

# STEPS

## ConTEXT XML

Pragma ADE / Hasselt NL

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## Description

This module is written in the process of defining a couple of styles for an educational math book. The macros provide you a way to visualize steps in for instance solving equations.

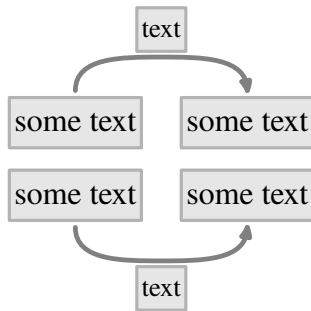
The horizontal visualization is called `stepchart`, while the vertical alternative carries the name `steptable`. The vertical alternative has a special case that permits alignment on a mid symbol (in most cases a relation).

The implementation uses a combination of  $\text{\TeX}$  and  $\text{\METAPOST}$ , and is set up in such a way that hyperlinks and alike will work okay.

## Structure

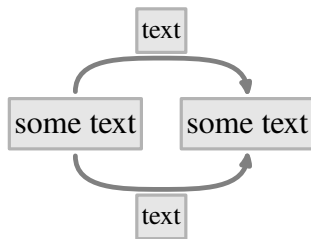
The horizontal stepcharts have at most four rows: two rows of cells with each an associated row of texts. The plural elements `cells` and `texts` each have two subelements. The `texts` elements are put between `cells`.

```
<stepchart>
  <cells> <top> some text </top> <bot> some text </bot> </cells>
  <texts> <top> text </top> <bot> text </bot> </texts>
  <cells> <top> some text </top> <bot> some text </bot> </cells>
</stepchart>
```



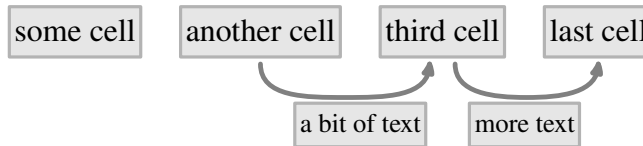
When a singular `cell` element is used in combination with the plural `texts`, we get one row of step cells with both top and bottom texts.

```
<stepchart>
  <cell> some text </cell>
  <texts> <top> text </top> <bot> text </bot> </texts>
  <cell> some text </cell>
</stepchart>
```



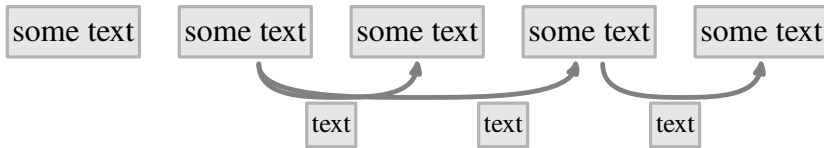
The third horizontal alternative only has singular elements, and as a result the texts are put below the step cells.

```
<stepchart>
  <cell> some cell </cell>
  <cell> another cell </cell> <text> a bit of text </text>
  <cell> third cell </cell> <text> more text </text>
  <cell> last cell </cell>
</stepchart>
```



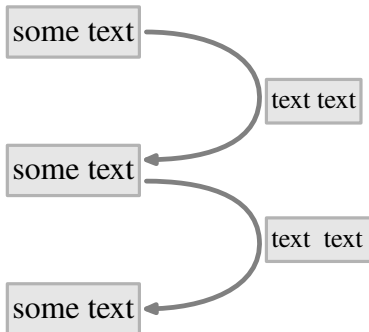
Normally, the lines go from cell to cell via a text. When you let the `cell` element follow by more than one `text` element (or their plural forms), all lines will start at the same point.

```
<stepchart>
  <cell> some text </cell>
  <cell> some text </cell> <text> text </text> <text> text </text>
  <cell> some text </cell>
  <cell> some text </cell> <text> text </text>
  <cell> some text </cell>
</stepchart>
```



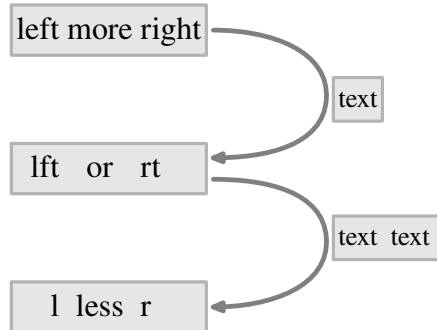
The vertical alternative (of course) looks different and permits pretty long explanations. The bonus element `br` forces a new line, while the `prep` element can be used to provide additional structure to the text. We will demonstrate this later.

```
<steptable>
  <cell> some text </cell>
  <text> text text </text>
  <cell> some text </cell>
  <text> <prep> text </prep> <element> text </element> </text>
  <cell> some text </cell>
</steptable>
```



