TELLWARE

BUILD-IT User Manual

Version 1.3

8th May 1998

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SYSTEM DELIVERY

Figure 1: The BUILD-IT system is delivered with the parts shown here and listed in Table 1.

Figure 2: Detailed view of camera, lamp, beamers with remote control and adjustment screw (left). All these parts have appropriate places for installation in the rack (right). Computer and keyboard are put into the lower part of the rack.

Table 1: List of system parts.

System part:	***Name of product & technical details:***
1 computer	Compaq PWS 5100 Dual Processor board 1x 300 MHz Pentium II MMX processor Minimum 64 MB RAM Diamond Fire GL 3000 graphic card PICPORT® STEREO Frame grabber from Leutron Vision GmbH
1 - 2 Beamers	ASK A4 high resolution LCD projector, 800 x 600 pix, with serial cable, remote control unit and positioning screw. (**Second projector is optional**)
1 Rack	visualisation box, made by Tellware GmbH, (width x depth x height: 55 x 50 x 160 cm with suspended mirror
1 Video camera	IR-sensitive camera, cable and objective
Software	Single user software licence BUILD-IT
1 Table	USM Schärer desk 2x2 meters, pearl-grey (**optional**)
1 Mirror with suspension	Made by Tellware GmbH
2 Lamp holders	Standard
2 Bulbs	Standard, 50 Watt
1 Portable screen	Projection screen PSTP007 2 x 2 meters, plus tripod (**optional**)
1 Brick	Passive interaction handler, made by Tellware GmbH
1 User manual	In English, colour print

SYSTEM DESCRIPTION

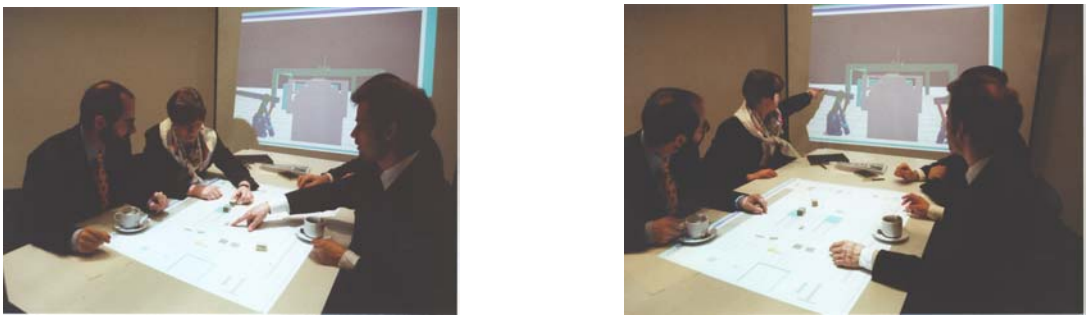


Figure 3: Planning takes place in the above view (left) and a dynamically bound perspective is offered in the side view (right).

The design room of Figure 3 enables users, grouped around a table, to interact in a space of virtual and real world objects. The vertical working area in the background (side view) gives a perspective view of the plant. In the horizontal working area there are several views (above and height views, menus) where objects can be selected and manipulated.

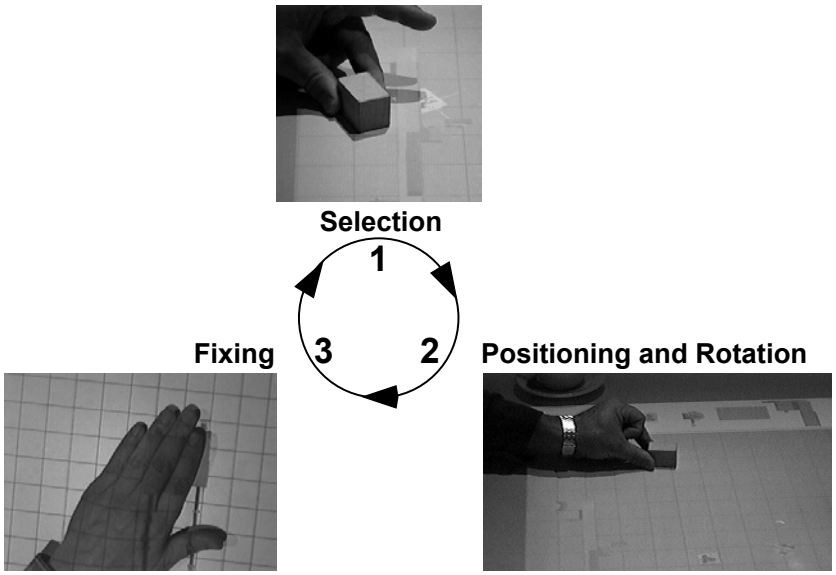


Figure 4: The basic steps for user manipulations with the interaction handler (brick).

The basic principle of BUILD-IT is shown in Figure 4. Users select an object by putting the brick at the object positions. The object can be positioned, rotated and fixed by simple brick manipulation. To allow two handed operation, the system supports multi-brick interaction. A second effect of multi-brick interaction, is that several users can take part in a simultaneous design process.

