

Personal Experiences of Providing and Using **Research Prototypes**

Tobias Isenberg Christian



Research Prototypes or Demos

- demos can have lasting impact
- videos or actual artifacts
- important to replicate work, compare it to new approaches, avoid copyright issues



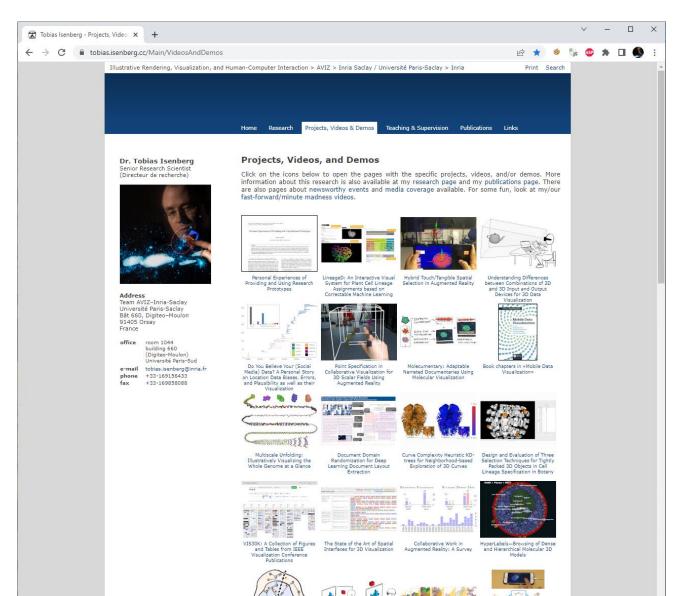
(0) Public Domain

demo programs in the form of source code or executables

available for some but not for many research projects ... why?

 checked own project web pages (105 at the time)

 40 did not necessarily need a demo (surveys, study papers, meta discussions)



 split into own projects, supervised projects, collaborative projects, and co-supervised/mentored projects

data

- does the project need a demo?
- does the project have a demo?
- source code provided?
- does the executable still run?
- demo/code self-hosted?
- special hardware required?

```
State_timer < 1 then opacity = market | State_timer > 2 then opacity | market | State_timer > 3 then opacity | 0 |

State_timer > 3 then opacity | 0 |

ove graphics setColor(255,255,255,0 ove graphics dram(splash, w/2,h/2,k ove graphics dram(splash))
```

| project ID incl. year (project webpage link) | should have a demo | type of demo | sources provided | exe runs still (W) | self- hosted | special HW required |
|--|-----------------------|--------------------|---------------------|-----------------------|-----------------|---------------------|
| Strothotte1999VKV | ✓ | Х | Х | | | Х |
| Isenberg20003IE | 1 | X | Х | | | X |
| Isenberg2002SSA | 1 | exe | Х | ✓ | 1 | X |
| Isenberg2003ADG | X | exe (partial) | Х | ✓ | 1 | X |
| Isenberg2004CTE | / | exe (partial) | Х | ✓ | 1 | X |
| Isenberg2006BFS | / | exe | Х | ✓ | 1 | X |
| Isenberg2006IAL | 1 | exe | Х | ✓ | 1 | (✓) |
| Isenberg2008IEV | / | exe | Х | ✓ | 1 | (✔) |
| Isenberg2008MST | ✓ | exe | Х | ✓ | 1 | (✓) |
| Isenberg2013VAS | ✓ | web + Java | X | √ (offline) | 1 | X |
| Isenberg2022DYB | ✓ | Python script | ✓ | ✓ | 1 | X |
| Zander2004HQH | ✓ | exe | Х | ✓ | 1 | X |
| Isenberg2006GCS | / | exe | Х | ✓ | 1 | X |
| Schwarz2007MRP | ✓ | exe | Х | ✓ | 1 | (✓) |
| Grubert2008ISN | 1 | exe | Х | ✓ | 1 | (✓) |
| Vlaming2008PTI | 1 | exe | Х | ? | 1 | 1 |
| Everts2009DDH | 1 | exe (W,L,M) | Х | ✓ | 1 | X |
| Svetachov2010DCI | ✓ | exe (W,L) | X | ✓ | 1 | GPU |
| Martin2010EBS | ✓ | exe (W,L) | Х | Х | 1 | X |
| Nijboer2010EFG | ✓ | exe | Х | ✓ | 1 | (✓) |
| Postma2010EDS | 1 | exe (W,L) | Х | ✓ | 1 | GPU |
| Yu2010FDT | / | exe | Х | ✓ | 1 | (✓) |
| Zwan2011IMV | ✓ | exe | X | ✓ | 1 | GPU |
| Gerl2012SAI | 1 | X | Х | | | GPU |
| Klein2012DSD | / | exe | Х | ✓ | 1 | (✓) |
| Yu2012ESA | 1 | exe | Х | ✓ | 1 | (✓) |
| Gerl2013IEH | 1 | X | Х | | | X |
| Everts2015EBW | / | X | Х | | | X |
| Everts2015IIL | 1 | X | Х | | | GPU |
| Besancon2017HTT | / | sources only | ✓ | n/a | X | 1 |
| Besancon2017PGF | 1 | sources only | ✓ | n/a | X | ✓ |
| Besancon2018RAR | 1 | sources only | / | n/a | X | X |
| Besancon2019HTT | / | sources only | ✓ | n/a | X | ✓ |
| Wang2019AT3 | 1 | sources only (iOS) | ✓ | n/a | X | 1 |
| Halladjian2020SIV | 1 | exe | Х | ✓ | 1 | GPU |
| Wang2020TUA | 1 | X | Х | | | / |
| Halladjian2022MUI | 1 | exe | X | ✓ | 1 | GPU |

| project ID incl. year (project webpage link) | should have a demo | type of demo | sources provided | exe runs still (W) | self- hosted | special HW required |
|---|-----------------------|--------------------|---------------------|-----------------------|-----------------|---------------------|
| Sonnet2003IWF | / | Х | Х | | | X |
| Isenberg2003IVD | / | X | X | | | X |
| Halper2003OAS | / | exe (partial) | X | 1 | 1 | X |
| Jesse2003UOH | / | exe | X | / | / | X |
| Schmidt2007SSI | / | exe | X | 1 | X | × |
| Stamp2007CSP | / | web, Java applet | 1 | X | 1 | X |
| Neumann2007NLI | 1 | exe | Х | / | / | X |
| Boukhelifa2012ESV | ✓ | X | X | | | X |
| Wood2012SRI | ✓ | library | / | ✓ | X | X |
| Bach2013IDG | ✓ | X | X | | | X |
| Willet2015LRS | 1 | web | ✓ | ✓ | X | X |
| Lawonn2016OBF | 1 | X | X | | | GPU |
| Yu2016CEE | 1 | exe | X | ✓ | 1 | (✓) |
| Isenberg2017VST | X | dataset | n/a | n/a | 1 | n/a |
| Isenberg2017VMC | Х | dataset | n/a | n/a | X | n/a |
| Martin2017SDS | Х | exe (W,L; partial) | ✓ | ✓ | ✓ | X |
| Isenberg2017VPS | X | dataset | n/a | n/a | ✓ | n/a |
| Martin2019ADC | X | exe (W,L) | X | ✓ | 1 | X |
| Chen2021VCF | X | dataset | n/a | n/a | X | n/a |
| Ling2021DDR | ✓ | dataset | n/a | n/a | X | n/a |
| Tietjen2005CSS | ✓ | X | X | | | X |
| Fanea2005I3I | ✓ | X | X | | | X |
| Meraj2008MHD | ✓ | X | X | | | X |
| Kim2009SBE | ✓ | exe | X | ✓ | ✓ | X |
| Hancock2010SST | ✓ | X | X | | | ✓ |
| Vlaming2010I2M | ✓ | × | X | | | ✓ |
| Chaboissier2011RTC | ✓ | X | X | | | ✓ |
| Zwan2012CNN | ✓ | exe | X | ✓ | ✓ | GPU |
| Kim2013BMM | √ | × | X | | | X |
| Issartel2016TVP | √ | X | Х | | | ✓ |
| Miao2018MVS | ✓ | X | X | | | GPU |
| Miao2018DDS | ✓. | X | Х | | | GPU |
| Kouril2021HBD | √ | X | Х | | | GPU |
| Lu2021CCH | √ | X | X | | | X |
| Kouril2022MAN | ✓ | × | X | | | GPU |

