



Foto: Scholz



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TEACHING DIGITAL LEXICOGRAPHY FROM SCRATCH

An Open-Source Tool for XML and HTML

WHAT THIS TALK IS (NOT) ABOUT

- Meet **x4ml**, an open-source **educational program** for teaching the basics of **XML/HTML-based technologies**.
 - x4ml is not "lexicographic software" in a usual sense, but it has been designed for aspiring lexicographers.
 - **Topics for today:**
 - why x4ml?
 - demo of x4ml
 - experiences and alternatives
-

**SOME MOTIVATION:
WHO NEEDS X4ML?**

A LITTLE BIT OF BACKGROUND

- x4ml was developed for a week-long "advanced module" on "**Modeling and Representing Data in Digital Lexicography**"
- this module is part of the curriculum of the **European Master of Lexicography (EMLex)** since 2019
 - Master program exists since 2009
 - Erasmus Mundus Joint Master Degree since 2016
 - for more, see <https://www.emlex.phil.fau.de/>
- the module was taught **five times** so far (on-site in Rome, Budapest; remote in Santiago de Compostela, Erlangen, Braga); of which twice using x4ml



A LITTLE BIT OF BACKGROUND

- x4ml was developed for a week-long "advanced module" on "**Modeling and Representing Data in Digital Lexicography**"
 - **objectives** of module: students should...
 - get a good grasp of **basic tech concepts** in data modeling and digital presentation
 - become **able to communicate** with computational lexicographers, and IT people involved in digital lexicographical projects
 - **point of departure:** *Internet lexicography* as a familiar and paradigmatic case
 - **XML** technologies: well-established set of tools, practices, standards; friendly learning curve, widespread adoption in current lexicography
 - **hands-on approach; addressed at IT novices (with previous exposure to XML basics)**
-

WISHLIST FOR A TEACHING TOOL

- **minimize support effort** in class; eliminate typical sources of errors
 - **one program for everything** (XML, schema, query language, stylesheet, HTML, ...)
- available **cross-platform** (Windows, Apple, Linux)
- **free of charge** / open source
- **lexicography-centric** functionality (e.g. create your own mini-dictionary from scratch)
- **low-threshold usage**
 - focus on technologies and concepts, not on idiosyncrasies of programs!
 - have the views/editors for XML – schema – HTML side by side on one screen
 - instant feedback upon changes, no tedious cycle of **edit – save – update preview**

This wishlist led to the creation of **x4ml** – "XML for Masterful Lexicographers".

**DEMO:
WORKING WITH X4ML**

DEPLOYING X4ML: IT'S JUST ONE FILE (X4ML.JAR)

- install it locally ('**Desktop mode**):
 - just double-click the downloaded executable JAR file to start
 - application itself does not require Internet connection!
- ...or use it in '**server mode**':
 - essentially a one-liner: **java -jar x4ml.jar [some params]**
 - concurrent multi-user operation
 - no setup issues for students
- in both modes, user interface runs in the **browser**
- only one **prerequisite**: Java Runtime (JRE 11 or higher)



The screenshot shows a web browser window with the URL `localhost:49918/mainpage?workdir=demo&username=__DESKTOP__`. The browser's address bar and navigation icons are visible at the top. Below the browser window, the x4ml interface is displayed. The header bar includes the x4ml logo, the text "desktop mode (/Users/peter/data/eLex23/x4ml)", and "current workspace: demo". The main content area is split into two vertical panes. The left pane has a dropdown menu labeled "select or create an XML file here" and an "actions" button with a gear icon. Below this, a list contains one item: "1 Please select or create a file using the dropdown above to get started." The right pane has a dropdown menu labeled "select or create a DTD, RelaxNG, X..." and an "actions" button with a gear icon. Below this, a list contains three items: "1 Please select or create a file using the dropdown above to get started.", "2", and "3 PLEASE NOTE: Most of the functionality in this right pane is available only if an XML file is open in the left pane." At the bottom of the interface, there are two sections: "MESSAGES" on the left and "OUTPUT" on the right, each with a horizontal line below its title. A vertical blue bar with a gear icon is positioned between the two main panes, and horizontal blue bars with minus signs are used for resizing the panes.

x4ml browser interface

- LEFT: **XML**
- RIGHT: sth. that **operates on XML**

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here actions

1 Please select or create a file using the dropdown above to get started.

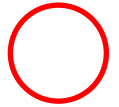
select or create a DTD, RelaxNG, X... actions

1 Please select or create a file using the dropdown above to get started.
2
3 PLEASE NOTE: Most of the functionality in this right pane is available only if an XML file is open in the left pane.

