

schemata — Generic package to aid construction of topical categories*

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Abstract

The `schemata` package helps the creation of topical outlines that illustrate the breakdown of concepts and categories in academic texts from the late medieval to early modern periods.

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1 Introduction

This package emerged from my personal need to typeset diagrams based on seventeenth-century theology books. I chose a “bare-bones” approach to make it platform-agnostic and simple to implement.

I would recommend that a package like *TikZ*, *PSTricks*, *METAPOST*, or some other powerful solution may have advantages over this one, especially for those seeking a top-to-bottom diagram, such as that in: H. DEMBOWSKI, *Einführung in die Christologie* (Darmstadt, 1993), 146.

Nevertheless, many packages do not handle both open *and* closed braces in a schema without a great amount of manual setup. This package uses math mode to do that, somewhat mimicking how a letterpress typesetter might design schemata for the works of Petrus Ramus, the *Loci Theologici* of Martin Chemnitz, the *Clavis Scripturae Sacrae* of Matthias Flacius Illyricus, and many others.

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2 Usage

2.1 Package Options and Loading

This package basically is a “wrapper” that takes some of the work out of using T_EX math mode to create *schemata* (plural of τó σχῆμα or *schema*, meaning *form*, *shape*, *appearance*, *bearing*, *manner*, *fashion*, and so on). Such diagrams were used quite frequently to break down a main concept into its component parts and demonstrate the relationship among various components.

The `schemata` package can be used with plain T_EX and L^AT_EX:

Users of L^AT_EX invoke: `\usepackage[options]{schemata}`

Plain T_EX users will use: `\input_schemata.sty`

2.2 Macro Overview

`\DoBraces` L^AT_EX users can choose among three global package options: `braces`, `brackets`, and `parens`. These set the defaults for the “braces.” If no options are chosen, the default is `braces`. Plain T_EX users get the same results by using `\DoBraces`, `\DoBrackets`, and `\DoParens`. These macros have the same effect as the package options. The default still remains `braces`, shown by the three examples below:

$$a \left\{ \begin{array}{l} b \\ c \end{array} \right. \quad a \left[\begin{array}{l} b \\ c \end{array} \right. \quad a \left(\begin{array}{l} b \\ c \end{array} \right) d$$

The next three examples use `\DoBrackets` to get brackets instead:

$$a \left[\begin{array}{l} b \\ c \end{array} \right. \quad a \left[\begin{array}{l} b \\ c \end{array} \right] d$$

The next three use `\DoParens`:

$$a \left(\begin{array}{l} b \\ c \end{array} \right) \quad a \left(\begin{array}{l} b \\ c \end{array} \right) d$$

All three macros should precede `\schema` and `\Schema` within a particular scope, and they remain in force within that scope unless changed. Additionally, `\DoBraces`, `\DoBrackets`, and `\DoParens` can change the style of “brace” within a schema. See Section 2.5, as well as the trivial example below:

$$a \left\{ \begin{array}{l} b \\ c \end{array} \right) d$$

```
1 \Schema{0ex}{2.4ex}
2   {\schemabox{a}}
3   {\DoParens\Schema[close]{0ex}{2.3ex}
4     {\schemabox{b\\c}}
5     {\schemabox{d}}
6 }
```

`\schema` A “simple” schema has a left-hand side with vertically-centered vertical material, a brace, and a right-hand side with vertically-centered vertical material:

$$\backslash\text{schema}[\langle type \rangle]{\langle left-hand side \rangle}{\langle right-hand side \rangle}$$

The $\langle left-hand side \rangle$ and $\langle right-hand side \rangle$ are vertical material in order to allow a `\smallskip` or other vertical adjustment as needed.

The $\langle type \rangle$ of a schema is `open` (to the right) by default: $a \left\{ \begin{array}{l} b \\ c \end{array} \right.$

Any value of $\langle type \rangle$ other than `open` makes a “closed” schema: $\left. \begin{array}{l} b \\ c \end{array} \right\} a$

In practice, `\schema` does not nest, so it is only useful for the right-hand “leaves” of a large schema. That makes formatting the “leaves” faster. Thus the `\schema` macro is used only in the framed boxes below:

$$\dots a \left\{ \begin{array}{l} \boxed{b \left\{ \begin{array}{l} c \\ d \end{array} \right.} \\ \boxed{e \left\{ \begin{array}{l} f \\ g \end{array} \right.} \end{array} \right.$$

Observe how the automatic sizing of `\schema` changes, depending on the height, depth, and even context of the letters. Avoid `\schema` if you need multiple copies of an example to look exactly alike. Section 2.3 gives more details on tweaking `\schema` as needed.

`\Schema` The “complex” form of a schema also has a left-hand side with vertically-centered vertical material, a brace, and a right-hand side of vertically-centered vertical material, along with two arguments that adjust the brace:

$$\backslash\text{Schema}[\langle type \rangle]{\langle adjust \rangle}{\langle size \rangle}{\langle left-hand side \rangle}{\langle right-hand side \rangle}$$

The $\langle type \rangle$ is `open` by default. As above, any other $\langle type \rangle$ except the exact string `open` will make it a “closed” schema.

Both $\langle adjust \rangle$ and $\langle size \rangle$ are dimensions that are expressed best with the unit “ex.” This allows for easier scaling of the schema.

Set $\langle adjust \rangle$ to move the brace up (negative value) or down (positive value). Set $\langle size \rangle$ to be a number of ex nearly equal to the number of lines that the brace should span. The value of $\langle size \rangle$ is converted into an absolute value.

Using `\Schema` allows one to adjust the brace height and centering manually. This is the only way to work around the way that `\schema` automatically adjusts for the height of everything on the open side of a brace. This is also the only way to get multiple examples of the same schema or similar schemata to look similar.

Admittedly, this method is nothing short of ugly. Perhaps its only redeeming feature is that you can count lines of text to get a rough estimate of adjustments. Yet source texts from the seventeenth century often present schemata that can evade an easy, automatic solution, *e.g.*:

$$\text{main idea} \left\{ \begin{array}{l} \text{part} \left\{ \begin{array}{l} \text{detail} \\ \text{detail} \end{array} \right. \\ \text{part} \left\{ \begin{array}{l} \text{detail} \\ \text{detail} \end{array} \right. \end{array} \right\} \text{synonym} \left\{ \begin{array}{l} \text{part} \left\{ \begin{array}{l} \text{detail} \\ \text{detail} \end{array} \right. \\ \text{part} \left\{ \begin{array}{l} \text{detail} \\ \text{detail} \end{array} \right. \end{array} \right.$$

`\schemabox` When in a `\schema` or a `\Schema`, this box stacks one or more lines of `\hbox`-enclosed material in a `\vbox`. It redefines the control sequence `\\` in a manner that terminates the current `\hbox` and begins a new one, with some options that can be modified (Section 2.3). Its syntax is:

```
\schemabox[⟨width⟩]{⟨text⟩}
```

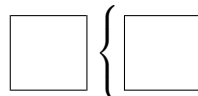
The `⟨width⟩` of a `\schemabox` is a dimension, *e.g.*, 3cm. No wrapping (as in a `\parbox`) takes place. If there are more than one line of text, each line of `⟨text⟩` must be terminated explicitly by `\\`, except the final line. Usually, the first line of a `\schemabox` inserts a `\strut` for aesthetic reasons.

When `\schemabox` occurs apart from internal vertical mode, it ignores `⟨width⟩` and merely reproduces `⟨text⟩`. With `\schemabox{blah}` you just get “blah.”

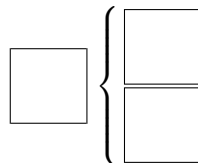
Certainly, one need not use a `\schemabox`, for example:

```
1 \def\Box{%
2   \hbox{%
3     \vrule%
4     \vbox to 1cm{\hrule\hbox to 1cm{\hfil}\vfil\hrule}%
5     \vrule%
6   }%
7 }
```

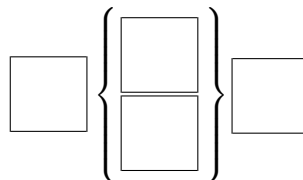
```
8 \schema{\Box}{\Box}
```



```
9 \schema{\Box}{\Box\Box}
```



```
10 \Schema{-0.2ex}{0.9cm}
11 {\Box}
12 {
13   \Schema[close]{-0.2ex}{0.9cm}
14   {\Box\hbox{\Box\kern0.2em}}
15   {\Box}
16 }
```



Both `\schema` and `\Schema` are vertical, so they will stack vertically if invoked sequentially outside of a tabular environment, display math, and so on, that can be used to display schemata horizontally.

