

Shifted bullets in graphs with METAPOST

abstract

With METAPOST fully integrated in CONTEXT using this graphic language has become convenient. When we tried to use John Hobby's "Graph.mp" package, however, it turned out to require extra initializations and to produce unacceptable, shifted data graphs. Solutions to both problems are given.

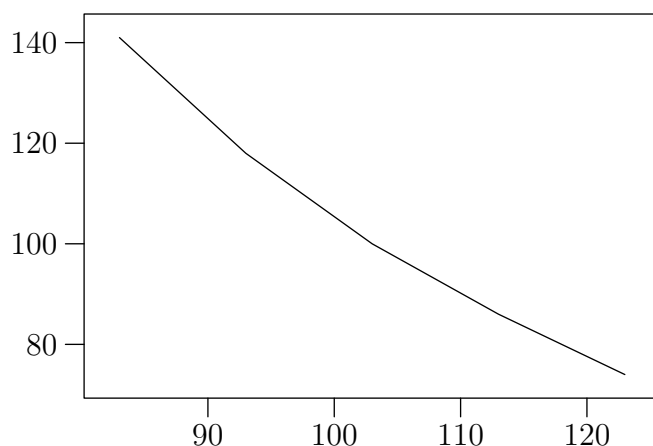
Introduction

METAPOST has become fun for these users when it became integrated in CONTEXT, which was the trigger for this exercise, but the same can be done in LATEX [1]. METAPOST is known for the high precision of its graphics output and for its perfect scalability. Since this sounds promising also for the presentation of scientific data in graphical form we looked for a package that would ease the plotting of data files. This was found in the "graph" package written by John Hobby [2], the author of METAPOST. In using this package we met with two problems: one, the lacking of proper initializations and two, the inaccurate placement of bullets at given coordinates.

Initialization

The inclusion of a METAPOST graphics specification in a CONTEXT document is simple and below is a code fragment that produces an XY-plot and places it as a graphic in this document.

```
\startuseMPgraphic{plot}  
  draw begingraph(3in,2in);  
    gdraw "bdoffset.d";  
  endgraph;  
\stopuseMPgraphic  
\midaligned{\useMPgraphic{plot}}
```



With `\startuseMPgraphic{plot}` CONTEXT is told that all instructions until the `\stopuseMPgraphic` are to be understood as METAPOST–speak. `draw` is a METAPOST–instruction and `gdraw` is one included in Hobby’s “graph” package which lives on top of METAPOST. The file `bdoffset.d` is a small data file arranged as:

```
83 141
93 118
103 100
113 86
123 74 <EOF>
```

This file must not have any extra empty lines (or all hell breaks loose). As a reminder, therefore, we placed an unnecessary `<EOF>` right after the final datum. The “graph” package accepts extra characters on a line, but no extra lines.

If you would try this program, the reason that it doesn’t work right away is that the “graph” package has not been input. This would usually be accomplished by an instruction

```
\startMPinclusions input graph; \stopMPinclusions
```

placed near the top between the start/stop of `useMPgraphic`. Since extra initializations appeared also needed, however, Hans Hagen¹ wrote the following little module that must be input for use (`\usemodule{graph}`) in the preamble area of the source file, i.e. before `\starttext`:

```
\forceMPTEXgraphictrue
\appendtoks
  initialize_numbers; % assure that pseudo typesetting is set up
  input graph;       % load the graph package
  Autoform:="@g";    % change the % template char into @
\to \MPinitializations
```

Place these instructions in a file named `m-graph.tex` and the graph package is input, properly initialized, and ready for work. Note that the file `m-graph.tex` is input with `\usemodule{graph}`. When CONTEXT reads `\usemodule` it inserts `m-` and appends `.tex` to the name automatically to find the correct file. Be sure to also place Hobby’s `graph.mp` in the same directory or at least where it can be found by CONTEXT. Using a rather recent version of CONTEXT (see “References”) and this module, compile again, and the data plot shown above should result.

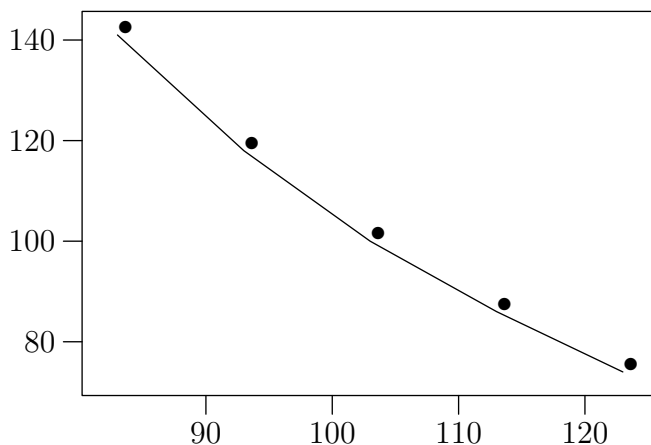
Shifted bullets

In the data plot the data pairs are plotted interconnected with straight lines. Since the curve is featureless the positions of the individual data points are barely discernable. Let us try to mark them more clearly. The manual for the “graph” package offers a solution. Simply replot the data but this time as bullets with the instruction

```
gdraw "bdoffset.d" plot btex$\bullet$etex
```

