schemata — Generic package to aid construction of topical categories*

Charles P. Schaum†

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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.

Contents

1 Introduction 1
2 Usage 2
2.1 Package Options and Loading . . . . . . . . . . 2
2.2 Macro Overview . . . . . 2
2.3 Romancing the \schema . 5
2.4 Tutorial . . . . . . . . . . 6
  2.4.1 Starting Off Basic 6
  2.4.2 Loci 101 . . . . . . 6
2.4.3 Going Big . . . . . 8
  2.5 Final features . . . . . . 17
3 Implementation 18
3.1 Package Options and Booleans . . . . . . . . . . 18
3.2 Macros . . . . . . . . . . . 18
4 Change History 26
5 Index 27

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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†E-mail: charles dot schaum at comcast dot net
2 Usage

2.1 Package Options and Loading

This package basically is a “wrapper” that takes some of the work out of using \TeX\ math mode to create schemata (plural of τό 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 \TeX\ and \LaTeX:\

Users of \LaTeX\ invoke: \usepackage[⟨options⟩]{schemata}

Plain \TeX\ users will use: \input schemata.sty

2.2 Macro Overview

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

\[ a \{ b \} a \left\{ \begin{array}{c} b \\ c \end{array} \right\} a \left\{ \begin{array}{c} b \\ c \end{array} \right\} d \]

The next three examples use \texttt{\DoBrackets} to get brackets instead:

\[ a \left[ b \right] a \left[ \begin{array}{c} b \\ c \end{array} \right] a \left[ \begin{array}{c} b \\ c \end{array} \right] d \]

The next three three use \texttt{\DoParens}:

\[ a \left( b \right) a \left( \begin{array}{c} b \\ c \end{array} \right) a \left( \begin{array}{c} b \\ c \end{array} \right) d \]

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

\[ a \left\{ \begin{array}{c} b \\ c \end{array} \right\} d \]

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

```
\schema[(type)]{(left-hand side)}{(right-hand side)}
```

The (left-hand side) and (right-hand side) are vertical material in order to allow a \smallskip or other vertical adjustment as needed.

The (type) of a schema is open (to the right) by default:

```
a \{ b \\
  c
\}
```

Any value of (type) other than open makes a “closed” schema:

```
b c \{ 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:

```
\ldots a \{
  b \{
    c \\
    d
  \\
  e \\
  f \{
    g
  \\
\}
\}
```

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.

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:

```
\Schema[(type)]{(adjust)}{(size)}{(left-hand side)}{(right-hand side)}
```

The (type) is open by default. As above, any other (type) except the exact string open will make it a “closed” schema.

Both (adjust) and (size) are dimensions that are expressed best with the unit “ex.” This allows for easier scaling of the schema.

Set (adjust) to move the brace up (negative value) or down (positive value). Set (size) to be a number of ex nearly equal to the number of lines that the brace should span. The value of (size) 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.:
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[(\textwidth)]{(\text{text})}
```

The `\textwidth` 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{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 `\textwidth` and merely reproduces `\text{text}`. With `\schemabox{blah}` you just get “blah.”

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

```latex
\begin{verbatim}
def \Box{
  \hbox{
    \vrule
    \vbox to 1cm{\hrule\hbox to 1cm{\hfil}\vfil\hrule}
  }
}
\end{verbatim}
```

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 `\textwidth` in a `\Schema`, one should specify a `\textwidth` slightly less than half the height of the contents. Above, a `\textwidth` 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 \texttt{\textbackslash schema}

\texttt{\textbackslash LC\textbackslash schema} By default, a \texttt{\textbackslash schemabox} adds a \texttt{\textbackslash strut} to the first line because it is often the case that the topics in a schema start in some fashion with a capital letter. To have braces in a \texttt{\textbackslash schema} that are big enough, you need that \texttt{\textbackslash 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 \texttt{\textbackslash schemabox} by placing \texttt{\textbackslash LC\textbackslash schema} immediately before it. \texttt{\textbackslash LC\textbackslash schema} will prevent all subsequent uses of \texttt{\textbackslash schemabox} from adding \texttt{\textbackslash strut} until you restore the default behavior with \texttt{\textbackslash UC\textbackslash schema}, also best placed before the intended \texttt{\textbackslash schemabox}.

