BEN FRY

PROCESSING
BEN FRY – PROJECTS
FATHOM – PROJECTS

A LITTLE BIT ABOUT

BEN FRY

BEN FRY

DESIGNER + TECHNOLIGIST
DATA VISUALIZATION EXPERT -> FATHOM
TOOL MAKER -> PROCESSING, VIZ TOOLS
EDUCATOR -> TALKS

WHAT IS
PROCESSING

Processing is
an **open-source**
graphical library
and **integrated development environment**
built for the electronic arts,
new media **art, and visual design** communities
with the purpose of teaching non-programmers
the **fundamentals of computer programming**
in a visual context.

LITERACY

- FOR PEOPLE IN VISUAL ARTS TO LEARN HOW TO BUILD THEIR OWN TOOLS

- TO FULLY EXPLORE THE COMPUTER AS AN ARTISTIC MATERIAL, UNDERSTAND THE ART OF COMPUTER PROGRAMMING.

- "READ" AND "WRITE" SOFTWARE

OPEN SOURCE

- APPLY THE SPIRIT OF OPEN SOURCE TO THE DOMAIN OF ARTS

- SHARING AND IMPROVING CODE: LEARN FROM EACH OTHER.

- NOT FROM SCRATCH

SOFTWARE

- SKETCHING: IT'S ABOUT "PROCESS"

  The idea of the name "**Processing**" was to focus on **process** over final results and to indicate the active state of software.

- NOT JUST FOR ENGINEERS

  How to **bring together** the world of visual exploration with the world of computer science.

- INTEGRATED DEVELOPMENT ENVIRONMENT

NETWORK / EDUCATION

- COMMUNITY

  Processing Community Day
  https://day.processing.org/

  Processing Fellowship
  https://processingfoundation.org/fellowships

  Processing Github
  https://github.com/processing

  Processing Online forum
  https://discourse.processing.org

  OpenProcessing - Community to share and learn
  https://www.openprocessing.org/

Both are open-source frameworks software projects that involve different aspects

Java

Kiosk Application - "fullscreen()"

Easy to export - (STL, Video, Img)

More native support for **Hardware**

A desktop editor

Let's take a look > Processing Desktop

https://processing.org/

Javascript

Easy to share on web

Mobile: Touch / Accelerometer sensor

Any text editor

Processing intuition times JavaScript power

https://p5js.org/

LET'S TAKE A LOOK AT SOME WORKS MADE WITH PROCESSING

- VIEW > HTTPS://PHILLIPSTEARNS.WORDPRESS.COM/FRAGMENTED-MEMORY/
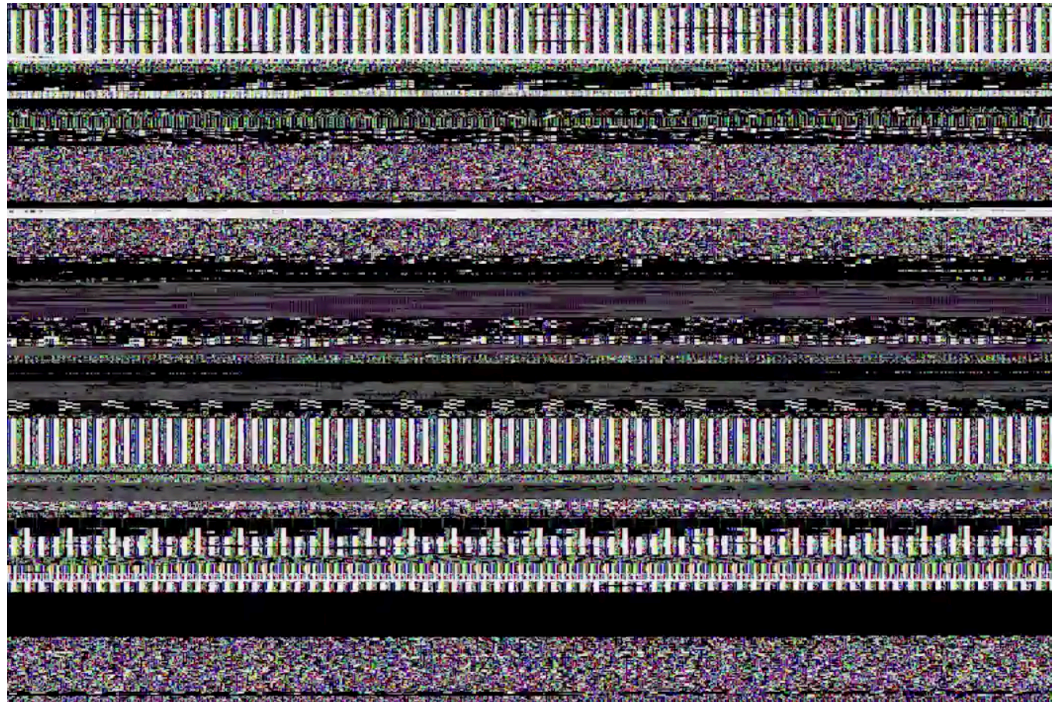
Fragmented Memory
by Phillip Stearns