If one does not use “ex” height for `⟨size⟩` in a `\Schema`, one should specify a `⟨size⟩` slightly less than half the height of the contents. Above, a `⟨size⟩` of 0.9cm suffices for a content of 2cm. Using “ex” height is meant to simplify sizing content according to lines of text.

A kern of 0.2em was added in the final snippet above to offset an automatic kern of -0.2em added between the left-hand material and the brace in a closed schema. More on that is given under `\NudgeSB` in the next section.

2.3 Romancing the `\schema`

`\LCschema` By default, a `\schemabox` adds a `\strut` to the first line because it is often the
`\UCschema` case that the topics in a schema start in some fashion with a capital letter. To have braces in a `\schema` that are big enough, you need that `\strut`.

If the first letter is not a capital or if the text seems a little off-center, you can turn off this default feature of `\schemabox` by placing `\LCschema` immediately before it. `\LCschema` will prevent all subsequent uses of `\schemabox` from adding `\strut` until you restore the default behavior with `\UCschema`, also best placed before the intended `\schemabox`.

Here is an example where an entire schema is in lowercase, so instead of placing `\LCschema` and `\UCschema` before a particular `\schemabox`, we put the two macros before and after the `\Schema`:

```

1 \LCschema%
2 \Schema{0.1ex}{4.8ex}
3 {\hbox{sensus literalis}}
4 {
5   \schema{\schemabox{sensus\\literalis\\(improprie)}}
6           {\schemabox{ex parallelismo clarior\\
7             ex analogia fidei\\ex evidentia rei}}
8           \smallskip\schemabox{sensus literae}
9 }
10 \UCschema%
```

The foregoing example produces the following:

$$\text{sensus literalis} \left\{ \begin{array}{l} \text{sensus} \\ \text{literalis} \\ \text{(improprie)} \\ \text{sensus literae} \end{array} \right. \left\{ \begin{array}{l} \text{ex parallelismo clarior} \\ \text{ex analogia fidei} \\ \text{ex evidentia rei} \end{array} \right.$$

`\SwitchSB` The macro `\SwitchSB` causes a particular `\schemabox` to do the opposite of whatever `\LCschema` and `\UCschema` call for. It should be placed immediately before the `\schemabox` to be affected and its effect is reset thereafter.

Note, however, that mixing lowercase and uppercase-styles of `\schemabox` may put parts of a schema slightly off-center, meaning that one must *<adjust>* a `\Schema` by a tenth of an ex, give or take.

Also remember that you can add `\strut` as needed to make manual adjustments.

`\NudgeSB` The macro `\NudgeSB` is another “per-use” macro that causes a particular `\schemabox` to add a 0.2em kern at the end of every line of text. This is meant to be used especially with left-hand-side material in a closed `\schema` or `\Schema` because they use a -0.2em kern to draw the braces closer to the box. That is because many lines of text in schemata terminate with punctuation. The negative kern is a default way to prevent too much white space.

When no punctuation is there and more white space is desired, `\NudgeSB` gets the text to be the same distance from the brace as the right-hand-side material. `\NudgeSB` should be placed immediately before the `\schemabox` to be affected and, like `\SwitchSB`, it is reset thereafter.

2.4 Tutorial

2.4.1 Starting Off Basic

So you want to typeset a seventeenth-century schema. You try the following:

```
1 \schema{a}{b\\c}          a          { b
                                     } c
```

That went badly. Then you remember that schemata hold internal vertical material and need something to organize the horizontal text in such a list. This weird `\schemabox` thing should do:

```
1 \schema
2   {\schemabox{a}}
3   {\schemabox{b\\c}}      a { b
                             } c
```

Now we are getting somewhere! The “big” side of the schema really should be more than one line high. Otherwise just use inline math mode or text.

2.4.2 *Loci* 101

Let’s try a few examples from *Loci Theologici*. We begin with this example, using only the `\schema` macro:

```
1 \schema
2 {
3   \schemabox{Subjectum theo-\\
4     logi\ae} est Notitia\\
5     Dei. Considerat\\
6     ergo, Dei, vel}
7 }
8 {
9   \schema
10  {
11    \schemabox{\textsc{Essentiam}},}
12  }
13  {
14    \schemabox{Unitate natur\ae}.\
15    Trinitate personarum.\
16    Operibus ad intra.}
17 }
18 \schema
19 {
20   \schemabox{\textsc{Voluntatem}},\
21   manifestatam in\\
22   operibus ad extra;\
23   ut in}
24 }
25 {
26   \schemabox{Creatione.\
27     Sustentatione natur\ae} laps\ae}.\
28     Reparatione.\
29     Conversione.\
30     Justificatione.\
31     Sanctificatione \&\
32     Glorificatione ejusdem.}
33 }
34 }
```

Subjectum theologiae est Notitia Dei. Considerat ergo, Dei, vel	{	ESSENTIAM,	{	Unitate naturæ. Trinitate personarum. Operibus ad intra.
		VOLUNTATEM, manifestatam in operibus ad extra; ut in	{	Creatione. Sustentatione naturæ lapsæ. Reparatione. Conversione. Justificatione. Sanctificatione & Glorificatione ejusdem.

Something is off here. The “simple” schema automatically adjusts the brace height to the right-hand side. But that includes the *entire* right-hand side. Moreover, `\schema` will produce cumulatively larger braces when nesting.

We have two “leaves” on the right-hand side, so we only have one `\schema` to change into a `\Schema`. We also add a `\smallskip` to separate the “leaves.” We change the following two lines above:

```
1 \Schema{-1ex}{8.7ex}
17   }\smallskip
```

Subjectum theologiae est Notitia Dei. Considerat ergo, Dei, vel	{	ESSENTIAM,	{	Unitate naturæ. Trinitate personarum. Operibus ad intra.
		VOLUNTATEM, manifestatam in operibus ad extra; ut in	{	Creatione. Sustentatione naturæ lapsæ. Reparatione. Conversione. Justificatione. Sanctificatione & Glorificatione ejusdem.

Now that looks better! We added a `\smallskip` at the end of the right-hand side material of a `\schema` to space out the “leaves.” That usually is the best practice in spacing out elements. You cannot put `\smallskip` and the like into a `\schemabox` in plain $\text{T}_{\text{E}}\text{X}$, and usually you want to avoid doing so in the first or last lines of a `\schemabox` in $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ to aid proper centering.