Here is an example where an entire schema is in lowercase, so instead of placing \texttt{\textbackslash LC\textbackslash schema} and \texttt{\textbackslash UC\textbackslash schema} before a particular \texttt{\textbackslash schemabox}, we put the two macros before and after the \texttt{\textbackslash Schema}:

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

The foregoing example produces the following:

\begin{verbatim}
{sensus literalis}
\begin{align*}
sensus\ literalis \quad & \text{ex parallelismo clairior} \\
\quad & \text{ex analogia fidei} \\
\quad & \text{ex evidentia rei} \\
\end{align*}
\end{verbatim}

\texttt{\textbackslash SwitchSB} The macro \texttt{\textbackslash SwitchSB} causes a particular \texttt{\textbackslash schemabox} to do the opposite of whatever \texttt{\textbackslash LC\textbackslash schema} and \texttt{\textbackslash UC\textbackslash schema} call for. It should be placed immediately before the \texttt{\textbackslash schemabox} to be affected and its effect is reset thereafter.

Note, however, that mixing lowercase and uppercase-styles of \texttt{\textbackslash schemabox} may put parts of a schema slightly off-center, meaning that one must \textit{(adjust)} a \texttt{\textbackslash Schema} by a tenth of an ex, give or take.

Also remember that you can add \texttt{\textbackslash strut} as needed to make manual adjustments.

\texttt{\textbackslash NudgeSB} The macro \texttt{\textbackslash NudgeSB} is another “per-use” macro that causes a particular \texttt{\textbackslash 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 \texttt{\textbackslash schema} or \texttt{\textbackslash 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, \texttt{\textbackslash NudgeSB} gets the text to be the same distance from the brace as the right-hand-side material. \texttt{\textbackslash NudgeSB} should be placed immediately before the \texttt{\textbackslash schemabox} to be affected and, like \texttt{\textbackslash 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:

```
\schema{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:

```
\schema
{\schemabox{a}}
{\schemabox{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:

```
\schema
{\schemabox{Subjectum theologiae est Notitia Dei. Considerat ergo, Dei, vel}}
{\schemabox{\textsc{Essentiam,}}}
{\schemabox{Unitate naturae.\ Trinitate personarum.\ Operibus ad intra.}}
{\schemabox{\textsc{Voluntatem,\ manifestatam in operibus ad extra;\ ut in}}}
{\schemabox{Creatione.\ Sustentatione naturae\ lapsae.\ Reparatione.\ Conversione.\ Justificatione.\ Sanctificatione \&\ Glorificatione ejusdem.}}
```
Subjectum theologiæ est Notitia Dei. Considerat ergo, Dei, vel Essentiam, \begin{itemize}
\item Unitate naturæ.
\item Trinitate personarum.
\item Operibus ad intra.
\end{itemize}
Voluntatem, manifestatam in operibus ad extra; ut in \begin{itemize}
\item Creatione.
\item Sustentatione naturæ lapsæ.
\item Reparatione.
\item Conversione.
\item Justificatione.
\item Sanctificatione & Glorificatione ejusdem.
\end{itemize}

Now that looks better! We added a \texttt{\smallskip} at the end of the right-hand side material of a \texttt{\schema} to space out the “leaves.” That usually is the best practice in spacing out elements. You cannot put \texttt{\smallskip} and the like into a \texttt{\schemabox} in plain $\TeX$, and usually you want to avoid doing so in the first or last lines of a \texttt{\schemabox} in $\LaTeX$ 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 $\texttt{\Schema}$ 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 $\langle\text{size}\rangle$ to 8.5ex and $\langle\text{adjust}\rangle$ to 0ex. The large brace will be a little too low. Set $\langle\text{adjust}\rangle$ 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 $\langle\text{size}\rangle$ to 8.7ex or to taste.

Changes in $\TeX$ 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 `\textsc{Schema}` braces all have dummy values of `0ex` \textit{(adjust)} and `5ex` \textit{(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:

```latex
\texttt{\textbackslash Schema\{0ex\}\{5ex\}}
\{
\begin{schema}
\texttt{\textbackslash schemabox\{Subjectum \& summa\}}
\texttt{univers\ae\} Scriptur\ae{},\}
\texttt{est \textsc{Cognitio} vel}
\end{schema}
\}
\{
\begin{schema}
\texttt{\textbackslash Schema\{0ex\}\{5ex\}}
\{
\begin{schema}
\texttt{\textbackslash schemabox\{Dei, qualis sit, aut\}}
\end{schema}
\end{schema}
\end{schema}
\end{document}
```
{  
  \textsc{Per se}: \textsc{Per Legem}, \textsc{Per Evangelium}, \textsc{Per Christum}, \textsc{Per Spiritum Sanctum}, \\
  \textsc{Per Verbum}, \textsc{Per Sacramenta}, \textsc{Per Crucem}, \\
  \textsc{In Resurrectionem Carnis}, \textsc{Ad Vitam \AE{} ternam}.}