own project

collaboration

supervised

co-supervised

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| Isenberg2003ADG | X | exe (partial) | Х | ✓ | 1 | X |
| Isenberg2004CTE | ✓ | exe (partial) | Х | ✓ | 1 | X |
| Isenberg2006BFS | ✓ | exe | Х | ✓ | 1 | X |
| Isenberg2006IAL | ✓ | exe | Х | ✓ | 1 | (✔) |
| Isenberg2008IEV | ✓ | exe | Х | ✓ | 1 | (✓) |
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| Zander2004HQH | ✓ | exe | Х | ✓ | ✓ | Х |
| Isenberg2006GCS | ✓ | exe | Х | ✓ | ✓ | X |
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| Vlaming2008PTI | ✓ | exe | Х | ? | ✓ | ✓ |
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| Svetachov2010DCI | ✓ | exe (W,L) | Х | ✓ | ✓ | GPU |
| Martin2010EBS | ✓ | exe (W,L) | Х | Х | ✓ | X |
| Nijboer2010EFG | ✓ | exe | Х | ✓ | ✓ | (✓) |
| Postma2010EDS | ✓ | exe (W,L) | Х | ✓ | ✓ | GPU |
| Yu2010FDT | ✓ | exe | Х | ✓ | ✓ | (✓) |
| Zwan2011IMV | ✓ | exe | Х | ✓ | ✓ | GPU |
| Gerl2012SAI | ✓ | Х | Х | | | GPU |
| Klein2012DSD | ✓ | exe | Х | ✓ | ✓ | (✓) |
| Yu2012ESA | ✓ | exe | Х | ✓ | ✓ | (✓) |
| Gerl2013IEH | ✓ | Х | Х | | | X |
| Everts2015EBW | ✓ | X | Х | | | X |
| Everts2015IIL | ✓ | X | Х | | | GPU |
| Besancon2017HTT | ✓ | sources only | ✓ | n/a | Х | ✓ |
| Besancon2017PGF | ✓ | sources only | ✓ | n/a | X | ✓ |
| Besancon2018RAR | ✓ | sources only | ✓ | n/a | X | × |
| Besancon2019HTT | ✓ | sources only | ✓ | n/a | Х | ✓ |
| Wang2019AT3 | ✓ | sources only (iOS) | ✓ | n/a | X | ✓ |
| Halladjian2020SIV | ✓ | exe | Х | ✓ | ✓ | GPU |
| Wang2020TUA | ✓ | X | Х | | | ✓ |
| Halladjian2022MUI | ✓ | exe | Х | ✓ | ✓ | GPU |
| | | | | | | |

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|--|-----------------------|--------------------|---------------------|-----------------------|-----------------|---------------------|
| Sonnet2003IWF | ✓ | Х | X | | | X |
| Isenberg2003IVD | ✓ | Х | Х | | | X |
| Halper2003OAS | ✓ | exe (partial) | X | ✓ | 1 | X |
| Jesse2003UOH | ✓ | exe | Х | ✓ | 1 | X |
| Schmidt2007SSI | ✓ | exe | Х | ✓ | X | X |
| Stamp2007CSP | ✓ | web, Java applet | ✓ | X | 1 | X |
| Neumann2007NLI | ✓ | exe | Х | ✓ | 1 | X |
| Boukhelifa2012ESV | ✓ | X | X | | | X |
| Wood2012SRI | ✓ | library | ✓ | ✓ | X | X |
| Bach2013IDG | 1 | Х | Х | | | X |
| Willet2015LRS | ✓ | web | ✓ | ✓ | X | X |
| Lawonn2016OBF | ✓ | Х | Х | | | GPU |
| Yu2016CEE | ✓ | exe | Х | ✓ | 1 | (✔) |
| Isenberg2017VST | Х | dataset | n/a | n/a | ✓ | n/a |
| Isenberg2017VMC | X | dataset | n/a | n/a | X | n/a |
| Martin2017SDS | X | exe (W,L; partial) | ✓ | ✓ | ✓ | X |
| Isenberg2017VPS | X | dataset | n/a | n/a | 1 | n/a |
| Martin2019ADC | X | exe (W,L) | Х | ✓ | 1 | X |
| Chen2021VCF | X | dataset | n/a | n/a | X | n/a |
| Ling2021DDR | ✓ | dataset | n/a | n/a | X | n/a |
| Tietjen2005CSS | ✓ | Х | Х | | | X |
| Fanea2005I3I | ✓ | X | X | | | X |
| Meraj2008MHD | ✓ | X | X | | | X |
| Kim2009SBE | ✓ | exe | X | ✓ | 1 | X |
| Hancock2010SST | ✓ | X | X | | | ✓ |
| Vlaming2010I2M | ✓ | X | X | | | ✓ |
| Chaboissier2011RTC | ✓ | X | X | | | ✓ |
| Zwan2012CNN | ✓ | exe | X | ✓ | 1 | GPU |
| Kim2013BMM | ✓ | X | X | | | X |
| Issartel2016TVP | ✓ | X | X | | | ✓ |
| Miao2018MVS | ✓ | X | X | | | GPU |
| Miao2018DDS | ✓ | X | X | | | GPU |
| Kouril2021HBD | ✓ | X | X | | | GPU |
| Lu2021CCH | ✓ | X | X | | | × |
| Kouril2022MAN | ✓ | X | X | | | GPU |

Three classes of problems

1. problems to provide demos yourself



2. problems running demos years later



3. problems of existing demos to remain accessible



Three classes of problems

1. problems to provide demos yourself



2. problems running demos years later



3. problems of existing demos to remain accessible



Extra effort

 low priority at end of (PhD) project

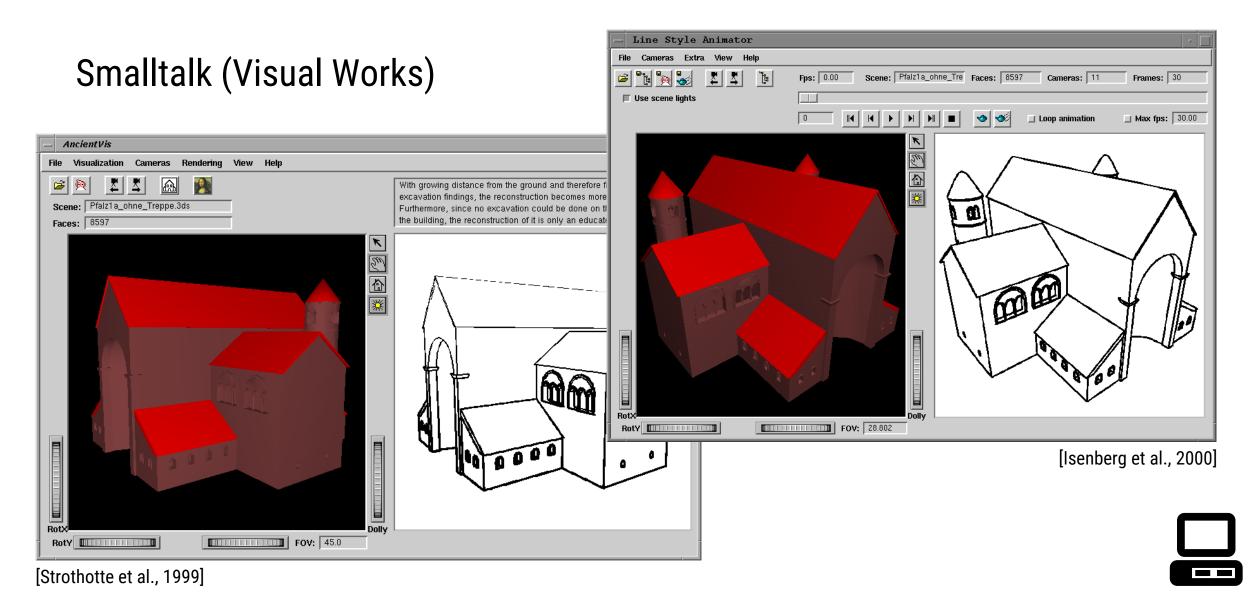
student(s) no longer paid

 incentive: eternal fame and glory

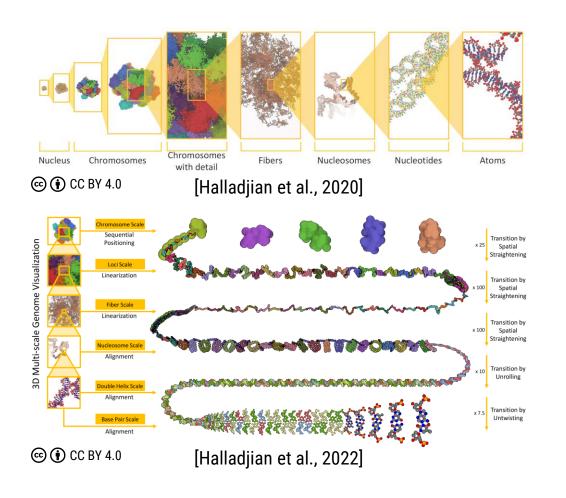




Problems with licenses for the used code



Problems with licenses for the used code





@ nanographics





Suitable license for distribution?