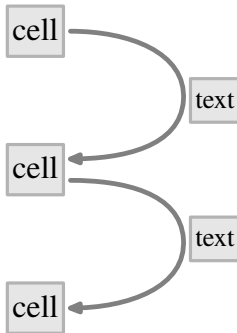
When the plural element `cells` is used, three sub-elements are expected. These align around the mid element `c2`.

```
<stepaligntable>
  <cells> <c1> left </c1> <c2> more </c2> <c3> right </c3> </cells>
  <text> text </text>
  <cells> <c1> lft </c1> <c2> or </c2> <c3> rt </c3> </cells>
  <text> <prep> text </prep> <element> text </element> </text>
  <cells> <c1> l </c1> <c2> less </c2> <c3> r </c3> </cells>
</stepaligntable>
```



There is an additional element `lines` that can be used to group cells and texts. Normally this grouping only makes sense when tuning the appearance of the chart, as we will see later.

```
<steptable>  
  <cell> cell </cell>  
  <text> text </text>  
  <lines>  
    <cell> cell </cell>  
    <text> text </text>  
    <cell> cell </cell>  
  </lines>  
</steptable>
```



## Usage

The step chart module is loaded with:

```
\usemodule[steps]
```

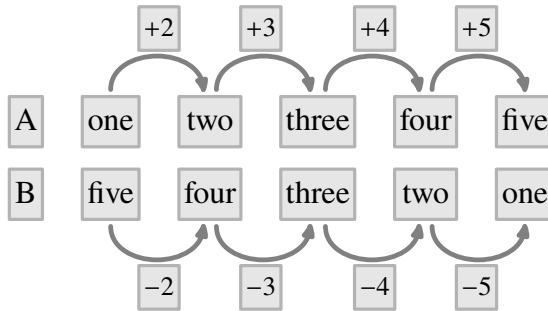
but in the case of embedded math, you should also load the MATHML module:

```
\usemodule[steps,mathml]
```

## XML example

```
<stepchart>
  <cells> <top> A           </top> <bot> B           </bot> </cells>
  <cells> <top> one        </top> <bot> five         </bot> </cells>
  <texts> <top> <m> +2 </m> </top> <bot> <m> -2 </m> </bot> </texts>
  <cells> <top> two        </top> <bot> four         </bot> </cells>
  <texts> <top> <m> +3 </m> </top> <bot> <m> -3 </m> </bot> </texts>
  <cells> <top> three      </top> <bot> three        </bot> </cells>
  <texts> <top> <m> +4 </m> </top> <bot> <m> -4 </m> </bot> </texts>
  <cells> <top> four       </top> <bot> two          </bot> </cells>
  <texts> <top> <m> +5 </m> </top> <bot> <m> -5 </m> </bot> </texts>
  <cells> <top> five      </top> <bot> one          </bot> </cells>
</stepchart>
```

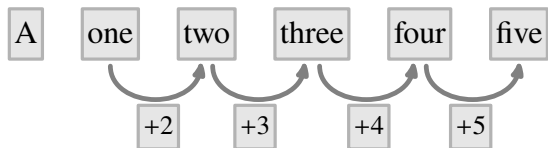




```

<stepchart>
  <cell> A      </cell>
  <cell> one   </cell> <text> <m> +2 </m> </text>
  <cell> two   </cell> <text> <m> +3 </m> </text>
  <cell> three </cell> <text> <m> +4 </m> </text>
  <cell> four  </cell> <text> <m> +5 </m> </text>
  <cell> five  </cell>
</stepchart>

