The luamplib package

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Abstract

Package to have metapost code typeset directly in a document with LuaTEX.

1 Documentation

This packages aims at providing a simple way to typeset directly metapost code in a document with LuaTEX. LuaTEX is built with the lua `mplib` library, that runs metapost code. This package is basically a wrapper (in Lua) for the Lua `mplib` functions and some TEX functions to have the output of the `mplib` functions in the pdf.

In the past, the package required PDF mode in order to output something. Starting with version 2.7 it works in DVI mode as well, though DVIPDFMx is the only DVI tool currently supported.

The metapost figures are put in a TEX `hbox` with dimensions adjusted to the metapost code.

Using this package is easy: in Plain, type your metapost code between the macros `\mplibcode` and `\endmplibcode`, and in LATEX in the `mplibcode` environment.

The code is from the `luatex-mplib.lua` and `luatex-mplib.tex` files from ConTEXt, they have been adapted to LATEX and Plain by Elie Roux and Philipp Gesang, new functionalities have been added by Kim Dohyun. The changes are:

- a LATEX environment
- all TEX macros start by `mplib`
- use of luatexbase for errors, warnings and declaration
- possibility to use `btex ... etex` to typeset TEX code. `textext()` is a more versatile macro equivalent to `TEX()` from TEX.mp. `TEX()` is also allowed and is a synomym of `textext()`.

  N.B. Since v2.5, `btex ... etex` input from external `mp` files will also be processed by luamplib. However, `verbatimtex ... etex` will be entirely ignored in this case.

- `verbatimtex ... etex` (in TEX file) that comes just before `beginfig()` is not ignored, but the TEX code inbetween will be inserted before the following mplib hbox. Using this command, each mplib box can be freely moved horizontally and/or vertically. Also, a box number might be assigned to mplib box, allowing it to be reused later (see test files). *E.G.*

```
\mplibcode
verbatimtex \moveright 3cm etex; beginfig(0); ... endfig;
verbatimtex \leavevmode etex; beginfig(1); ... endfig;
verbatimtex \leavevmode\lower 1ex etex; beginfig(2); ... endfig;
verbatimtex \endgraf\moveright 1cm etex; beginfig(3); ... endfig;
\endmplibcode
```

  N.B. `\endgraf` should be used instead of `\par` inside `verbatimtex ... etex`.

- TEX code in `VerbatimTeX(...)` or `verbatimtex ... etex` (in TEX file) between `beginfig()` and `endfig` will be inserted after flushing out the mplib figure. *E.G.*

```
\mplibcode
  D := sqrt(2)**7;
  beginfig(0);
  draw fullcircle scaled D;
  VerbatimTeX("\gdef\Dia{" & decimal D & "}");
  endfig;
\endmplibcode
diameter: \Dia bp.
```

- Notice that, after each figure is processed, macro `\MPwidth` stores the width value of latest figure; `\MPheight`, the height value. Incidentally, also note that `\MPllx`, `\MPlly`, `\MPurx`, and `\MPury` store the bounding box information of latest figure without the unit `bp`.

- Since v2.3, new macros `\everymplib` and `\everyendmplib` redefine token lists `\everymplibtoks` and `\everyendmplibtoks` respectively, which will be automatically inserted at the beginning and ending of each mplib code. *E.G.*

```
\everymplib{ verbatimtex \leavevmode etex; beginfig(0); }
\everyendmplib{ endfig; }
\mplibcode % beginfig/endfig not needed; always in horizontal mode
  draw fullcircle scaled 1cm;
\endmplibcode
```

  N.B. Many users have complained that mplib figures do not respect alignment commands such as `\centering` or `\raggedleft`. That's because **luamplib** does not force horizontal or vertical mode. If you want all mplib figures center- (or right-) aligned, please use `\everymplib` command with `\leavevmode` as shown above.

- Since v2.3, `\mpdim` and other raw TEX commands are allowed inside mplib code. This feature is inpired by gmp.sty authored by Enrico Gregorio. Please refer the manual of gmp package for details. *E.G.*

```
\begin{mplibcode}
  draw origin--(\mpdim{\linewidth},0) withpen pencircle scaled 4
  dashed evenly scaled 4 withcolor \mpcolor{orange};
\end{mplibcode}
```

  N.B. Users should not use the protected variant of `btex ... etex` as provided by gmp package. As **luamplib** automatically protects TEX code inbetween, `\btex` is not supported here.

- With `\mpcolor` command, color names or expressions of **color**/**xcolor** packages can be used inside mplibcode enviroment, though **luamplib** does not automatically load these packages. See the example code above. For spot colors, **(x)spotcolor** (in PDF mode) and **xespotcolor** (in DVI mode) packages are supported as well.

- Users can choose `numbersystem` option since v2.4. The default value `scaled` can be changed to `double` by declaring `\mplibnumbersystem{double}`. For details see http://github.com/lualatex/luamplib/issues/21.

- To support `btex ... etex` in external `.mp` files, **luamplib** inspects the content of each and every `.mp` input files and makes caches if neceeccsary, before returning their paths to LuaTEX's mplib library. This would make the compilation time longer wastefully, as most `.mp` files do not contain `btex ... etex` command. So **luamplib** provides macros as follows, so that users can give instruction about files that do not require this functionality.

  - `\mplibmakenocache{<filename>[,<filename>,...]}`
  - `\mplibcancelnocache{<filename>[,<filename>,...]}`

  where `<filename>` is a file name excluding `.mp` extension. Note that `.mp` files under `$TEXMFMAIN/metapost/base` and `$TEXMFMAIN/metapost/context/base` are already registered by default.

- By default, cache files will be stored in `$TEXMFVAR/luamplib_cache` or, if it's not available, in the same directory as where pdf/dvi output file is saved. This however can be changed by the command `\mplibcachedir{<directory path>}`, where tilde (~) is interpreted as the user's home directory (on a windows machine as well). As backslashes (\) should be escaped by users, it would be easier to use slashes (/) instead.

- Starting with v2.6, `\mplibtextextlabel{enable}` enables string labels typeset via `textext()` instead of `infont` operator. So, `label("my text",origin)` thereafter is exactly the same as `label(textext("my text"),origin)`. *N.B.* In the background, **luamplib** redefines `infont` operator so that the right side argument (the

font part) is totally ignored. Every string label therefore will be typeset with current TEX font. Also take care of `char` operator in the left side argument, as this might bring unpermitted characters into TEX.

- Starting with v2.9, `\mplibcodeinherit{enable}` enables the inheritance of variables, constants, and macros defined by previous `mplibcode` chunks. On the contrary, the default value `\mplibcodeinherit{disable}` will make each code chunks being treated as an independent instance, and never affected by previous code chunks.

  N.B. It does not work to pass across code chunks those variables containing `btex ... etex` pictures, as these are not METAPOST, but TEX elements from the standpoint of **luamplib**. Likewise, `graph.mp` does not work properly with the inheritance functionality.

```
\mplibcodeinherit{enable}
\everymplib{ beginfig(0);} \everyendmplib{ endfig;}
A circle
\mplibcode
  u := 10;
  draw fullcircle scaled u;
\endmplibcode
and twice the size
\mplibcode
  draw fullcircle scaled 2u;
\endmplibcode
```

- Starting with v2.11, users can issue `\mplibverbatim{enable}`, after which the contents of mplibcode environment will be read verbatim. As a result, users cannot use `btex` ... `etex`, `verbatimtex` ... `etex`, `\mpdim`, `\mpcolor` etc. All TEX commands are not expanded and will be fed literally into the mplib process.

- At the end of package loading, **luamplib** searches `luamplib.cfg` and, if found, reads the file in automatically. Frequently used settings such as `\everymplib` or `\mplibcachedir` are suitable for going into this file.

There are (basically) two formats for metapost: *plain* and *metafun*. By default, the *plain* format is used, but you can set the format to be used by future figures at any time using `\mplibsetformat{`⟨*format name*⟩`}`.