Fragmented Memory are portraits of raw binary data extracted from computer memory and rendered as an image using Processing. These images are then imported into software used by textile designers and finally fed to computerised looms to weave the designs.

Links: Phillip Stearns

- VIEW > HTTPS://NEOANALOG.IO/PARTICLE-FLOW
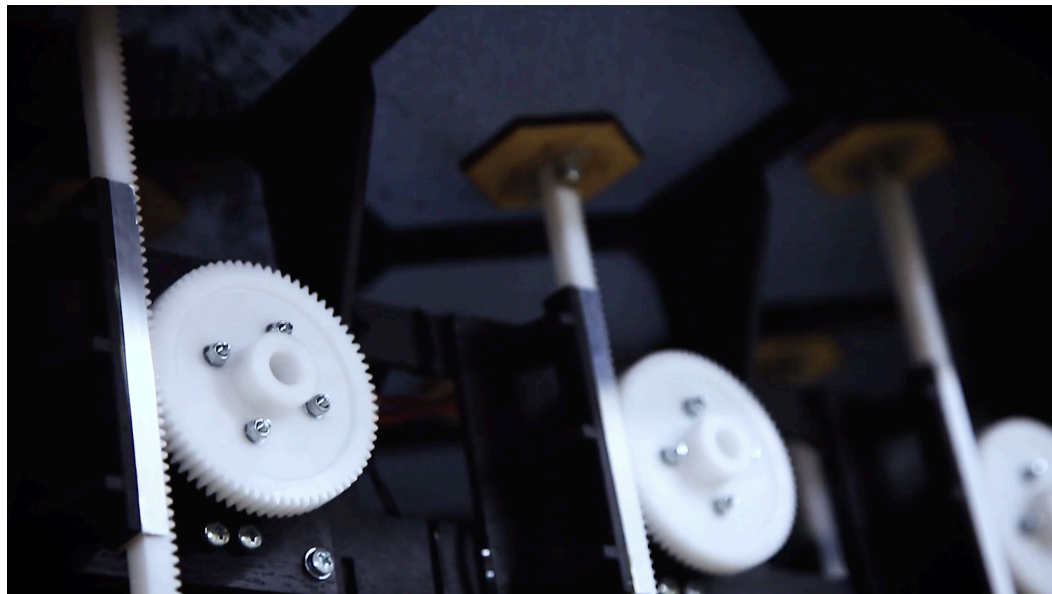
Particle Flow
by NEOANALOG

Particle Flow is a physical installation comprised of granules driven by gravity and topography forming an analogue particle system. A moving slanted plane and a grid of motorized stamps control the elements to form infinite variations of behaviours and patterns.

