Generalized Playback Bar for Interactive Branched Video

Eric Lindskog, Jesper Wrang, Madeleine Bäckström, Linn Hallonqvist, Niklas Carlsson

We have all seen a movie where we may have wanted our favorite character to make a different choice...
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... or that we would be more in control of their choices.
Interactive branched streaming

- Clickable objects allow the user to make viewing choices that impact the storyline
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- Branched video have not become mainstream yet
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Problem: Generalized playback bar

• Traditional video players use general playback bar (e.g., shows progress and buffer levels)

• There currently does not exist any generic playback bar for branched video that helps visualize the upcoming branch choices

(a) YouTube (linear) example
Problem: Generalized playback bar

- Traditional video players use general playback bar (e.g., shows progress and buffer levels)
- There currently does not exist any generic playback bar for branched video that helps visualize the upcoming branch choices
- Most branched videos use per-video custom-made user interfaces

(a) YouTube (linear) example

(b) Netflix’s “Pussy in Boots”
Problem: Generalized playback bar

- Need for a generalized interface that easily can be reused for many videos and that provides clear visual information about
  - upcoming branch choices,
  - playback progress, and
  - buffer levels.
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  - upcoming branch choices,
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  - buffer levels.

- Again, these aspects are expected by traditional video players, but not yet available for branched players
Contributions at a glance

1) Design and implementation of a novel branched video player
   - includes a generalized playback bar and other branch features
   - open source: dash.js

2) Results and insights from a three-step user study
   - evaluate the user perceived effort and the added value of the use of such a playback bar,
   - compare alternative designs, and
   - evaluate the integration of the playback bar and other branch-related features
May 2017 and a per-website-based analysis
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System design

- HTTP-based Adaptive streaming (dash.js)

- Extending dash.js for branched Meta file format (in JSON) based on Krishnamoorthi et al. [MM 2014]: (i) branch points, and (ii) segments defined by (i) unique identifier, (ii) start/end times, (iii) branch options, and (iv) a descriptive name

- Player keeps track of playpoint, determines the next branch point, presents branch options, prefetches data for upcoming segments

- A novel customized playback bar using Javascript and canvas elements for drawing the graphics

- Playback bar consists of multiple segments. Each segment shows what has been played (if any) and what has been buffered (if any)
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Example player

Run away

Go loco
Playback bar features (designed/evaluated)

• How much of the tree to show?
  • Compared alternatives; e.g., “full structure”, “simple zoom-and-follow”, and “prune non-selected paths”

• Position, visibility, and timing?
  • Placement and size of branch choice buttons?
  • How far in advance?
  • When to show (or not to show) the playback bar?

• Visual appearance of branches?
  • Generalized shape of branches (e.g., arctan, log, step function, …)?
  • Focus-based visual distortion (e.g., fish-eye effects)?

• Integration and branch-choice labeling
  • Matching branch labeling?
  • Highlight path when hovering?
  • Clickable playback bar?
  • Explicit buttons in tree?
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User study

• 32 participants
  • University students from mix of programs
  • Ages 20-30 (mean = 22.7)
  • 10 female; 22 male
  • Half never seen a branched video before; rest 1-5 times
  • Bandersnatch dominated among first such video seen
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• Three steps
  1. With vs without [default]: User perceived effort (NASA-TLX), complexity (SEQ), and measured response time
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• Tried to reduce potential influence
  • E.g., avoid leading questions
Example results [step 1/3]: Perceived effort (with “default” version and in first step of study)

- Effort: Low effort (e.g., all < 9/20) and small (non-significant) differences
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![Graph showing mean scores for different NASA-TLX questions with and without a certain feature. The graph indicates that the mean score for 'Temporal Effort' with the feature is significantly lower (9) compared to without the feature (20). The scale is 1-20 (low to high).]
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In the paper also other effort and complexity measures are considered.

**Figure 7: CDFs of the branch selection times.**

**Table 1: Summary of SEQ (scale 1-7; low-to-high).**

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<th>Implementation</th>
<th>Mean ($\mu \pm \sigma$)</th>
<th>95% interval</th>
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<td>With PBB</td>
<td>6.63 ± 0.83</td>
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- Effort: Low effort (e.g., all < 9/20) and small (non-significant) differences

- Value added: Playback bar can add value (e.g., > 13/20)

Branched playback bar can add value at the cost of very limited perceived client effort

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Example results [step 2/3]: Added value
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<th>Aspect of consideration</th>
<th>Score ($\mu \pm \sigma$)</th>
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<td>13.6 ± 5.2</td>
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<td>The video structure and choices at hand</td>
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Table 3: Summary of like/dislike evaluation results. Here, we use (**) to indicate when a result is significant.

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<td>Clickable playback bar, without any buttons</td>
<td>0</td>
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</table>
Example results [step 3/3]: Like/dislikes

Table 3: Summary of like/dislike evaluation results. Here, we use (**)) to indicate when a result is significant.

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<tr>
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<th>Don’t know</th>
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<tbody>
<tr>
<td>Simple zoom-and-follow</td>
<td>13</td>
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<tr>
<td>Prune non-selected paths</td>
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</tr>
<tr>
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<td>3</td>
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<td>Mouse-eye</td>
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<tr>
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- No silver bullet, but some features provided significant differences (**)
Example results [step 3/3]: Like/dislikes

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Feature: Prune non-selected paths

Example comments(+) : “removes unnecessary information”, “focus on the part of interest”, “reduces the chance regretting past choices”, and “feels more realistic”
Example results [step 3/3]: Like/dislikes

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Feature: Highlight path when hovering over button

Example comments (+): “simple”, “made it clear what path you consider choosing”, “feels more in control”, and “connects playback bar to the buttons”
Conclusions and summary

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2. Three-step user study in which we evaluated the playback bar and compared with alternative designs and branch-related features
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Generalized Playback Bar for Interactive Branched Video

Eric Lindskog, Jesper Wrang, Madeleine Bäckström, Linn Hallonqvist, Niklas Carlsson