The application is designed to support providers of assembly lines and plants in the early design processes. However, it can easily be prepared to support a range of other applications, such as interior architecture, city and urban planning. Graphical display is based on the class library MET++ (Ackermann, 1996). The system can read and render arbitrary virtual 3D objects. These objects are sent from a CAD system to BUILD-IT using Virtual Reality Modelling Language (VRML). The system has been engineered to send and receive numerous forms of meta-data.

SYSTEM ASSEMBLY

Figure 5: Put the computer and keyboard in the bottom of the rack. Arrange rack, table, chairs and screen as shown here.

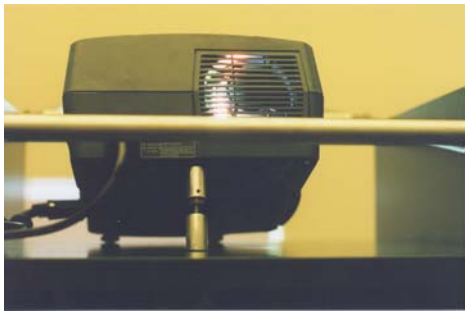
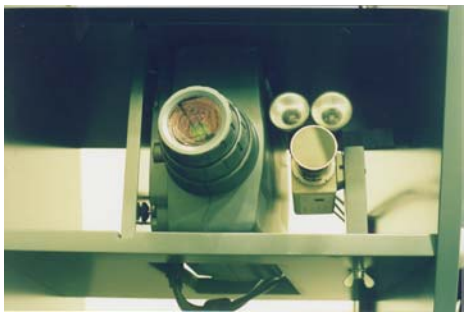


Figure 6: Position and cable one beamer at the top level of the rack. This is called the side view beamer. Adjust the vertical screw of the side view beamer

Figure 7: Lead the mirror suspension and mirror into the rack.



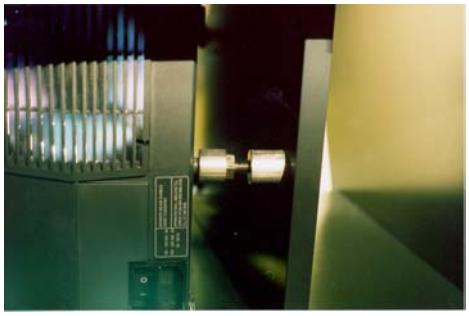


Figure 8: Slide the second beamer into the rack from the front side of the rack (left) and cable it. This is called the above view beamer. Fix and cable the video and lamps. Adjust the lateral positioner (right) of the above view beamer. Turn on the system switch in the bottom of the rack.

Figure 9: Move the mirror suspension backwards or forewords (left) so that that the light field is centred on the mirror (right).

Figure 10: It may be necessary to rotate the excentered, horizontal rod, situated up front in the rack.

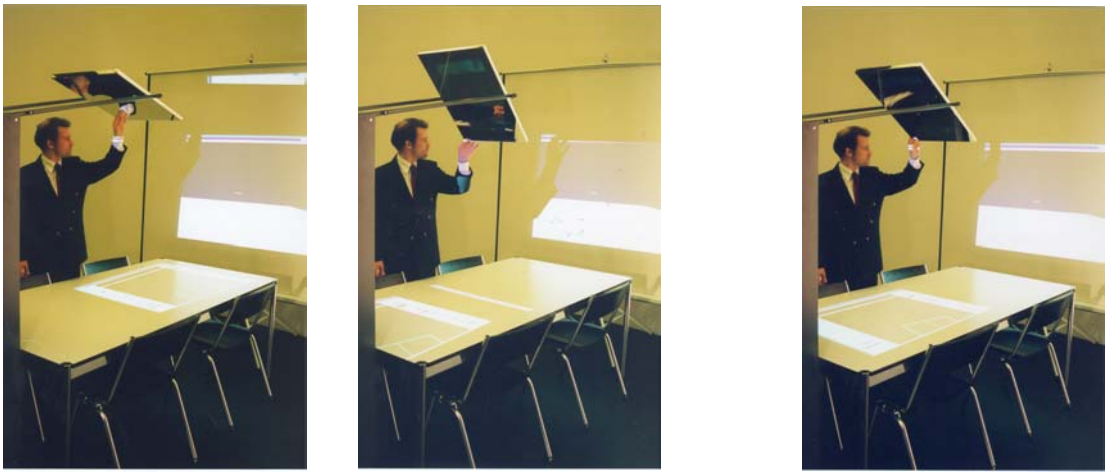


Figure 11: Rotate mirror so that the image is only projected onto the table. Two wrong (left, centre) positions one correct one (right) are show here.

BEAMER AND VIDEO ADJUSTMENT

The ***beamers*** should be correctly set, but they may need adjustment if they have been used for other purposes. Direct remote control toward i) the projector or ii) the image, of the projector you want to adjust. A single remote control can be used with both beamers.