```



```

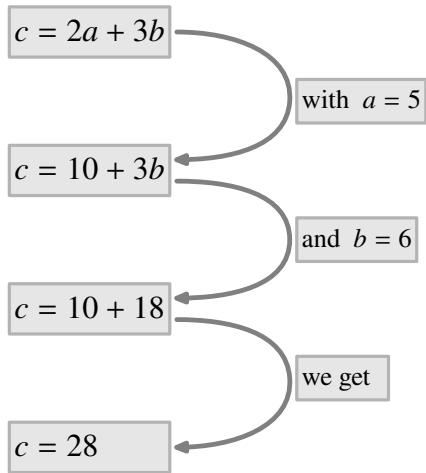
<steptable>
  <cell>
    <math>
      <apply> <eq/> <ci> c </ci>
        <apply> <plus/>
          <apply> <times/> <cn> 2 </cn> <ci> a </ci> </apply>
          <apply> <times/> <cn> 3 </cn> <ci> b </ci> </apply>
        </apply>
      </math>
    </cell>
    <text> <prep>with</prep>
      <math>
        <apply> <eq/> <ci> a </ci> <cn> 5 </cn> </apply>
      </math>
    </text>
    <cell>
      <math>
        <apply> <eq/> <ci> c </ci>
          <apply> <plus/> <cn> 10 </cn>
            <apply> <times/> <cn> 3 </cn> <ci> b </ci> </apply>
          </apply>
        </math>
    </cell>
  </steptable>

```

```

</cell>
<text> <prep>and</prep>
  <math>
    <apply> <eq/> <ci> b </ci> <cn> 6 </cn> </apply>
  </math>
</text>
<cell>
  <math>
    <apply> <eq/> <ci> c </ci>
      <apply> <plus/> <cn> 10 </cn> <cn> 18 </cn> </apply>
    </apply>
  </math>
</cell>
<text>
  <prep>we get</prep>
</text>
<cell>
  <math>
    <apply> <eq/> <ci> c </ci> <cn> 28 </cn> </apply>
  </math>
</cell>
</steptable>

```

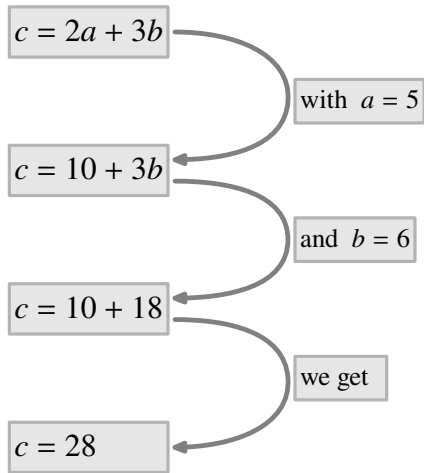


```

<stepaligntable>
  <cells>
    <c1> <m>c</m> </c1> <c2> <m>=</m> </c2> <c3> <m>2a+3b</m> </c3>
  </cells>
  <text>
    <prep>with</prep> <m>a=5</m>
  </text>
  <cells>
    <c1> <m>c</m> </c1> <c2> <m>=</m> </c2> <c3> <m>10+3b</m> </c3>
  </cells>
  <text>

```

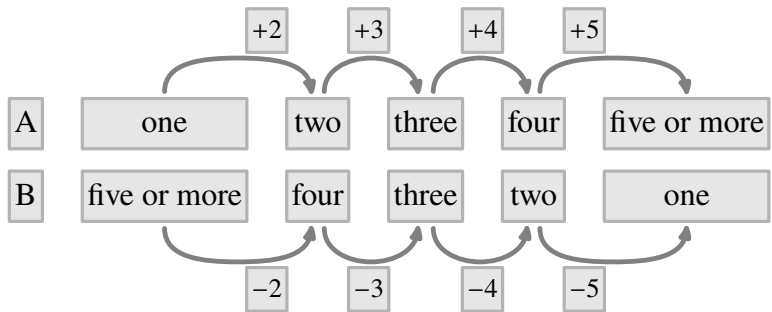
```
<prep>and</prep> <m>b=6</m>
</text>
<cells>
  <c1> <m>c</m> </c1> <c2> <m>=</m> </c2> <c3> <m>10+18</m> </c3>
</cells>
<text>
  <prep>we get</prep>
</text>
<cells>
  <c1> <m>c</m> </c1> <c2> <m>=</m> </c2> <c3> <m>28</m> </c3>
</cells>
</stepaligntable>
```