}{  
  \textsc{Deum}

{  
  \textsc{Hominis}, qualis sit

}{  
  \textsc{Ad hominem}\ quem vel

{  
  \textsc{Ante lapsum.}

{  
  \textsc{Post lapsum.}

{  
  \textsc{Ante Regenerationem \& Renovationem Sancti.}

{  
  \textsc{Post Regenerationem \& Renovationem Sancti.}

{  
  \textsc{Deum}

{  
  \textsc{P\oe{} nitentia agens, agnitis peccatis \&\&
  \textsc{Ex Lege}.\&
  \textsc{Voce Evangelii}.\&
  \textsc{In Christum Salvatorem}.\&
  \textsc{Spiritui Sancto} impellenti.\&
  \textsc{In Sacramentis}.\&
  \textsc{In Crucem}.\&
  \textsc{In glorificationem}

\textsc{Ad Vitam \AE{} ternam}.}
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:

\begin{verbatim}
15  { \schemabox{Unus in essentia.}\smallskip
16       \schemabox{Trinus in personis.}}
17 \smlskp

You can add a \texttt{\smallskip} within a \texttt{\schemabox} in \LaTeX{}, but not in plain \TeX{}. We have split the text into two boxes to make it format-agnostic. See also how the second \texttt{\smallskip} follows the closing brace of the right-hand side, not the \texttt{\schemabox}.

\textsc{Ad Vitam \AE{} ternam}.}
\textsc{Ad Vitam \AE{} ternam}.}
\end{verbatim}

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

\begin{verbatim}
29  { \schemabox{Ante lapsum.}\smallskip
30    \schema
31       {\schemabox{Post lapsum:}}
32        { \schemabox{Ante Regenerationem \&
33                  Renovationem S. Sancti.}\medskip
34        \schemabox{Post Regenerationem \&
35                  Renovationem S. Sancti.}\smallskip
36        } \smallskip
37 \end{verbatim}

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

\begin{verbatim}
65  \textsc{Ad Vitam \AE{} ternam}.}
66 \end{verbatim}

Next we estimate the lines from the top of a \texttt{\Schema} brace to the bottom, e.g., from “\texttt{PER SE.}” to “quem vel”. We use those “ex” height figures for \langle \texttt{size} \rangle:
Subjectum & summa
universæ Scripturæ,
est Cognitio
vel

Dei, qualis
sit, aut

Ad hominem
quem vel

PER SE:
scilicet.

Unus in essentia.
Trimus in personis.

Accusat & terret, PER LEGEM,
Consolatur & erigit, PER EVANGELIUM.
Salvat, PER CHRISTUM.
Renovat, PER SPIRITUM SANCTUM.
Sanctificat, PER VERBUM & SACRAMENTA.
Castigat, tentat & exercet, PER CRUCEM.
Glorificat PER RESURRECTIONEM CARNIS
AD VITAM ÆTERNAM.

Ante lapsum.

PER SE:
Post lapsum:

Ante Regenerationem &
Renovationem S. Sancti.
Post Regenerationem &
Renovationem S. Sancti.

Poenitentia agens, agnitis peccatis &
ira Dei cognita EX LEGE.
Erigens se 
VOCE EVANGELII.
Credens IN CHRISTUM SALVATOREM.
Non repugnans SPIRITUI SANCTO impellenti.
Audientes VERBUM: & utens SACRAMENTIS.
Sperans & expectans glorificationem
IN RESURRECTIONE CARNIS
AD VITAM ÆTERNAM.

DEUM

HOMINIS,
qualis sit

Ad

seipsum ratione

ANIMA
vel

CORPORIS

Proximum,

Anicum ra-
tione vel

Religionis.
Politicæ & Æconomicæ.
Cognationis.
Agnationis.

Inimicum.