MESSAGES OUTPUT

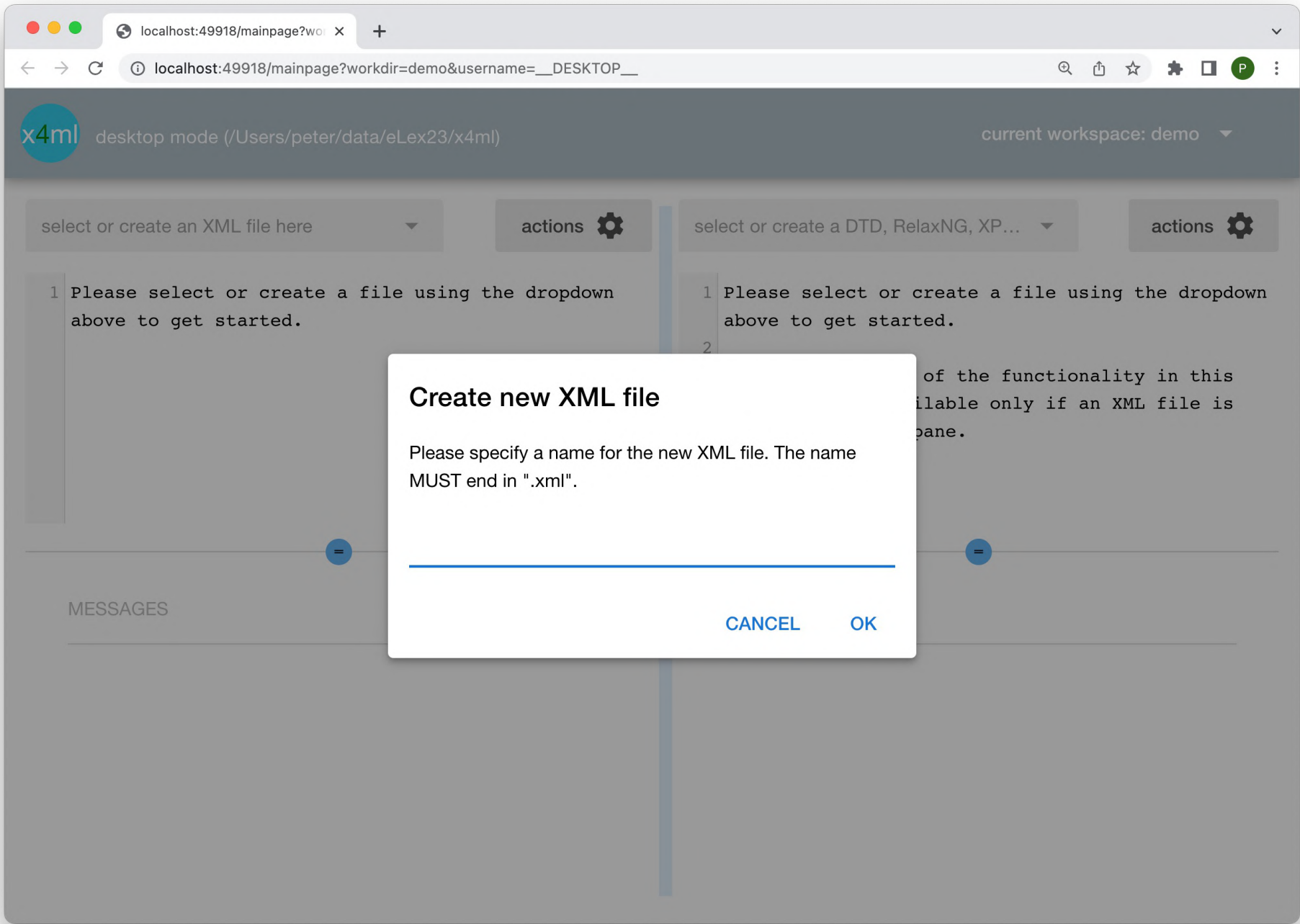
red circle

= 'click here'



create XML file

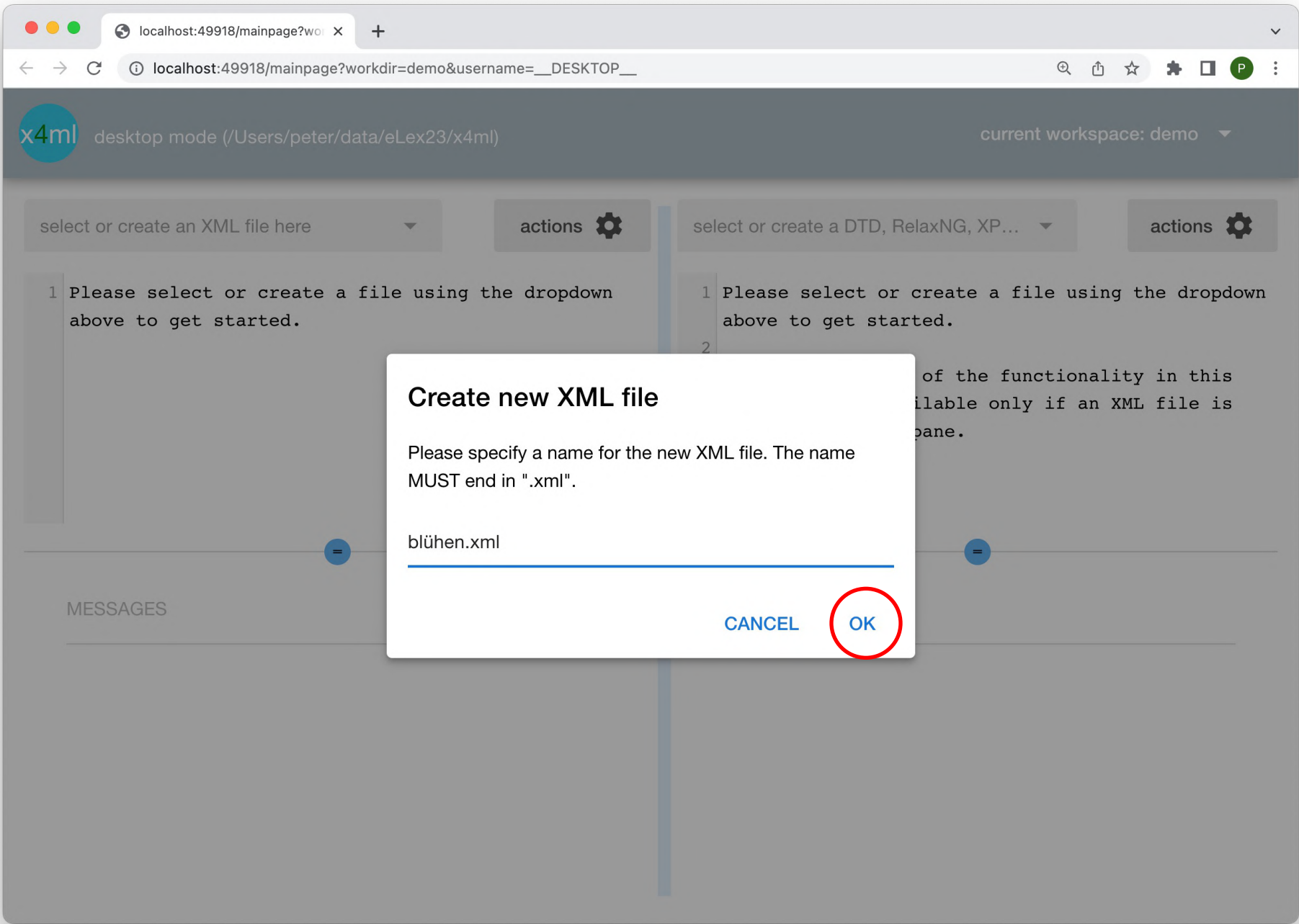
all files are stored in a folder on the local computer or on the server



Create new XML file

Please specify a name for the new XML file. The name MUST end in ".xml".