## T<sub>E</sub>X example

```

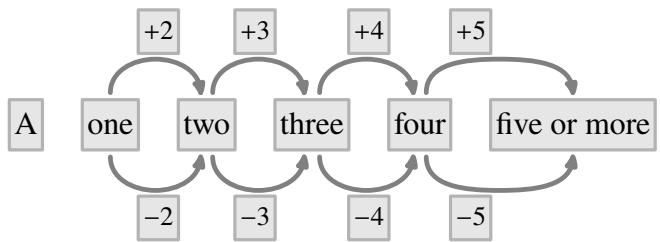
\startSTEPchart
\cells {A}           {B}
\cells {one}         {five or more} \texts{${+2$}}{${-2$}}
\cells {two}         {four}         \texts{${+3$}}{${-3$}}
\cells {three}       {three}        \texts{${+4$}}{${-4$}}
\cells {four}        {two}          \texts{${+5$}}{${-5$}}
\cells {five or more} {one}
\stopSTEPchart
  
```



```

\startSTEPchart
\cell {A}
\cell {one}           \texts{+$2$}{-$2$}
\cell {two}           \texts{+$3$}{-$3$}
\cell {three}         \texts{+$4$}{-$4$}
\cell {four}          \texts{+$5$}{-$5$}
\cell {five or more}
\stopSTEPchart

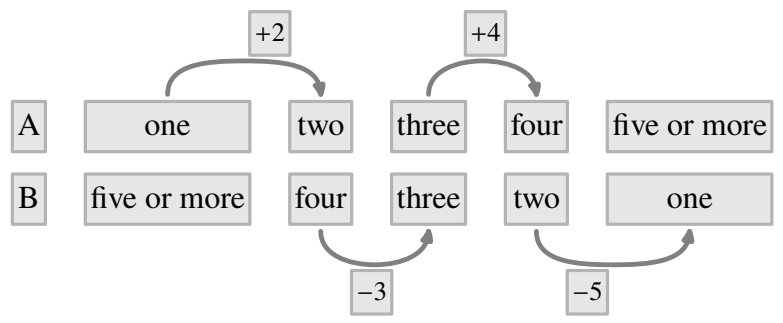
```



```

\startSTEPchart
\cells {A}           {B}
\cells {one}         {five or more} \texts{+$2$}{}
\cells {two}         {four}         \texts{}{-3$}
\cells {three}       {three}        \texts{+$4$}{}
\cells {four}        {two}          \texts{}{-5$}
\cells {five or more} {one}
\stopSTEPchart

```



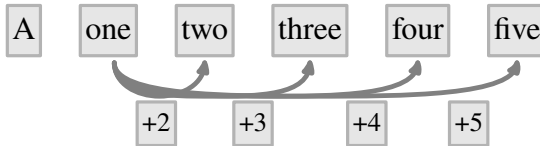
```

\startSTEPchart
\cell {A}
\cell {one} \text{+2} \text{+3} \text{+4} \text{+5}
\cell {two}
\cell {three}
\cell {four}

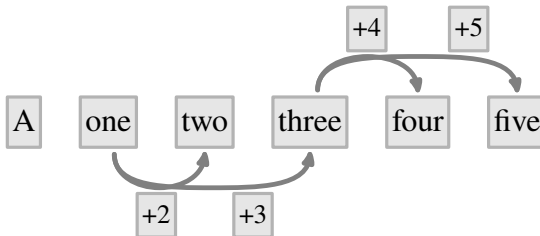
```



```
\cell {five}
\stopSTEPchart
```



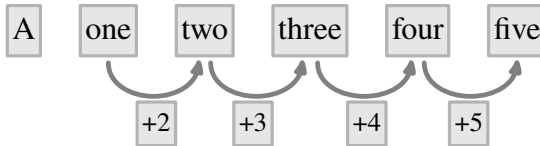
```
\startSTEPchart
\cell {A}
\cell {one} \texts{}{+2} \texts{}{+3}
\cell {two}
\cell {three} \texts{+4}{} \texts{+5}{}
\cell {four}
\cell {five}
\stopSTEPchart
```



```

\startSTEPchart
\cell {A}
\cell {one}   \text{+2}
\cell {two}   \text{+3}
\cell {three} \text{+4}
\cell {four}  \text{+5}
\cell {five}
\stopSTEPchart

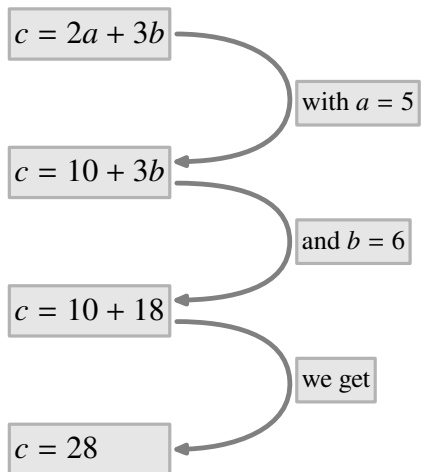
```



```

\startSTEPtable
\cell {$c=2a+3b$}
\text {with $a=5$}
\cell {$c=10+3b$}
\text {and $b=6$}
\cell {$c=10+18$}
\text {we get}
\cell {$c=28$}
\stopSTEPtable