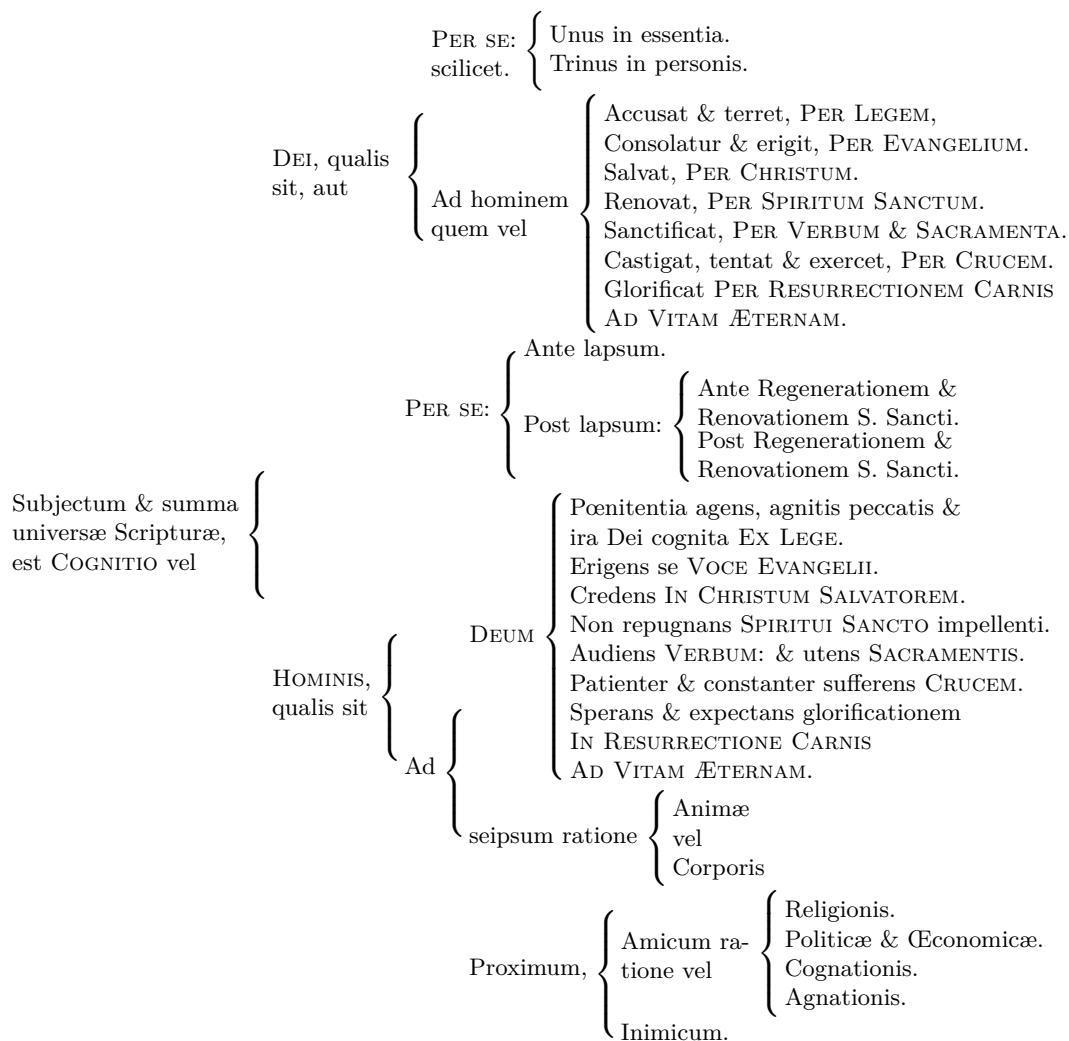
Always work from right to left when adjusting the spacing of a schema. Start from the “leaves” and work to the “root.”

The `\Schema` macro requires manual brace adjustment and sizing. Count the lines of text, estimate, then revise. Here we have between eight and nine lines of text from “ESSENTIAM” down to “ut in.” First set the `\size` to `8.5ex` and `\adjust` to `0ex`. The large brace will be a little too low. Set `\adjust` to `-1ex` to raise the brace about half a line and to lower the left-hand side about half a line, keeping everything centered. Finally, set `\size` to `8.7ex` or to taste.

Changes in $\text{T}_{\text{E}}\text{X}$ distributions can change font metrics and thus, the metrics of your schemata.

2.4.3 Going Big

We begin with the following example, where the `\Schema` braces all have dummy values of `0ex` (*adjust*) and `5ex` (*size*). Please do not be alarmed at how bad this looks right now!



Below we have the code listing for the schema above, wherein you can get the idea of how the example correlates with the source. The code listing breaks at sensible places across pages:

```

1 \Schema{0ex}{5ex}
2 {
3   \schemabox{Subjectum \& summa\\
4     univers\ae{} Scriptur\ae{}},\\
5     est \textsc{Cognitio} vel}
6 }
7 {
8   \Schema{0ex}{5ex}
9   {
10    \schemabox{\textsc{Dei}, qualis \\ sit, aut}
11  }

```



```

12 {
13   \schema
14   {\schemabox{\textsc{Per se}:\ \ scilicet.}}
15   {
16     \schemabox{Unus in essentia.}
17     \schemabox{Trinus in personis.}
18   }
19   \schema
20   {\schemabox{Ad hominem\ \ quem vel}}
21   {
22     \schemabox{Accusat \& terret, \textsc{Per Legem},\ \
23       Consolatur \& erigit, \textsc{Per Evangelium}.\ \
24       Salvat, \textsc{Per Christum}.\ \
25       Renovat, \textsc{Per Spiritum Sanctum}.\ \
26       Sanctificat, \textsc{Per Verbum} \& \textsc{Sacramenta}.\ \
27       Castigat, tentat \& exercet, \textsc{Per Crucem}.\ \
28       Glorificat \textsc{Per Resurrectionem Carnis}\ \
29       \textsc{Ad Vitam \AE{}ternam}.}
30   }
31 }
32 \Schema{0ex}{5ex}
33 {
34   \schemabox{\textsc{Hominis},\ \ qualis sit}
35 }
36 {
37   \Schema{0ex}{5ex}
38   {\schemabox{\textsc{Per se}:}}
39   {
40     \schemabox{Ante lapsum.}
41     \schema
42     {\schemabox{Post lapsum:}}
43     {
44       \schemabox{Ante Regenerationem \&\ \
45         Renovationem S. Sancti.}
46       \schemabox{Post Regenerationem \&\ \
47         Renovationem S. Sancti.}
48     }
49   }
50   \Schema{0ex}{5ex}
51   {\schemabox{Ad}}
52   {
53     \schema
54     {\schemabox{\textsc{Deum}}}
55     {
56       \schemabox{P\oe{}nitentia agens, agnitis peccatis \&\ \
57         ira Dei cognita \textsc{Ex Lege}.\ \
58         Erigens se \textsc{Voce Evangelii}.\ \
59         Credens \textsc{In Christum Salvatorem}.\ \
60         Non repugnans \textsc{Spiritui Sancto} impellenti.\ \
61         Audiens \textsc{Verbum}: \& utens \textsc{Sacramentis}.\ \
62         Patienter \& constanter sufferens \textsc{Crucem}.\ \
63         Sperans \& expectans glorificationem\ \
64         \textsc{In Resurrectione Carnis}\ \
65         \textsc{Ad Vitam \AE{}ternam}.}
66     }

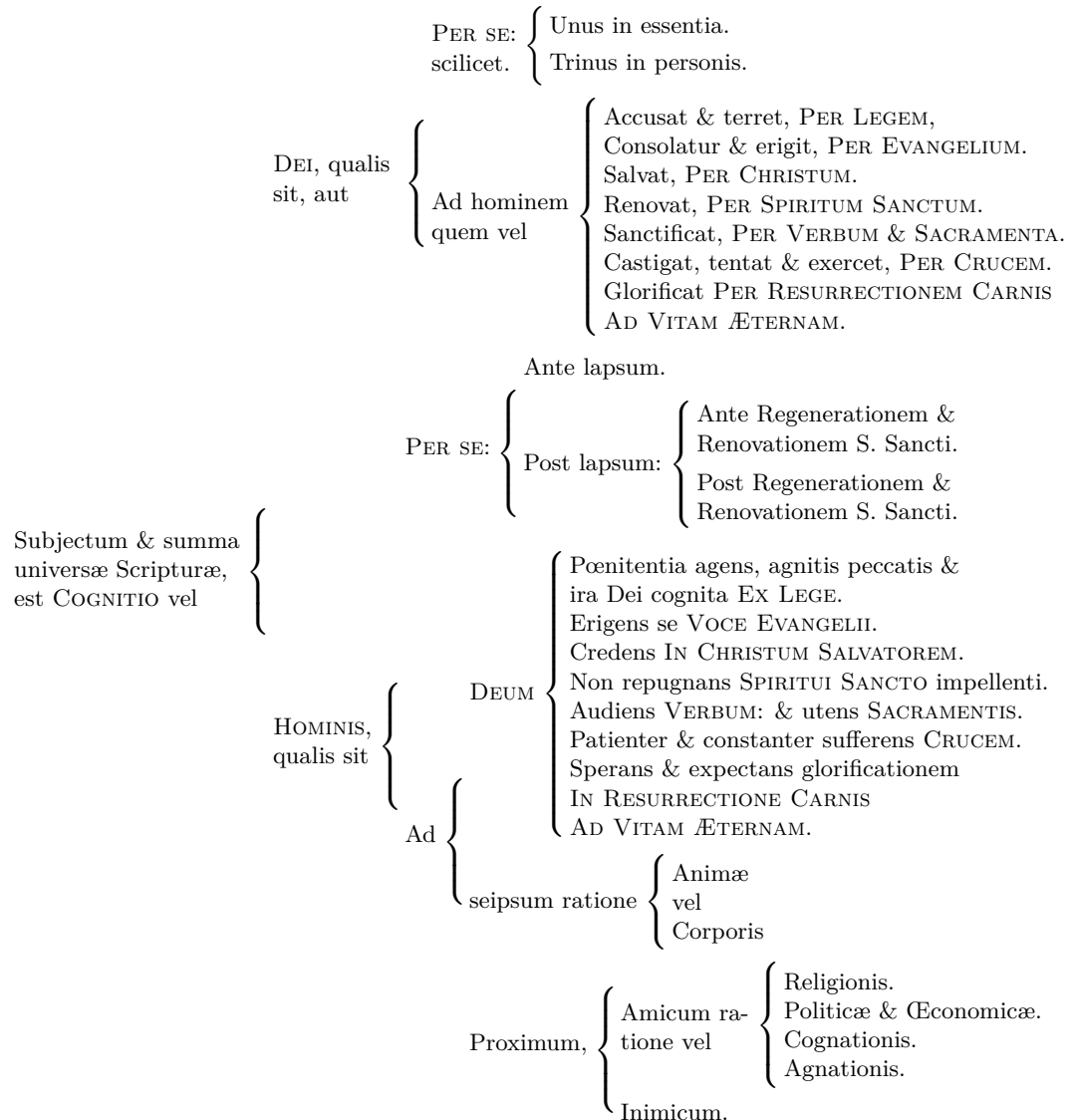
```

```

67     \schema
68     {\schemabox{seipsum ratione}}
69     {\schemabox{Anim\ae{}}\ vel\ Corporis}}
70     \Schema{0ex}{5ex}
71     {\schemabox{Proximum,}}
72     {
73         \schema
74         {\schemabox{Amicum ra-\ tione vel}}
75         {
76             \schemabox{Religionis.\
77             Politic\ae{}} \& \OE{ }conomic\ae{}}.\
78             Cognationis.\
79             Agnationis.}
80         }
81     \schemabox{Inimicum.}
82 }
83 }
84 }
85 }