cc creative commons

- Apache License 2.0
- BSD 3-Clause "New" or "Revised" license
- BSD 2-Clause "Simplified" or "FreeBSD" license
- GNU General Public License (GPL)
- GNU Library or "Lesser" General Public License (LGPL)
- MIT license
- Mozilla Public License 2.0
- Common Development and Distribution License
- Eclipse Public License version 2.0









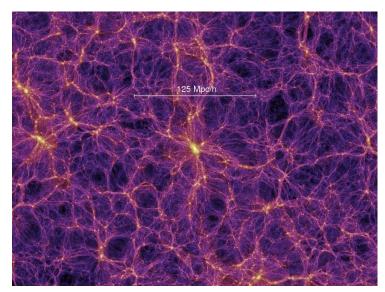




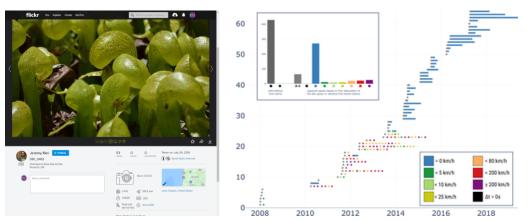


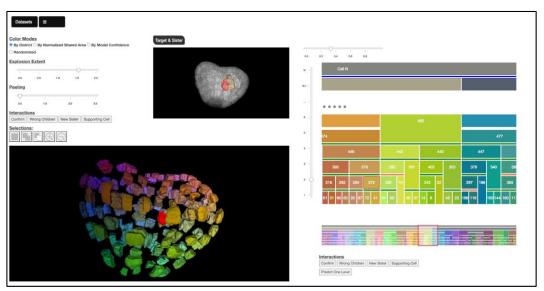


License or usage rights of included data?



Springel et al. (Virgo Consortium), MPI for Astrophysics





© (†) CC BY 4.0 [Hong et al., 2022]







© () CC BY 4.0 [Isenberg et al., 2022]

Three classes of problems

1. problems to provide demos yourself

2. problems running demos years later

3. problems of existing demos to remain accessible







Choice of operating system





Windows







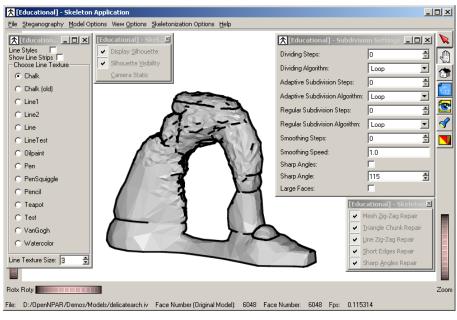


iOS

android

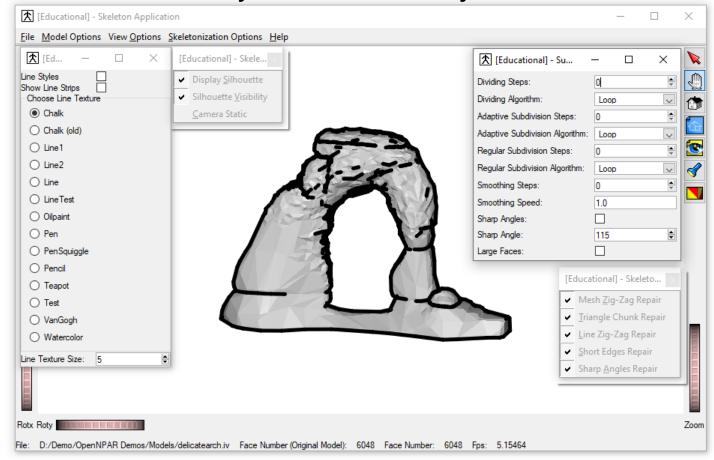
MS Windows appears to work best (for me)





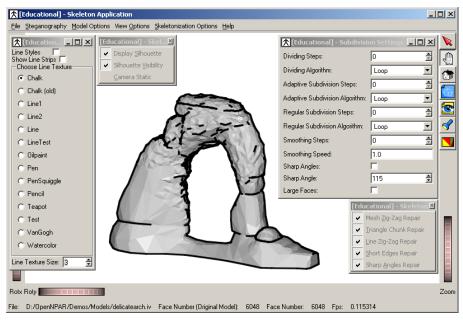
2002ish, Windows XP

2022, 20 years and 4 major versions later



MS Windows appears to work best (for me)

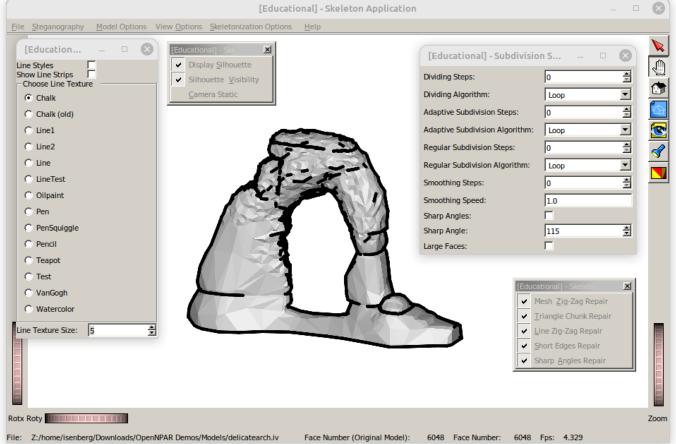




2002ish, Windows XP

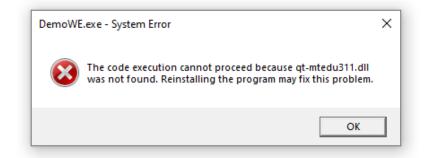


works even under Linux w/ Wine



Dynamic-link libraries (DLLs)