2 Implementation

2.1 Lua module

Use the `luamplib` namespace, since `mplib` is for the metapost library itself. ConTEXt uses `metapost`.

[1]

```
luamplib          = luamplib or { }

```

Identification.

```

local luamplib    = luamplib
luamplib.showlog  = luamplib.showlog or false
luamplib.lastlog  = ""

local err, warn, info, log = luatexbase.provides_module({
  name          = "luamplib",
  version       = "2.11.0",
  date          = "2015/08/01",
  description   = "Lua package to typeset Metapost with LuaTeX's MPLib.",
})


```

This module is a stripped down version of libraries that are used by ConTEXt. Provide a few "shortcuts" expected by the imported code.

```

local format, abs = string.format, math.abs

local stringgsub    = string.gsub
local stringfind    = string.find
local stringmatch   = string.match
local stringgmatch  = string.gmatch
local stringexplode = string.explode
local tableconcat   = table.concat
local texsprint     = tex.sprint
local textprint     = tex.tprint

local texget      = tex.get
local texset      = tex.set
local texgettoks  = tex.gettoks
local texsettoks  = tex.settoks
local texgetbox   = tex.getbox

local mplib = require ('mplib')
local kpse  = require ('kpse')
local lfs   = require ('lfs')

local lfsattributes = lfs.attributes
local lfsisdir      = lfs.isdir
local lfsmkdir      = lfs.mkdir
local lfstouch      = lfs.touch
local ioopen        = io.open

local file = file
if not file then
```

This is a small trick for LaTeX. In LaTeX we read the metapost code line by line, but it needs to be passed entirely to `process()`, so we simply add the lines in `data` and at the end we call `process(data)`.

A few helpers, taken from `l-file.lua`.

```
  file = { }

  function file.replacesuffix(filename, suffix)
    return (stringgsub(filename,"%.[%a%d]+$","")) .. "." .. suffix
  end

  function file.stripsuffix(filename)
    return (stringgsub(filename,"%.[%a%d]+$",""))
  end
end

```

`btex ... etex` in input .mp files will be replaced in finder.

```
local is_writable = file.is_writable or function(name)
  if lfsisdir(name) then
    name = name .. "/_luam_plib_temp_file_"
    local fh = ioopen(name,"w")
    if fh then
      fh:close(); os.remove(name)
      return true
    end
  end
end
local mk_full_path = lfs.mkdirs or function(path)
  local full = ""
  for sub in stringgmatch(path,"(/*[^\\/]+)") do
    full = full .. sub
    lfsmkdir(full)
  end
end

local luamplibtime = kpse.find_file("luamplib.lua")
luamplibtime = luamplibtime and lfsattributes(luamplibtime,"modification")

local currenttime = os.time()

local outputdir
if lfstouch then
  local texmfvar = kpse.expand_var('$TEXMFVAR')
  if texmfvar and texmfvar ~= "" and texmfvar ~= '$TEXMFVAR' then
    for _,dir in next,stringexplode(texmfvar,os.type == "windows" and ";" or ":") do
      if not lfsisdir(dir) then
        mk_full_path(dir)
      end
      if is_writable(dir) then
```

```
        local cached = format("%s/luamplib_cache",dir)
        lfsmkdir(cached)
        outputdir = cached
        break
      end
    end
  end
end
if not outputdir then
  outputdir = "."
  for _,v in ipairs(arg) do
    local t = stringmatch(v,"%-output%-directory=(.+)")
    if t then
      outputdir = t
      break
    end
  end
end

function luamplib.getcachedir(dir)
  dir = stringgsub(dir,"##","#")
  dir = stringgsub(dir,"^~",
    os.type == "windows" and os.getenv("UserProfile") or os.getenv("HOME"))
  if lfstouch and dir then
    if lfsisdir(dir) then
      if is_writable(dir) then
        luamplib.cachedir = dir
      else
        warn("Directory '"..dir.."' is not writable!")
      end
    else
      warn("Directory '"..dir.."' does not exist!")
    end
  end
end

local noneedtoreplace = {
  ["boxes.mp"] = true,
  --  ["format.mp"] = true,
  ["graph.mp"] = true,
  ["marith.mp"] = true,
  ["mfplain.mp"] = true,
  ["mpost.mp"] = true,
  ["plain.mp"] = true,
  ["rboxes.mp"] = true,
  ["sarith.mp"] = true,
  ["string.mp"] = true,
  ["TEX.mp"] = true,
  ["metafun.mp"] = true,
  ["metafun.mpiv"] = true,
```

```
  ["mp-abck.mpiv"] = true,
  ["mp-apos.mpiv"] = true,
  ["mp-asnc.mpiv"] = true,
  ["mp-bare.mpiv"] = true,
  ["mp-base.mpiv"] = true,
  ["mp-butt.mpiv"] = true,
  ["mp-char.mpiv"] = true,
  ["mp-chem.mpiv"] = true,
  ["mp-core.mpiv"] = true,
  ["mp-crop.mpiv"] = true,
  ["mp-figs.mpiv"] = true,
  ["mp-form.mpiv"] = true,
  ["mp-func.mpiv"] = true,
  ["mp-grap.mpiv"] = true,
  ["mp-grid.mpiv"] = true,
  ["mp-grph.mpiv"] = true,
  ["mp-idea.mpiv"] = true,
  ["mp-luas.mpiv"] = true,
  ["mp-mlib.mpiv"] = true,
  ["mp-page.mpiv"] = true,
  ["mp-shap.mpiv"] = true,
  ["mp-step.mpiv"] = true,
  ["mp-text.mpiv"] = true,
  ["mp-tool.mpiv"] = true,
}
luamplib.noneedtoreplace = noneedtoreplace

local function replaceformatmp(file,newfile,ofmodify)
  local fh = ioopen(file,"r")
  if not fh then return file end
  local data = fh:read("*all"); fh:close()
  fh = ioopen(newfile,"w")
  if not fh then return file end
  fh:write(
    "let normalinfont = infont;\n",
    "primarydef str infont name = rawtextext(str) enddef;\n",
    data,
    "vardef Fmant_(expr x) = rawtextext(decimal abs x) enddef;\n",
    "vardef Fexp_(expr x) = rawtextext(\"$^{\"&decimal x&\"}$\") enddef;\n",
    "let infont = normalinfont;\n"
  ); fh:close()
  lfstouch(newfile,currenttime,ofmodify)
  return newfile
end

local esctex = "!!!T!!!E!!!X!!!"
local esclbr = "!!!!!LEFTBRCE!!!!!"
local escrbr = "!!!!!RGHTBRCE!!!!!"
local escshar = "!!!!!SHARPE!!!!!"
local escpcnt = "!!!!!PERCENT!!!!!"
```

```
local eschash = "!!!!!HASH!!!!!"
local begname = "%f[A-Z_a-z]"
local endname = "%f[^A-Z_a-z]"

local function protecttexcontents(str)
  str = stringgsub(str,"\\%%","\\"..escpcnt)
  str = stringgsub(str,"%%.-\n", "")
  str = stringgsub(str,"%%.-$", "")
  str = stringgsub(str,'"',"&ditto&"')
  str = stringgsub(str,"\n%s*"," ")
  return str
end

local function replaceinputmpfile (name,file)
  local ofmodify = lfsattributes(file,"modification")
  if not ofmodify then return file end
  local cachedir = luamplib.cachedir or outputdir
  local newfile = stringgsub(name,"%W","_")
  newfile = cachedir .."/luamplib_input_"..newfile
  if newfile and luamplibtime then
    local nf = lfsattributes(newfile)
    if nf and nf.mode == "file" and ofmodify == nf.modification and luamplibtime < nf.ac-
  cess then
      return nf.size == 0 and file or newfile
    end
  end
  if name == "format.mp" then return replaceformatmp(file,newfile,ofmodify) end

  local fh = ioopen(file,"r")
  if not fh then return file end
  local data = fh:read("*all"); fh:close()
  data = stringgsub(data, "\"[^\n]-\"",
    function(str)
      str = stringgsub(str,"([bem])tex"..endname,"%1"..esctex)
      return str
    end)
  local count,cnt = 0,0
  data,cnt = stringgsub(data,
    begname.."btex"..endname.."%s*(.-)%s*"..begname.."etex"..endname,
    function(str)
      str = protecttexcontents(str)
      str = stringgsub(str,"\\"..escpcnt,"\\%%")
      return format("rawtextext(\"%s\")",str)
    end)
  count = count + cnt
  data,cnt = stringgsub(data,
    begname.."verbatimtex"..endname.."%s*.-%s*"..begname.."etex"..endname,
    "")
  count = count + cnt
  if count == 0 then
```

```
    noneedtoreplace[name] = true
    fh = ioopen(newfile,"w");
    if fh then
      fh:close()
      lfstouch(newfile,currenttime,ofmodify)
    end
    return file
  end
  data = stringgsub(data,"([bem])"..esctex,"%1tex")
  fh = ioopen(newfile,"w")
  if not fh then return file end
  fh:write(data); fh:close()
  lfstouch(newfile,currenttime,ofmodify)
  return newfile
end

local randomseed = nil
```