Frequency adjustment:

Use text as benchmark image.
Remote control : Menu
Track ball : 'Einstellung', 'Frequenz'
Lower white : Press
Track ball : All letters should be clearly visible and there should at most be one band which is not accurate. This might be OK with the value 1692.
Left white : Press for OK and one step up in menu hierarchy
Track ball : ('Einstellung'), 'Feinabgleich'
Lower white : Press
Track ball : Do fine adjustment
Left white : Press
Remote control : Press menu (OK)

Position adjustment:

For the ABOVE_VIEW beamer:
Remote control : Menu
Track ball : 'Einstellung', Position
Lower white : Press
Track ball : As far up as possible (approx. 467)
Adjusted left (approx. 335)
Remote control : Press menu (OK)

For the SIDE_VIEW beamer:
Remote control : Menu
Track ball : 'Einstellung', Position
Lower white : Press
Track ball : As far down as possible (0)
Adjusted left (approx. 323)
Remote control : Press menu (OK)

The ***video camera*** should not need any adjustments.

CALIBRATION

Calibration is needed:
i) after system assembly, or
ii) when real and virtual objects do not correspond fully.

Double-click **install.bat**. You see the image processing window in your application. The camera detects bricks as bright areas. You normally need to adjust the camera fixation to the rack and to adjust it to give a sharp picture. If the camera still does not see full view you might need to adjust buildit.Video.NumRow and buildit.Video.NumCol in the ETRC file (Appendix 2).

To stop this operation, click the **X** in the upper right window corner.

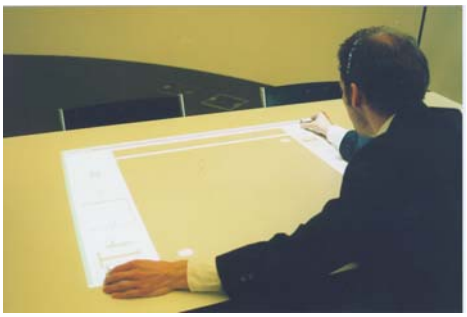


Figure 12: Place two bricks in image corners.

Now double-click **calibrate.bat**.

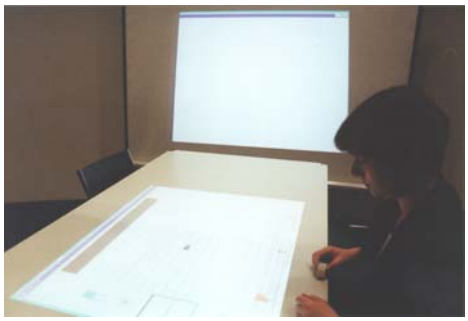


Figure 13: Calibration by putting brick at a reference section displayed in the corners of the above view.

You can now work with the system. For all later system usage, it is sufficient to start up as described in the proceeding chapter. To stop the application, click the **X** in the upper right window corner.

SYSTEM START-UP, USAGE AND SHUT DOWN

To start the system, double-click **buildit.exe**.

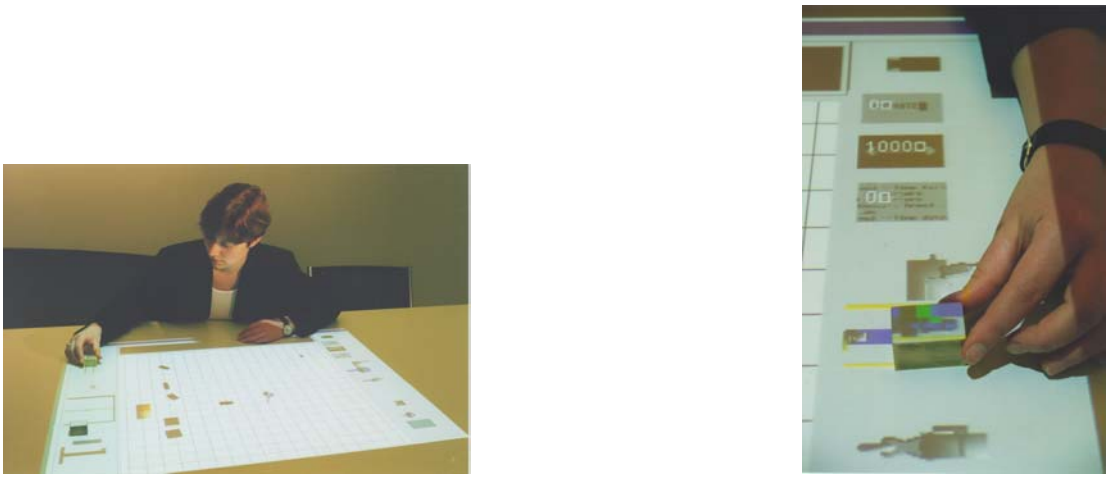


Figure 14: Selection of virtual object in virtual object store (menu). The menu has a left and right part, as shown in this figure.