Links: NEOANALOG, CreativeApplications.Net

https://processing.org/exhibition/
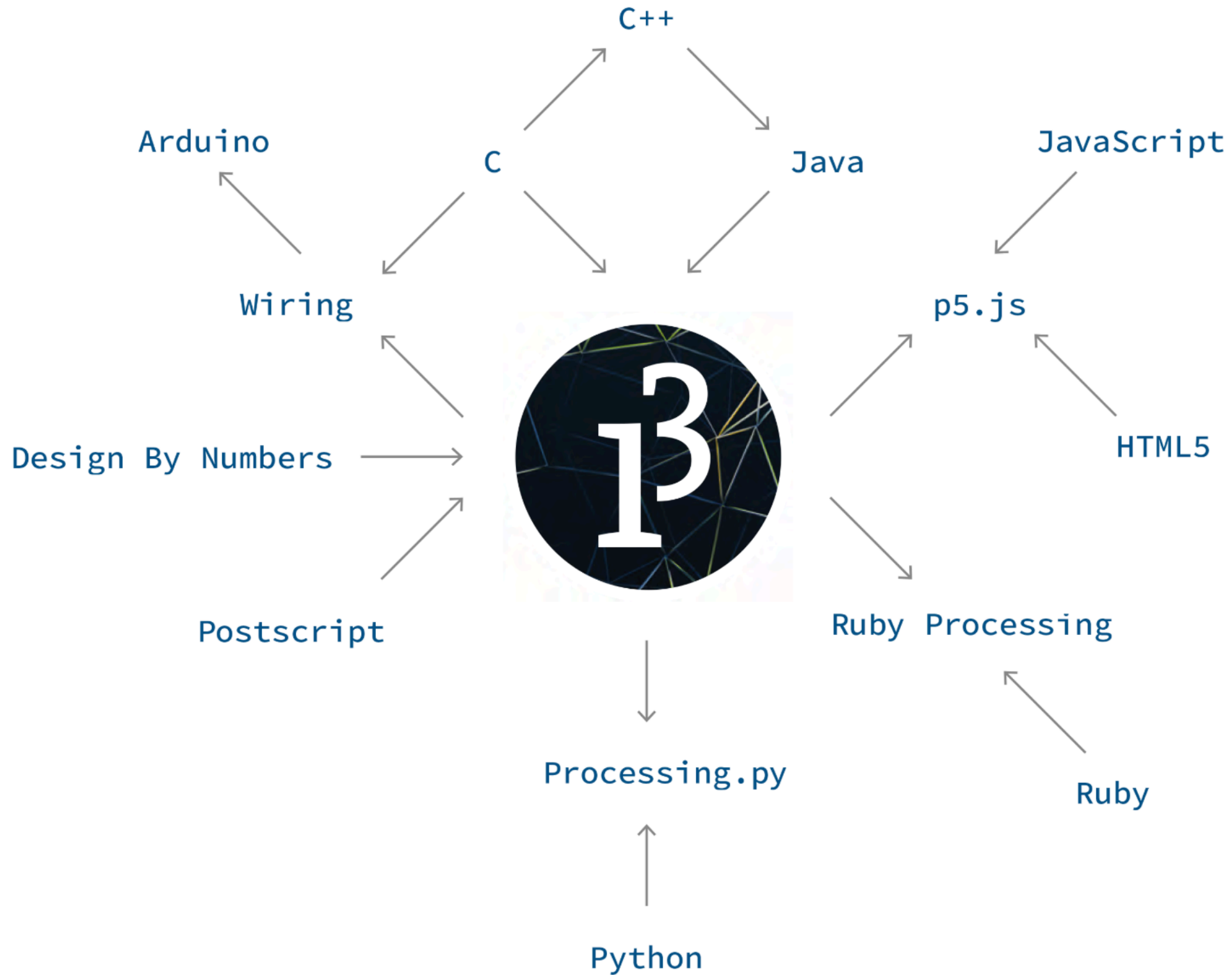
Processing has been influenced by other coding systems and it has influenced others.