As the finder function for `mplib`, use the `kpse` library and make it behave like as if MetaPost was used (or almost, since the engine name is not set this way—not sure if this is a problem).

```

local mpkpse = kpse.new("luatex", "mpost")

local special_ftype = {
  pfb = "type1 fonts",
  enc = "enc files",
}

local function finder(name, mode, ftype)
  if mode == "w" then
    return name
  else
    ftype = special_ftype[ftype] or ftype
    local file = mpkpse:find_file(name,ftype)
    if file then
      if not lfstouch or ftype ~= "mp" or noneedtoreplace[name] then
        return file
      end
      return replaceinputmpfile(name,file)
    end
    return mpkpse:find_file(name,stringmatch(name,"[a-zA-Z]+$"))
  end
end
luamplib.finder = finder

```

The rest of this module is not documented. More info can be found in the LuaTEX manual, articles in user group journals and the files that ship with ConTEXt.

```

```

```
function luamplib.resetlastlog()
  luamplib.lastlog = ""
end

```

Below included is section that defines fallbacks for older versions of mplib.

```
local mplibone = tonumber(mplib.version()) <= 1.50

if mplibone then

  luamplib.make = luamplib.make or function(name,mem_name,dump)
    local t = os.clock()
    local mpx = mplib.new {
      ini_version = true,
      find_file = luamplib.finder,
      job_name = file.stripsuffix(name)
    }
    mpx:execute(format("input %s ;",name))
    if dump then
      mpx:execute("dump ;")
      info("format %s made and dumped for %s in %0.3f seconds",mem_name,name,os.clock()-t)
    else
      info("%s read in %0.3f seconds",name,os.clock()-t)
    end
    return mpx
  end

  function luamplib.load(name)
    local mem_name = file.replacesuffix(name,"mem")
    local mpx = mplib.new {
      ini_version = false,
      mem_name = mem_name,
      find_file = luamplib.finder
    }
    if not mpx and type(luamplib.make) == "function" then
      -- when i have time i'll locate the format and dump
      mpx = luamplib.make(name,mem_name)
    end
    if mpx then
      info("using format %s",mem_name,false)
      return mpx, nil
    else
      return nil, { status = 99, error = "out of memory or invalid format" }
    end
  end

else

```

These are the versions called with sufficiently recent mplib.

```
  local preamble = [[
    boolean mplib ; mplib := true ;
    let dump = endinput ;
    let normalfontsize = fontsize;
    input %s ;
  ]]

  luamplib.make = luamplib.make or function()
  end

  function luamplib.load(name)
    local mpx = mplib.new {
      ini_version = true,
      find_file = luamplib.finder,
```

Provides `numbersystem` option since v2.4. Default value `"scaled"` can be changed by declaring `\mplibnumbersystem{double}`. See https://github.com/lualatex/luamplib/issues/21.

```
      math_mode = luamplib.numbersystem,
      random_seed = randomseed,
    }
```

Append our own preamble to the preamble above.

```
    local preamble = preamble .. luamplib.mplibcodepreamble
    if luamplib.textextlabel then
      preamble = preamble .. luamplib.textextlabelpreamble
    end
    local result
    if not mpx then
      result = { status = 99, error = "out of memory"}
    else
      result = mpx:execute(format(preamble, file.replacesuffix(name,"mp")))
    end
    luamplib.reporterror(result)
    return mpx, result
  end

end

local currentformat = "plain"

local function setformat (name) --- used in .sty
  currentformat = name
end
luamplib.setformat = setformat


luamplib.reporterror = function (result)
  if not result then
    err("no result object returned")
```

```
  else
    local t, e, l = result.term, result.error, result.log
    local log = stringgsub(t or l or "no-term","^%s+","\n")
    luamplib.lastlog = luamplib.lastlog .. "\n " .. (l or t or "no-log")
    if result.status > 0 then
      warn("%s",log)
      if result.status > 1 then
        err("%s",e or "see above messages")
      end
    end
    return log
  end
end

local function process_indeed (mpx, data, indeed)
  local converted, result = false, {}
  if mpx and data then
    result = mpx:execute(data)
    local log = luamplib.reporterror(result)
    if indeed and log then
      if luamplib.showlog then
        info("%s",luamplib.lastlog)
        luamplib.resetlastlog()
      elseif result.fig then
```

v2.6.1: now luamplib does not disregard `show` command, even when `luamplib.showlog` is false. Incidentally, it does not raise error, but just prints a warning, even if output has no figure.

```
        if stringfind(log,"\n>>") then info("%s",log) end
        converted = luamplib.convert(result)
      else
        info("%s",log)
        warn("No figure output. Maybe no beginfig/endfig")
      end
    end
  else
    err("Mem file unloadable. Maybe generated with a different version of mplib?")
  end
  return converted, result
end

```

v2.9 has introduced the concept of 'code inherit'

```
luamplib.codeinherit = false
local mplibinstances = {}
local process = function (data,indeed)
  local standalone, firstpass = not luamplib.codeinherit, not indeed
  local currfmt = currentformat .. (luamplib.numbersystem or "scaled")
  currfmt = firstpass and currfmt or (currfmt.."2")
  local mpx = mplibinstances[currfmt]
```

```
  if standalone or not mpx then
    randomseed = firstpass and math.random(65535) or randomseed
    mpx = luamplib.load(currentformat)
    mplibinstances[currfmt] = mpx
  end
  return process_indeed(mpx, data, indeed)
end
luamplib.process = process

local function getobjects(result,figure,f)
  return figure:objects()
end

local function convert(result, flusher)
  luamplib.flush(result, flusher)
  return true -- done
end
luamplib.convert = convert

local function pdf_startfigure(n,llx,lly,urx,ury)
```

The following line has been slightly modified by Kim.

```
  texsprint(format("\\mplibstarttoPDF{%f}{%f}{%f}{%f}",llx,lly,urx,ury))
end

local function pdf_stopfigure()
  texsprint("\\mplibstoptoPDF")
end

```

`tex.tprint` and catcode regime -2, as sometimes # gets doubled in the argument of pdfliteral. — modified by Kim

```
local function pdf_literalcode(fmt,...) -- table
  textprint({"\\mplibtoPDF{"},{-2,format(fmt,...)},{"}"})
end
luamplib.pdf_literalcode = pdf_literalcode

local function pdf_textfigure(font,size,text,width,height,depth)
```

The following three lines have been modified by Kim.

```
  -- if text == "" then text = "\0" end -- char(0) has gone
  text = text:gsub(".",function(c)
    return format("\\hbox{\\char%i}",string.byte(c)) -- kerning happens in meta-
post
  end)
  texsprint(format("\\mplibtextext{%s}{%f}{%s}{%s}{%f}",font,size,text,0,-( 7200/ 7227)/65536*depth))
end
luamplib.pdf_textfigure = pdf_textfigure

local bend_tolerance = 131/65536