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

1 \Schema{}{23ex}
8 \Schema{}{8ex}
32 \Schema{}{16ex}
37 \Schema{}{5ex}
50 \Schema{}{16ex}
70 \Schema{}{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.
Subjectum et summa universae Scripturae, est Cognitio vel Dei, qualis sit, aut Ad hominem quem vel

Unus in essentia. Trinus in personis.


Ante lapsum.


Penitentia agens, agnitis peccatis & ira Dei cognita Ex Lege. Erigens se VOCE EVANGELII. Credens IN CHRISTUM SALVATOREM. Non repugnans SPIRITUI SANCTO impellenti. Audiens VERBUM: & utens SACRAMENTIS. Patienter & constanter sufferens CRUCEM. Sperans & expectans glorificationem IN RESURRECTIOE CARNIS AD VITAM ÂTERNAM.

Animae vel


Corporis

Amicum ratione vel

Proximum,
The next example illustrates spacing, adjusting, and `\DoParens` 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 \texttt{\gk} creates Greek text.

\begin{verbatim}
\\texttt{\vskip1ex}\texttt{\gk<oomous \textquotesingle iois}\\ \texttt{& co\ae{} ternis}
\end{verbatim}
Balanced open and closed schemata take the general form below:

\[
\begin{align*}
\text{\textbackslash Schema}\{(adjust)\}\{$(height)$\} \\
\{(left_1)\} \\
\text{\textbackslash Schema[close]}\{(adjust)\}\{$(height)$\} \\
\{(left_2)\} \\
\{(right_2)\}
\end{align*}
\]

The result is:

\[
left_1 \{ left_2 \} right_2
\]

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.

\[
\begin{align*}
&\{ \\
&\quad \left\{ \\
&\quad \quad \begin{array}{c}
&\text{a}\\
&\quad \text{b}\\
&\quad \text{c}\\
&\quad \text{d}\\
&\end{array}\\
&\quad \begin{array}{c}
&\text{e}\\
&\quad \text{f}\\
&\quad \text{g}\\
&\quad \text{h}\\
&\end{array}\\
&\quad \begin{array}{c}
&\text{i}\\
&\quad \text{j}\\
&\quad \text{k}\\
&\end{array}\\
&\quad \text{l}\\
&\quad \text{m}\\
&\quad \text{n}\\
&\quad \text{o}\\
&\quad \text{p}\\
&\end{array}
\end{align*}
\]

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

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

\begin{verbatim}
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 }
\end{verbatim}
3 Implementation

The concept of using math mode to generate schemata was first implemented by me in plain \TeX, then migrated to \LaTeX.

3.1 Package Options and Booleans

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

\begin{verbatim}
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
\end{verbatim}

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.

\begin{verbatim}
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%
\end{verbatim}

3.2 Macros

\texttt{\DoBraces} Set the default option for \texttt{braces}.
\begin{verbatim}
19 \expandafter\ifx\csname newenvironment\endcsname\relax
20 \else
21 \newcommand{\DoBraces}{\let\@schemata@LD\lbrace \let\@schemata@RD\rbrace}%
22 \fi
\end{verbatim}

\texttt{\DoBrackets} Set the “branches” to be \texttt{brackets}.
\begin{verbatim}
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
\end{verbatim}

\texttt{\DoParens} Set the “branches” to be parentheses.
\begin{verbatim}
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
\end{verbatim}
\LCschema  Set global settings to assume lowercase initial text in `\schemaboxes`.  
   \expandafter\ifx\csname newenvironment\endcsname\relax
   \def\LCschema\{}\@schemata@LCBoxtrue\%
   \else
   \newcommand\LCschema\{}\@schemata@LCBoxtrue\%
   \fi

\UCschema Set global settings to assume uppercase initial text in `\schemaboxes`.  
   \expandafter\ifx\csname newenvironment\endcsname\relax
   \def\UCschema\{}\@schemata@LCBoxfalse\%
   \else
   \newcommand\UCschema\{}\@schemata@LCBoxfalse\%
   \fi

\SwitchSB  Flip the UC/LC settings for one `\schemabox`, which will reset this value on exit.  
   \expandafter\ifx\csname newenvironment\endcsname\relax
   \def\SwitchSB\{}\@schemata@SWBoxtrue\%
   \else
   \newcommand\SwitchSB\{}\@schemata@SWBoxtrue\%
   \fi