```

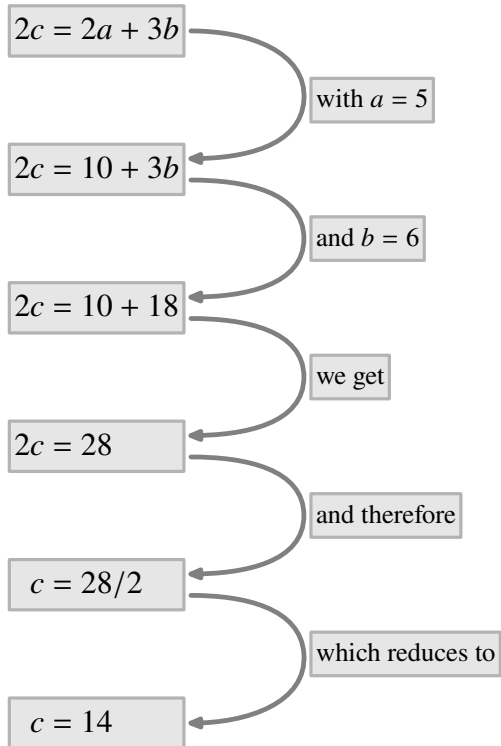


```

\startSTEPalignable
\cells {$2c$} {$=$} {$2a+3b$}
\text {with $a=5$}
\cells {$2c$}{$=$} {$10+3b$}
\text {and $b=6$}
\cells {$2c$} {$=$} {$10+18$}
\text {we get}
\cells {$2c$} {$=$} {$28$}
\text {and therefore}
\cells {$c$} {$=$} {$28/2$}
\text {which reduces to}

```

```
\cells {$c$} {$=$} {$14$}  
\stopSTEPalign
```



## Configuring

The charts and tables can have their own spacing set. Quite certainly the distances between cells will differ.

```
\setupSTEPcharts [..., .= ..., ...]
```

```
before      command
after       command
hoffset     dimension
voffset     dimension
method      number
offset      dimension
height      dimension
```

---

parameter	meaning
after	hook for commands to execute after the table
before	hook for commands to execute before the table
method	line drawing method
height	height of the connecting line
offset	the distance between lines and cells and texts

hoffset	the horizontal distance between cells
voffset	the vertical distance between cells

---

```
\setupSTEPTables[...]=...]
```

before	<i>command</i>
after	<i>command</i>
distance	<i>dimension</i>
voffset	<i>dimension</i>
offset	<i>dimension</i>
width	<i>dimension</i>

---

parameter	meaning
-----------	---------

---

after	hook for commands to execute after the table
before	hook for commands to execute before the table
method	line drawing method
width	height of the connecting line
offset	the distance between lines and cells and texts
distance	the horizontal distance between subcells
voffset	the vertical distance between cells

---

Both charts and tables have common settings with respect to the cells, texts and lines.

```
\setupSTEPcells[...,..=...,..]
```

```
backgroundcolor   name
rulethickness     dimension
framecolor        name
offset            dimension
style             normal bold slanted boldslanted type cap small... command
color             name
```

```
\setupSTEPtexts[...,..=...,..]
```

```
..=..   see \setupSTEPcells
```

parameter	meaning
backgroundcolor	the background color identified by name
rulethickness	the width of the lines between cells
framecolor	the frame color identified by name
offset	the space between content and frame
style	a (preferable named) style
color	the color of the content

```
\setupSTEPlines[...]=...]
```

alternative	<i>number</i>
rulethickness	<i>dimension</i>
color	<i>name</i>

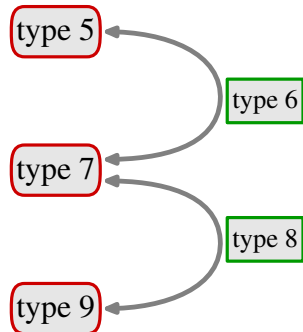
parameter	meaning
alternative	the kind of line to draw between cells
rulethickness	the width of the lines between cells
color	the line color identified by name