```

```
local rx, sx, sy, ry, tx, ty, divider = 1, 0, 0, 1, 0, 0, 1

local function pen_characteristics(object)
  local t = mplib.pen_info(object)
  rx, ry, sx, sy, tx, ty = t.rx, t.ry, t.sx, t.sy, t.tx, t.ty
  divider = sx*sy - rx*ry
  return not (sx==1 and rx==0 and ry==0 and sy==1 and tx==0 and ty==0), t.width
end

local function concat(px, py) -- no tx, ty here
  return (sy*px-ry*py)/divider,(sx*py-rx*px)/divider
end

local function curved(ith,pth)
  local d = pth.left_x - ith.right_x
  if abs(ith.right_x - ith.x_coord - d) <= bend_tolerance and abs(pth.x_coord - pth.left_x - d) <= bend_tolerance then
    d = pth.left_y - ith.right_y
    if abs(ith.right_y - ith.y_coord - d) <= bend_tolerance and abs(pth.y_coord - pth.left_y - d) <= bend_tolerance then
      return false
    end
  end
  return true
end

local function flushnormalpath(path,open)
  local pth, ith
  for i=1,#path do
    pth = path[i]
    if not ith then
      pdf_literalcode("%f %f m",pth.x_coord,pth.y_coord)
    elseif curved(ith,pth) then
      pdf_literalcode("%f %f %f %f %f %f c",ith.right_x,ith.right_y,pth.left_x,pth.left_y,pth.x_coord,p
    else
      pdf_literalcode("%f %f l",pth.x_coord,pth.y_coord)
    end
    ith = pth
  end
  if not open then
    local one = path[1]
    if curved(pth,one) then
      pdf_literalcode("%f %f %f %f %f %f c",pth.right_x,pth.right_y,one.left_x,one.left_y,one.x_coord,o
    else
      pdf_literalcode("%f %f l",one.x_coord,one.y_coord)
    end
  elseif #path == 1 then
    -- special case .. draw point
    local one = path[1]
    pdf_literalcode("%f %f l",one.x_coord,one.y_coord)
```

```
  end
  return t
end

local function flushconcatpath(path,open)
  pdf_literalcode("%f %f %f %f %f %f cm", sx, rx, ry, sy, tx ,ty)
  local pth, ith
  for i=1,#path do
    pth = path[i]
    if not ith then
      pdf_literalcode("%f %f m",concat(pth.x_coord,pth.y_coord))
    elseif curved(ith,pth) then
      local a, b = concat(ith.right_x,ith.right_y)
      local c, d = concat(pth.left_x,pth.left_y)
      pdf_literalcode("%f %f %f %f %f %f c",a,b,c,d,concat(pth.x_coord, pth.y_co-
ord))
    else
      pdf_literalcode("%f %f l",concat(pth.x_coord, pth.y_coord))
    end
    ith = pth
  end
  if not open then
    local one = path[1]
    if curved(pth,one) then
      local a, b = concat(pth.right_x,pth.right_y)
      local c, d = concat(one.left_x,one.left_y)
      pdf_literalcode("%f %f %f %f %f %f c",a,b,c,d,concat(one.x_coord, one.y_co-
ord))
    else
      pdf_literalcode("%f %f l",concat(one.x_coord,one.y_coord))
    end
  elseif #path == 1 then
    -- special case .. draw point
    local one = path[1]
    pdf_literalcode("%f %f l",concat(one.x_coord,one.y_coord))
  end
  return t
end

```

Below code has been contributed by Dohyun Kim. It implements `btex` / `etex` functions.

v2.1: `textext()` is now available, which is equivalent to `TEX()` macro from TEX.mp. `TEX()` is synonym of `textext()` unless TEX.mp is loaded.

v2.2: Transparency and Shading

v2.3: `\everymplib`, `\everyendmplib`, and allows naked TEX commands.

```
local further_split_keys = {
  ["MPlibTEXboxID"] = true,
  ["sh_color_a"]    = true,
  ["sh_color_b"]    = true,
}
```

```
549
550 local function script2table(s)
551   local t = {}
552   for _,i in ipairs(stringexplode(s,"\13+")) do
553     local k,v = stringmatch(i,"(.-)=(.*)") -- v may contain = or empty.
554     if k and v and k ~= "" then
555       if further_split_keys[k] then
556         t[k] = stringexplode(v,":")
557       else
558         t[k] = v
559       end
560     end
561   end
562   return t
563 end
564
565 local mplibcodepreamble = [[
566 vardef rawtextext (expr t) =
567   if unknown TEXBOX_:
568     image( special "MPlibmkTEXbox="&t;
569       addto currentpicture doublepath unitsquare; )
570   else:
571     TEXBOX_ := TEXBOX_ + 1;
572     if known TEXBOX_wd_[TEXBOX_]:
573       image ( addto currentpicture doublepath unitsquare
574         xscaled TEXBOX_wd_[TEXBOX_]
575         yscaled (TEXBOX_ht_[TEXBOX_] + TEXBOX_dp_[TEXBOX_])
576         shifted (0, -TEXBOX_dp_[TEXBOX_])
577         withprescript "MPlibTEXboxID=" &
578           decimal TEXBOX_ & ":" &
579           decimal TEXBOX_wd_[TEXBOX_] & ":" &
580           decimal(TEXBOX_ht_[TEXBOX_]+TEXBOX_dp_[TEXBOX_]); )
581     else:
582       image( special "MPlibTEXError=1"; )
583     fi
584   fi
585 enddef;
586 if known context_mlib:
587   defaultfont := "cmtt10";
588   let infont = normalinfont;
589   let fontsize = normalfontsize;
590   vardef thelabel@#(expr p,z) =
591     if string p :
592       thelabel@#(p infont defaultfont scaled defaultscale,z)
593     else :
594       p shifted (z + labeloffset*mfun_laboff@# -
595         (mfun_labxf@#*lrcorner p + mfun_labyf@#*ulcorner p +
596         (1-mfun_labxf@#-mfun_labyf@#)*llcorner p))
597     fi
598   enddef;
```

```
  def graphictext primary filename =
    if (readfrom filename = EOF):
      errmessage "Please prepare '"&filename&"' in advance with"&
      " 'pstoedit -ssp -dt -f mpost yourfile.ps "&filename&"'";
    fi
    closefrom filename;
    def data_mpy_file = filename enddef;
    mfun_do_graphic_text (filename)
  enddef;
  if unknown TEXBOX_: def mfun_do_graphic_text text t = enddef; fi
else:
  vardef textext@# (text t) = rawtextext (t) enddef;
fi
def externalfigure primary filename =
  draw rawtextext("\includegraphics{"& filename &"}")
enddef;
def TEX = textext enddef;
def specialVerbatimTeX (text t) = special "MPlibVerbTeX="&t; enddef;
def normalVerbatimTeX  (text t) = special "PostMPlibVerbTeX="&t; enddef;
let VerbatimTeX = specialVerbatimTeX;
extra_beginfig := extra_beginfig & " let VerbatimTeX = normalVerbatimTeX;" ;
extra_endfig   := extra_endfig   & " let VerbatimTeX = specialVerbatimTeX;" ;
]]
luamplib.mplibcodepreamble = mplibcodepreamble

local textextlabelpreamble = [[
primarydef s infont f = rawtextext(s) enddef;
def fontsize expr f =
  begingroup
  save size,pic; numeric size; picture pic;
  pic := rawtextext("\hskip\pdffontsize\font");
  size := xpart urcorner pic - xpart llcorner pic;
  if size = 0: 10pt else: size fi
  endgroup
enddef;
]]
luamplib.textextlabelpreamble = textextlabelpreamble

local function protecttextext(data)
  local everymplib    = texgettoks('everymplibtoks')    or ''
  local everyendmplib = texgettoks('everyendmplibtoks') or ''
  data = "\n" .. everymplib .."\n".. data .."\n".. everyendmplib
  data = stringgsub(data,"\r","\n")
  data = stringgsub(data, "\"[^\n]-\"",
    function(str)
      str = stringgsub(str,"%%",escpcnt)
      str = stringgsub(str,"([bem])tex"..endname,"%1"..esctex)
      return str
    end)
  data = stringgsub(data,
```

```
    begname..”btex”..endname..”%s*(.-)%s*”..begname..”etex”..endname,
    function(str)
      str = protecttexcontents(str)
      return format(”rawtextext(\”%s\”)”,str)
    end)
  data = stringgsub(data,
    begname..”verbatimtex”..endname..”%s*(.-)%s*”..begname..”etex”..endname,
    function(str)
      str = protecttexcontents(str)
      return format(”VerbatimTeX(\”%s\”)”,str)
    end)
  data = stringgsub(data, ”\”[^\n]-\””,
    function(str)
      str = stringgsub(str,”([bem])”..esctex,”%1tex”)
      str = stringgsub(str,”{”, esclbr)
      str = stringgsub(str,”}”, escrbr)
      str = stringgsub(str,”#”, escshar)
      return format(”\\detokenize{%s}”,str)
    end)
  data = stringgsub(data,”%%.-\n”, ””)
  luamplib.mpxcolors = {}
  data = stringgsub(data, ”\\mpcolor”..endname..”(.-){(.-)}”,
    function(opt,str)
      local cnt = #luamplib.mpxcolors + 1
      luamplib.mpxcolors[cnt] = format(
        ”\\expandafter\\mplibcolor\\csname mpxcolor%i\\endcsname%s{%s}”,
        cnt,opt,str)
      return format(”\\csname mpxcolor%i\\endcsname”,cnt)
    end)
```