\NudgeSB  Add a kern to the end of each line in a `\schemabox`. This will be reset on exit from the `\schemabox`.  
   \expandafter\ifx\csname newenvironment\endcsname\relax
   \def\NudgeSB\{}\@schemata@NudgeBoxtrue\%
   \else
   \newcommand\NudgeSB\{}\@schemata@NudgeBoxtrue\%
   \fi
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.

\begin{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.
\end{schemabox}
\else
  \newcommand{\schemabox}[2][0pt]{%
    \ifinner
      \if@schemata@LCBox
        \def\@Adj{}
        \if@schemata@SWBox\def\@Adj{\strut}\fi
      \else
        \def\@Adj{\strut}\
        \if@schemata@SWBox\def\@Adj{}\fi
      \fi
    \fi
    \if@schemata@NudgeBox
      \def\@Nudge{\kern0.2em}\
    \else
      \def\@Nudge{}\
    \fi
    \ifdim#1<1pt
      \def\{\@Nudge\egroup\hbox\bgroup\ignorespaces }%  
      \vbox{\hbox\bgroup\@Adj\ignorespaces #2\@Nudge\egroup}%
    \else
      \def\{\hfil\egroup\hbox to #1\bgroup\ignorespaces }%  
      \vbox{\hbox to #1\bgroup\@Adj\ignorespaces #2\hfil\egroup}%
    \fi
  \else
    #2%
    \@schemata@SWBoxfalse%
    \@schemata@NudgeBoxfalse%
  \fi
}%
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.

```latex
\gdef\schema{\futurelet\testchar@schema}
\gdef\@schema{\ifx[\testchar \let\next\@@schema%
\else \let\next\@@schem@ \fi \next}
\gdef\@@schem@#1#2{\@@schema[open]{#1}{#2}}
\gdef\@@schema[#1]{#2#3}{
\def\@ption{#1}\def\@pen{open}\ifx\@ption\@pen
\setbox\@rhs=\vbox{#3}\@rheight=\ht\@rhs\advance\@rheight\dp\@rhs\advance\@rheight by 1.44265ex\hbox{$\vcenter{#2}\@schemata@lbrace{\@rheight}\vcenter{#3}$}\else\setbox\@lhs=\vbox{#2}\@lheight=\ht\@lhs\advance\@lheight\dp\@lhs\advance\@lheight by 1.44265ex\hbox{$\vcenter{#2}\kern-0.2em\@schemata@rbrace{\@lheight}\vcenter{#3}$}\fi\else\newcommand{\schema}[3][open]{\ifx\@ption\@pen
\setbox\@rhs=\vbox{#3}\@rheight=\ht\@rhs\advance\@rheight\dp\@rhs\advance\@rheight by 1.44265ex\hbox{$\vcenter{#2}\@schemata@lbrace{\@rheight}\vcenter{#3}$}\else\setbox\@lhs=\vbox{#2}\@lheight=\ht\@lhs\advance\@lheight\dp\@lhs\advance\@lheight by 1.44265ex\hbox{$\vcenter{#2}\kern-0.2em\@schemata@rbrace{\@lheight}\vcenter{\@lheight}$}\fi}\fi}\fi
```

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 sizes. It works the same as above, but requires manual adjustment of the braces.

\begin{verbatim}
\def\Schema#1#2#3#4#5{\def\option{#1} \def\open{open} \dimen0=#2 \if\option\open \hbox{$\vcenter{\vskip1.44265\dimen0#4}$} \@@Schema@biglbrace{#2}{#3}\vcenter{#5}\$\} \else \hbox{$\vcenter{\vskip1.44265\dimen0#4}\kern-0.2em\@@Schema@bigrbrace{#2}{#3}\vcenter{#5}\$\} \fi} \else \newcommand{\Schema}[5][open]{\def\option{#1} \def\open{open} \dimen0=#2 \if\option\open \hbox{$\vcenter{\vskip1.44265\dimen0#4}$} \@@Schema@biglbrace{#2}{#3}\vcenter{#5}\$\} \else \hbox{$\vcenter{\vskip1.44265\dimen0#4}\kern-0.2em\@@Schema@bigrbrace{#2}{#3}\vcenter{#5}\$\} \fi}}
\end{verbatim}

\@@Schema@lbrace
\@@Schema@rbrace

\@@Schema@bracket
\@@Schema@bracket

Draw an on-center brace to the left of a simple box.

