

A WYSIWYG Framework

by

Johannes-Lukas Bombach

Submitted to the Fachbereich Informatik, Kommunikation und
Wirtschaft

in partial fulfillment of the requirements for the degree of

Master of Science

at the

HOCHSCHULE FÜR TECHNIK UND WIRTSCHAFT BERLIN

August 2015

Author
Johannes-Lukas Bombach
August 26, 2015

Certified by
Prof. Dr. Debora Weber-Wulff
Associate Professor
Thesis Supervisor

A WYSIWYG Framework

by

Johannes-Lukas Bombach

Submitted to the Fachbereich Informatik, Kommunikation und Wirtschaft
on August 26, 2015, in partial fulfillment of the
requirements for the degree of
Master of Science

Abstract

Browsers do not offer native elements that allow for rich-text editing. There are third-party libraries that emulate these elements by utilizing the `contenteditable`-attribute. However, the API enabled by `contenteditable` is limited and unstable. Bugs and unwanted behavior can only be worked around and not fixed. The library "Type" demonstrates that rich-text editing can be achieved without requiring the `contenteditable` attribute, thus solving many problems contemporary third-party rich-text editor libraries have.

Thesis Supervisor: Prof. Dr. Debora Weber-Wulff
Title: Associate Professor

Acknowledgments

I would like to extend my thanks to my supervisor Prof. Dr. Debora Weber-Wulff for giving me the opportunity to work on a topic I have been passionate about for years.

I would like to thank Marijn Haverbeke for his work on CodeMirror, from which I could learn a lot.

I would like to thank my father for supporting me. Always.

Contents

1	Introduction	13
1.1	Motivation	13
1.2	Structure	15
2	Text editing in desktop environments	17
2.1	Basics of plain-text editing	17
2.2	Basics Rich-text editing	17
2.3	Libraries for desktop environments	17
3	Text editing in browser environments	19
3.1	Plain-text inputs	19
3.2	History of rich-text editing	19
4	Implementation	21
4.1	On writing a JavaScript Library	21
4.2	Ich habe verwendet	21
4.3	Coding conventions	22
4.4	Coding Klassen	22
4.5	Programmstruktur	22
4.6	Type	23
4.7	Caret	23
4.8	Range	23
4.9	Selection	23

4.10	Selection Overlay	23
4.11	Input	23
4.12	Formatting	23
4.13	Change Listener	23
4.14	Contents	24
4.15	Development	24
4.16	Dom Utilities	24
4.17	Dom Walker	24
4.18	Environment	24
4.19	Core Api	24
4.20	Event Api	24
4.21	Events	24
4.22	Input Pipeline	25
4.23	Plugin Api	25
4.24	Settings	25
4.25	Text Walker	25
4.26	Utilities	25
A	Tables	27
B	Figures	29

List of Figures

List of Tables

2.1	Rich-text components in desktop environments	18
-----	--	----

Chapter 1

Introduction

1.1 Motivation

Rich-text editors are commonly used by many on a daily basis. Often, this happens knowingly, for instance in an office suite, when users wilfully format text. But often, rich-text editors are being used without notice. For instance when writing e-mails, entering a URL inserts a link automatically in many popular e-mail-applications. Also, many applications, like note-taking apps, offer rich-text capabilities that go unnoticed. Many users do not know the difference between rich-text and plain-text writing. Rich-text editing has become a de-facto standard, that to many users is *just there*. Even many developers do not realise that formatting text is a feature that needs special implementation, much more complex than plain-text editing.

While there are APIs for creating rich-text input controls in many desktop programming environments, web-browsers do not offer native rich-text inputs. However, third-party JavaScript libraries fill the gap and enable developers to include rich-text editors in web-based projects.

The libraries available still have downsides. Most importantly, only a few of them work. As a web-developer, the best choices are either to use CKEditor or TinyMCE. Most other editors are prone to bugs and unwanted behaviour. Piotrek Koszuliński, core developer of CKEditor comments this on StackOverflow as follows:

*Don't write wysiwyg editor[sic] - use one that exists. It's going to consume all your time and still your editor will be buggy. We and guys from other... two main editors (guess why only three exist) are working on this for years and we still have full bugs lists ;).*¹

A lot of the bugs CKEditor and other editors are facing are due to the fact that they rely on so-called "HTML Editing APIs" that have been implemented in browsers for years, but only been standardized with HTML5. Still, to this present day, the implementations are prone to numerous bugs and behave inconsistently across different browsers. And even though these APIs are the de-facto standard for implementing rich-text editing, with their introduction in Internet Explorer 5.5, it has never been stated they have been created to be used as such.

It's a fact, that especially on older browsers, rich-text editors have to cope with bugs and inconsistencies, that can only be worked around, but not fixed, as they are native to the browser. On the upside, these APIs offer a high-level API to call so-called "commands" to format the current text-selection.

However, calling commands will only manipulate the document's DOM tree, in order to format the text. This can also be achieved without using editing APIs, effectively avoiding unfixable bugs and enabling a consistent behaviour across all browsers.

Furthermore CKEditor, TinyMCE and most other libraries are shipped as user interface components. While being customizable, they tend to be invasive to web-projects.

This thesis demonstrates a way to enable rich-text editing in the browser without requiring HTML Editing APIs, provided as a GUI-less software library. This enables web-developers to implement rich-text editors specific to the requirements of their web-projects.