Next three lines to address bug #55

```
  data = stringgsub(data, ”([‘\\])#”, ”%1”..eschash)
  data = stringgsub(data, ”#”, ”##”)
  data = stringgsub(data, eschash, ”#”)
  texsprint(data)
end

luamplib.protecttextext = protecttextext

local TeX_code_t = {}

local function domakeTEXboxes (data)
  local num = 255 -- output box
  if data and data.fig then
    local figures = data.fig
    for f=1, #figures do
      TeX_code_t[f] = nil
      local figure = figures[f]
      local objects = getobjects(data,figure,f)
      if objects then
```

```
        for o=1,#objects do
          local object    = objects[o]
          local prescript = object.prescript
          prescript = prescript and script2table(prescript)
          local str = prescript and prescript.MPlibmkTEXbox
          if str then
            num = num + 1
            texsprint(format("\\setbox%i\\hbox{%s}",num,str))
          end
```

`verbatimtex ... etex` before `beginfig()` is not ignored, but the TEX code inbetween is inserted before the mplib box.

```
          local texcode = prescript and prescript.MPlibVerbTeX
          if texcode and texcode ~= "" then
            TeX_code_t[f] = texcode
          end
        end
      end
    end
  end
end

local function makeTEXboxes (data)
  data = stringgsub(data, "##", "#") -- restore # doubled in input string
  data = stringgsub(data, escpcnt, "%%")
  data = stringgsub(data, esclbr,"{")
  data = stringgsub(data, escrbr,"}")
  data = stringgsub(data, escshar,  "#" )
  local _,result = process(data, false)
  domakeTEXboxes(result)
  return data
end

luamplib.makeTEXboxes = makeTEXboxes

local factor = 65536*(7227/7200)

local function processwithTEXboxes (data)
  if not data then return end
  local num = 255 -- output box
  local prepreamble = format("TEXBOX_:=%i;\n",num)
  while true do
    num = num + 1
    local box = texgetbox(num)
    if not box then break end
    prepreamble = format(
      "%sTEXBOX_wd_[%i]:=%f;\nTEXBOX_ht_[%i]:=%f;\nTEXBOX_dp_[%i]:=%f;\n",
      prepreamble,
      num, box.width /factor,
      num, box.height/factor,
```

```
      num, box.depth /factor)
  end
  process(prepreamble .. data, true)
end
luamplib.processwithTEXboxes = processwithTEXboxes

local pdfmode = texget("pdfoutput") > 0 and true or false

local function start_pdf_code()
  if pdfmode then
    pdf_literalcode("q")
  else
    texsprint("\\special{pdf:bcontent}") -- dvipdfmx
  end
end
local function stop_pdf_code()
  if pdfmode then
    pdf_literalcode("Q")
  else
    texsprint("\\special{pdf:econtent}") -- dvipdfmx
  end
end

local function putTEXboxes (object,prescript)
  local box = prescript.MPlibTEXboxID
  local n,tw,th = box[1],tonumber(box[2]),tonumber(box[3])
  if n and tw and th then
    local op = object.path
    local first, second, fourth = op[1], op[2], op[4]
    local tx, ty = first.x_coord, first.y_coord
    local sx, rx, ry, sy = 1, 0, 0, 1
    if tw ~= 0 then
      sx = (second.x_coord - tx)/tw
      rx = (second.y_coord - ty)/tw
      if sx == 0 then sx = 0.00001 end
    end
    if th ~= 0 then
      sy = (fourth.y_coord - ty)/th
      ry = (fourth.x_coord - tx)/th
      if sy == 0 then sy = 0.00001 end
    end
    start_pdf_code()
    pdf_literalcode("%f %f %f %f %f %f cm",sx,rx,ry,sy,tx,ty)
    texsprint(format("\\mplibputtextbox{%i}",n))
    stop_pdf_code()
  end
end

```

Transparency and Shading

```
local pdf_objs = {}

if not pdfmode then
  texsprint("\\special{pdf:obj @MPlibTr<<>>}",
            "\\special{pdf:obj @MPlibSh<<>>}")
end

-- objstr <string> => obj <number>, new <boolean>
local function update_pdfobjs (os)
  local on = pdf_objs[os]
  if on then
    return on,false
  end
  if pdfmode then
    on = pdf.immediateobj(os)
  else
    on = pdf_objs.cnt or 0
    pdf_objs.cnt = on + 1
  end
  pdf_objs[os] = on
  return on,true
end

local transparancy_modes = { [0] = "Normal",
  "Normal",       "Multiply",     "Screen",       "Overlay",
  "SoftLight",    "HardLight",    "ColorDodge",   "ColorBurn",
  "Darken",       "Lighten",      "Difference",   "Exclusion",
  "Hue",          "Saturation",   "Color",        "Luminosity",
  "Compatible",
}

local pgf_loaded

local function update_tr_res(res,mode,opaq)
  local os = format("<</BM /%s/ca %.3f/CA %.3f/AIS false>>",mode,opaq,opaq)
  local on, new = update_pdfobjs(os)
  if new then
    if pdfmode then
      res = format("%s/MPlibTr%i %i 0 R",res,on,on)
    else
      if pgf_loaded then
        texsprint(format("\\csname pgf@sys@addpdfresource@extgs@plain\\endcsname{/MPlibTr%i%s}",on,os))
      else
        texsprint(format("\\special{pdf:put @MPlibTr<</MPlibTr%i%s>>}",on,os))
      end
    end
  end
  return res,on
end