```

First, we add space between the “leaves” of the tree. If you do not work from right to left, you will waste time revising the “leaves” and “branches.”



The following lines, shown with some surrounding context, were changed as a result of adding spaces:

```

15     {
16         \schemabox{Unus in essentia.}\smallskip
17         \schemabox{Trinus in personis.}
18     }\smallskip

```

You can add a `\smallskip` within a `\schemabox` in L^AT_EX, but not in plain T_EX. We have split the text into two boxes to make it format-agnostic. See also how the second `\smallskip` follows the closing brace of the right-hand side, not the `\schemabox`.

```

29         \textsc{Ad Vitam \AE{}ternam}.}
30     }\medskip

```

Again, the skip comes at the close of a right-hand side.

```

39     {
40         \schemabox{Ante lapsum.}\smallskip
41         \schema
42         {\schemabox{Post lapsum:}}
43         {
44             \schemabox{Ante Regenerationem \&\
45                 Renovationem S. Sancti.}\medskip
46             \schemabox{Post Regenerationem \&\
47                 Renovationem S. Sancti.}\smallskip
48         }\smallskip
49     }

```

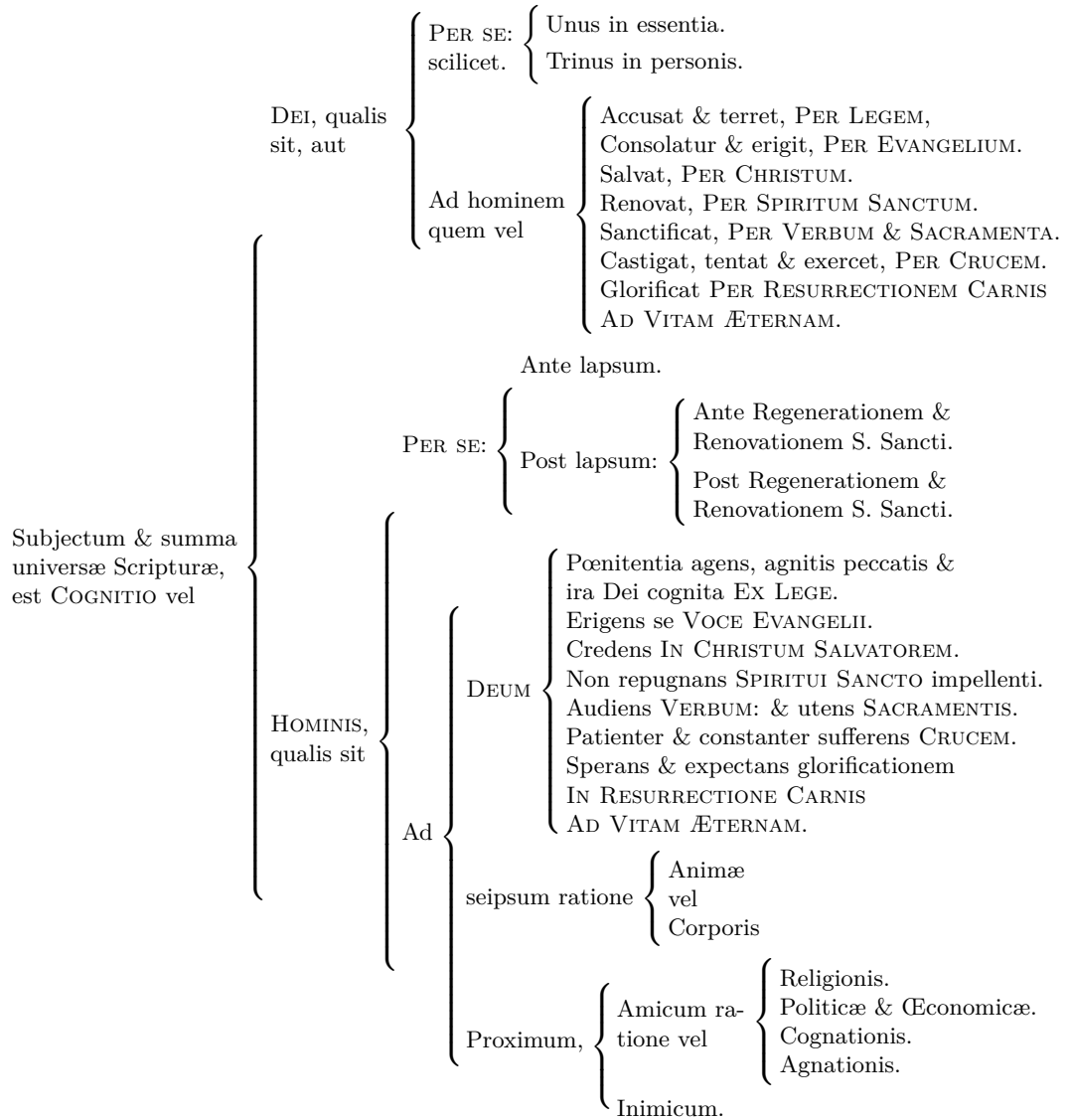
In the snippet above, the first skip helps to separate the lone `\schemabox` from the `\schema` below it. This illustrates how the internal vertical lists of schemata can contain heterogeneous material. A medium skip is placed between two `\schemaboxes`, which slightly throws off the way the brace spans the boxes. A small skip is put at the end of the last `\schemabox` to correct that, illustrating that putting skips within a `\schema` can be tricky. Then a `\smallskip` is added again at the end of the right-hand side. The skips below generally follow the same pattern.

```

65         \textsc{Ad Vitam \AE{}ternam}.}
66     }\smallskip
67     \schema
68     {\schemabox{seipsum ratione}}
69     {\schemabox{Anim\ae{} \ vel \ Corporis}}\smallskip
70
80         }\smallskip
81         \schemabox{Inimicum.}