\begin{verbatim}
\def\@schemata@rbrace#1{\ifmmode\left\@schemata@RD\vcenter{\vbox to #1{\vfil}}\right.\fi}
\else\newcommand{\@schemata@rbrace}[1]{\ifmmode\left\@schemata@RD\vcenter{\vbox to #1{\vfil}}\right.\fi}\fi}
\end{verbatim}

\@@Schema@bracket
\@@Schema@bracket

Draw an on-center brace to the right of a simple box.

\begin{verbatim}
\def\@schemata@rbrace#1{\ifmmode\left.\vcenter{\vbox to #1{\vfil}}\right\@schemata@LD\fi}
\else\newcommand{\@schemata@rbrace}[1]{\ifmmode\left.\vcenter{\vbox to #1{\vfil}}\right\@schemata@LD\fi}\fi}
\end{verbatim}
\@schemata@biglbrace \text{Draw a vertically-adjustable brace to the left of a complex assortment of boxes.}

\expandafter\ifx\csname newenvironment\endcsname\relax
\def\@schemata@biglbrace#1#2{% 
  \dimen0=#1\%
  \dimen2=#2\%
  \dimen4=-\dimen2\%
  \ifdim\dimen4>\dimen2\dimen2=\dimen4\fi
  \ifdim\dimen0<0pt 
  \ifmmode\vcenter{\hbox{$\left.\vbox to 1.44265\dimen2{\vfil}\right\@schemata@LD\atop\vbox to -1.44265\dimen0{\vfil}$}}\fi
  \else 
  \ifmmode\vcenter{\hbox{$\vbox to 1.44265\dimen0{\vfil}\atop\left.\vbox to 1.44265\dimen2{\vfil}\right\@schemata@LD$}}\fi
  \fi 
% 
\else 
\newcommand{\@schemata@biglbrace}[2]{% 

  \ifmmode\vcenter{\hbox{$\left.\vbox to 1.44265\dimen2{\vfil}\right\@schemata@LD\atop\vbox to -1.44265\dimen0{\vfil}$}}\fi
  \else 
  \ifmmode\vcenter{\hbox{$\vbox to 1.44265\dimen0{\vfil}\atop\left.\vbox to 1.44265\dimen2{\vfil}\right\@schemata@LD$}}\fi
  \fi 
}%
\fi
Draw a vertically-adjustable brace to the right of a complex assortment of boxes.

\newcommand{\@schemata@bigrbrace}{% 
\dimen0=#1% 
\dimen2=#2% 
\dimen4=-\dimen2% 
\ifdim\dimen4>\dimen2\dimen2=\dimen4\fi 
\ifdim\dimen0<0pt 
\ifmmode\vcenter{\hbox{$\left.\vbox to 1.44265\dimen2{\vfil}\right\@schemata@RD$}}\fi 
\else 
\ifmmode\vcenter{\hbox{$\vbox to 1.44265\dimen0{\vfil}\atop\left.\vbox to 1.44265\dimen2{\vfil}\right\@schemata@RD$}}\fi 
\fi 
\else 
\newcommand{\@schemata@bigrbrace}{% 
\dimen0=#1% 
\dimen2=#2% 
\dimen4=-\dimen2% 
\ifdim\dimen4>\dimen2\dimen2=\dimen4\fi 
\ifdim\dimen0<0pt 
\ifmmode\vcenter{\hbox{$\left.\vbox to 1.44265\dimen2{\vfil}\right\@schemata@RD$}}\fi 
\else 
\ifmmode\vcenter{\hbox{$\vbox to 1.44265\dimen0{\vfil}\atop\left.\vbox to 1.44265\dimen2{\vfil}\right\@schemata@RD$}}\fi 
\fi 
\fi}
### 4 Change History

#### v0.5
- General: Initial version

#### v0.6
- General: Added brackets and parens as well as braces
- Added features
- Added UC/LC tweaks
- \DoBraces: Added macro
- \DoBrackets: Added macro
- \DoParens: Added macro
- \LCschema: Added macro
- \schemabox: Added lowercase tweaks
- \SwitchSB: Added macro
- \UCschema: Added macro

#### v0.7
- General: Changed contact info

#### v0.8
- \schemata@biglbrace: Renamed; use absolute value of brace size
- \schemata@bigrbrace: Renamed; Use absolute value of brace size
- \schemata@lbrace: Renamed
- \schemata@rbrace: Renamed
- General: Renamed box/dimen registers
- \NudgeSB: Added macro
- \schemabox: Added nudge feature; fix errors when not in internal vertical mode
5 Index

Numbers written in italic refer to the page where the corresponding entry is described; numbers underlined refer to the code line of the definition; numbers in roman refer to the code lines where the entry is used.