The `btex...etex` pair signifies to METAPOST that the instructions in between should be interpreted as T_EX–typeset instructions. Thus, within the CONTEXT document we first instruct CONTEXT to look at a set of text lines as METAPOST and within these lines METAPOST is asked to consider some words as instructions to T_EX, which is why you need a recent version CONTEXT. Still, the system works and the result is the following graphic:

1. of Pragma–ADE, the author of CONTEXT.



The dots don't fall on the line. Our first thought was that we did something wrong and our first action was to ask for help. Our second action was to check the graphic made with similar instructions in the "graph" manual. By tearing out the manual's page on which Fig. 2 is plotted and placing it over Fig. 1 such that the tick marks match we observed that equally in the manual the dots appear shifted towards the upper right. It turns out that \TeX positions each glyph with its reference point, not its midpoint, at the specified coordinates [3]. The reference point of the bullet is at the lower left of its box:² ■. Thus, neither \TeX nor we did wrong but the instruction is wrong. The first solution suggested is to shift the bullet in opposite direction by replacing the \TeX instruction \bullet with:

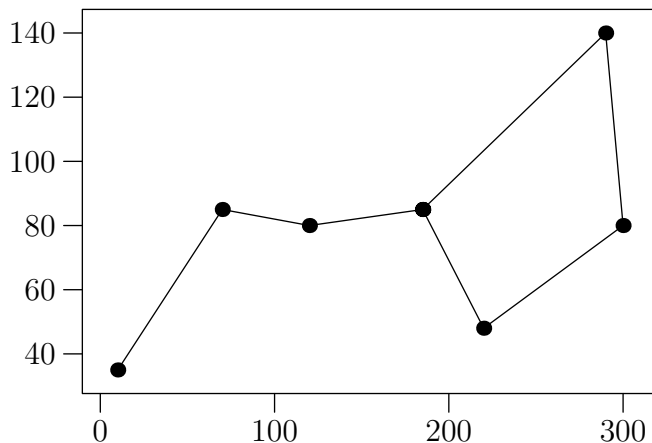
```
\kern-1mm\raisebox{-1mm}[0mm][0mm]{\bullet}
```

which should shift the dot 1 mm to the left and 1 mm down, but doesn't. \TeX within METAPOST within CONTEXT forgets the original coordinates somewhere on the way and nothing is output. Since we hard-program shifts in mm for glyphs that could vary in dimension with the symbol specified it is not a general purpose solution either. Yet, it might have worked.

A solution which stays within METAPOST came from the author of MetaFun [4]. It declares and defines the bullet as a METAPOST picture and plots the picture repeatedly at each coordinate specified. The full text of the example becomes:

```
\startuseMPgraphic{buldot}
  picture Buldot;
  Buldot:=image(draw origin withpen pencircle scaled 2mm);
  draw begingraph(3in,2in);
  gdraw "other.d";
  gdraw "other.d" plot Buldot;
  endgraph;
\stopuseMPgraphic
\midaligned{\useMPgraphic{buldot}}
```

2. This can be observed in CONTEXT by typing $\text{\ruledhbox{\bullet}}$



The problem is solved. The ‘picture’, of course, could be anything, like stars or squares or triangles or even doughnuts, as long as its midpoint is defined at the origin. And yes, we did change the data points to something more recognizable (a big dipper).

Acknowledgement

We would like to express our appreciation to the respondents to our questions, they know who they are, that offered help and helped to a nice solution, all within the timespan of one workday.

References

1. Popineau F: METAPost pratique. Cahiers GUTenberg n^o 41 — Novembre 2001.
2. Hobby J D: Drawings graphs with MetaPost.
`\texmf\doc\metapost\base\mpgraph.pdf`
3. Knuth D E: The T_EXbook (Chapter 11). Addison Wesley 1970.
4. Hagen H: Metafun.
`\texmf\doc\context>manuals\metafun-p.pdf`

The directory paths above are for the T_EXLive CDROM set, issue nr 7, June 2002, Volume 1. The MetaFun manual and the CONTEXT software are also available from <http://www.pragma-ade.com/>