CANCEL OK



Create new XML file

Please specify a name for the new XML file. The name MUST end in ".xml".

blühen.xml

CANCEL

OK

The screenshot shows the x4ml web application interface. At the top, the browser address bar displays the URL `localhost:49918/mainpage?workdir=demo&username=__DESKTOP__`. The application header includes the x4ml logo, the text "desktop mode (/Users/peter/data/eLex23/x4ml)", and "current workspace: demo".

The main interface is divided into two vertical panes. The left pane is titled "select or create an XML file here" and shows a file named "blühen.xml". The XML content in the left pane is:

```
1 <?xml version="1.0" encoding="UTF-8" ?>
2 <entry>This is a very simple sample XML document.</entry>
```

The right pane is titled "select or create a DTD, Relax..." and contains the following text:

```
1 Please select or create a file using the
  dropdown above to get started.
2
3 PLEASE NOTE: Most of the functionality
  in this right pane is available only if
  an XML file is open in the left pane.
```

Below the XML panes are two horizontal sections: "MESSAGES" on the left and "OUTPUT" on the right. The "MESSAGES" section displays the message "XML is well-formed." The "OUTPUT" section is currently empty.

**new XML document created
with dummy content**

**bottom left:
XML well-formed?**

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
blühen.xml

actions

1

select or create a DTD, Relax...

actions

1 Please select or create a file using the dropdown above to get started.
2
3 PLEASE NOTE: Most of the functionality in this right pane is available only if an XML file is open in the left pane.

MESSAGES

OUTPUT

ok, let's start from scratch,
so delete that dummy stuff...

typing XML code...

after each keystroke all panes are updated, all changed contents saved

...with only a *little* bit of editor convenience,

such as adding end tag automatically

→ "barebones" approach

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
blühen.xml

actions

```
1 <entry>
2   <lemma pos="v">blühen</lemma>
3   <senses>
4     <sense>to blossom</sense>
5   </senses>
6 </entry>
```

select or create a DTD, Relax... actions

```
1 Please select or create a file using the
2 dropdown above to get started.
3 PLEASE NOTE: Most of the functionality
4 in this right pane is available only if
5 an XML file is open in the left pane.
```

MESSAGES

XML is well-formed.

OUTPUT

done with our first dictionary entry

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
blühen.xml

blühen.xml

CREATE A NEW FILE

```
5 </senses>
6 </entry>
```

actions

select or create a DTD, Relax...

actions

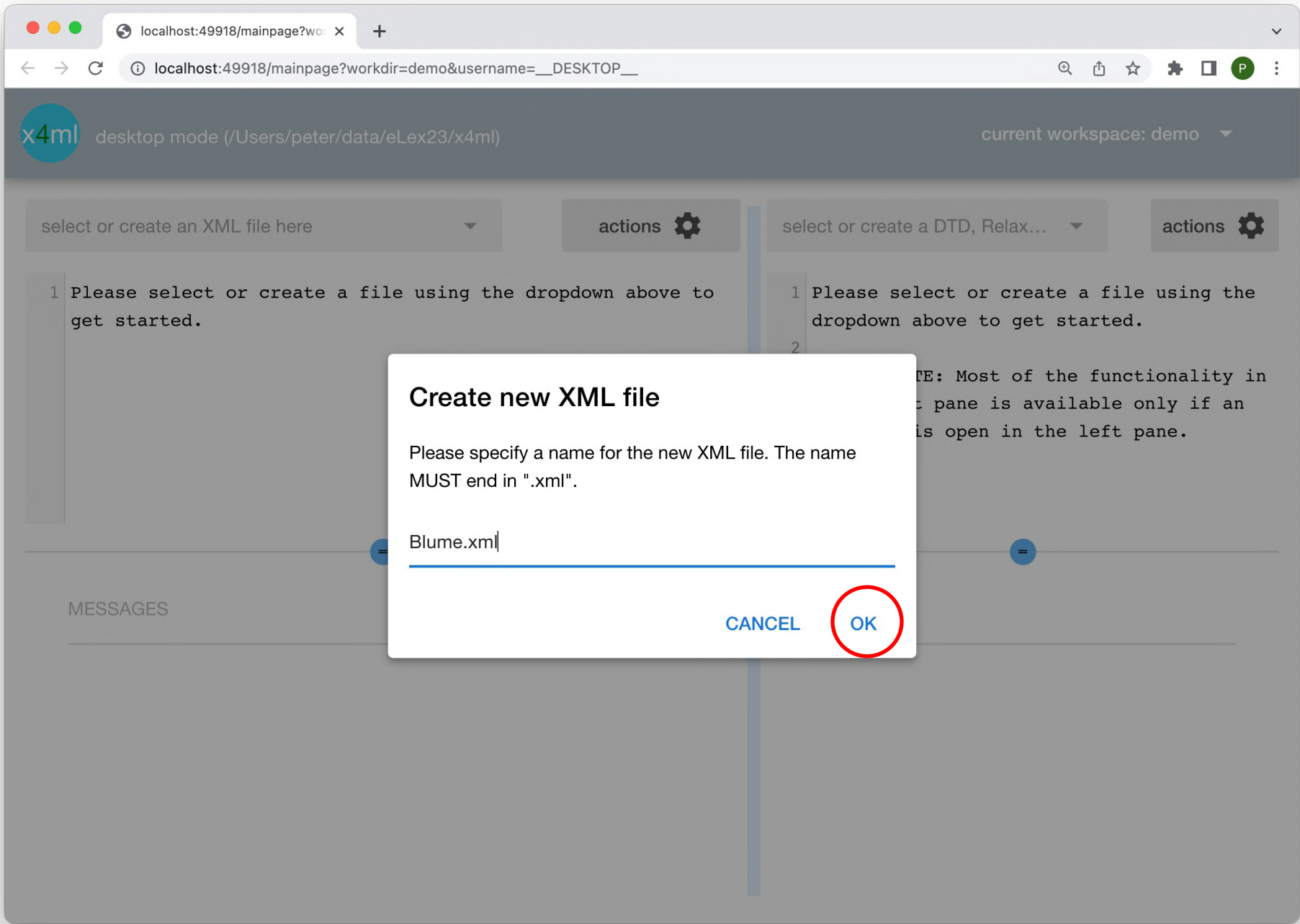
- 1 Please select or create a file using the dropdown above to get started.
- 2
- 3 PLEASE NOTE: Most of the functionality in this right pane is available only if an XML file is open in the left pane.