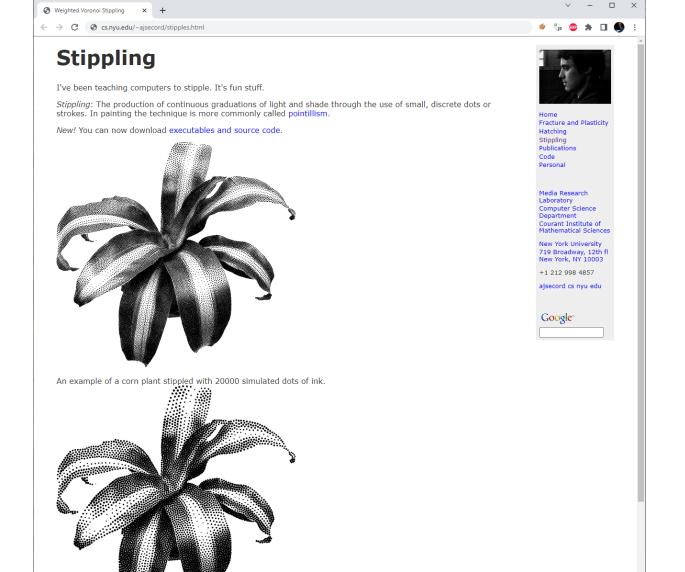






| 13-Apr-06 22:59 | Application exten | 116 KB |
|-----------------|---|---|
| 22-Sep-04 15:21 | Application exten | 204 KB |
| 21-Jul-02 06:06 | Application exten | 2,828 KB |
| 25-May-04 10:48 | Application exten | 3,844 KB |
| 19-Apr-06 20:13 | Application exten | 108 KB |
| 22-Sep-04 15:21 | Application exten | 68 KB |
| 13-Apr-06 23:02 | Application exten | 2,156 KB |
| 22-Sep-04 15:21 | Application exten | 3,660 KB |
| 26-Feb-03 20:35 | Application exten | 5,372 KB |
| 28-Oct-04 18:01 | Application exten | 6,500 KB |
| 22-Sep-04 15:21 | Application exten | 365 KB |
| 22-Sep-04 14:21 | Application exten | 313 KB |
| 05-Oct-04 05:08 | Application exten | 55 KB |
| | 22-Sep-04 15:21 21-Jul-02 06:06 25-May-04 10:48 19-Apr-06 20:13 22-Sep-04 15:21 13-Apr-06 23:02 22-Sep-04 15:21 26-Feb-03 20:35 28-Oct-04 18:01 22-Sep-04 15:21 22-Sep-04 15:21 | 22-Sep-04 15:21 Application exten 21-Jul-02 06:06 Application exten 25-May-04 10:48 Application exten 19-Apr-06 20:13 Application exten 22-Sep-04 15:21 Application exten 13-Apr-06 23:02 Application exten 22-Sep-04 15:21 Application exten 22-Sep-04 15:21 Application exten 26-Feb-03 20:35 Application exten 28-Oct-04 18:01 Application exten 22-Sep-04 15:21 Application exten 22-Sep-04 15:21 Application exten 22-Sep-04 14:21 Application exten |

External libraries

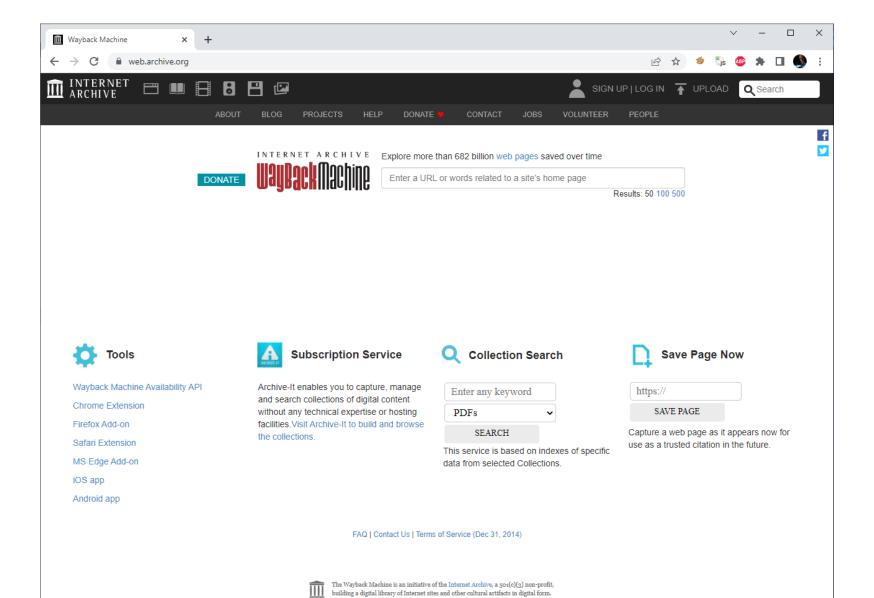




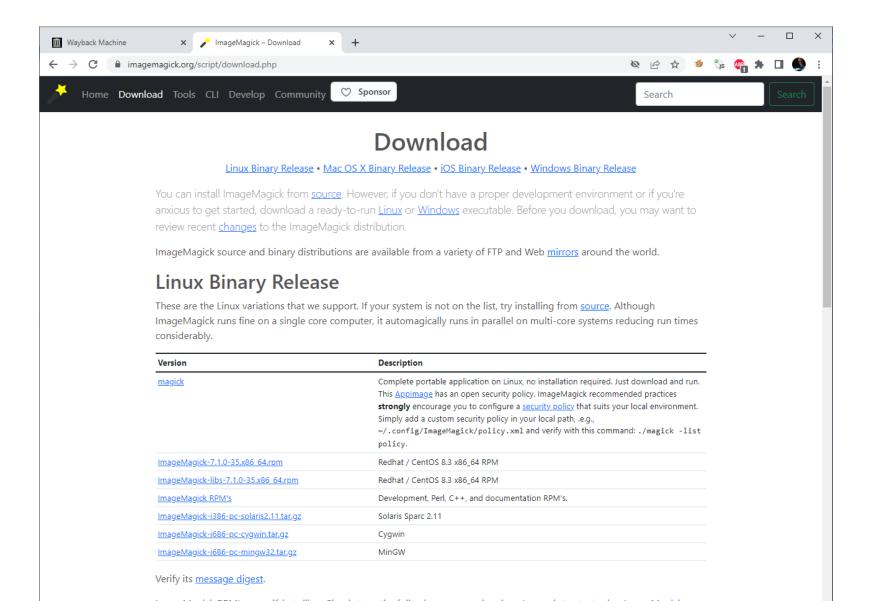


- used DLLs of project
- needs: 6.2.5-5 (or so, from 2005)
- today: version $7.1.x \rightarrow$ incompatible
- old versions no longer available