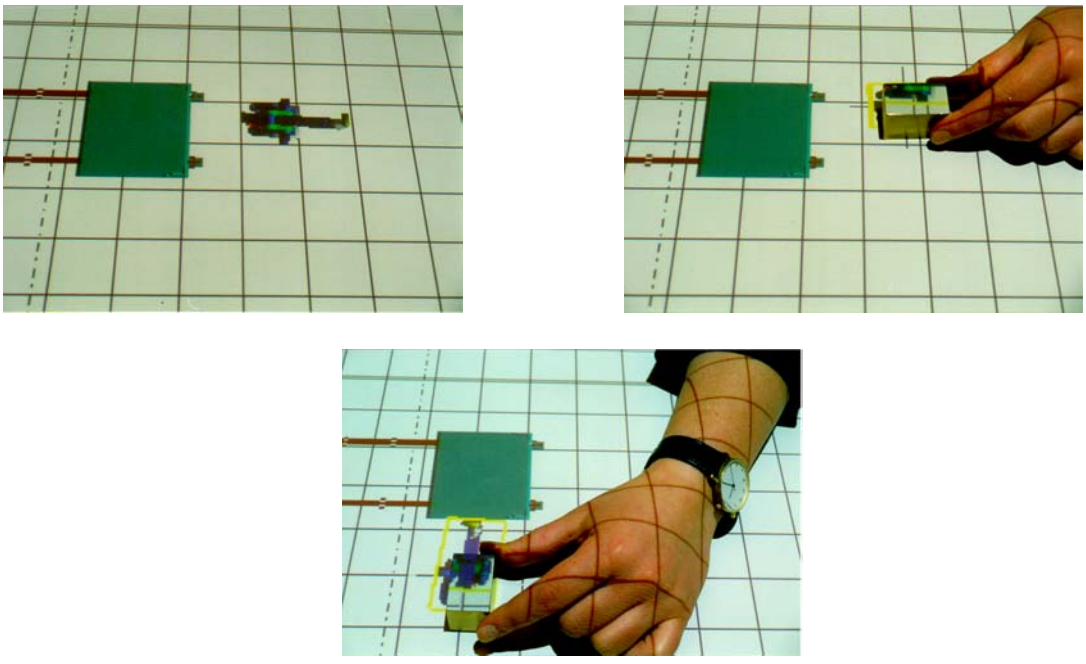


Figure 15: Selection, positioning and rotation of a machine in the virtual plant by moving the interaction handler to the preferred position in the plant layout of the above view.

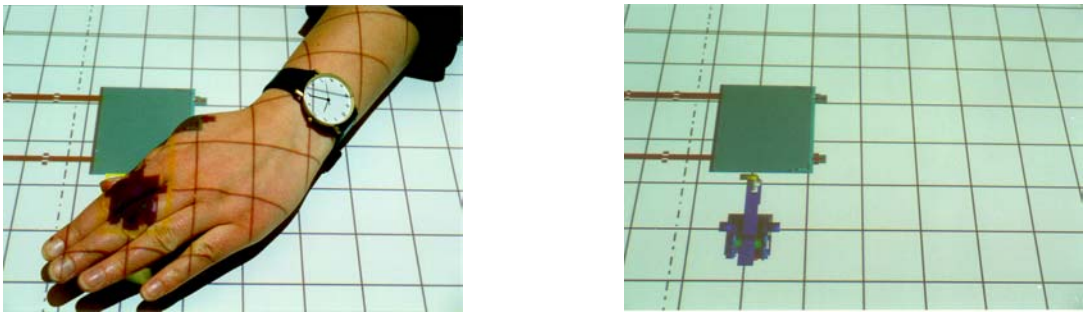


Figure 16: Fixing the machine by manually covering the surface of the interaction handler and then removing it.

Figure 17: Removing an object by moving it back into one of the menus.

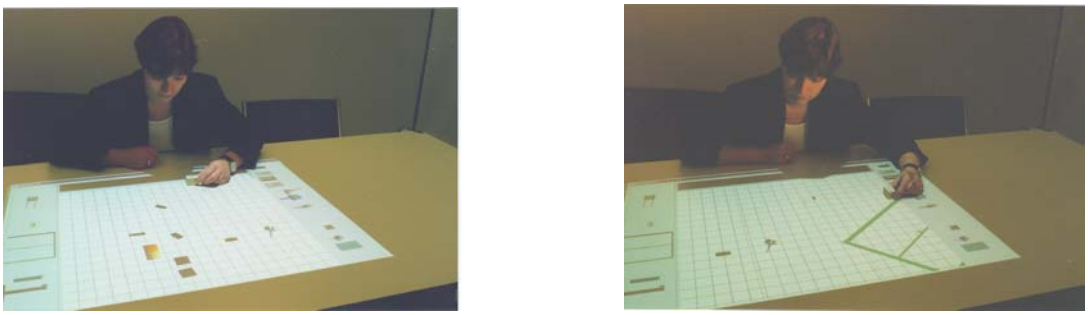


Figure 18: Scrolling in the above view in top-bottom sense (left) and left-right sense (right).