```

```
local function tr_pdf_pageresources(mode,opaq)
  pgf_loaded = pgf_loaded or (newtoken and newtoken.create("pgfutil@everybye").cmdname == "assign_toks")
  local res, on_on, off_on = "", nil, nil
  res, off_on = update_tr_res(res, "Normal", 1)
  res, on_on  = update_tr_res(res, mode, opaq)
  if pdfmode then
    if res ~= "" then
      local tpr = texget("pdfpageresources") -- respect luaotfload-colors
      local no_extgs = not stringfind(tpr,"/ExtGState<<.*>>")
      local pgf_pdf_loaded = no_extgs and pgf_loaded
      if pgf_pdf_loaded then
        texsprint(format("\\csname pgf@sys@addpdfresource@extgs@plain\\endcsname{%s}",res))
      else
        if no_extgs then
          tpr = tpr.."/ExtGState<<>>"
        end
        tpr = stringgsub(tpr,"/ExtGState<<","%1"..res)
        texset("global","pdfpageresources",tpr)
      end
    end
  else
    if not pgf_loaded then
      texsprint(format("\\special{pdf:put @resources<</ExtGState @MPlibTr>>}"))
    end
  end
  return on_on, off_on
end

local shading_res
local getpageres = pdf.getpageresources or function() return pdf.pageresources end
local setpageres = pdf.setpageresources or function(s) pdf.pageresources = s end

local function shading_initialize ()
  shading_res = {}
  if pdfmode then
    require('luatexbase.mcb')
    if luatexbase.is_active_callback then -- luatexbase 0.7+
      local shading_obj = pdf.reserveobj()
      setpageres(format("%s/Shading %i 0 R",getpageres() or "",shading_obj))
      luatexbase.add_to_callback("finish_pdffile", function()
        pdf.immediateobj(shading_obj,format("<<%s>>",tableconcat(shading_res)))
      end, "luamplib.finish_pdffile")
      pdf_objs.finishpdf = true
    end
  end
end

local function sh_pdfpageresources(shtype,domain,colorspace,colora,colorb,coordinates)
  if not shading_res then shading_initialize() end
```

```
  local os = format("<</FunctionType 2/Domain [ %s ]/C0 [ %s ]/C1 [ %s ]/N 1>>",
                    domain, colora, colorb)
  local funcobj = pdfmode and format("%i 0 R",update_pdfobjs(os)) or os
  os = format("<</ShadingType %i/ColorSpace /%s/Function %s/Coords [ %s ]/Extend [ true true ]/AntiAlias true>>",
              shtype, colorspace, funcobj, coordinates)
  local on, new = update_pdfobjs(os)
  if pdfmode then
    if new then
      local res = format("/MPlibSh%i %i 0 R", on, on)
      if pdf_objs.finishpdf then
        shading_res[#shading_res+1] = res
      else
        local pageres = getpageres() or ""
        if not stringfind(pageres,"/Shading<<.*>>") then
          pageres = pageres.."/Shading<<>>"
        end
        pageres = stringgsub(pageres,"/Shading<<","%1"..res)
        setpageres(pageres)
      end
    end
  else
    if new then
      texsprint(format("\\special{pdf:put @MPlibSh<</MPlibSh%i%s>>}",on,os))
    end
    texsprint(format("\\special{pdf:put @resources<</Shading @MPlibSh>>}"))
  end
  return on
end

local function color_normalize(ca,cb)
  if #cb == 1 then
    if #ca == 4 then
      cb[1], cb[2], cb[3], cb[4] = 0, 0, 0, 1-cb[1]
    else -- #ca = 3
      cb[1], cb[2], cb[3] = cb[1], cb[1], cb[1]
    end
  elseif #cb == 3 then -- #ca == 4
    cb[1], cb[2], cb[3], cb[4] = 1-cb[1], 1-cb[2], 1-cb[3], 0
  end
end

local prev_override_color

local function do_preobj_color(object,prescript)
  -- transparency
  local opaq = prescript and prescript.tr_transparency
  local tron_no, troff_no
  if opaq then
    local mode = prescript.tr_alternative or 1
```

```
  mode = transparancy_modes[tonumber(mode)]
  tron_no, troff_no = tr_pdf_pageresources(mode,opaq)
  pdf_literalcode("/MPlibTr%i gs",tron_no)
end
-- color
local override = prescript and prescript.MPlibOverrideColor
if override then
  if pdfmode then
    pdf_literalcode(override)
    override = nil
  else
    texsprint(format("\\special{color push %s}",override))
    prev_override_color = override
  end
else
  local cs = object.color
  if cs and #cs > 0 then
    pdf_literalcode(luamplib.colorconverter(cs))
    prev_override_color = nil
  elseif not pdfmode then
    override = prev_override_color
    if override then
      texsprint(format("\\special{color push %s}",override))
    end
  end
end
-- shading
local sh_type = prescript and prescript.sh_type
if sh_type then
  local domain  = prescript.sh_domain
  local centera = stringexplode(prescript.sh_center_a)
  local centerb = stringexplode(prescript.sh_center_b)
  for _,t in pairs({centera,centerb}) do
    for i,v in ipairs(t) do
      t[i] = format("%f",v)
    end
  end
  centera = tableconcat(centera," ")
  centerb = tableconcat(centerb," ")
  local colora  = prescript.sh_color_a or {0};
  local colorb  = prescript.sh_color_b or {1};
  for _,t in pairs({colora,colorb}) do
    for i,v in ipairs(t) do
      t[i] = format("%.3f",v)
    end
  end
  if #colora > #colorb then
    color_normalize(colora,colorb)
  elseif #colorb > #colora then
    color_normalize(colorb,colora)
```

```
    end
    local colorspace
    if     #colorb == 1 then colorspace = ”DeviceGray”
    elseif #colorb == 3 then colorspace = ”DeviceRGB”
    elseif #colorb == 4 then colorspace = ”DeviceCMYK”
    else   return troff_no,override
    end
    colora = tableconcat(colora, ” ”)
    colorb = tableconcat(colorb, ” ”)
    local shade_no
    if sh_type == ”linear” then
      local coordinates = tableconcat({centera,centerb},” ”)
      shade_no = sh_pdfpageresources(2,domain,colorspace,colora,colorb,coordinates)
    elseif sh_type == ”circular” then
      local radiusa = format(”%f”,prescript.sh_radius_a)
      local radiusb = format(”%f”,prescript.sh_radius_b)
      local coordinates = tableconcat({centera,radiusa,centerb,radiusb},” ”)
      shade_no = sh_pdfpageresources(3,domain,colorspace,colora,colorb,coordinates)
    end
    pdf_literalcode(”q /Pattern cs”)
    return troff_no,override,shade_no
  end
  return troff_no,override
end

local function do_postobj_color(tr,over,sh)
  if sh then
    pdf_literalcode(”W n /MPlibSh%s sh Q”,sh)
  end
  if over then
    texsprint(”\\special{color pop}”)
  end
  if tr then
    pdf_literalcode(”/MPlibTr%i gs”,tr)
  end
end

```

End of `btex – etex` and Transparency/Shading patch.

```

local function flush(result,flusher)
  if result then
    local figures = result.fig
    if figures then
      for f=1, #figures do
        info(”flushing figure %s”,f)
        local figure = figures[f]
        local objects = getobjects(result,figure,f)
        local fignum = tonumber(stringmatch(figure:filename(),”([%d]+)$”) or fig-
   ure:charcode() or 0)
```

```
        local miterlimit, linecap, linejoin, dashed = -1, -1, -1, false
        local bbox = figure:boundingbox()
        local llx, lly, urx, ury = bbox[1], bbox[2], bbox[3], bbox[4] -- faster than unpack
        if urx < llx then
          -- invalid
          pdf_startfigure(fignum,0,0,0,0)
          pdf_stopfigure()
        else
```

Insert `verbatimtex` code before mplib box. And prepare for those codes that will be executed afterwards.

```
          if TeX_code_t[f] then
            texsprint(TeX_code_t[f])
          end
          local TeX_code_bot = {} -- PostVerbatimTeX
          pdf_startfigure(fignum,llx,lly,urx,ury)
          start_pdf_code()
          if objects then
            for o=1,#objects do
              local object        = objects[o]
              local objecttype    = object.type
```