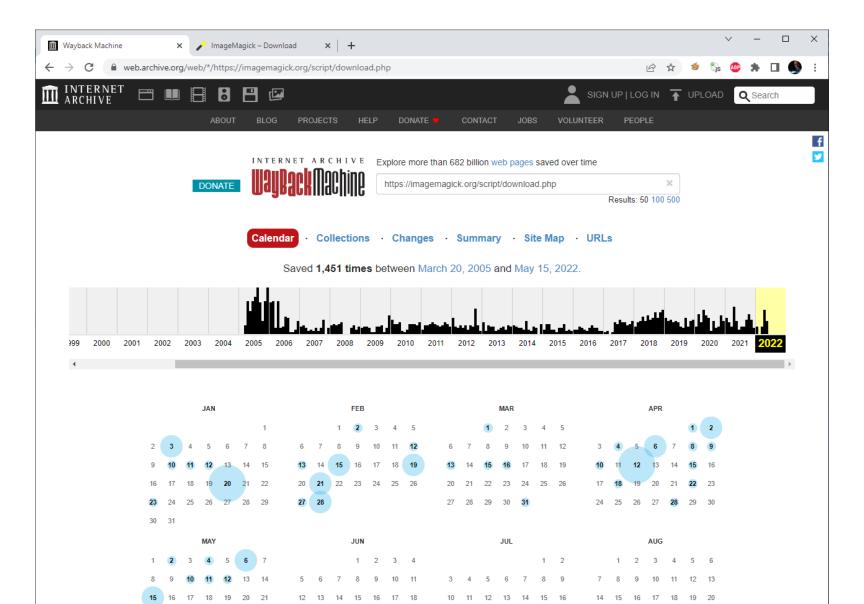




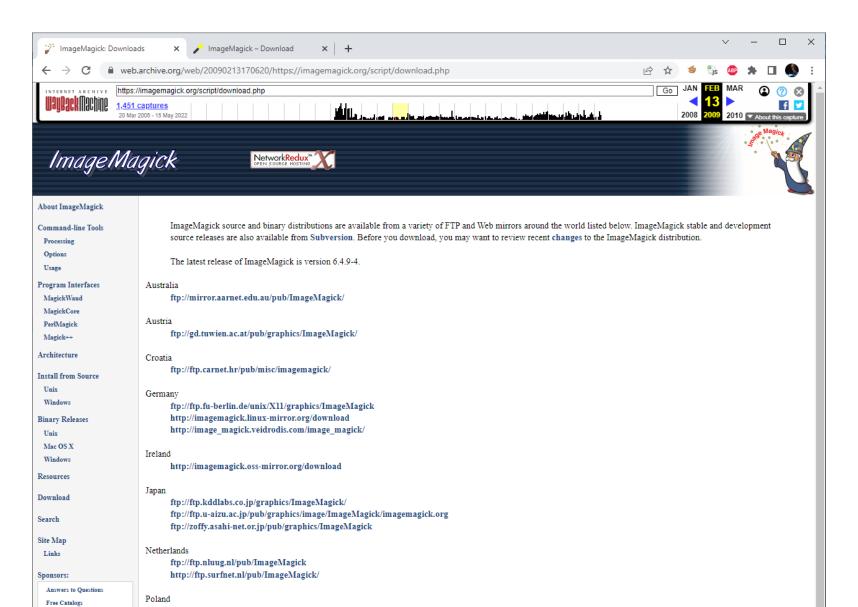




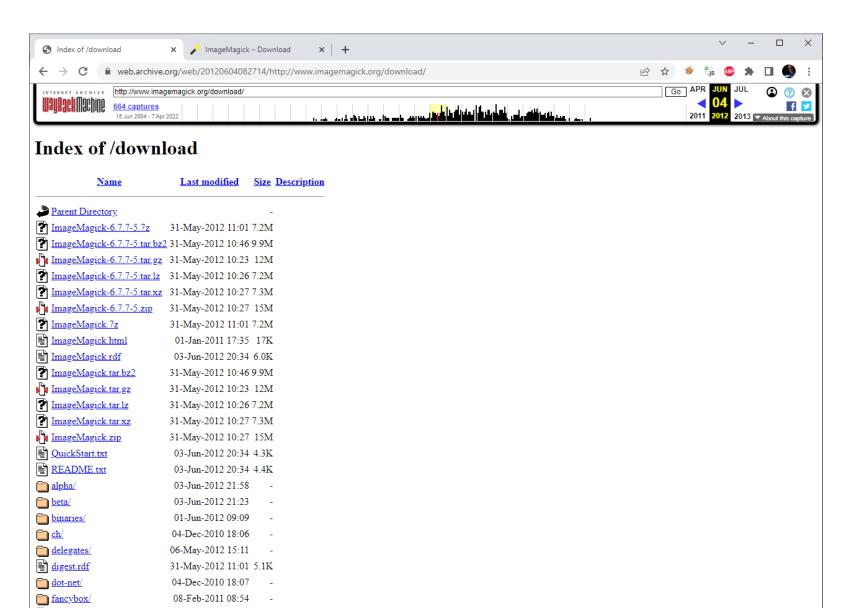




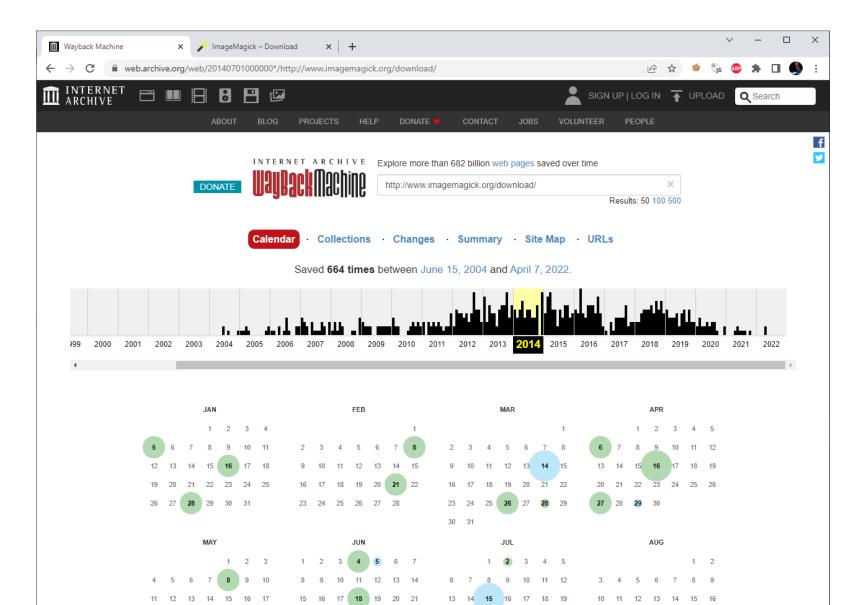




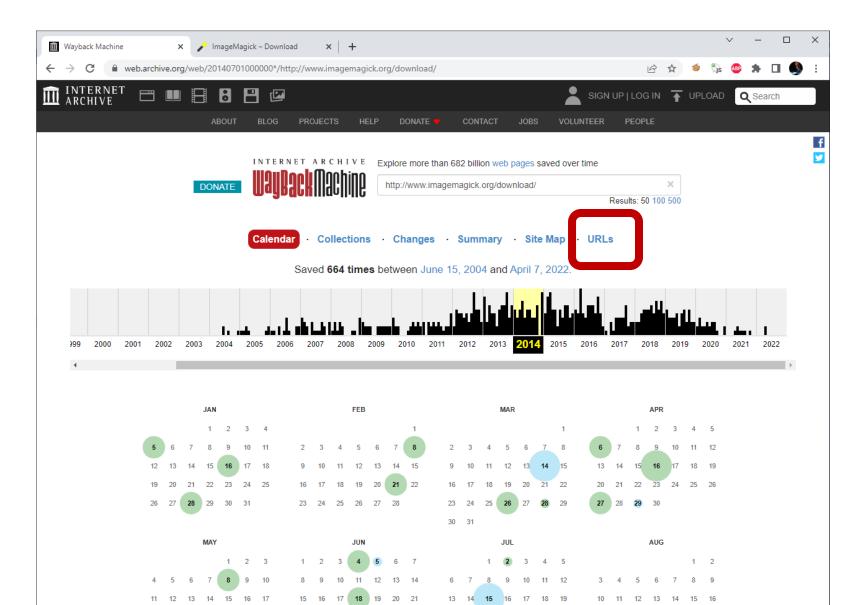




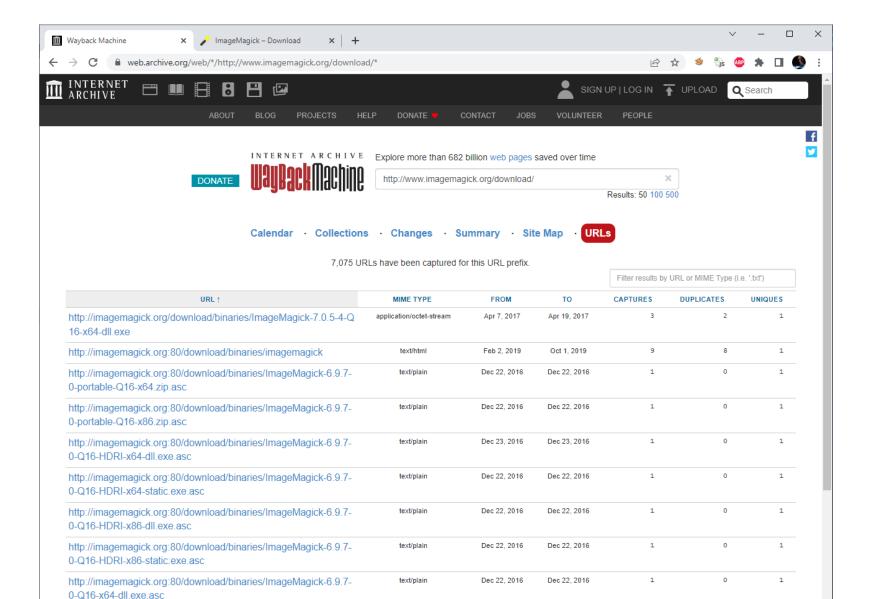






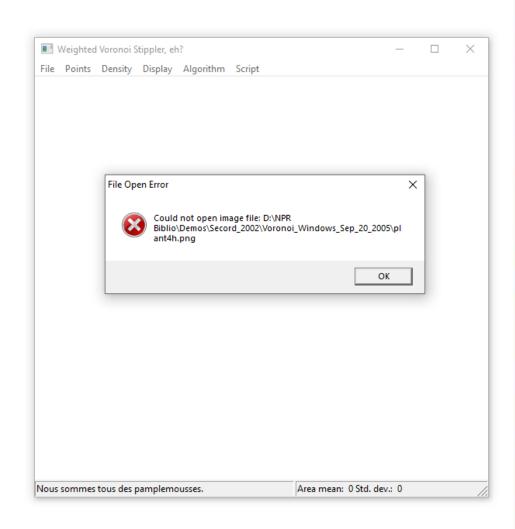


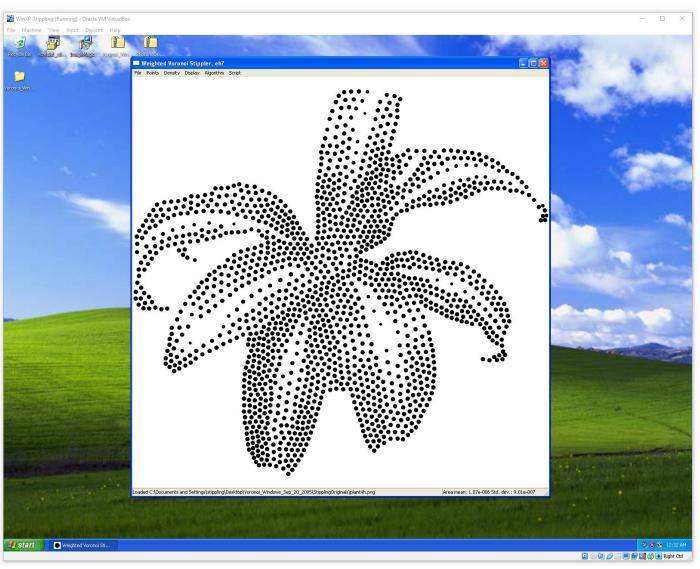




Random issues and virtual machines

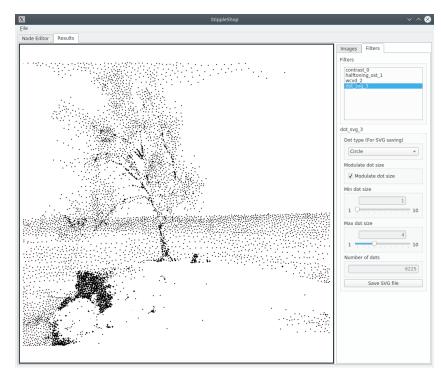




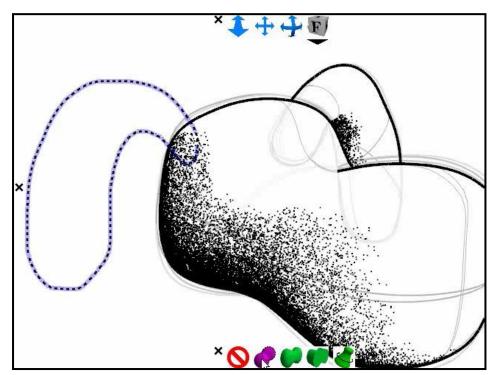


Larger software suites





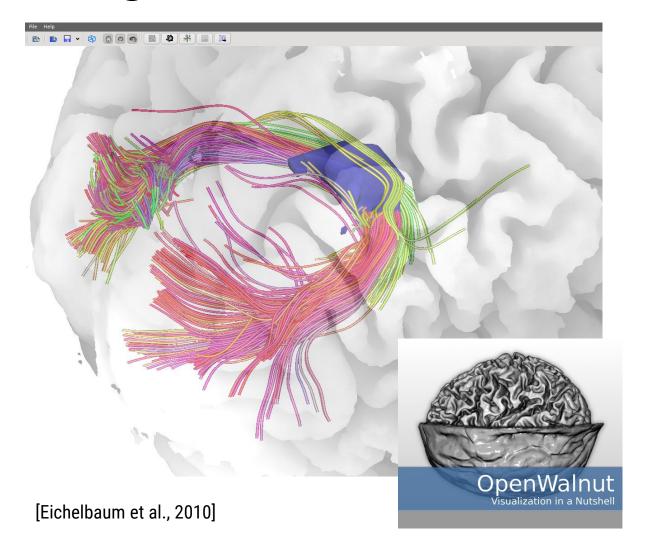
StippleShop [Martín et al., 2017]



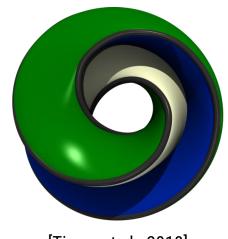