MESSAGES

XML is well-formed.

OUTPUT

create second XML document



Create new XML file

Please specify a name for the new XML file. The name MUST end in ".xml".

Blume.xml

CANCEL OK

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```
1 <?xml version="1.0" encoding="UTF-8" ?>
2 <entry>This is a very simple sample XML document.</entry>
```

select or create a DTD, Relax... actions

```
1 Please select or create a file using the
  dropdown above to get started.
2
3 PLEASE NOTE: Most of the functionality
  in this right pane is available only if
  an XML file is open in the left pane.
```

MESSAGES

XML is well-formed.

OUTPUT

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
Blume.xml

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

actions

select or create a DTD, Relax... actions

```
1 Please select or create a file using the
2 dropdown above to get started.
3 PLEASE NOTE: Most of the functionality
4 in this right pane is available only if
5 an XML file is open in the left pane.
```

MESSAGES

XML is well-formed.

OUTPUT

this entry has two word senses!

**now let's create a RelaxNG
schema
on the right hand side**
(DTD also supported)

now let's create a RelaxNG schema on the right hand side (DTD also supported)

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
Blume.xml

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath, or HTM...

CREATE A NEW FILE

using the dropdown above to get started.

PLEASE NOTE: Most of the functionality in this right pane is available only if an XML file is open in the left pane.

MESSAGES

XML is well-formed.

OUTPUT

now let's create a RelaxNG schema on the right hand side (DTD also supported)

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of bee</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath... actions

```
1 Please select or create a file using the dropdown
   above to get started.
```

of the functionality in this
available only if an XML file is
pane.

MESSAGES

XML is well-formed.

Create new
DTD/RelaxNG/XPath/HTML file

Please specify a name for the new file. The name **MUST** end in ".dtd", ".rnc", ".xpath", or ".html".

CANCEL OK

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of bee</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath... actions

```
1 Please select or create a file using the dropdown
   above to get started.
```

of the functionality in this
available only if an XML file is
pane.

MESSAGES

XML is well-formed.

Create new DTD/RelaxNG/XPath/HTML file

Please specify a name for the new file. The name MUST end in ".dtd", ".rnc", ".xpath", or ".html".

schema.rnc

CANCEL OK

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
Blume.xml actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath, or HTM...
schema.rnc actions

```
1 |
```

MESSAGES

XML is well-formed.

OUTPUT

The screenshot shows the x4ml web application interface. At the top, the browser address bar displays 'localhost:49918/mainpage?workdir=demo&username=__DESKTOP__'. The application header includes the x4ml logo, 'desktop mode (/Users/peter/data/eLex23/x4ml)', and 'current workspace: demo'. Below the header, there are two main panels. The left panel, titled 'select or create an XML file here', shows 'Blume.xml' and contains the following XML code:

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

The right panel, titled 'select or create a DTD, RelaxNG, XPath, or HTML...', shows 'schema.rnc' and contains the following RNC code:

```
1 element entry {
2   element lemma {
3     attribute pos {n | v }
4     text
5   },
6   element senses {
7     element sense {text}
8   }
9 }
```

The RNC code has a syntax error: the attribute definition on line 3 is missing closing quotes for the values 'n' and 'v'. A blue vertical bar is positioned between the two panels, and a blue circle highlights the error in the RNC code. Below the panels, there are two sections: 'MESSAGES' on the left and 'OUTPUT' on the right. The 'MESSAGES' section displays 'XML is well-formed.' The 'OUTPUT' section displays two error messages:

```
3:20: reference to non-existent grammar
3:24: reference to non-existent grammar
```

bottom right:
syntax errors in the schema
(missing quotes)

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
Blume.xml

actions ⚙

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath, or HTM...
schema.rnc

actions ⚙

```
1 element entry {
2   element lemma {
3     attribute pos {'n' | 'v' },
4     text
5   },
6   element senses {
7     element sense {text}
8   }
9 }
```

MESSAGES

XML is well-formed.

OUTPUT

```
5:12: element "sense" not allowed here;
expected the element end-tag
```

now the schema is well-formed, but the XML document on the left is not valid wrt. this schema

any file on the RHS is automatically applied to the XML document on the LHS

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
Blume.xml

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

actions ⚙

select or create a DTD, RelaxNG, XPath, or HTM...
schema.rnc