Change from ConTEXt code: the following 7 lines are part of the `btex...etex` patch. Again, colors are processed at this stage. Also, we collect TEX codes that will be executed after flushing.

```
              local prescript     = object.prescript
              prescript = prescript and script2table(prescript) -- prescript is now a table
              local tr_opaq,cr_over,shade_no = do_preobj_color(object,prescript)
              if prescript and prescript.MPlibTEXboxID then
                putTEXboxes(object,prescript)
              elseif prescript and prescript.PostMPlibVerbTeX then
                TeX_code_bot[#TeX_code_bot+1] = prescript.PostMPlibVerbTeX
              elseif objecttype == "start_bounds" or objecttype == "stop_bounds" then
                -- skip
              elseif objecttype == "start_clip" then
                start_pdf_code()
                flushnormalpath(object.path,t,false)
                pdf_literalcode("W n")
              elseif objecttype == "stop_clip" then
                stop_pdf_code()
                miterlimit, linecap, linejoin, dashed = -1, -1, -1, false
              elseif objecttype == "special" then
                -- not supported
                if prescript and prescript.MPlibTEXError then
                  warn("textext() anomaly. Try disabling \\mplibtextextlabel.")
                end
              elseif objecttype == "text" then
                local ot = object.transform -- 3,4,5,6,1,2
```

```
                start_pdf_code()
                pdf_literalcode("%f %f %f %f %f %f cm",ot[3],ot[4],ot[5],ot[6],ot[1],ot[2])
                pdf_textfigure(object.font,object.dsize,object.text,object.width,object.height,object.d
                stop_pdf_code()
              else
```

Color stuffs are modified and moved to several lines above.

```
                local ml = object.miterlimit
                if ml and ml ~= miterlimit then
                  miterlimit = ml
                  pdf_literalcode("%f M",ml)
                end
                local lj = object.linejoin
                if lj and lj ~= linejoin then
                  linejoin = lj
                  pdf_literalcode("%i j",lj)
                end
                local lc = object.linecap
                if lc and lc ~= linecap then
                  linecap = lc
                  pdf_literalcode("%i J",lc)
                end
                local dl = object.dash
                if dl then
                  local d = format("[%s] %i d",tableconcat(dl.dashes or {}," "),dl.offset)
                  if d ~= dashed then
                    dashed = d
                    pdf_literalcode(dashed)
                  end
                elseif dashed then
                  pdf_literalcode("[] 0 d")
                  dashed = false
                end
                local path = object.path
                local transformed, penwidth = false, 1
                local open = path and path[1].left_type and path[#path].right_type
                local pen = object.pen
                if pen then
                  if pen.type == 'elliptical' then
                    transformed, penwidth = pen_characteristics(object) -- boolean, value
                    pdf_literalcode("%f w",penwidth)
                    if objecttype == 'fill' then
                      objecttype = 'both'
                    end
                  else -- calculated by mplib itself
                    objecttype = 'fill'
                  end
                end
                if transformed then
                  start_pdf_code()
```

```
                end
                if path then
                  if transformed then
                    flushconcatpath(path,open)
                  else
                    flushnormalpath(path,open)
                  end
```

Change from ConTEXt code: color stuff

```
                  if not shade_no then ----- conflict with shading
                    if objecttype == "fill" then
                      pdf_literalcode("h f")
                    elseif objecttype == "outline" then
                      pdf_literalcode((open and "S") or "h S")
                    elseif objecttype == "both" then
                      pdf_literalcode("h B")
                    end
                  end
                end
                if transformed then
                  stop_pdf_code()
                end
                local path = object.htap
                if path then
                  if transformed then
                    start_pdf_code()
                  end
                  if transformed then
                    flushconcatpath(path,open)
                  else
                    flushnormalpath(path,open)
                  end
                  if objecttype == "fill" then
                    pdf_literalcode("h f")
                  elseif objecttype == "outline" then
                    pdf_literalcode((open and "S") or "h S")
                  elseif objecttype == "both" then
                    pdf_literalcode("h B")
                  end
                  if transformed then
                    stop_pdf_code()
                  end
                end
--              if cr then
--                pdf_literalcode(cr)
--              end
              end
```

Added to ConTEXt code: color stuff. And execute `verbatimtex` codes.

```
              do_postobj_color(tr_opaq,cr_over,shade_no)
```

```
            end
          end
          stop_pdf_code()
          pdf_stopfigure()
          if #TeX_code_bot > 0 then
            texsprint(TeX_code_bot)
          end
        end
      end
    end
  end
end
luamplib.flush = flush

local function colorconverter(cr)
  local n = #cr
  if n == 4 then
    local c, m, y, k = cr[1], cr[2], cr[3], cr[4]
    return format("%.3f %.3f %.3f %.3f k %.3f %.3f %.3f %.3f K",c,m,y,k,c,m,y,k), "0 g 0 G"
  elseif n == 3 then
    local r, g, b = cr[1], cr[2], cr[3]
    return format("%.3f %.3f %.3f rg %.3f %.3f %.3f RG",r,g,b,r,g,b), "0 g 0 G"
  else
    local s = cr[1]
    return format("%.3f g %.3f G",s,s), "0 g 0 G"
  end
end
luamplib.colorconverter = colorconverter
```

2.2 TEX package

⟨∗package⟩

First we need to load some packages.

```
\bgroup\expandafter\expandafter\expandafter\egroup
\expandafter\ifx\csname selectfont\endcsname\relax
  \input luatexbase-modutils.sty
\else
  \NeedsTeXFormat{LaTeX2e}
  \ProvidesPackage{luamplib}
    [2015/08/01 v2.11.0 mplib package for LuaTeX]
  \RequirePackage{luatexbase-modutils}
\fi
```

Loading of lua code.

```
\RequireLuaModule{luamplib}
```

Set the format for metapost.

```
\def\mplibsetformat#1{%
  \directlua{luamplib.setformat("\luatexluaescapestring{#1}")}}
```

luamplib works in both PDF and DVI mode, but only DVIPDFMx is supported currently among a number of DVI tools. So we output a warning.

```
\ifnum\pdfoutput>0
  \let\mplibtoPDF\pdfliteral
\else
  \def\mplibtoPDF#1{\special{pdf:literal direct #1}}
  \ifcsname PackageWarning\endcsname
    \PackageWarning{luamplib}{take dvipdfmx path, no support for other dvi tools currently.}
  \else
    \write16{}
    \write16{luamplib Warning: take dvipdfmx path, no support for other dvi tools currently.}
    \write16{}
  \fi
\fi
\def\mplibsetupcatcodes{%
 %catcode`\{=12 %catcode`\}=12
  \catcode`\#=12 \catcode`\^=12 \catcode`\~=12 \catcode`\_=12
  \catcode`\&=12 \catcode`\$=12 \catcode`\%=12 \catcode`\^^M=12 \endlinechar=10
}
```

Make `btex...etex` box zero-metric.

```
\def\mplibputtextbox#1{\vbox to 0pt{\vss\hbox to 0pt{\raise\dp#1\copy#1\hss}}}
\newcount\mplibstartlineno
\def\mplibpostmpcatcodes{%
  \catcode`\{=12 \catcode`\}=12 \catcode`\#=12 \catcode`\%=12 }
\def\mplibreplacenewlinebr{%
  \begingroup \mplibpostmpcatcodes \mplibdoreplacenewlinebr}
\begingroup\lccode`\~=`\^^M \lowercase{\endgroup
  \def\mplibdoreplacenewlinebr#1^^J{\endgroup\luatexscantextokens{{}#1~}}}
```

The Plain-specific stuff.

```
\bgroup\expandafter\expandafter\expandafter\egroup
\expandafter\ifx\csname selectfont\endcsname\relax
\def\mplibreplacenewlinecs{%
  \begingroup \mplibpostmpcatcodes \mplibdoreplacenewlinecs}
\begingroup\lccode`\~=`\^^M \lowercase{\endgroup
  \def\mplibdoreplacenewlinecs#1^^J{\endgroup\luatexscantextokens{\relax#1~}}}
\def\mplibcode{%
  \mplibstartlineno\inputlineno
  \begingroup
  \begingroup
  \mplibsetupcatcodes
  \mplibdocode
}
\long\def\mplibdocode#1\endmplibcode{%
  \endgroup
  \ifdefined\mplibverbatimYes
    \directlua{luamplib.process([===[\the\everymplibtoks\detokenize{#1}\the\everyendmplibtoks]===],true)}%
```

```
  \else
    \edef\mplibtemp{\directlua{luamplib.protecttextext([===[\unexpanded{#1}]===])}}%
    \directlua{ tex.sprint(luamplib.mpxcolors) }%
    \directlua{luamplib.tempdata = luamplib.makeTEXboxes([===[\mplibtemp]===])}%
    \directlua{luamplib.processwithTEXboxes(luamplib.tempdata)}%
  \fi
  \endgroup
  \ifnum\mplibstartlineno<\inputlineno\expandafter\mplibreplacenewlinecs\fi
}
\else
```