In T<sub>E</sub>X, the settings can be passed as optional arguments to the cells and texts, or intermixed with the definitions. In XML, the settings are passed as processing instructions.

```
\startSTEPtable
\setupSTEPcells [alternative=5, framecolor=darkred]
\setupSTEPtexts [framecolor=darkgreen]
\setupSTEPlines [alternative=3]
\cell {type 5}
\text {type 6}
\cell {type 7}
\text {type 8}
```



```
\cell {type 9}
\stopSTEPTable
```



There are a couple of alternative shapes available. The most relevant ones are: [5](#) [6](#) [7](#) [8](#) [9](#) [12](#) [13](#) [14](#) [15](#) [16](#) [17](#) [18](#) [19](#) [22](#) [23](#) [24](#) [25](#) [26](#) [27](#) [28](#) [29](#).

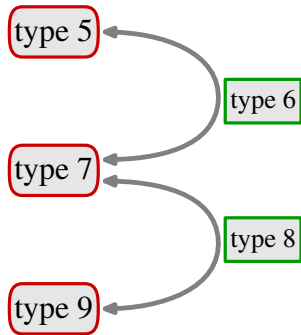
Although it is not too wise to set up the layout in the middle of a document, for graphics one can seldom get by some local fine-tuning. Here we encounter a rather fundamental difference between  $\text{T}_{\text{E}}\text{X}$  and XML. In  $\text{T}_{\text{E}}\text{X}$ , you can easily change settings on a temporary basis by using groups. In XML on the other hand, settings are passed either as attributes, which makes them local by concept (sort of), or by adding processing instructions, in which case they are kind of global.

Another problem, which probably goes unnoticed unless you study the implementation, is that in a multiple pass typesetting approach as used here<sup>1</sup> in between settings need to be reset before each pass. The next examples hopefully demonstrate how and where to apply settings.

```
<steptable>
<?context-steptable-directive cells alternative 5 ?>
<?context-steptable-directive cells framecolor darkred ?>
<?context-steptable-directive texts framecolor darkgreen ?>
<?context-steptable-directive lines alternative 3 ?>
<cell> type 5 </cell>
<text> type 6 </text>
<cell> type 7 </cell>
<text> type 8 </text>
<cell> type 9 </cell>
</steptable>
```

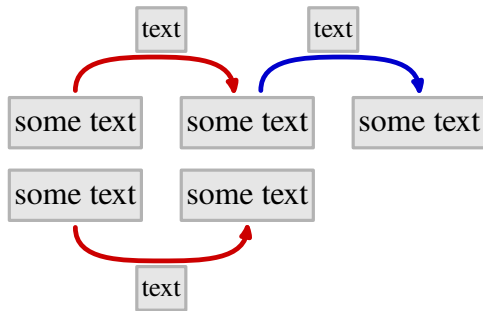
---

<sup>1</sup> First the cells and texts are calculated, then the lines are figured out, and finally cells, lines, and texts are packaged (in this order).



```

<stepchart>
  <cells> <top> some text </top> <bot> some text </bot> </cells>
  <?context-stepchart-directive lines color darkred ?>
  <texts> <top> text </top> <bot> text </bot> </texts>
  <cells> <top> some text </top> <bot> some text </bot> </cells>
  <?context-stepchart-directive lines color darkblue ?>
  <texts> <top> text </top> </texts>
  <cells> <top> some text </top> </cells>
</stepchart>
  
```



```
<stepchart>
```

```
  <cells> <top> A </top> <bot> B </bot> </cells>
```

```
  <cells> <top> one </top> <bot> five </bot> </cells>
```

```
  <texts> <top> <m> +2 </m> </top> <bot> <m> -2 </m> </bot> </texts>
```

```
  <cells> <top> two </top> <bot> four </bot> </cells>
```

```
  <texts> <top> <m> +3 </m> </top> <bot> <m> -3 </m> </bot> </texts>
```

```
  <cells> <top> three </top> <bot> three </bot> </cells>
```

```
  <lines color="darkgreen" alternative="3">
```

```
    <texts> <top> <m> +4 </m> </top> <bot> <m> -4 </m> </bot> </texts>
```