```

Next we estimate the lines from the top of a `\Schema` brace to the bottom, e.g., from “PER SE:” to “quem vel”. We use those “ex” height figures for *<size>*:



The following lines, illustrate our “ball park” figures, where we include lines of text and blank lines in the total count:

```

1  \Schema{0ex}{23ex}

8   \Schema{0ex}{8ex}

32  \Schema{0ex}{16ex}

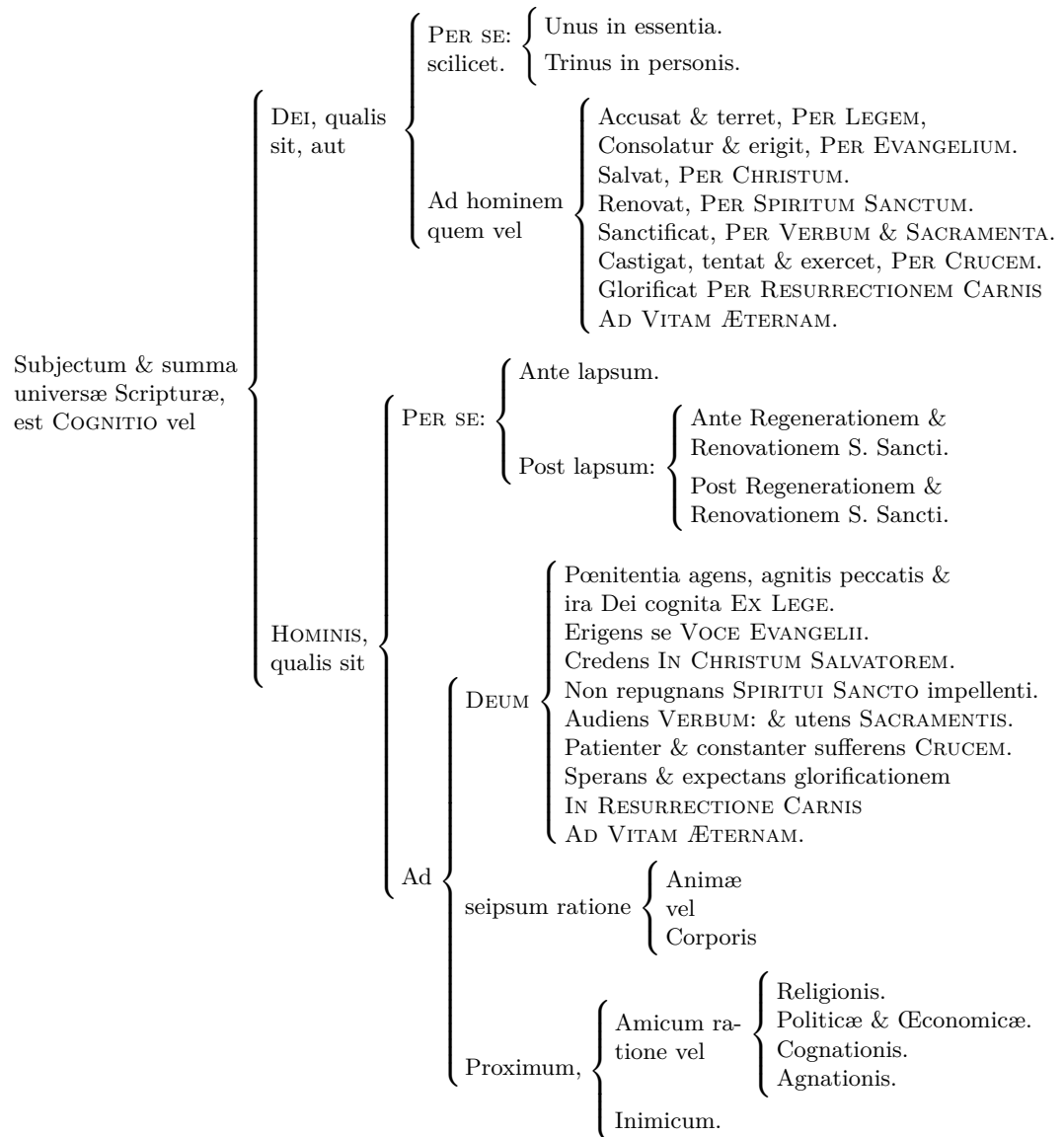
37   \Schema{0ex}{5ex}

50   \Schema{0ex}{16ex}

70   \Schema{0ex}{5ex}

```

Next we add the *adjust values* by counting the lines in the direction the brace needs to move, multiplying by two, and making it negative for up and positive for down. Using an editor, e.g., *texworks* makes this fairly easy. We also adjust the final *size* of the braces. Work from leaves to root.



We get the following changes, with a few final tweaks:

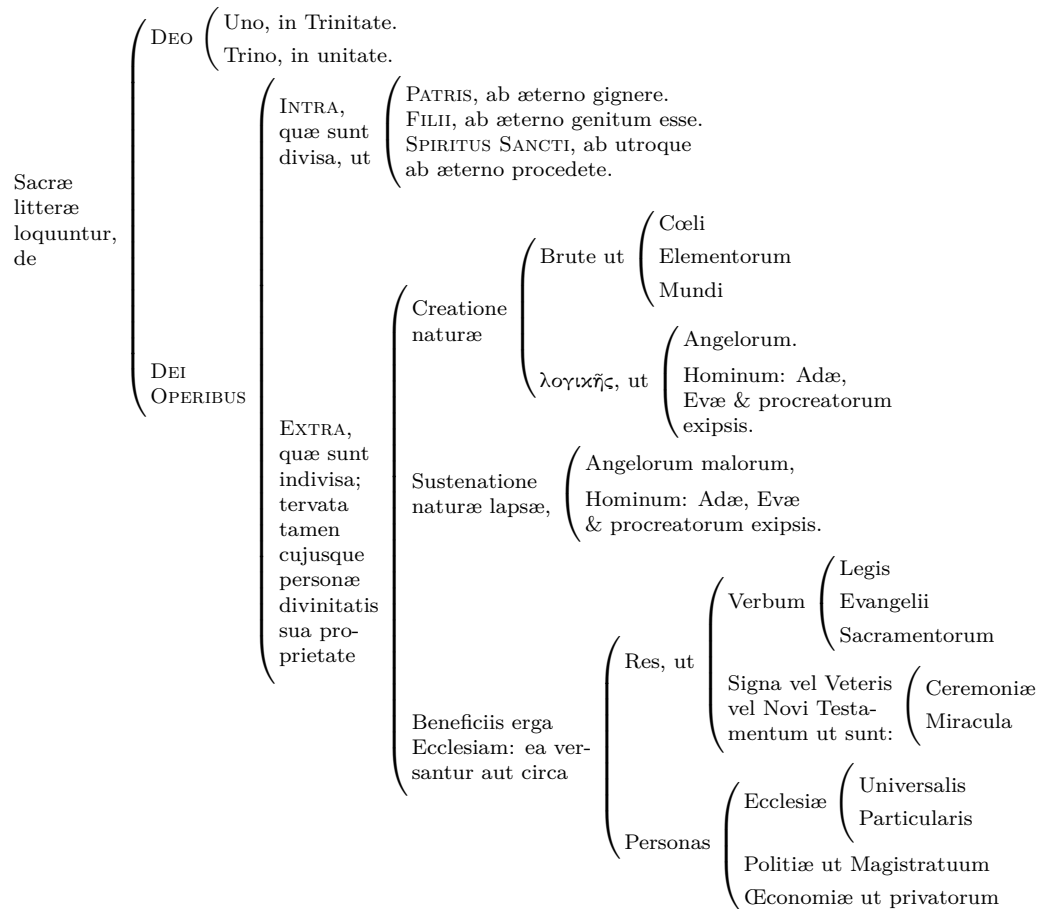
```

1 \Schema{-25ex}{20.6ex}% Do this one last.
8 \Schema{-6.4ex}{8.5ex}% Do this one first.
32 \Schema{-13.4ex}{17.4ex}% Do this one fifth.
37 \Schema{-4.4ex}{5ex}% Do this one second.
50 \Schema{4.2ex}{14.4ex}% Do this one fourth.
70 \Schema{2ex}{5.1ex}% Do this one third.
```