The LaTeX-specific parts: a new environment.

```
\newenvironment{mplibcode}{%
  \global\mplibstartlineno\inputlineno
  \toks@{}\ltxdomplibcode
}{}
\def\ltxdomplibcode{%
  \begingroup
  \mplibsetupcatcodes
  \ltxdomplibcodeindeed
}
\def\mplib@mplibcode{mplibcode}
\long\def\ltxdomplibcodeindeed#1\end#2{%
  \endgroup
  \toks@\expandafter{\the\toks@#1}%
  \def\mplibtemp@a{#2}\ifx\mplib@mplibcode\mplibtemp@a
    \ifdefined\mplibverbatimYes
      \directlua{luamplib.process([===[\the\everymplibtoks\the\toks@\the\everyendm-
plibtoks]===],true)}%
    \else
      \edef\mplibtemp{\directlua{luamplib.protecttextext([===[\the\toks@]===])}}%
      \directlua{ tex.sprint(luamplib.mpxcolors) }%
      \directlua{luamplib.tempdata=luamplib.makeTEXboxes([===[\mplibtemp]===])}%
      \directlua{luamplib.processwithTEXboxes(luamplib.tempdata)}%
    \fi
    \end{mplibcode}%
    \ifnum\mplibstartlineno<\inputlineno
      \expandafter\expandafter\expandafter\mplibreplacenewlinebr
    \fi
  \else
    \toks@\expandafter{\the\toks@\end{#2}}\expandafter\ltxdomplibcode
  \fi
}
\fi
\def\mplibverbatim#1{%
  \begingroup
  \def\mplibtempa{#1}\def\mplibtempb{enable}%
  \expandafter\endgroup
  \ifx\mplibtempa\mplibtempb
    \let\mplibverbatimYes\relax
```

```
  \else
    \let\mplibverbatimYes\undefined
  \fi
}
```

`\everymplib` & `\everyendmplib`: macros redefining `\everymplibtoks` & `\everyendmplibtoks` respectively

```
\newtoks\everymplibtoks
\newtoks\everyendmplibtoks
\protected\def\everymplib{%
  \mplibstartlineno\inputlineno
  \begingroup
  \mplibsetupcatcodes
  \mplibdoeverymplib
}
\long\def\mplibdoeverymplib#1{%
  \endgroup
  \everymplibtoks{#1}%
  \ifnum\mplibstartlineno<\inputlineno\expandafter\mplibreplacenewlinebr\fi
}
\protected\def\everyendmplib{%
  \mplibstartlineno\inputlineno
  \begingroup
  \mplibsetupcatcodes
  \mplibdoeveryendmplib
}
\long\def\mplibdoeveryendmplib#1{%
  \endgroup
  \everyendmplibtoks{#1}%
  \ifnum\mplibstartlineno<\inputlineno\expandafter\mplibreplacenewlinebr\fi
}
\def\mpdim#1{ begingroup \the\dimexpr #1\relax\space endgroup } % gmp.sty
```

Support color/xcolor packages. User interface is: `\mpcolor{teal}` or `\mpcolor[HTML]{008080}`, for example.

```
\def\mplibcolor#1{%
  \def\set@color{\edef#1{1 withprescript "MPlibOverrideColor=\current@color"}}%
  \color
}
\def\mplibnumbersystem#1{\directlua{luamplib.numbersystem = "#1"}}
\def\mplibmakenocache#1{\mplibdomakenocache #1,*,}
\def\mplibdomakenocache#1,{%
  \ifx\empty#1\empty
    \expandafter\mplibdomakenocache
  \else
    \ifx*#1\else
      \directlua{luamplib.noneedtoreplace["#1.mp"]=true}%
      \expandafter\expandafter\expandafter\mplibdomakenocache
    \fi
  \fi
}
```

```
\def\mplibcancelnocache#1{\mplibdocancelnocache #1,*,}
\def\mplibdocancelnocache#1,{%
  \ifx\empty#1\empty
    \expandafter\mplibdocancelnocache
  \else
    \ifx*#1\else
      \directlua{luamplib.noneedtoreplace["#1.mp"]=false}%
      \expandafter\expandafter\expandafter\mplibdocancelnocache
    \fi
  \fi
}
\def\mplibcachedir#1{\directlua{luamplib.getcachedir("\unexpanded{#1}")}}
\def\mplibtextextlabel#1{%
  \begingroup
  \def\tempa{enable}\def\tempb{#1}%
  \ifx\tempa\tempb
    \directlua{luamplib.textextlabel = true}%
  \else
    \directlua{luamplib.textextlabel = false}%
  \fi
  \endgroup
}
\def\mplibcodeinherit#1{%
  \begingroup
  \def\tempa{enable}\def\tempb{#1}%
  \ifx\tempa\tempb
    \directlua{luamplib.codeinherit = true}%
  \else
    \directlua{luamplib.codeinherit = false}%
  \fi
  \endgroup
}
```

We use a dedicated scratchbox.

```
\ifx\mplibscratchbox\undefined \newbox\mplibscratchbox \fi
```

We encapsulate the litterals.

```
\def\mplibstarttoPDF#1#2#3#4{%
  \hbox\bgroup
  \xdef\MPllx{#1}\xdef\MPlly{#2}%
  \xdef\MPurx{#3}\xdef\MPury{#4}%
  \xdef\MPwidth{\the\dimexpr#3bp-#1bp\relax}%
  \xdef\MPheight{\the\dimexpr#4bp-#2bp\relax}%
  \parskip0pt%
  \leftskip0pt%
  \parindent0pt%
  \everypar{}%
  \setbox\mplibscratchbox\vbox\bgroup
  \noindent
}
\def\mplibstoptoPDF{%
```

```
  \egroup %
  \setbox\mplibscratchbox\hbox %
    {\hskip-\MPllx bp%
     \raise-\MPlly bp%
     \box\mplibscratchbox}%
  \setbox\mplibscratchbox\vbox to \MPheight
    {\vfill
     \hsize\MPwidth
     \wd\mplibscratchbox0pt%
     \ht\mplibscratchbox0pt%
     \dp\mplibscratchbox0pt%
     \box\mplibscratchbox}%
  \wd\mplibscratchbox\MPwidth
  \ht\mplibscratchbox\MPheight
  \box\mplibscratchbox
  \egroup
}
```

Text items have a special handler.

```
\def\mplibtextext#1#2#3#4#5{%
  \begingroup
  \setbox\mplibscratchbox\hbox
    {\font\temp=#1 at #2bp%
     \temp
     #3}%
  \setbox\mplibscratchbox\hbox
    {\hskip#4 bp%
     \raise#5 bp%
     \box\mplibscratchbox}%
  \wd\mplibscratchbox0pt%
  \ht\mplibscratchbox0pt%
  \dp\mplibscratchbox0pt%
  \box\mplibscratchbox
  \endgroup
}
```

input luamplib.cfg when it exists

```
\openin0=luamplib.cfg
\ifeof0 \else
  \closein0
  \input luamplib.cfg
\fi
```

That's all folks!

⟨/package⟩

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If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

> Gnomovision version 69, Copyright (C) yyyy name of author
> Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type 'show w'.
> This is free software, and you are welcome to redistribute it under certain conditions; type 'show c' for details.

The hypothetical commands `show w` and `show c` should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than `show w` and `show c`; they could even be mouse-clicks or menu items—whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the program, if necessary. Here is a sample; alter the names:

> Yoyodyne, Inc., hereby disclaims all copyright interest in the program 'Gnomovision' (which makes passes at compilers) written by James Hacker.
>
> signature of Ty Coon, 1 April 1989
> Ty Coon, President of Vice

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