```
1 element entry {
2   element lemma {
3     attribute pos {'n' | 'v' },
4     text
5   },
6   element senses {
7     element sense {text} +|
8   }
9 }
```

actions ⚙

MESSAGES

XML is well-formed.

OUTPUT

XML is valid relative to this RelaxNG.

finally, everything works

The screenshot shows the x4ml web application interface. At the top, the browser address bar displays 'localhost:49918/mainpage?workdir=demo&username=__DESKTOP__'. The application header includes the x4ml logo, the text 'desktop mode (/Users/peter/data/eLex23/x4ml)', and 'current workspace: demo'. Below the header, there are two main panels. The left panel is titled 'select or create an XML file here' and shows 'Blume.xml'. It contains an XML editor with the following code:

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

Below the editor is a 'MESSAGES' section with the text 'XML is well-formed.'. The right panel is titled 'select or create a DTD, RelaxNG, XPath, or HTML...' and shows 'schema.rnc'. It contains an RNC schema:

```
1 element entry {
2   element lemma {
3     attribute pos {'n' | 'v' },
4     text
5   },
6   element senses {
7     element sense {text} +
8   }
9 }
```

Below the editor is an 'OUTPUT' section with the text 'XML is valid relative to this RelaxNG.'. A red circle highlights the 'actions' button in the top right of the right panel.

apply validation to *all* XML documents

(analogous functionality for XPath queries and HTML templates)

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
Blume.xml

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

actions ⚙

select or create a DTD, RelaxNG, XPath, or HTM...
schema.rnc

actions ⚙

- validate HTML
- render HTML in external browser window/tab
- insert code to iterate HTML elements
- insert code to iterate HTML elements, with separator
- show as dictionary
- set name of dictionary
- set XPath for dictionary headwords
- show output for all XML files
- evaluate XPath query on all XML docs ('database mode')

MESSAGES

XML is well-formed.

apply validation to *all* XML documents

(analogous functionality for XPath queries and HTML templates)

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
Blume.xml actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath, or HTM...
schema.rnc actions

```
1 element entry {
2   element lemma {
3     attribute pos {'n' | 'v' },
4     text
5   },
```

OUTPUT

=====
Blume.xml
=====
XML is valid relative to this RelaxNG.

=====
blühen.xml
=====
XML is valid relative to this RelaxNG.

MESSAGES

XML is well-formed.

we're lucky...

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
Blume.xml

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

actions

select or create a DTD, RelaxNG, XPath, or HTML file
schema.rnc

```
1 element entry {
2   element lemma {
3     attribute pos {'n' | 'v' },
4     text
5   },
```

OUTPUT

=====
Blume.xml
=====
XML is valid relative to this RelaxNG.

=====
blühen.xml
=====
XML is valid relative to this RelaxNG.

MESSAGES

XML is well-formed.

Let's create XPath queries –
which we save in an *.xpath
file

XQuery 3.1 is supported.

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of bee</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath... actions

1 Please select or create a file using the dropdown above to get started.

of the functionality in this available only if an XML file is pane.

Create new DTD/RelaxNG/XPath/HTML file

Please specify a name for the new file. The name MUST end in ".dtd", ".rnc", ".xpath", or ".html".

my.xpath

CANCEL OK

MESSAGES

XML is well-formed.

OUTPUT

Let's create XPath queries –
which we save in an *.xpath
file

XQuery 3.1 is supported.

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

MESSAGES

XML is well-formed.

select or create a DTD, RelaxNG, XPath, or HTML file here my.xpath actions

```
1 /put/your/own/xpath/expression/here
2
3 (:
4 Only one XPath or XQuery expression per file!
5 If you have multiple expressions, comma-separate them.
6 :)
7 |
```

OUTPUT

No results.

initial dummy content

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
Blume.xml

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

actions ⚙

select or create a DTD, RelaxNG, XPath, or HTML file here
my.xpath

```
1 //sense
```

actions ⚙

MESSAGES

XML is well-formed.

OUTPUT

result 1:

<sense>flower</sense>

result 2:

<sense>head on top of beer</sense>

XPath query result is a sequence of two <sense> elements

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath, or HTML file here my.xpath actions

```
1 //lemma/text()
```

MESSAGES

XML is well-formed.

OUTPUT

result 1:

Blume

what's the headword of the entry on the LHS?

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
Blume.xml

actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath, or HTML file here
my.xpath

actions

```
1 //lemma/text()
```

MESSAGES

XML is well-formed.

OUTPUT

result 1:

Blume

what are the headwords of all our entries?

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath, or HTML file here my.xpath actions

```
1 //lemma/te
```

OUTPUT

result 1:

Blume

- validate HTML
- render HTML in external browser window/tab
- insert code to iterate HTML elements
- insert code to iterate HTML elements, with separator
- show as dictionary
- set name of dictionary
- set XPath for dictionary headwords
- show output for all XML files
- evaluate XPath query on all XML docs ('database mode')

MESSAGES

XML is well-formed.

what are the headwords of all our entries?

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath, or HTML file here my.xpath actions

```
1 //lemma/text
```

OUTPUT

result 1:

Blume

MESSAGES

XML is well-formed.

- validate HTML
- render HTML in external browser window/tab
- insert code to iterate HTML elements
- insert code to iterate HTML elements, with separator
- show as dictionary
- set name of dictionary
- set XPath for dictionary headwords
- show output for all XML files
- evaluate XPath query on all XML docs ('database mode')

what are the headwords of all our entries?

The screenshot shows the x4ml web application interface. The browser address bar indicates the URL is localhost:49918/mainpage?workdir=demo&username=__DESKTOP__. The application header shows 'x4ml desktop mode (/Users/peter/data/eLex23/x4ml)' and 'current workspace: demo'. The main interface is divided into two panels. The left panel, titled 'select or create an XML file here', shows 'Blume.xml' selected. Below this is a code editor with the following XML content:

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

The right panel, titled 'select or create a DTD, RelaxNG, XPath, or HTML file here', shows 'my.xpath' selected. Below this is a code editor with the following XPath query:

```
1 //lemma/text()
```

Below the code editors are two 'actions' buttons with gear icons. A vertical blue line separates the two panels. Below the line, there are two sections: 'MESSAGES' on the left and 'OUTPUT' on the right. The 'MESSAGES' section shows the message 'XML is well-formed.'. The 'OUTPUT' section shows the results of the XPath query:

```
OUTPUT
-----
result 1:
-----
Blume

result 2:
-----
blühen
```

so we basically created a **headword list**

"database mode": root node has all XML document nodes as its children

count(//sense) would yield the result **3** in 'database mode': two senses in entry **Blume**, plus one sense in entry **blühen**

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of bee</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath, or ... actions

```
1 Please select or create a file using the dropdown above
to get started.
```

functionality in this right pane
XML file is open in the left

MESSAGES

XML is well-formed.

Create new DTD/RelaxNG/XPath/HTML file

Please specify a name for the new file. The name MUST end in ".dtd", ".rnc", ".xpath", or ".html".

my.html

CANCEL OK

Let's create an HTML file.

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath, or HTML file here my.html actions

```
1 <!doctype html>
2 <html lang="en">
3   <head>
4     <meta charset="utf-8">
5     <title>your title here</title>
6   </head>
7   <body>
8     <p>This is a very minimal sample HTML document.
9   </body>
10 </html>
```

MESSAGES

XML is well-formed.

OUTPUT show HTML source code

This is a very minimal sample HTML document.

initial dummy content

HTML is **rendered** in lower right pane.

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```
1 <entry>
2 <lemma pos="n">Blume</lemma>
3 <senses>
4 <sense>flower</sense>
5 <sense>head on top of beer</sense>
6 </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath, or HTML file here my.html actions

```
1 <!doctype html>
2 <html lang="en">
3
4
5 <title your title here</title>
6 </head>
7 <body>
8 <p>This is a very minimal sample HTML document.</p>
9 </body>
10 </html>
```

Special characters must be escaped : [<].
Tag must be paired, no start tag: [</title>]

MESSAGES

XML is well-formed.

OUTPUT show HTML source code

deleted the closing bracket of **<title>** – code checking is now done in the editor itself

x4ml can also call the W3C Markup Validation Service for HTML

The screenshot shows the x4ml web application interface. At the top, the browser address bar shows the URL `localhost:49918/mainpage?workdir=demo&username=__DESKTOP__`. The application header includes the x4ml logo, the text "desktop mode (/Users/peter/data/eLex23/x4ml)", and "current workspace: demo".

There are two main panels for editing files:

- Left Panel:** "select or create an XML file here" with "Blume.xml" selected. The XML content is:

```
1 <entry>
2 <lemma pos="n">Blume</lemma>
3 <senses>
4   <sense>flower</sense>
5   <sense>head on top of beer</sense>
6 </senses>
7 </entry>
```
- Right Panel:** "select or create a DTD, RelaxNG, XPath, or HTML file here" with "my.html" selected. The HTML content is:

```
1 <!doctype html>
2 <html lang="en">
3   <head>
4     <meta charset="utf-8">
5     <title>your title here</title>
6   </head>
7   <body>
8     <p>This is entry <i>{{//lemma}}</i>.</p>
9   </body>
10 </html>
```

Below the XML editor is a "MESSAGES" section with the message "XML is well-formed." Below the HTML editor is an "OUTPUT" section with a checkbox "show HTML source code" and the rendered text "This is entry *Blume*.".

XSLT is (too) hard to teach to IT novices in a short course.

But we must get the idea across of **how to turn our XML into an HTML-based presentation!**

In x4ml, HTML files can be used as **templates** that pick data from XML via **XPath** expressions in **{{moustaches}}**

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

select or create a DTD, RelaxNG, XPath, or HTML file here my.html actions

```
1 <!doctype html>
2 <html lang="en">
3   <head>
4     <meta charset="utf-8">
5     <title>entry {{//lemma}}</title>
6   </head>
7   <body>
8     <h3>{{//lemma}} <i>{{//lemma/@pos}}.</i></h3>
9     <ul>
10
11   </ul>
12 </body>
13 </html>
```

MESSAGES

XML is well-formed.

Blume (n.)

iterating through XML elements cannot be done with moustaches-mechanism

so how do we insert one list item `` per `<sense>` element here?!

The screenshot shows the x4ml web application in desktop mode. The interface is split into two main editing areas. The left area is for XML, with a file named 'Blume.xml' selected. The XML content is as follows:

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```

The right area is for HTML, with a file named 'my.html' selected. The HTML content is as follows:

```
1 <!doctype
2 <html la
3 <head>
4   <met
5   <tit
6 </head>
7 <body>
8   <h3>
9   <ul>
10
11 </ul>
12 </body>
13 </html>
```

An actions menu is open over the HTML editor, listing the following options:

- undo
- redo
- format HTML (WARNING: might change the content!)
- validate HTML
- render HTML in external browser window/tab
- insert code to iterate HTML elements (highlighted with a red circle)
- insert code to iterate HTML elements, with separator
- show as dictionary
- set name of dictionary

Below the editors is a 'MESSAGES' section containing the text: 'XML is well-formed.' Below that, the text 'Blume (n.' is partially visible.

there is an *action* for that

The screenshot shows the x4ml web application interface. At the top, the browser address bar shows the URL `localhost:49918/mainpage?workdir=demo&username=__DESKTOP__`. The application header includes the x4ml logo, the text "desktop mode (/Users/peter/data/eLex23/x4ml)", and "current workspace: demo".

There are two main panels for editing files:

- Left Panel:** File "Blume.xml". The XML content is:

```
1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>
```
- Right Panel:** File "my.html". The HTML content is:

```
1 <!doctype html>
2 <html lang="en">
3   <head>
4     <meta charset="utf-8">
5     <title>entry {{//lemma}}</title>
6   </head>
7   <body>
8     <h3>{{//lemma}} <i>({{//lemma/@pos}}.</i></h3>
9     <ul>
10      <!-- repeat for all $x in /your/xpath -->
11        (insert HTML instead of this text)|
12      <!-- end repeat for all $x -->
13    </ul>
```

Below the XML editor, a "MESSAGES" section displays the message: "XML is well-formed." Below the HTML editor, the rendered output is shown as "Blume (n.)".

two special HTML comments are inserted, in a default version with some explanatory text

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```

1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>

```

select or create a DTD, RelaxNG, XPath, or HTML file here my.html actions

```

1 <!doctype html>
2 <html lang="en">
3   <head>
4     <meta charset="utf-8">
5     <title>entry {{//lemma}}</title>
6   </head>
7   <body>
8     <h3>{{//lemma}} <i>({{//lemma/@pos}}.</i></h3>
9     <ul>
10      <!-- repeat for all $s in //sense -->
11       <li>'{{$s}}'</li>
12      <!-- end repeat for all $s -->
13    </ul>

```

MESSAGES

XML is well-formed.

Blume (n.)

- 'flower'
- 'head on top of beer'

everything between these comments is **iterated!**

Moustaches +
repeat mechanism +
 XQuery
 =
 a lot of templating power!

localhost:49918/mainpage?wo... X +

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here Blume.xml actions

```

1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>

```

select or create a DTD, RelaxNG, XPath, or HTML file here my.html actions

```

1 <!doctype
2 <html la
3 <head>
4   <met
5   <tit
6 </head>
7 <body>
8   <h3>
9   <ul>
10   <!--
11
12   <!--
13 </ul>

```

validate HTML

render HTML in external browser window/tab

insert code to iterate HTML elements

insert code to iterate HTML elements, with separator

show as dictionary

set name of dictionary

set XPath for dictionary headwords

show output for all XML files

evaluate XPath query on all XML docs ('database mode')

Blume (n.

- 'flower
- 'head on top of beer'

MESSAGES

XML is well-formed.

let's make a dictionary, finally!

The screenshot shows a web browser window with two tabs. The active tab is titled "German botanic terms". The address bar shows the URL "localhost:49918/dictionary?workdir=demo&uuid=fd8accff-4334-47cb-a709-72026b74f8da". The page content is as follows:

German botanic terms

Blume

blühen

Blume (*n.*)

- 'flower'
- 'head on top of beer'

users can configure:

- a **dictionary title**
- an **XPath** expression for the **headword**

localhost:49918/mainpage?workdir=demo&username=__DESKTOP__

x4ml desktop mode (/Users/peter/data/eLex23/x4ml) current workspace: demo

select or create an XML file here
Blume.xml

actions ⚙️

select or create a DTD, RelaxNG, XPath, or HTML file here
my.html

```

1 <entry>
2   <lemma pos="n">Blume</lemma>
3   <senses>
4     <sense>flower</sense>
5     <sense>head on top of beer</sense>
6   </senses>
7 </entry>

```

```

1 <!doctype html>
2 <html lang="en">
3   <head>
4     <meta charset="utf-8">
5     <title>entry {{{lemma}}}
6   </head>
7   <body>
8     <h3>{{{lemma}}<i> ({{{lemma/@pos}}}.</i></h3>
9     <ul>
10      <!-- repeat for all $s in //sense -->
11      <li>'{{{s}}}'</li>
12      <!-- end repeat for all $s -->
13    </ul>

```

MESSAGES

XML is well-formed.

Blume (n.)

- 'flower'
- 'head on top of beer'

go to a workspace:

- demo
- playground

create and open new workspace

manage workspaces...

files that belong together (e.g. as a dictionary project) are stored in a **workspace** – basically a folder on the local computer or on the server

- you may create **arbitrarily many** workspaces
- workspaces **don't interfere with each other**

localhost:49918/mainpage?wo... X localhost:49918/workdirmanag... X +






localhost:49918/workdirmanager?username=__DESKTOP__


Workspace Management


A *workspace* is just a folder that contains XML, XPath, DTD, HTML, ... files that belong to one of your project of yours, e.g. for a certain dictionary.
A workspace may contain a *resources* folder for files that you want to use in your HTML, e.g. image files.
To correctly reference a resource file such as **yourpicture.jpg** in your HTML code, do it like this: ``.

Workspace demo

Files in the workspace:

- Blume.xml 
- blühen.xml 
- my.html 
- my.xpath 
- schema.rnc 

Files in the *resources* folder of the workspace: 

- flower.jpg 

in the **workspace manager**,
you may

- delete files
- add (upload) new files

for all your workspaces

localhost:49918/mainpage?wo... X localhost:49918/workdirmanag... X +






localhost:49918/workdirmanager?username=__DESKTOP__


Workspace Management


A *workspace* is just a folder that contains XML, XPath, DTD, HTML, ... files that belong to one of your project of yours, e.g. for a certain dictionary.
A workspace may contain a *resources* folder for files that you want to use in your HTML, e.g. image files.
To correctly reference a resource file such as **yourpicture.jpg** in your HTML code, do it like this: ``.