ShapeShop [Schmidt et al., 2007]

Larger software suites





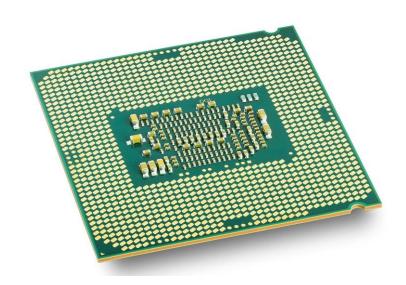




[Tierny et al., 2018]

CPU vs. GPU implementations





VS.







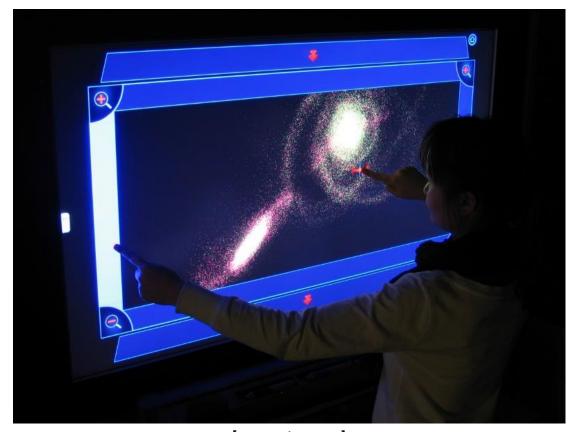


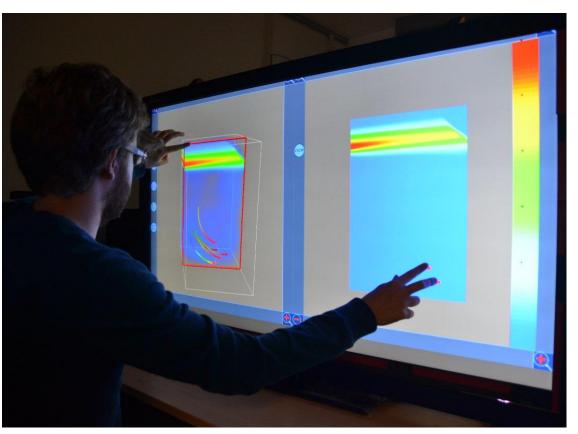
NVIDIA_® vs.

intel

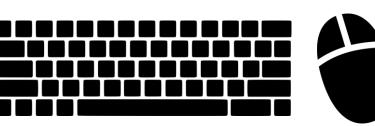
Proprietary, special hardware







[Yu et al., 2010]

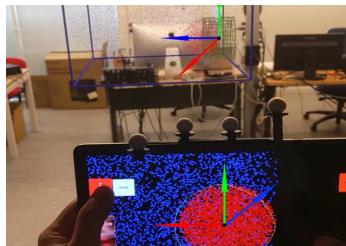


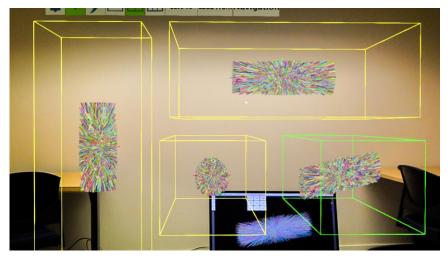
[Klein et al., 2012]

More than one computing device in sync :::









[Besançon et al., 2019]

[Sereno et al., 2022]

[Wang et al., 2020]