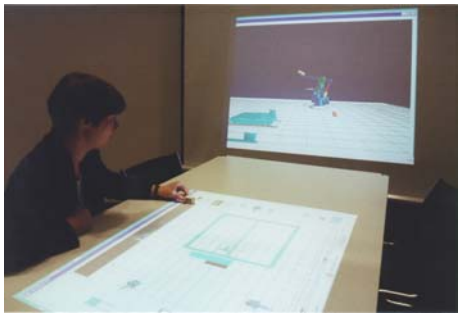
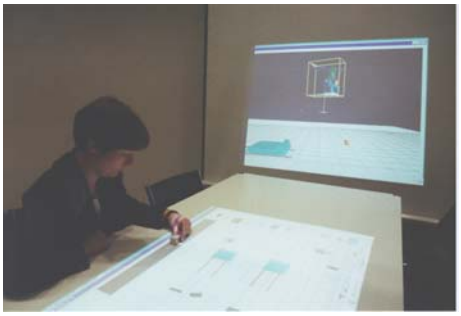


Figure 19: Scrolling in the height view.



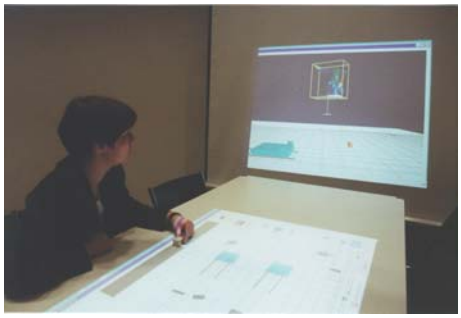
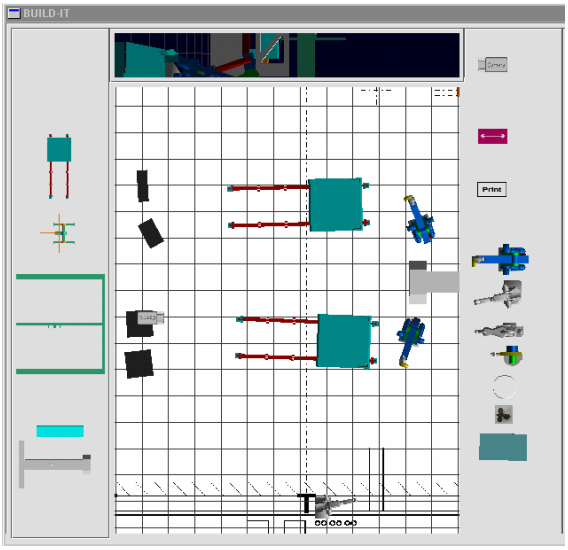


Figure 20: Direct modification of object altitude in height view (left), and visual feedback in side view (right).

Modification of the perspective in the height and side views is achieved by camera manipulation in the above view. There is at least one camera available in the above view, but more can be activated from the menu. Numerous cameras, each representing a distinct perspective, can exist at a time. The last one selected determines the current perspective.



Camera

Scaling

Save and Print

Figure 21: Camera, scaling, save and print are permanently offered functions. They are described in more detail in the following figures.

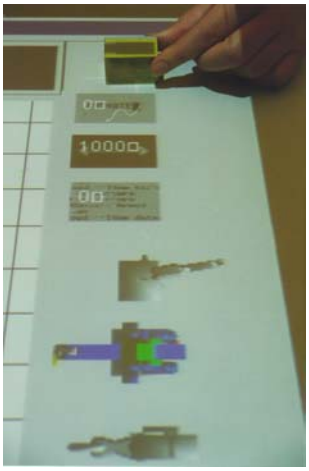


Figure 22: Camera allows for side view perspective modification.

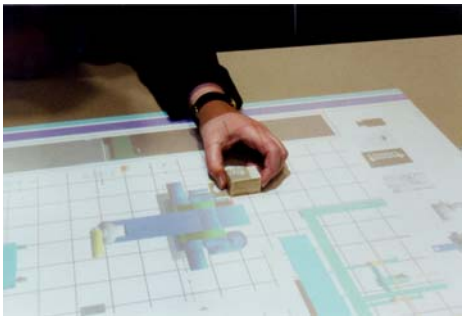


Figure 23: Scaling applied on an object in the above view. First, select scaling function in the menu, then go to the object to be scaled. Drawing away from the object, makes it bigger along the axis (x or y) of movement, smaller when approaching the object.