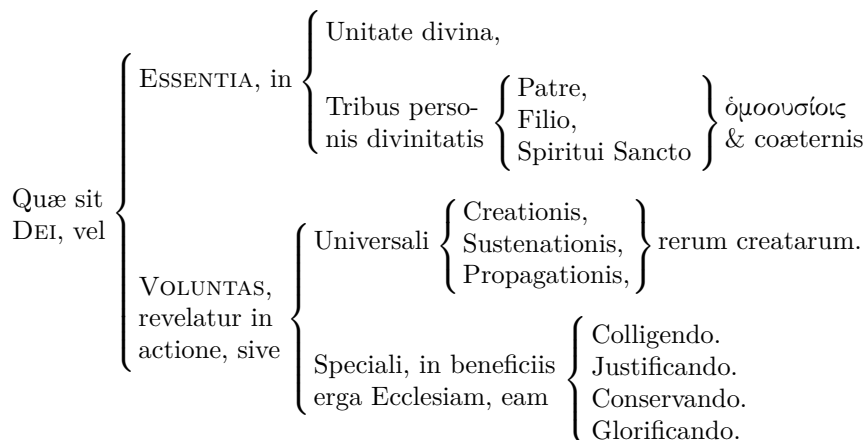
If all your dimensions are in ex height, scaling your (large) schema gets easier. For example, one ex is a different size for different fonts and font sizes:

<code>\Large</code>	<code>\large</code>	<code>\normalsize</code>	<code>\footnotesize</code>
6.2pt	5.16667pt	4.71451pt	3.87498pt

The next example illustrates spacing, adjusting, and `\DoParents` inside a group scope:



Next we see some closed schemata. This example merits consideration because it uses not only open schemata but closed ones nested within them. One must use `\Schema` in that case to prevent the opening braces from being slightly larger than the closing braces.



The following listing of the previous example illustrates how one handles closed schemata in this fashion. The macro `\gk` creates Greek text.

```

1 \Schema{-1.4ex}{10ex}
2 {
3   \schemabox{Qu\ae{} sit\\ \textsc{Dei}, vel}
4 }
5 {
6   \Schema{-1ex}{5ex}
7   {
8     \schemabox{\textsc{Essentia}, in}
9   }
10  {
11    \vskip1ex\schemabox{Unitate divina,}
12    \medskip
13    \Schema{0ex}{3.4ex}
14    {
15      \schemabox{Tribus perso-\\ nis divinitatis}
16    }
17    {
18      \Schema[close]{0ex}{3.4ex}
19      {
20        \NudgeSB\schemabox{Patre,\\ Filio,\\ Spiritui Sancto}
21      }
22      {
23        \schemabox{\gk{<omous'iois}\\ \& co\ae{}ternis}
24      }
25    }
26  }
27  \medskip
28  \Schema{-0.2ex}{6.4ex}
29  {
30    \schemabox{\textsc{Voluntas},\\ revelatur in\\ actione, sive}
31  }
32  {
33    \Schema{0ex}{3.4ex}
34    {
35      \schemabox{Universali}
36    }
37    {
38      \Schema[close]{0ex}{3.4ex}
39      {
40        \schemabox{Creationis,\\ Sustentionis,\\ Propagationis,}
41      }
42      {
43        \schemabox{rerum creatarum.}
44      }
45    }
46    \medskip
47    \schema
48    {
49      \schemabox{Speciali, in beneficiis\\ erga Ecclesiam, eam}
50    }
51    {
52      \schemabox{Colligendo.\\ Justificando.\\ Conservando.\\
53        Glorificando.}
54    }
55  }
56 }

```

Balanced open and closed schemata take the general form below:

```
\Schema{<adjust>}{<height>}
  {<left1>}
  {\Schema[close]{<adjust>}{<height>}
    {<left2>}
    {<right2>}
  }
```

The result is:

$$left_1 \left\{ left_2 \right\} right_2$$

Try to produce the following. Everything to the right of the leftmost brace is the RHS of the outermost schema. Everything between the leftmost brace and the rightmost brace is the LHS of the first nested schema, and so on.

$$a \left\{ \begin{array}{l} b \left\{ \begin{array}{l} f \\ g \\ h \end{array} \right\} l \\ c \left\{ \begin{array}{l} m \\ n \\ o \end{array} \right\} \end{array} \right\} p$$

If you choose to give up, the listing is below:

```
1 \Schema{0ex}{5.6ex}
2 {\schemabox{a}}
3 {
4   \Schema[close]{0ex}{5.6ex}
5   {
6     \Schema{0ex}{3.3ex}
7     {\schemabox{b\c}}
8     {
9       \Schema[close]{0ex}{3.3ex}
10      {\schemabox{f\g\h}}
11      {\schemabox{l\m}}
12     }
13     \Schema{0ex}{3.3ex}
14     {\schemabox{d\e}}
15     {
16       \Schema[close]{0ex}{3.3ex}
17       {\schemabox{i\j\k}}
18       {\schemabox{n\o}}
19     }
20   }
21 {\schemabox{p}}
22 }
```


2.5 Final features

This final example illustrates how one can set the width of a `\schemabox`, and for what sort of use that might be. Below we invoke `\DoBrackets` after the start of the group containing the right-hand side of the first `\Schema`.

Curricula Texts	{	I. General Studies	[1. Collected Works 2. Encyclopedias
		II. Literary Disciplines	[1. Philology 2. Historical Introduction 3. Literary Theory 4. Application
		III. Philosophical Disciplines	[1. Source Texts 2. History of Philosophy 3. General Surveys 4. Specific Studies
		IV. Historical Disciplines	[1. General Surveys 2. Specialized Works

```

1 \Schema{-0.2ex}{14.4ex}
2 {\schemabox{\bfseries Curricula\\\bfseries Texts}}
3 {
4   \DoBrackets%
5   \newbox\mybox\setbox\mybox=\hbox{\bfseries III. Philosophical }%
6   \dimen0=\wd\mybox%
7   \schema
8     {\schemabox[\dimen0]{\bfseries I. General\\Studies}}
9     {\schemabox{1. Collected Works\\2. Encyclopedias}}
10  \smallskip
11  \schema
12    {\schemabox[\dimen0]{\bfseries II. Literary\\Disciplines}}
13    {\schemabox{1. Philology\\
14      2. Historical Introduction\\
15      3. Literary Theory\\
16      4. Application}}
17  \smallskip
18  \schema
19    {\schemabox[\dimen0]{\bfseries III. Philosophical\\Disciplines}}
20    {\schemabox{1. Source Texts\\
21      2. History of Philosophy\\
22      3. General Surveys\\
23      4. Specific Studies}}
24  \smallskip
25  \schema
26    {\schemabox[\dimen0]{\bfseries IV. Historical\\Disciplines}}
27    {\schemabox{1. General Surveys\\
28      2. Specialized Works}}
29  }

```

3 Implementation

The concept of using math mode to generate schemata was first implemented by me in plain T_EX, then migrated to L^AT_EX.