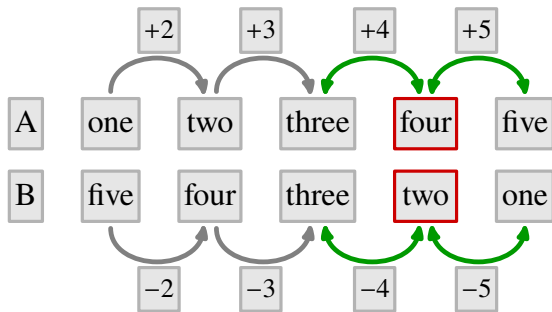
```
    <cells framecolor="darkred"> <top> four </top> <bot> two </bot> </ce
```

```
    <texts> <top> <m> +5 </m> </top> <bot> <m> -5 </m> </bot> </texts>
```

```
    <cells> <top> five </top> <bot> one </bot> </cells>
```

```
  </lines>
```

```
</stepchart>
```



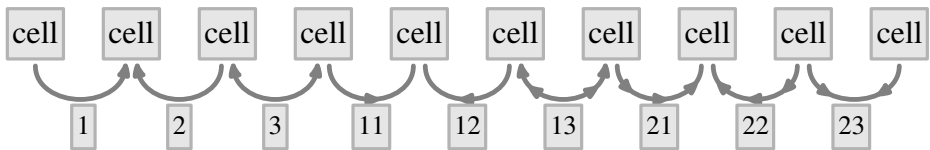
<stepchart>

```

<lines alternative= "1"> <cell> cell </cell> <text> 1 </text> </lines>
<lines alternative= "2"> <cell> cell </cell> <text> 2 </text> </lines>
<lines alternative= "3"> <cell> cell </cell> <text> 3 </text> </lines>
<lines alternative="11"> <cell> cell </cell> <text> 11 </text> </lines>
<lines alternative="12"> <cell> cell </cell> <text> 12 </text> </lines>
<lines alternative="13"> <cell> cell </cell> <text> 13 </text> </lines>
<lines alternative="21"> <cell> cell </cell> <text> 21 </text> </lines>
<lines alternative="22"> <cell> cell </cell> <text> 22 </text> </lines>
<lines alternative="23"> <cell> cell </cell> <text> 23 </text> </lines>
<cell> cell </cell>

```

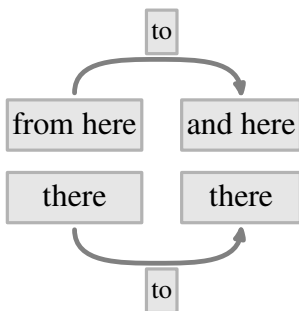
</stepchart>



```

<stepchart>
  <?context-stepchart-directive cells hoffset 1ex ?>
  <cells> <top> from here </top> <bot> there </bot> </cells>
  <texts> <top> to </top> <bot> to </bot> </texts>
  <cells> <top> and here </top> <bot> there </bot> </cells>
</stepchart>

```

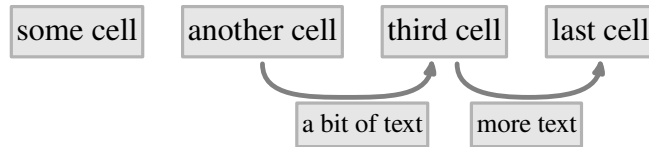


Some settings can only be set per chart and therefore have to take place outside the chart itself.

```

<?context-stepchart-directive lines height 30pt ?>
<?context-stepchart-directive lines offset 5pt ?>
<stepchart>
  <cell> some cell </cell>
  <cell> another cell </cell> <text> a bit of text </text>
  <cell> third cell </cell> <text> more text </text>
  <cell> last cell </cell>
</stepchart>

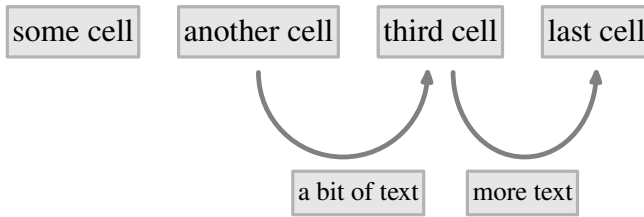
```