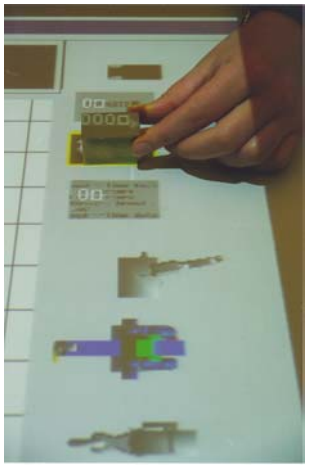
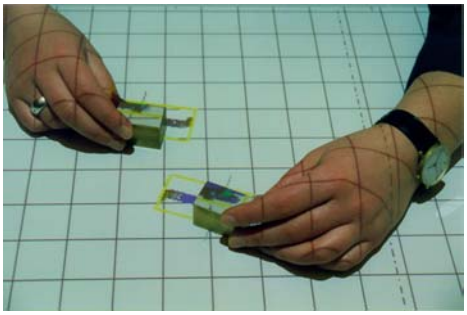
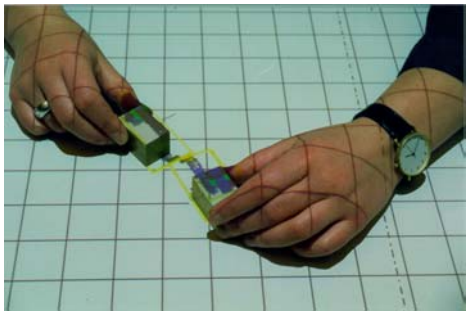


Figure 24: Save and Print of the views. Printing only takes place if *buildit.EnablePrinting(Bool)* of the ETRC file (Appendix 2) has been set.





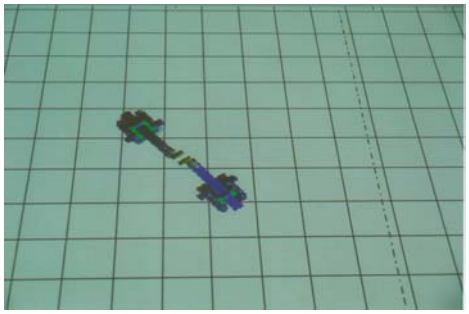


Figure 25: Multi-brick interaction allows user to position two (or more) objects at a time.

Figure 26: Many persons can interact with multiple bricks at a time.

To stop the application, click the **X** in the upper right window corner.

INPUT OF 3D-CAD OBJECTS: VRML DATA

The BUILD-IT system understands 3D-CAD objects on the VRML format. VRML data describe the complete geometry and visual characteristics of an object. Data exchange between a 3D-CAD system and BUILD-IT is handled by the CAD-connection.

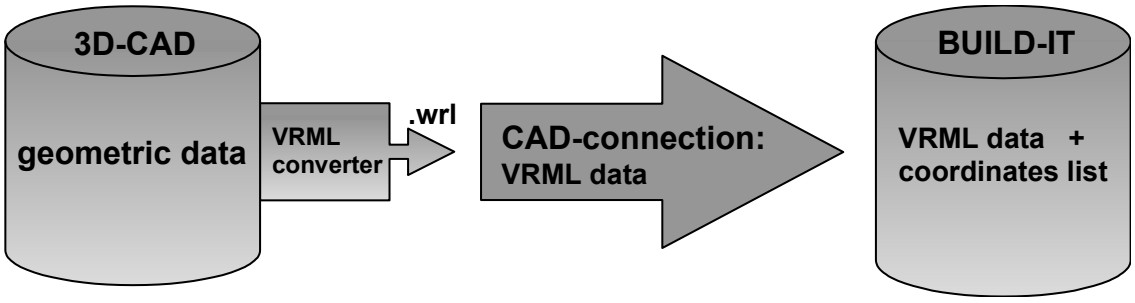


Figure 27: Data flow from the 3D-CAD to the BUILD-IT system.

The connection between a 3D-CAD system and BUILD-IT is called CAD-connection and shown in Figure 27. CAD users are presented with a list of all available objects and can select the geometric data required for their specific planning session. The selected geometric data is *converted* to VRML format and offered by the CAD system as ".wrl" files. Using the CAD-connection, the selected geometric data is then sent as ".wrl" files to BUILD-IT.

A VRML based connection offers the important advantage of data compression, allowing for reduced information flow and less object complexity. This feature is just as vital to object handling in the Web as with the BUILD-IT system. Without data reduction, only high performance CAD systems would be able to deliver multiple 3D object within acceptable time.