3.1 Package Options and Booleans

Three options are implemented, namely, `braces` (the default), `brackets`, and `parens`. Plain T_EX does not use options as such, but simply declares braces as the default and allows the user to change that after the file is `\input`.

```
1 \expandafter\ifx\csname newenvironment\endcsname\relax
2   \catcode'@=11%
3   \def\DoBraces{\let\schemata@LD\lbrace \let\schemata@RD\rbrace}%
4   \DoBraces%
5 \else
6   \DeclareOption{braces}{\let\schemata@LD\lbrace \let\schemata@RD\rbrace}
7   \DeclareOption{brackets}{\let\schemata@LD\lbrack \let\schemata@RD\rbrack}
8   \DeclareOption{parens}{\let\schemata@LD( \let\schemata@RD)}
9   \ExecuteOptions{braces}
10  \ProcessOptions\relax
11 \fi
```

Two box registers and two dimen registers are used to analyze the left-hand and right-hand vertical sizes of the boxes in a schema.

```
12 \newbox\@rhs%
13 \newbox\@lhs%
14 \newdimen\@rheight%
15 \newdimen\@lheight%

16 \newif\if@schemata@LCBox%
17 \newif\if@schemata@SWBox%
18 \newif\if@schemata@NudgeBox%
```

3.2 Macros

`\DoBraces` Set the default option for braces.

```
19 \expandafter\ifx\csname newenvironment\endcsname\relax
20 \else
21   \newcommand{\DoBraces}{\let\schemata@LD\lbrace \let\schemata@RD\rbrace}%
22 \fi
```

`\DoBrackets` Set the “branches” to be brackets.

```
23 \expandafter\ifx\csname newenvironment\endcsname\relax
24   \def\DoBrackets{\let\schemata@LD\lbrack \let\schemata@RD\rbrack}%
25 \else
26   \newcommand{\DoBrackets}{\let\schemata@LD\lbrack \let\schemata@RD\rbrack}%
27 \fi
```

`\DoParens` Set the “branches” to be parentheses.

```
28 \expandafter\ifx\csname newenvironment\endcsname\relax
29   \def\DoParens{\let\schemata@LD( \let\schemata@RD)}%
30 \else
31   \newcommand{\DoParens}{\let\schemata@LD( \let\schemata@RD)}%
32 \fi
```

`\LCschema` Set global settings to assume lowercase initial text in `\schemaboxes`.

```

33 \expandafter\ifx\csname newenvironment\endcsname\relax
34   \def\LCschema{\@schemata@LCBoxtrue}%
35 \else
36   \newcommand{\LCschema}{\@schemata@LCBoxtrue}%
37 \fi

```

`\UCschema` Set global settings to assume uppercase initial text in `\schemaboxes`.

```

38 \expandafter\ifx\csname newenvironment\endcsname\relax
39   \def\UCschema{\@schemata@LCBoxfalse}%
40 \else
41   \newcommand{\UCschema}{\@schemata@LCBoxfalse}%
42 \fi

```

`\SwitchSB` Flip the UC/LC settings for one `\schemabox`, which will reset this value on exit.

```

43 \expandafter\ifx\csname newenvironment\endcsname\relax
44   \def\SwitchSB{\@schemata@SWBoxtrue}%
45 \else
46   \newcommand{\SwitchSB}{\@schemata@SWBoxtrue}%
47 \fi

```

`\NudgeSB` Add a kern to the end of each line in a `\schemabox`. This will be reset on exit from the `\schemabox`.

```

48 \expandafter\ifx\csname newenvironment\endcsname\relax
49   \def\NudgeSB{\@schemata@NudgeBoxtrue}%
50 \else
51   \newcommand{\NudgeSB}{\@schemata@NudgeBoxtrue}%
52 \fi

```

`\schemabox` If in internal vertical mode, wrap a stack of left-aligned `\hboxes` with optional width in a `\vbox`. This allows the box to be only as wide as needed. The syntax is reminiscent of a one-column tabular. Normally insert a `\strut` in the first `\hbox`.

```

53 \expandafter\ifx\cscname newenvironment\endcscname\relax
54 \gdef\schemabox{\futurelet\testchar\schemabox}
55 \gdef\schemabox{%
56 \ifx[\testchar
57 \let\next\@schemabox%
58 \else
59 \let\next\@schemab@x%
60 \fi
61 \next%
62 }%
63 \gdef\@schemab@x#1{\@schemabox[Opt]{#1}}
64 \gdef\@schemabox[#1]#2{%
65 \ifinner
66 \if@schemata@LCBox
67 \def\@Adj{}%
68 \if@schemata@SWBox\def\@Adj{\strut}\fi
69 \else
70 \def\@Adj{\strut}%
71 \if@schemata@SWBox\def\@Adj{}\fi
72 \fi
73 \if@schemata@NudgeBox
74 \def\@Nudge{\kern0.2em}%
75 \else
76 \def\@Nudge{}%
77 \fi
78 \ifdim#1<1pt
79 \def\{\@Nudge\egroup\hbox\bgroup\ignorespaces }%
80 \vbox{\hbox\bgroup\@Adj\ignorespaces #2\@Nudge\egroup}%
81 \else
82 \def\{\hfil\egroup\hbox to #1\bgroup\ignorespaces }%
83 \vbox{\hbox to #1\bgroup\@Adj\ignorespaces #2\hfil\egroup}%
84 \fi
85 \else
86 #2%
87 \fi
88 \@schemata@SWBoxfalse%
89 \@schemata@NudgeBoxfalse%
90 }%

```

```

91 \else
92   \newcommand{\schemabox}[2][0pt]{%
93     \ifinner
94       \if@schemata@LCBox
95         \def\@Adj{}%
96         \if@schemata@SWBox\def\@Adj{\strut}\fi
97       \else
98         \def\@Adj{\strut}%
99         \if@schemata@SWBox\def\@Adj{}\fi
100      \fi
101      \if@schemata@NudgeBox
102        \def\@Nudge{\kern0.2em}%
103      \else
104        \def\@Nudge{}%
105      \fi
106      \ifdim#1<1pt
107        \def\{\@Nudge\egroup\hbox\bgroup\ignorespaces }%
108        \vbox{\hbox\bgroup\@Adj\ignorespaces #2\@Nudge\egroup}%
109      \else
110        \def\{\hfil\egroup\hbox to #1\bgroup\ignorespaces }%
111        \vbox{\hbox to #1\bgroup\@Adj\ignorespaces #2\hfil\egroup}%
112      \fi
113    \else
114      #2%
115    \fi
116    \@schemata@SWBoxfalse%
117    \@schemata@NudgeBoxfalse%
118  }%
119 \fi

```

`\schema` This “simple” schema vertically centers two boxes of internal vertical material and puts a “simple” brace between the boxes based on the height of the box and the options passed to the schema. By default, a schema has a box to the left, an open delimiter, and a box to the right. If any optional argument other than "open" is used, the schema prints a box to the left, a close brace, and a box to the right.

```

120 \expandafter\ifx\cename newenvironment\endcename\relax
121 \gdef\schemat{\futurelet\testchar\@schemat}
122 \gdef\@schemat{\ifx[\testchar \let\next\@@schemat%
123 \else \let\next\@@schemat \fi \next}
124 \gdef\@@schemat#1#2{\@@schemat[open]{#1}{#2}}
125 \gdef\@@schemat[#1]#2#3{%
126 \def\@option{#1}\def\@open{open}%
127 \ifx\@option\@open
128 \setbox\@rhs=\vbox{#3}%
129 \@rheight=\ht\@rhs%
130 \advance\@rheight\dp\@rhs%
131 \advance\@rheight by 1.44265ex%
132 \hbox{\$ \vcenter{#2}}%
133 \schemat@lbrace{\@rheight}%
134 \vcenter{#3}$}%
135 \else
136 \setbox\@lhs=\vbox{#2}%
137 \@lheight=\ht\@lhs%
138 \advance\@lheight\dp\@lhs%
139 \advance\@lheight by 1.44265ex%
140 \hbox{\$ \vcenter{#2}}%
141 \kern-0.2em\schemat@rbrace{\@lheight}%
142 \vcenter{#3}$}%
143 \fi
144 }%
145 \else
146 \newcommand{\schemat}[3][open]{%
147 \def\@option{#1}\def\@open{open}%
148 \ifx\@option\@open
149 \setbox\@rhs=\vbox{#3}%
150 \@rheight=\ht\@rhs%
151 \advance\@rheight\dp\@rhs%
152 \advance\@rheight by 1.44265ex%
153 \hbox{\$ \vcenter{#2}}%
154 \schemat@lbrace{\@rheight}%
155 \vcenter{#3}$}%
156 \else
157 \setbox\@lhs=\vbox{#2}%
158 \@lheight=\ht\@lhs%
159 \advance\@lheight\dp\@lhs%
160 \advance\@lheight by 1.44265ex%
161 \hbox{\$ \vcenter{#2}}%
162 \kern-0.2em\schemat@rbrace{\@lheight}%
163 \vcenter{#3}$}%
164 \fi
165 }%
166 \fi