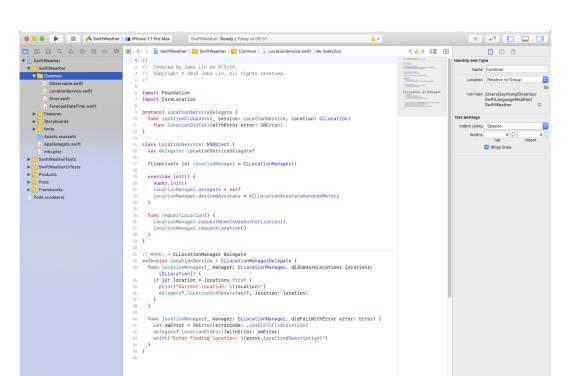




Mobile devices



iOS



android



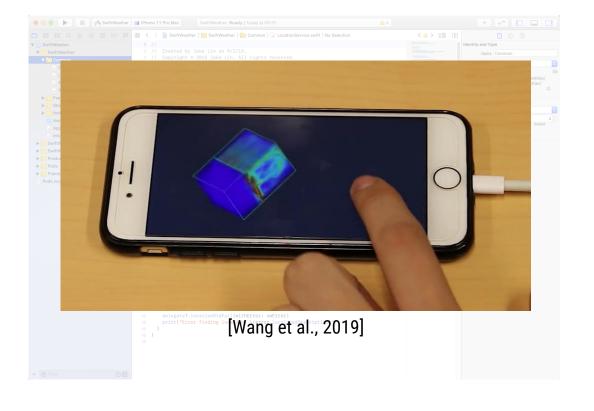
Mobile devices



iOS

android



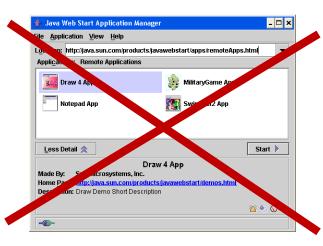


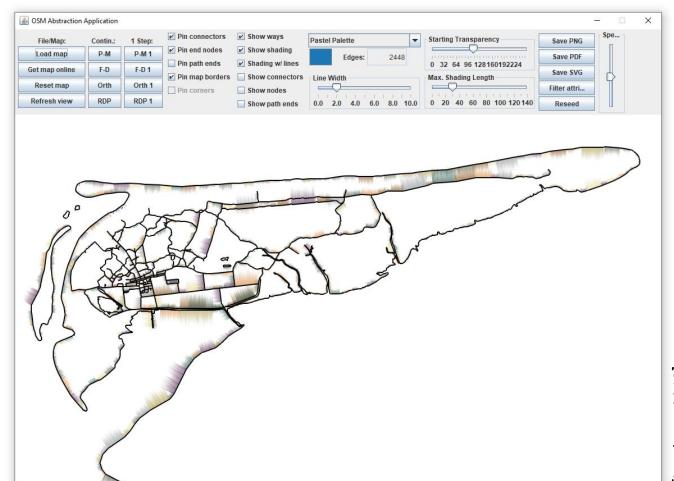


OS-independent implementations







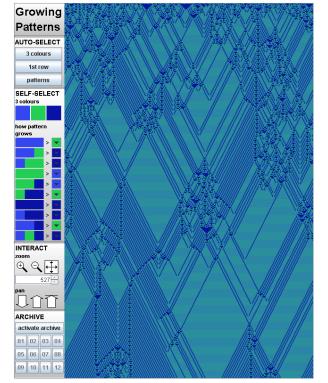


[Isenberg, 2013]

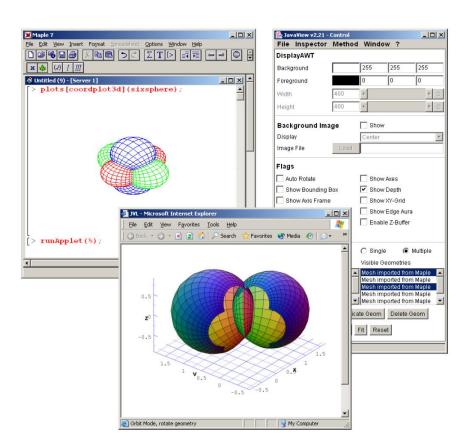
Web-based solutions: Java applets







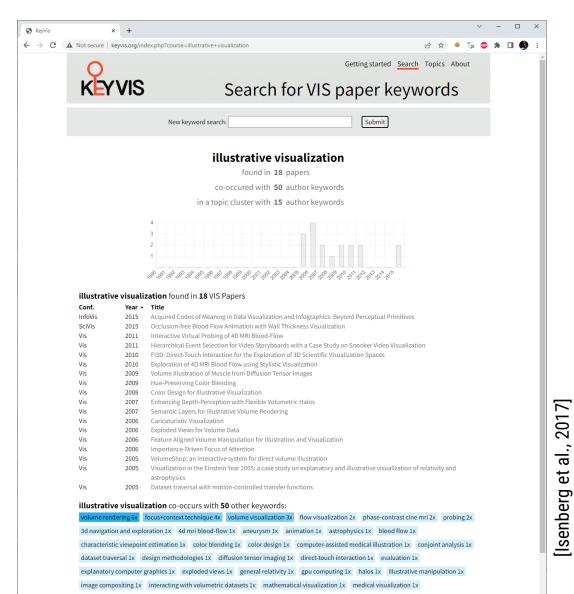
[Stamp et al., 2007]

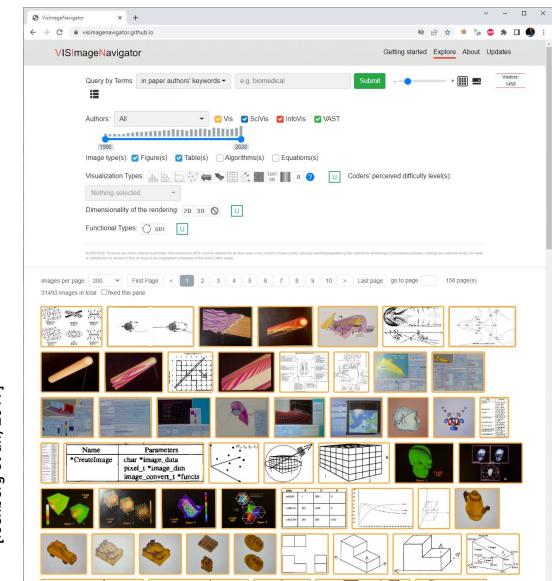


[Skrodzki, 2020]

Web-based solutions: general







[Chen et al., 2020]

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2. problems running demos years later

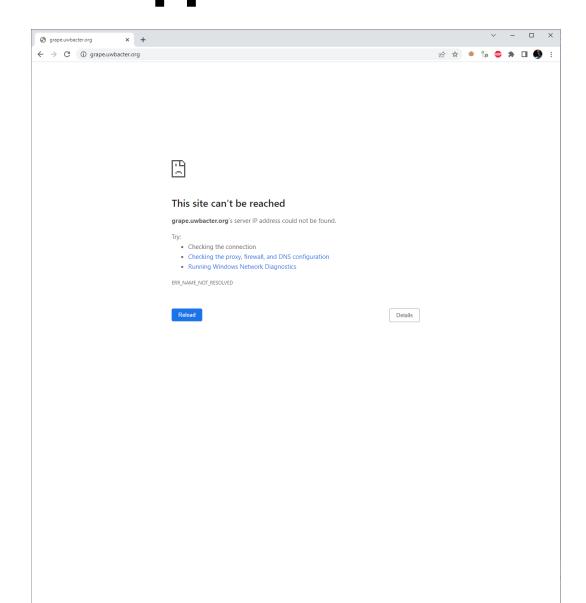


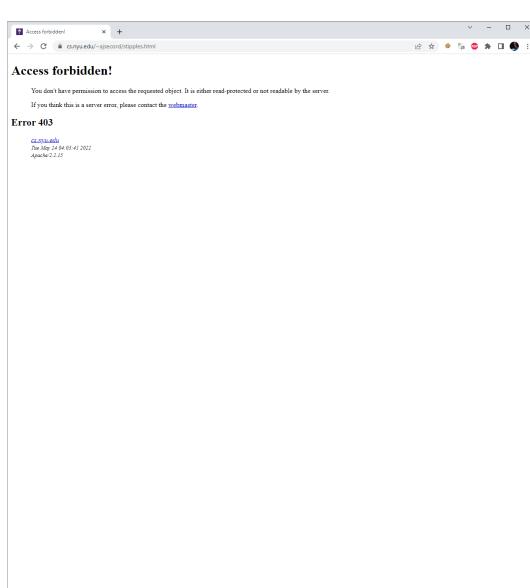
3. problems of existing demos to remain accessible