Workspace demo

Files in the workspace:

- Blume.xml 
- blühen.xml 
- my.html 
- my.xpath 
- schema.rnc 

Files in the *resources* folder of the workspace: 

- flower.jpg 



flower.jpg

You may also **preview** your files

(yes, you can include media in your HTML)

USING X4ML IN CLASS: PRELIMINARY ASSESSMENT – ALTERNATIVES

X4ML IN THE WILD

OR: HOW THE WORD *INVISIBLE* WAS SQUEEZED INTO THIS TALK

- the program has been used twice for the week-long EMLex course:
 - Braga, 2022 (remote teaching)
 - Budapest, 2023 (on-site)
 - **drastic reduction** of technical support time (both in and after class)
 - most notable challenge: getting started in Desktop mode – due to unsigned binary / malware protection
 - app was mostly **INVISIBLE** to students and instructor
 - positive evaluation by students: one-stop shop, integrated user experience
 - but no user studies so far
-

ALTERNATIVE 1: LEXONOMY.EU

LEXONOMY FOR TEACHING XML/HTML total 1 entries

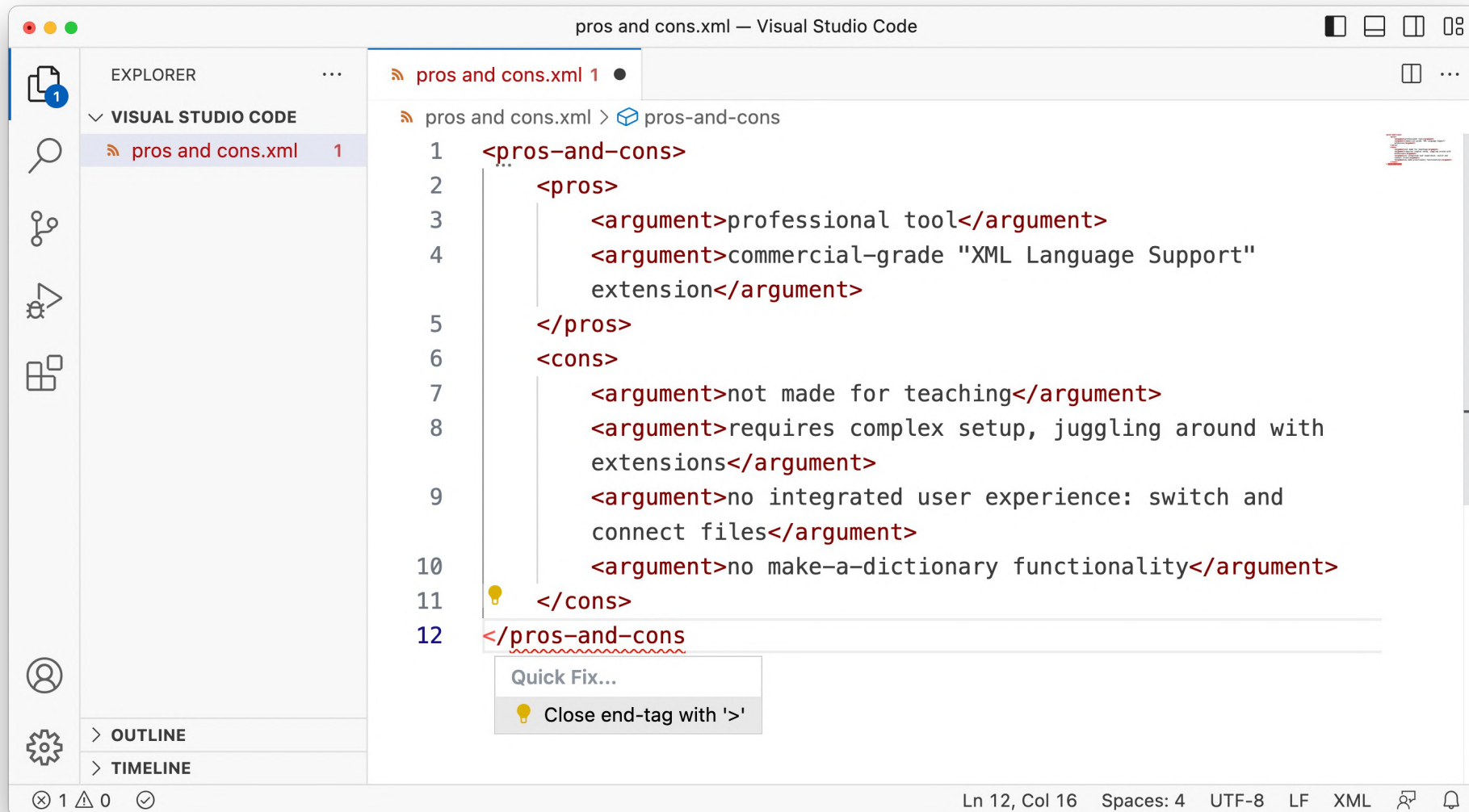
search × starts like this

1. super-easy start, well-known tool

NEW + ID > SAVE CLONE DELETE

```
<entry>
  <pros>
    <argument>super-easy start, well-known tool </argument>
    <argument>one-click dictionary: connection to corpus data</argument>
  </pros>
  <cons>
    <argument>cannot toy around with XML without schema</argument>
    <argument>no XPath</argument>
    <argument>schema and HTML per default configured via GUI</argument>
    <argument>DTD, XSLT supported but difficult to use in class</argument>
  </cons>
</entry>
```

ALTERNATIVE 2: USE A FREE (XML) EDITOR – SUCH AS VS CODE



The screenshot shows the Visual Studio Code interface with a file named 'pros and cons.xml' open. The XML content is as follows:

```
1 <pros-and-cons>
2   <pros>
3     <argument>professional tool</argument>
4     <argument>commercial-grade "XML Language Support"
5     extension</argument>
6   </pros>
7   <cons>
8     <argument>not made for teaching</argument>
9     <argument>requires complex setup, juggling around with
10    extensions</argument>
11    <argument>no integrated user experience: switch and
12    connect files</argument>
13    <argument>no make-a-dictionary functionality</argument>
14  </cons>
15 </pros-and-cons>
```

A red squiggly line underlines the closing tag '</pros-and-cons>' on line 12, indicating a syntax error. A 'Quick Fix...' menu is open below the error, showing the option 'Close end-tag with '>''.

The status bar at the bottom indicates: Ln 12, Col 16 Spaces: 4 UTF-8 LF XML

The x4ml application will be published as open source software on GitHub, end of July 2023:

<https://github.com/PeterMeyerIDS/x4ml>

<GRATITUDE ADDRESSEE="AUDIENCE" REASON="INTEREST" />

meyer@ids-mannheim.de