Interactive and Real-Time Typesetting for Demonstration and Experimentation

TUG 2023

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Digital Typesetting: a fascinating domain

- Strong focus on beauty and aesthetics (the Art)
- Full of interesting technical challenges (the Science)
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- Requirements (the same!)
  - real-time
  - interactive

State of the Art: none
- WYSIWYG tools are of varying quality
- \( \text{TEX} \) is not really interactive
- Neither have easily accessible internals (production systems)

Conclusion: DIY!
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In olden times when wishing still helped one, there lived a king whose daughters were all beautiful; and the youngest was so beautiful that the sun itself, which has seen so much, was astonished whenever it shone in her face. Close by the king's castle lay a great dark forest, and under an old lime-tree in the forest was a well, and when the day was very warm, the king's child went out into the forest and sat down by the side of the cool fountain; and when she was bored she took a golden ball, and threw it up on high and caught it; and this ball was her favorite plaything.
# The benefits of being multi-paradigm: concision

<table>
<thead>
<tr>
<th></th>
<th>LoC</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUI</td>
<td>800</td>
</tr>
<tr>
<td>Hyphenation</td>
<td>150</td>
</tr>
<tr>
<td>Lineup</td>
<td>500</td>
</tr>
<tr>
<td>Algorithms</td>
<td>150 – 450</td>
</tr>
<tr>
<td>Knuth-Plass</td>
<td>700 (total for the 2 variants)</td>
</tr>
</tbody>
</table>
**Object-Oriented Programming**

**Inheritance & polymorphism: code reuse**

- kp-mixin
  - pass-number
  - demerits

- paragraph
  - width
  - disposition
  - lines

- graph-par
  - layouts-number

- kp-dyn-par
  - nodes-number

- kp-graph-par
Higher-order functions: parametrization

;; Duncan
(make-graph lineup width) ;; default behavior

;; Knuth-Plass graph variant
(make-graph lineup width
  :next-boundaries #'kp-next-boundaries ;; KP-specific function...
  :threshold pre-tolerance) ;; ... with specific arguments
Real-time reflexive access to the *running* program
Graph Considerations #1

What about the graph sizes? (20 LoC)

Graph size vs. Paragraph width (pt)

- Fulls/None
- Fulls/Fallback
- Fulls/Preventive
How many solutions? (20 LoC)
Comparative Study #1

How many fulls? (10 LoC)

[Graph showing under/overfulls number vs paragraph width (pt) for different typesetting methods: Best-Fit, Barnett, Duncan, Knuth-Plass/Graph, and Knuth-Plass/Dynamic.]
Comparative Study #2

How many hyphens? (6 LoC)

[Graph showing the number of hyphens as a function of paragraph width for different typesetting methods: Best-Fit, Barnett, Duncan, Knuth-Plass/Graph, and Knuth-Plass/Dynamic.]

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What about the average scaling? (8 LoC)
And the scaling variance? (14 LoC)
TEX's view on the competition? (14 LoC)
Comparative Study #6 (anecdote)

With or without pre-tolerance (1 LoC)

![Graph showing TeX's Demerits against Paragraph width (pt).]
Future Work

- Bibliography
  - Study more literature
  - HELP! Barnett / Duncan original papers wanted!
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  - Revisit Knuth-Plass
  - New algorithms
  - ...
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https://github.com/didierverna/etap

Thank you!