For the following CAD representations, conversion to VRML-DATA is supported:

1. CATIA native (Version 3.x-4.1.7)
2. Unigraphics (Version 11.1 - 13.0)
3. Auto CAD (Version 13.0)
4. STEP PART 203
5. IGES 4.0 (depends on the CAD system)
6. MINICAD Macintosh
7. LOGOCAD

APPENDIX 1: DIRECTORIES AND FILES

Files in buildit main directory:

buildit.exe (The executable starting the BUILD-IT system)
ETRC (Resource file containing customer specific settings)
buildit.key (License information)
README (General information)
lvcamera.dat, lvlcxppx.dat,Lvreg.dat,leutron.ini, Cmnres32.dll,
Dsy_ms32.dll,lvlog32.dll,Lvrps32.dll,Prvph32.dll (Data needed for Image analysis)
View.dat (Keeps a list of the objects (directory and files) for the above view)
Menu_left.dat (Keeps a list of the objects (directory and files) for the left part of the menu)
Menu_right.dat (Keeps a list of the objects (directory and files) for the right part of the menu)
GestureServerData.dat (Protocol of current user interaction)

Directories in buildit main directory:

i) database

Files in database direcotry:
AffineMapping.dat (Data needed for calibration)
AffinePairs.dat (Data needed for calibration)
CalibrationPar.dat (Results of calibration)
camera.dat (Camera specific data)

ii) objects (User defined directory containing objects)

Files that can be located in arbitrary directories specified by customer
all object files (*.wrl) (Source directory specified in ETRC)
all converted object files (*.3d) (Location specified in Menu_left.dat, Menu_right.dat, or View.dat)
SnapInfo.dat (Location specified in ETRC)

APPENDIX 2: ETRC FILE; GENERAL CONFIGURATION

Table 2: ETRC file; parameter name, values, significance and files concerned.

Parameter name and parameter value	Significance	Files concerned
#buildit.SimulateRead(Bool): TRUE	Read brick positions from file	GestureServerData.dat
buildit.SimulateWrite(Bool): TRUE	Write brick positions to file	GestureServerData.dat
buildit.ShowVideoInput(Bool): FALSE	Show video input in above view (for camera adjustment during system installation)	
buildit.Calibrate(Bool): FALSE	Do calibration	AffineMapping.dat AffinePairs.dat CalibrationPar.dat
buildit.ObjectDirectory: objects\\optics	Directory containing object data, original .wrl files are automatically converted to *.3d files	*.wrl *.3d Menu_left.dat Menu_right.dat View.dat
buildit.ObjectScaling: 0.001	Scaling factor from CAD object data (*.wrl) to buildit data (*.3d)	
buildit.ObjectRotation: 90 90 0	Rotation factor from CAD object data (*.wrl) to buildit data (*.3d)	
buildit.DefaultObjPosition: 2 0 0	Default position, where new objects from CAD (*.wrl) appear in the right menu	
buildit.ShowSnapPoints(Bool): FALSE	Display snapping box	
buildit.EnablePrinting(Bool): FALSE	Enable printing	
buildit.Video.NumRow: 505	Video image, number of rows	
buildit.Video.NumCol: 600	Video image, number of columns	
buildit.TwinScreenGraphics(Bool): TRUE	Twin screens supported	
buildit.MenuUpdateWaitTime 10000	Waiting time between each check for new CAD data	
buildit.AutoFileUpdate(Bool): FALSE	Automatic updating of View.dat, Menu_left.dat, Menu_right.dat	View.dat Menu_left.dat Menu_right.dat
buildit.SnapInfoFile: objects\\SnapInfo.dat	File name of snap information	objects\\SnapInfo.dat
video.StdDevX: .12	Video x standard deviation	
video.StdDevY: .1	Video y standard deviation	
video.StdDevAngle: 0.3	Video angular standard deviation	
*.TPR.LOG(Bool): FALSE	Display run time diagnosis window	
*.System.Debug(Bool): FALSE	Run in debug modus	
*.System.MemStat: 1	MET variable, do not change	
*.System.MemStat.size(Num): -1	MET variable, do not change	
*.System.MemStat.cnt(Num): -1	MET variable, do not change	
*.System.IgnoreLevel(Num): 1000	MET variable, do not change	
*.System.AbortLevel(Num): 2000	MET variable, do not change	
*.ConvertThread.UseConvertThread(bool): FALSE	MET variable, do not	

	change	
*.WindowSystem.DoubleBuffer(Bool): ON	MET variable, do not change	
*.WindowSystem.MaxDepth(Num): 32	MET variable, do not change	
*.WindowSystem.GreyScale(Bool): OFF	MET variable, do not change	
*.WindowSystem.HighlightColor(RGBColor): 2 0 255 0 0 0	MET variable, do not change	
*.WindowSystem.WindowHighlightColor(RGBColor): 2 0 168 168 168 0	MET variable, do not change	
*.WindowSystem.WindowBackgroundColor(RGBColor): 2 0 140 140 140 0	MET variable, do not change	
*.WindowSystem.DisableColor(RGBColor): 2 0 200 200 200 0	MET variable, do not change	
*.WindowSystem.Motif(Bool): 1	MET variable, do not change	
*.WindowSystem.Gamma: 1600	MET variable, do not change	
*.WindowSystem.UpdateTimeout(Num): 40	MET variable, do not change	
*.ScrollBar.Width: 16	MET variable, do not change	
*.Look.Border: 3	MET variable, do not change	
*.IAC.Debug(Bool): TRUE	MET variable, do not change	
*.Font.Size(Num): 12	MET variable, do not change	
*.Font.Sys(Font): Helvetica	MET variable, do not change	
*.Font.Appl(Font): Helvetica	MET variable, do not change	
*.Font.Fixed(Font): Courier	MET variable, do not change	
*.TextView.CaretColor(RGBColor): 2 0 255 0 0 0	MET variable, do not change	
*.TextView.DragAndDrop(Bool): YES	MET variable, do not change	
*.TextView.BatchTimeout(Num): 50	MET variable, do not change	
*.RTF.PromptForReadingVObjects(Bool): NO	MET variable, do not change	
*.ShellText.UseStyles(Bool): YES	MET variable, do not change	
*.CodeText.UseStyles(Bool): YES	MET variable, do not change	
*.CodeText.AllowGraphics(Bool): YES	MET variable, do not change	
*.CodeText.DeclarationSizeIncrement(Num): 2	MET variable, do not change	
*.CodeText.CommentColor(RGBColor): 2 0 0 0 255	MET variable, do not change	
*.CodeText.ClassColor(RGBColor): 6 0 0 0 0 255	MET variable, do not change	
*.CodeText.FunctionColor(RGBColor): 2 0 0 200 0	MET variable, do not change	
*.CodeText.TabPos(Num): 8	MET variable, do not change	