```

`\Schema` This is the general-purpose form of schemata. The arguments include whether it is an open or closed schema, the vertical adjustment of the left-hand side, the size of the brace, and the contents of the left and right-hand sides. It works the same as above, but requires manual adjustment of the braces.

```

167 \expandafter\ifx\cename newenvironment\endcename\relax
168 \gdef\Schema{\futurelet\testchar\@Schema}
169 \gdef\@Schema{\ifx[\testchar \let\next\@@Schema%
170             \else \let\next\@@Schem@ \fi \next}
171 \gdef\@@Schem@#1#2#3#4{\@@Schema[open]{#1}{#2}{#3}{#4}}
172 \gdef\@@Schema[#1]#2#3#4#5{%
173   \def\@option{#1}%
174   \def\@open{open}%
175   \dimen0=#2%
176   \ifx\@option\@open
177     \hbox{${\vcenter{\vskip1.44265\dimen0#4}}%
178           \@schemata@biglbrace{#2}{#3}\vcenter{#5}$}%
179   \else
180     \hbox{${\vcenter{\vskip1.44265\dimen0#4}\kern-0.2em%
181           \@schemata@bigrbrace{#2}{#3}\vcenter{#5}$}%
182   \fi
183   }%
184 \else
185   \newcommand{\Schema}[5][open]{%
186     \def\@option{#1}%
187     \def\@open{open}%
188     \dimen0=#2%
189     \ifx\@option\@open
190       \hbox{${\vcenter{\vskip1.44265\dimen0#4}}%
191             \@schemata@biglbrace{#2}{#3}\vcenter{#5}$}%
192     \else
193       \hbox{${\vcenter{\vskip1.44265\dimen0#4}\kern-0.2em%
194             \@schemata@bigrbrace{#2}{#3}\vcenter{#5}$}%
195     \fi
196   }%
197 \fi

```

`\@schemata@lbrace` Draw an on-center brace to the left of a simple box.

```

198 \expandafter\ifx\cename newenvironment\endcename\relax
199 \def\@schemata@lbrace#1{%
200   \ifmmode\left.\vcenter{\vbox to #1{\vfil}}\right\@schemata@LD\fi}
201 \else
202   \newcommand{\@schemata@lbrace}[1]{%
203     \ifmmode\left.\vcenter{\vbox to #1{\vfil}}\right\@schemata@LD\fi}
204 \fi

```

`\@schemata@rbrace` Draw an on-center brace to the right of a simple box.

```

205 \expandafter\ifx\cename newenvironment\endcename\relax
206 \def\@schemata@rbrace#1{%
207   \ifmmode\left\@schemata@RD\vcenter{\vbox to #1{\vfil}}\right.\fi}
208 \else
209   \newcommand{\@schemata@rbrace}[1]{%
210     \ifmmode\left\@schemata@RD\vcenter{\vbox to #1{\vfil}}\right.\fi}
211 \fi

```

`\@schemata@biglbrace` Draw a vertically-adjustable brace to the left of a complex assortment of boxes.

```
212 \expandafter\ifx\csname newenvironment\endcsname\relax
213 \def\@schemata@biglbrace#1#2{%
214   \dimen0=#1%
215   \dimen2=#2%
216   \dimen4=-\dimen2%
217   \ifdim\dimen4>\dimen2\dimen2=\dimen4\fi
218   \ifdim\dimen0<0pt
219     \ifmmode\vcenter{\hbox{\$left.%
220                       \vbox to 1.44265\dimen2{\vfil}%
221                       \right\@schemata@LD%
222                       \atop\vbox to -1.44265\dimen0{\vfil}$}}\fi
223   \else
224     \ifmmode\vcenter{\hbox{\$vbox to 1.44265\dimen0{\vfil}%
225                       \atopleft.%
226                       \vbox to 1.44265\dimen2{\vfil}%
227                       \right\@schemata@LD$}}\fi
228   \fi
229 }%
230 \else
231 \newcommand{\@schemata@biglbrace}[2]{%
232   \dimen0=#1%
233   \dimen2=#2%
234   \dimen4=-\dimen2%
235   \ifdim\dimen4>\dimen2\dimen2=\dimen4\fi
236   \ifdim\dimen0<0pt
237     \ifmmode\vcenter{\hbox{\$left.%
238                       \vbox to 1.44265\dimen2{\vfil}%
239                       \right\@schemata@LD%
240                       \atop\vbox to -1.44265\dimen0{\vfil}$}}\fi
241   \else
242     \ifmmode\vcenter{\hbox{\$vbox to 1.44265\dimen0{\vfil}%
243                       \atopleft.%
244                       \vbox to 1.44265\dimen2{\vfil}%
245                       \right\@schemata@LD$}}\fi
246   \fi
247 }%
248 \fi
```


`\@schemata@bigrbrace` Draw a vertically-adjustable brace to the right of a complex assortment of boxes.

```
249 \expandafter\ifx\csname newenvironment\endcsname\relax
250 \def\@schemata@bigrbrace#1#2{%
251   \dimen0=#1%
252   \dimen2=#2%
253   \dimen4=-\dimen2%
254   \ifdim\dimen4>\dimen2\dimen2=\dimen4\fi
255   \ifdim\dimen0<0pt
256     \ifmmode\vcenter{\hbox{\$left.%
257                       \vbox to 1.44265\dimen2{\vfil}%
258                       \right\@schemata@RD%
259                       \atop\vbox to -1.44265\dimen0{\vfil}$}}\fi
260   \else
261     \ifmmode\vcenter{\hbox{\$vbox to 1.44265\dimen0{\vfil}%
262                       \atopleft.%
263                       \vbox to 1.44265\dimen2{\vfil}%
264                       \right\@schemata@RD$}}\fi
265   \fi
266 }%
267 \else
268 \newcommand{\@schemata@bigrbrace}[2]{%
269   \dimen0=#1%
270   \dimen2=#2%
271   \dimen4=-\dimen2%
272   \ifdim\dimen4>\dimen2\dimen2=\dimen4\fi
273   \ifdim\dimen0<0pt
274     \ifmmode\vcenter{\hbox{\$left.%
275                       \vbox to 1.44265\dimen2{\vfil}%
276                       \right\@schemata@RD%
277                       \atop\vbox to -1.44265\dimen0{\vfil}$}}\fi
278   \else
279     \ifmmode\vcenter{\hbox{\$vbox to 1.44265\dimen0{\vfil}%
280                       \atopleft.%
281                       \vbox to 1.44265\dimen2{\vfil}%
282                       \right\@schemata@RD$}}\fi
283   \fi
284 }%
285 \fi

286 \expandafter\ifx\csname newenvironment\endcsname\relax
287 \catcode'\@=12
288 \fi
```

4 Change History

v0.5		v0.8	
General: Initial version	1	<code>\@schemata@biglbrace</code> : Renamed; use absolute value of brace size .	24
v0.6		<code>\@schemata@bigrbrace</code> : Renamed; Use absolute value of brace size .	25
General: Added brackets and parens as well as braces	18	<code>\@schemata@lbrace</code> : Renamed	23
Added features	1	<code>\@schemata@rbrace</code> : Renamed	23
Added UC/LC tweaks.	18	General: Renamed box/dimen regis- ters	18
<code>\DoBraces</code> : Added macro	18	Renamed internal macros	18
<code>\DoBrackets</code> : Added macro	18	Rewrote manual; moved to dtxgen	1
<code>\DoParens</code> : Added macro	18	<code>\NudgeSB</code> : Added macro	19
<code>\LCschema</code> : Added macro	19	<code>\schemabox</code> : Added nudge feature; fix errors when not in internal vertical mode	20
<code>\schemabox</code> : Added lowercase tweaks	20		
<code>\SwitchSB</code> : Added macro	19		
<code>\UCschema</code> : Added macro	19		
v0.7			
General: Changed contact info	1		

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