¹<http://stackoverflow.com/questions/11240602/paste-as-plain-text-contenteditable-div-textarea-word-excel/1129008211290082>, last checked on 07/13/2015

1.2 Structure

The first part of this thesis explains rich-text editing on desktop PCs. The second part explains how rich-text editors are currently being implemented in a browser-environment and the major technical differences to the desktop. Part three will cover the downsides and the problems that arise with the current techniques used. Part four will explain how rich-text editing can be implemented on the web bypassing these problems. Part five dives into the possibilities of web-based rich-text editing in particular when using the techniques explained in this thesis.

Chapter 2

Text editing in desktop environments

2.1 Basics of plain-text editing

caret selection input

2.2 Basics Rich-text editing

document tree formatting algorithms

2.3 Libraries for desktop environments

It is no longer needed to implement basic rich-text editing components from the ground up. Rich-text editing has become a standard and most modern Frameworks, system APIs or GUI libraries come with built-in capabilities. Table 2.1 lists rich-text text components for popular languages and frameworks.

Environment	Component
Java (Swing)	JTextPane / JEditorPane
MFC	CRichEditCtrl
Windows Forms / .NET	RichTextBox
Cocoa	NSTextView
Python	Tkinter Text
Qt	QTextDocument

Table 2.1: Rich-text components in desktop environments

Chapter 3

Text editing in browser environments

3.1 Plain-text inputs

Browsers have native However not an editor. Confining the W3C specifications, there are 2 elements made for text input * input fields and * textareas

3.2 History of rich-text editing

Since the browser is a rich-text viewer, we can utilize this and just modify the dom.

Chapter 4

Implementation

4.1 On writing a JavaScript Library

No IDEs, tools, not even conventions.

Not for building: Big JS libraries all do it differently. Top 3 client side JavaScript repositories (stars) on github <https://github.com/search?l=JavaScript&q=stars%3A%3E1&s=stars&ty>
Angular.js: Grunt d3 Makefile, also ein custom build script welche node packages aufruft jQuery custom scripts, mit grunt und regex und so

Not for Architecture Angular custom module system with own conventions d3 mit nested objects (assoc arrays) und funktionen jQuery mit .fn ACE mit Klassen, daraus habe ich gelernt

4.2 Ich habe verwendet

Gulp requireJs AMDClean Uglify

JSLint - Douglas Crockford coding dogmatas / conventions JSCS - JavaScript style guide checker

Livereload PhantomJs Mocha Chai

Durch Require und AMDClean schÃ¶ne arbeitsweise (am ende Ãijber bord geworfen) und kleine DateigrÃ¶Ãe, wenig overhead.

Automatisierte Client side Tests mit PhantomJs und Mocha/Chai

4.3 Coding conventions

Habe mich größtenteils an Crockfordstyle orientiert, aber die Klassen anders geschrieben. Habe den Stil von ACE editor verwendet, denn der ist gut lesbar. Lesbarkeit war mir wichtiger als Crockford style. Für private Eigenschaften und Methoden habe ich die prefix convention verwendet. https://developer.mozilla.org/en-US/Add-ons/SDK/Guides/Contributor_s_Guide/Private_Properties Sie bewirkt keine echte accessibility restriction, aber es ist eine allgemein anerkannten convention und ist auch viel besser lesbar.

4.4 Coding Klassen

Ich habe mich für Klassen entschieden. Das hat folgende Vorteile:

- * Klassen sind ein bewährtes Konzept um Code zu kapseln, logisch zu strukturieren und lesbar zu verwalten
- * Durch prototypische Vererbung existiert die funktionalität von Klassen nur 1x im Browser 7 RAM
- * Zudem gibt es Instanzvariablen, die für jede Type Instanz extra existieren und so mehrere Instanzen erlauben
- * Die instanzvariablen sind meistens nur Pointer auf Instanzen anderer Klassen
- * Das ganze ist dadurch sehr schlank

4.5 Programmstruktur

Es gibt ein Basisobjekt, das ist die Type "Klasse". Darin werden dann die anderen Klassen geschrieben "Type.Caret", "Type.Selection", "Type.Range", ... Das hat den Vorteil dass das ganze ge-name-spaced ist, so dass ich keine Konflikte mit Systemnamen habe (Range) (und auch nicht mit anderen Bibliotheken) Effektiv gibt es eine (flache) Baumstruktur und so mit Ordnung. Für bestimmte Klassen, "Type.Event.Input", "Type.Input.Filter.X" geht es tiefer. Der zweite Grund ist, dass ich somit alle Klassen die ich geschrieben habe für Entwickler sichtbar bereit stelle und nicht implizit und versteckt über irgend nen Quatsch.

Ich werde jetzt die einzelnen Module erklären

4.6 Type

Die Type

4.7 Caret

caret

4.8 Range

range

4.9 Selection

selection

4.10 Selection Overlay

overlay

4.11 Input

input

4.12 Formatting

formatting

4.13 Change Listener

change

4.14 Contents

contents

4.15 Development

developmment

4.16 Dom Utilities

dom util

4.17 Dom Walker

dom walker

4.18 Environment

env

4.19 Core Api

core api

4.20 Event Api

ev api

4.21 Events

Input input event only event required so far

4.22 Input Pipeline

pipeline ideas

Caret caret

Command command

Headlines head lines

Line Breaks line breaks

Lists lists

Remove remove

Spaces spaces

4.23 Plugin Api

plugin api

4.24 Settings

settings

4.25 Text Walker

text walker

4.26 Utilities

util

Appendix A

Tables

Appendix B

Figures

Bibliography