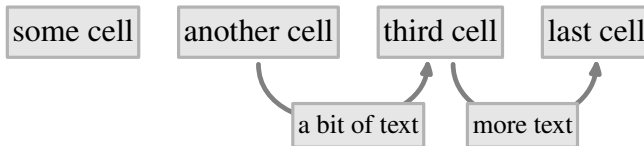
```

<stepchart height="30pt" offset="5pt">
  <cell> some cell </cell>
  <cell> another cell </cell> <text> a bit of text </text>
  <cell> third cell </cell> <text> more text </text>
  <cell> last cell </cell>
</stepchart>

```

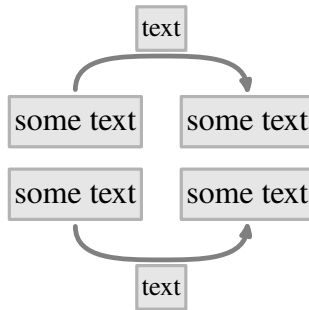


```
<stepchart method="2">
  <cell> some cell </cell>
  <cell> another cell </cell> <text> a bit of text </text>
  <cell> third cell </cell> <text> more text </text>
  <cell> last cell </cell>
</stepchart>
```



```
<stepchart>
  <cells> <top> some text </top> <bot> some text </bot> </cells>
  <texts> <top> text </top> <bot> text </bot> </texts>
  <cells> <top> some text </top> <bot> some text </bot> </cells>
</stepchart>
```

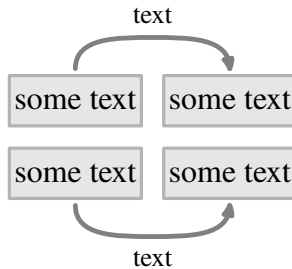




```

<?context-stepchart-directive charts hoffset 1ex ?>
<?context-stepchart-directive texts alternative 0 ?>
<?context-stepchart-directive texts offset 0pt ?>
<stepchart>
  <cells> <top> some text </top> <bot> some text </bot> </cells>
  <texts> <top> text </top> <bot> text </bot> </texts>
  <cells> <top> some text </top> <bot> some text </bot> </cells>
</stepchart>

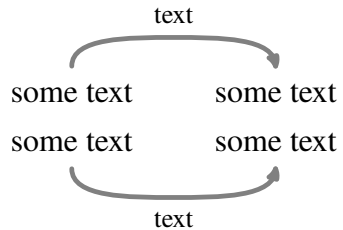
```



```

<?context-stepchart-directive charts hoffset 2.5em ?>
<?context-stepchart-directive charts voffset .5ex ?>
<?context-stepchart-directive cells alternative 0 ?>
<?context-stepchart-directive cells offset 0pt ?>
<?context-stepchart-directive texts alternative 0 ?>
<?context-stepchart-directive texts offset 0pt ?>
<stepchart>
  <cells> <top> some text </top> <bot> some text </bot> </cells>
  <texts> <top> text </top> <bot> text </bot> </texts>
  <cells> <top> some text </top> <bot> some text </bot> </cells>
</stepchart>

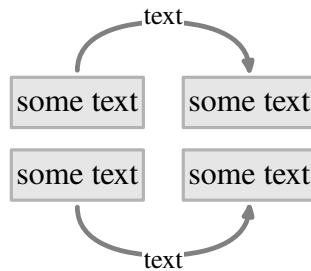
```



```

<?context-stepchart-directive charts method 2 ?>
<?context-stepchart-directive texts alternative 1 ?>
<?context-stepchart-directive texts backgroundcolor white ?>
<?context-stepchart-directive texts offset 0pt ?>
<stepchart>
  <cells> <top> some text </top> <bot> some text </bot> </cells>
  <texts> <top> text </top> <bot> text </bot> </texts>
  <cells> <top> some text </top> <bot> some text </bot> </cells>
</stepchart>

```



## Documentation

There is no additional documentation on this module.

## Colofon

This manual is part of the CON<sub>T</sub>E<sub>X</sub>T distribution, and is authored and maintained by Hans Hagen. CON<sub>T</sub>E<sub>X</sub>T is developed at PRAGMA ADE, Hasselt, The Netherlands. This manual is produced on October 26, 2001.