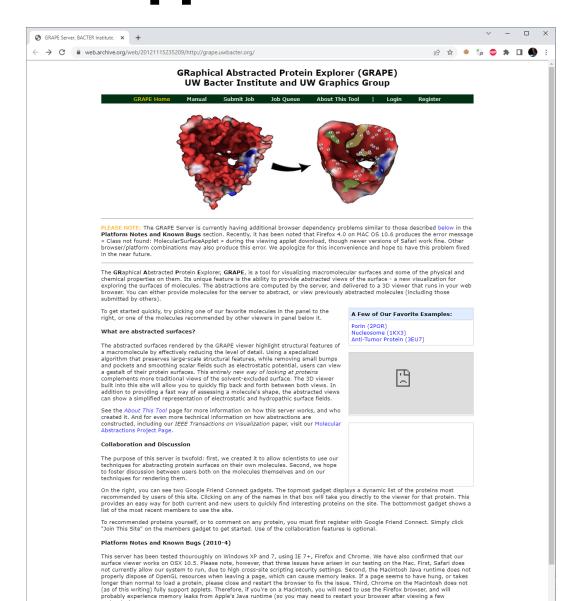
Disappearance from the Web

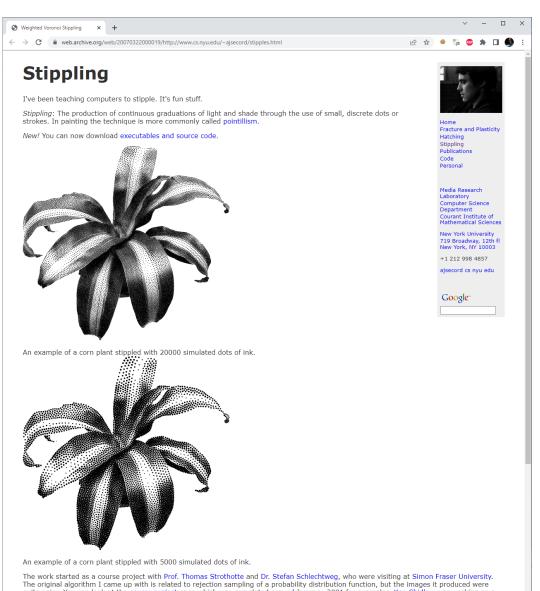






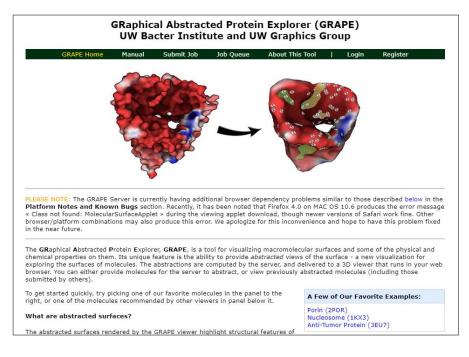






Web-based solutions unrescuable





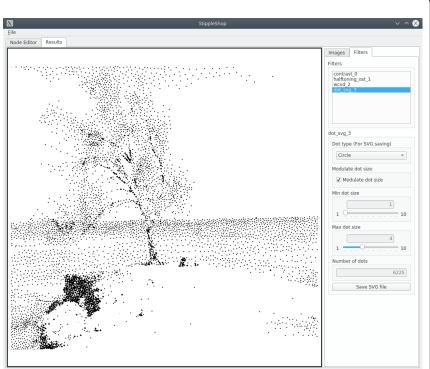


[Cipriano et al., 2010]: 2010 plus a few years

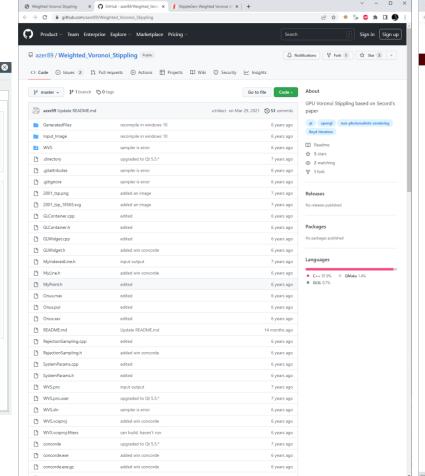


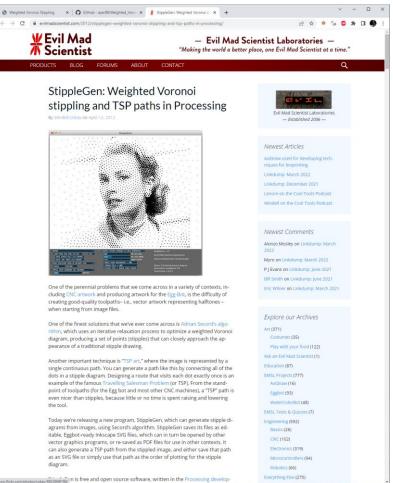
Re-implementations



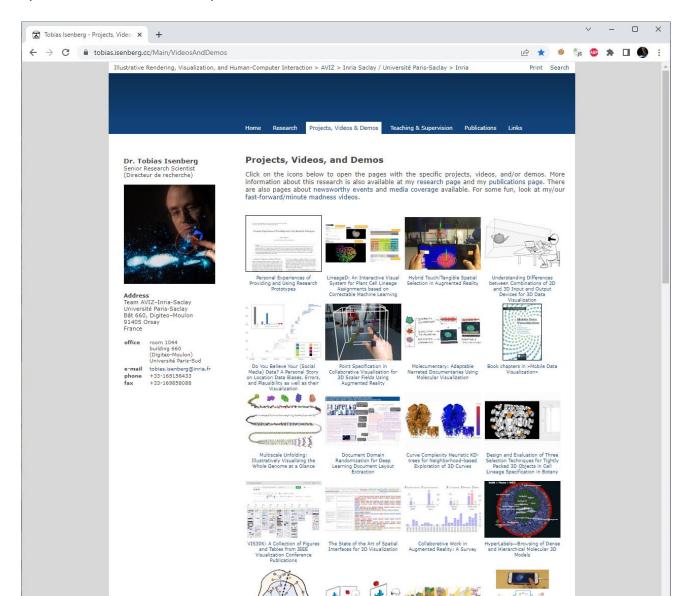


StippleShop [Martín et al., 2017]















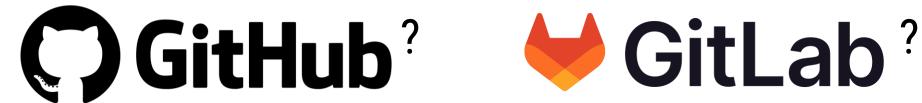








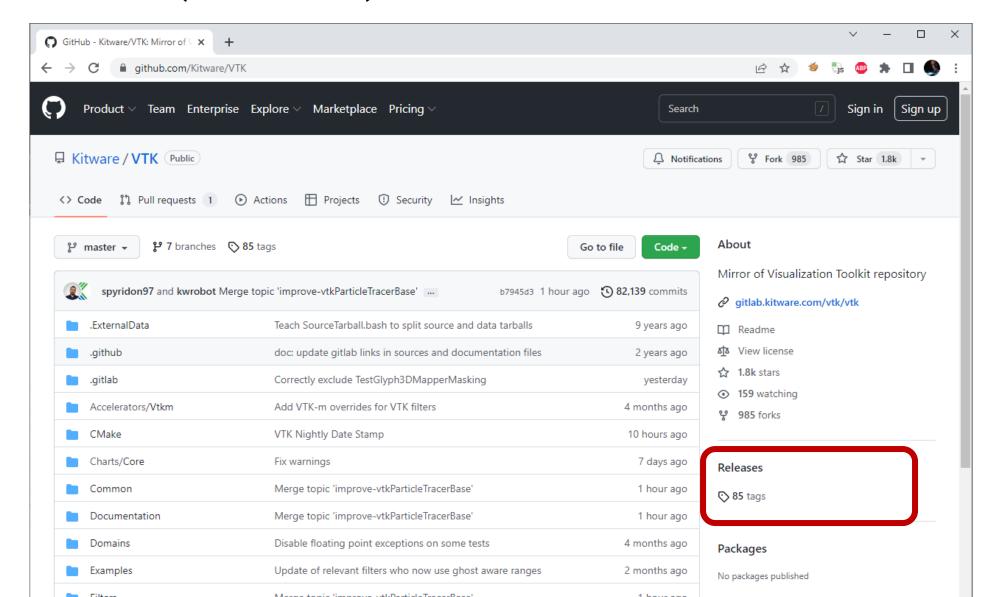












Summary/Conclusion

- executable demos as important as source code
- Windows works, with constraints
- no(t only) self-hosting
- "eternal fame and glory" argument not enough
- (R)

- local: student requirement, exit procedure
- global: integrate into open science initiatives



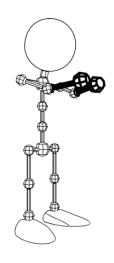
- publications, source code, data, and executable demos!

Limitations

- only personal, self-focused view; many issues well-known
- mostly paper demo programs, not large software suites
- (good & bad) examples are only examples, many others exist
- no finger-pointing at anyone

Big thanks ...

... to all my past & present students and collaborators who actually made all the demos of our work available!





Personal Experiences of Providing and Using **Research Prototypes**

Tobias Isenberg Correction Contraction Con