Symbols
\@@Schem@ ........................................ 170, 171
\@@Schema ...................................... 169, 171, 172
\@@schem@ ........................................ 123, 124
\@@schema ......................................... 122, 124, 125
\@@schemabox .................................... 57, 63, 64
\@Adj .............................................. 67, 68, 70, 71, 80, 83, 95, 96, 98, 99, 108, 111
\@Nudge .......................................... 74, 76, 79, 80, 102, 104, 107, 108, 109
\@Schema .......................................... 168, 169
\@lheight ........................................... 15, 137, 138, 139, 141, 150, 151, 152, 154
\@lhs ............................................... 13, 136, 137, 138, 157, 158, 159
\@pen ................................................ 126, 127, 147, 148, 174, 176, 187, 189
\@option ............................................ 126, 127, 147, 148, 173, 176, 186, 189
\@rheight ............................................ 14, 129, 130, 131, 133, 150, 151, 152, 154
\@rhs ................................................ 12, 128, 129, 130, 149, 150, 151
\@schema ........................................... 121, 122
\@schemabox ....................................... 54, 55
\@schemata@LCBoxfalse .............................. 39, 41
\@schemata@LCBoxtrue ........................................ 34, 36
\@schemata@LD .................................... 3, 6, 7, 8, 21, 24, 26, 29, 31, 200, 203, 221, 227, 239, 245
\@schemata@NudgeBoxfalse ............................ 89, 117
\@schemata@NudgeBoxtrue ............................ 49, 51
\@schemata@RD .................................. 3, 6, 7, 8, 21, 24, 26, 29, 31, 207, 210, 258, 264, 276, 282
\@schemata@SWBoxfalse .............................. 88, 116
\@schemata@SWBoxtrue .................................... 44, 46
\@schemata@biglbrace ................................ 178, 191, 212
\@schemata@bigrbrace ................................ 181, 194, 249
\@schemata@lbrace .................................. 133, 154, 198
\@schemata@rbrace .................................. 141, 162, 205
\\ .................................................. 79, 82, 107, 110
\A ......................................................
\\advance ........................................... 130, 131, 138, 139, 151, 152, 159, 160
\\atop ............................................ 222, 225, 240, 243, 259, 262, 277, 280
\C ....................................................
\\catcode .......................................... 2, 287
\D ....................................................
\\DoBraces ........................................ 2, 3, 4, 19
\\DoBrackets ...................................... 2, 23
\\DoParensto ...................................... 2, 28
\\dp ........................................ 130, 138, 151, 159
\H ....................................................
\\ht ................................................ 129, 137, 150, 158
\I ....................................................
\\if@schemata@LCBox .................................. 16, 66, 94
\\if@schemata@NudgeBoxtrue ............................ 18, 73, 101
\\if@schemata@SWBox .................................. 17, 68, 71, 96, 99
\\ifinner .......................................... 65, 93
\K ......................................................
\\kern ........................................ 74, 102, 141, 162, 180, 193
\L ......................................................
\\lbrack ............................................. 7, 24, 26
\\{ ................................................. 3, 6, 21
\\rbrack .......................................... 7, 24, 26
\\\left .............................................. 3, 6, 21, 24, 26, 29, 31, 207, 210, 219, 225, 237, 243, 256, 262, 274, 280
\\\Cschema ........................................ 5, 33
\\left .............................................. 3, 6, 21, 24, 26
\\\rbrack .......................................... 7, 24, 26
\\\right .......................................... 3, 6, 21, 24, 26
\\\\right ........................................ 200, 203, 207, 210, 221, 227, 239, 245, 256, 264, 276, 282
\N ......................................................
\\NudgeSB ......................................... 5, 48
\R ......................................................
\\rbrace .......................................... 3, 6, 21
\\rbrack .......................................... 7, 24, 26
\\right .......................................... 200, 203, 207, 210, 221, 227, 239, 245, 256, 264, 276, 282
\S ......................................................
\\Schema ........................................ 3, 167
\\schema ........................................ 3, 120
\\schemabox ....................................... 4, 53
\\strut ............................................. 68, 70, 96, 98
\\SwitchSB ......................................... 5, 43
\U ......................................................
\\UCschema ........................................ 5, 38

27