disparity between the potential non-intrusive interfaces promised by Victor's theory and the current existing ones exemplified by the BVG app. While some of Victor's issues with the usability problem of software have been resolved, those are merely surface level. A fundamentally graphic approach to software design is not practised.

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