*.CodeText.AutoIndent(Bool): YES	MET variable, do not change	
*.CodeText.WordWrap(Bool): FALSE	MET variable, do not change	
*.CodeText.AutoReformatInterval: 4000	MET variable, do not change	
*.CodeText.PicturePath: .:%e/doc:images	MET variable, do not change	
*.Slider.ThumbInk(Ink):	MET variable, do not change	
*.Slider.Ink(Ink):	MET variable, do not change	
*.ProgEnv.UseMapFiles(Bool): YES	MET variable, do not change	
*.ProgEnv.SrcPath: .:%e/src:%e/src/PROGENV:%e/src/PRINTERS:%e/src/SUNWINDOW:%e/src/XWINDOW:%e/src/UNIX:%e/src/STREAMS:%e/src/CONTAINER:%e/src/CONVERTERS:%e/src/LOOKS	MET variable, do not change	
*.Application.DebugButtonInAlert(Bool): YES	MET variable, do not change	
*.Document.MakeBackup(Bool): YES	MET variable, do not change	
*.Document.Size(Point): 1600 595	Size of BUILD-IT window (both working areas)	
*.Document.UndoLevel(Num): 10	MET variable, do not change	
*.Browser.FastIcons(Bool): FALSE	MET variable, do not change	
*.Browser.Panes(Num): 3	MET variable, do not change	
*.AudioSystem.SamplingRate: 44100	MET variable, do not change	
write.followShowsNew: YES	MET variable, do not change	
MIDISystem.Install(Bool): NO	MET variable, do not change	
*3D.UseCaching TRUE	MET variable, do not change	

APPENDIX 3: SNAPINFO.DAT FILE; SNAPPING AMONG OBJECTS

Table 3: SnapInfo.dat file; parameter name, values and significance.

Parameter name and parameter values	**Significance**
display:	Display the following information by program start-up
y	
FileName:	Name of a machine/object
objects\mikron\karussell.3d	
nPoint:	
12	Only two of them are shown.
SnappingPoints (x,y,z,_AZ,_AX,_AY,_sx,_sy,_sz) [m,m,m,deg,deg,deg,m,m,m]:	Each snap point, with snap position (x, y, z) in object co-ordinate system, snapping orientation in degrees in object co-ordinate system (0..360) (_AZ ...), size of snapping box in meters (size_x, size_y, size_z), where box is centred around snap position (x, y, z)
0.76 0.44 0.50 30 0 0 0.4 0.4 0.3	
0.44 0.76 0.50 60 0 0 0.4 0.4 0.3	
...	
FileName:	Same as above, another object
objects\mikron\buildit_triax.3d	
nPoint:	
1	
SnappingPoints (x,y,z,_AZ,_AX,_AY,_sx,_sy,_sz) [m,m,m,deg,deg,deg,m,m,m]:	
-0.20 0.1 0.00 0 0 0 0.4 0.4 0.3	
FileName:	Same as above, another object
objects\mikron\buildit_schere.3d	
nPoint:	
1	
SnappingPoints (x,y,z,_AZ,_AX,_AY,_sx,_sy,_sz) [m,m,m,deg,deg,deg,m,m,m]:	
0.20 0.10 -0.20 180 0 0 0.4 0.4 0.3	
Snapping:	Information about snapping, based on the above files
StaticObject: objects\mikron\karussell.3d (1 2 3 4 5 6 7 8 9 10 11 12)	
MovingObject: objects\mikron\buildit_triax.3d (1)	
Add	
StaticObject: objects\mikron\karussell.3d (13 14 15 16 17 18 19 20 21 22 23 24)	
MovingObject: objects\mikron\buildit_schere.3d (1)	
Add	

APPENDIX 4: ADDRESSES

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