https://medium.com/processing-foundation/a-modern-prometheus-59aed94abe85

Also

Processing.py - Python for Processing: https://py.processing.org/

Processing for Android: https://py.processing.org/

Processing for Raspberry Pi: https://pi.processing.org/

Processing.js - Converting an existing processing code to javascript:http://processingjs.org/

PROJECTS BY

BEN FRY

ZIPDECODE, 1999 -> 2004 -> 2014

type the digits of a zip code

zoom

ENTIRE PROCESS

COMPUTER SCIENCE   MATHEMATICS, STATISTICS, AND DATA MINING   GRAPHIC DESIGN   INFOVIS AND HCI
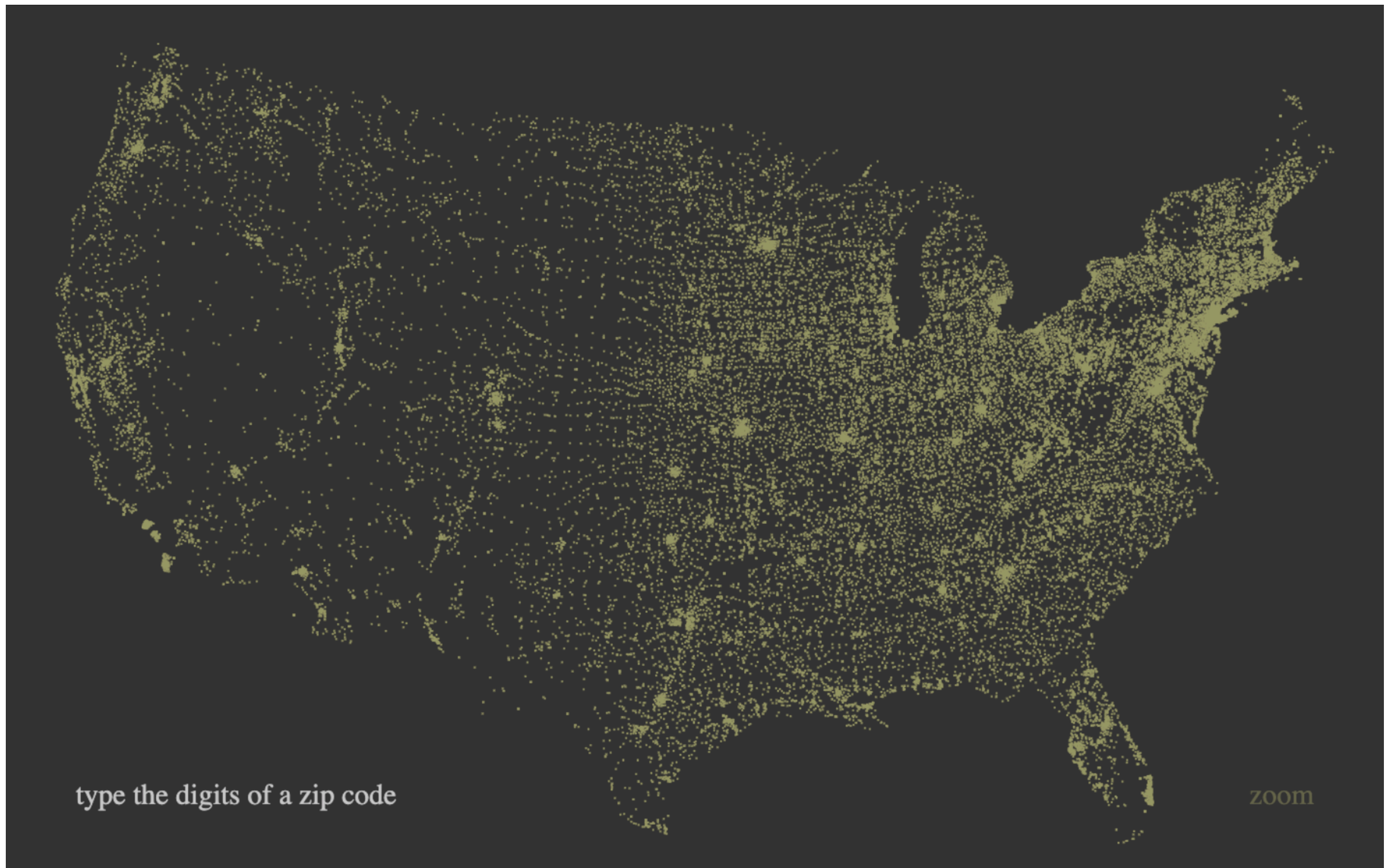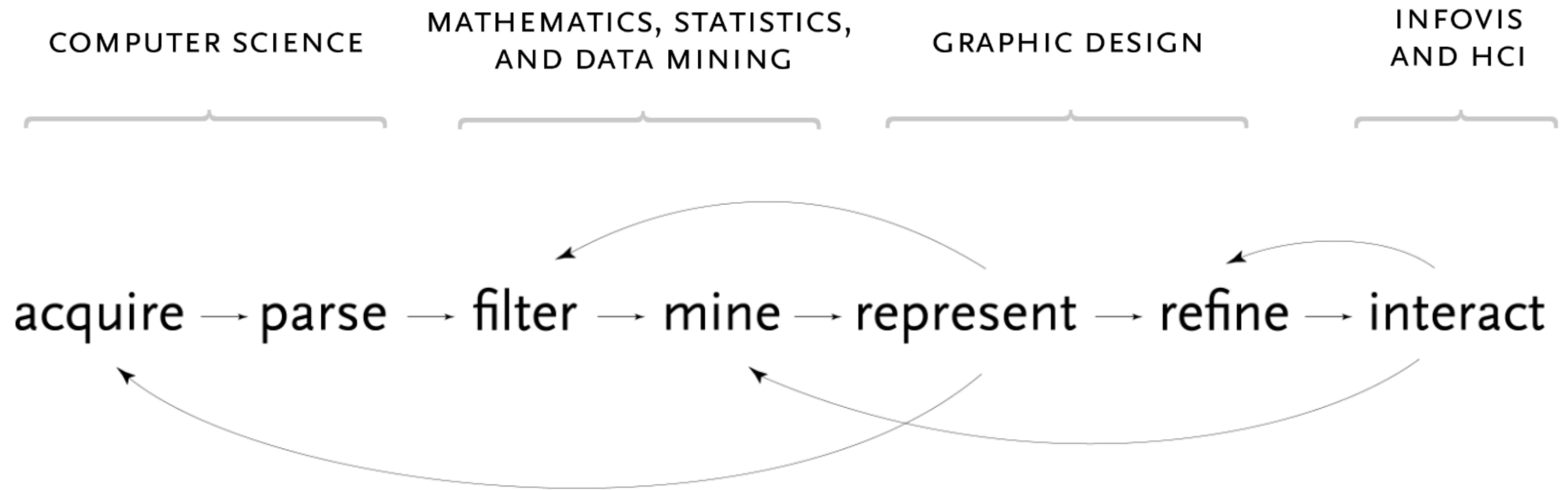
acquire → parse → filter → mine → represent → refine → interact

00210	+43.005895	-071.013202	U	PORTSMOUTH	33	015
00211	+43.005895	-071.013202	U	PORTSMOUTH	33	015
00212	+43.005895	-071.013202	U	PORTSMOUTH	33	015
00213	+43.005895	-071.013202	U	PORTSMOUTH	33	015
00214	+43.005895	-071.013202	U	PORTSMOUTH	33	015
00215	+43.005895	-071.013202	U	PORTSMOUTH	33	015
00501	+40.922326	-072.637078	U	HOLTSVILLE	36	103
00544	+40.922326	-072.637078	U	HOLTSVILLE	36	103
00601	+18.165273	-066.722583		ADJUNTAS	72	001
00602	+18.393103	-067.180953		AGUADA	72	003
00603	+18.455913	-067.145780		AGUADILLA	72	005
00604	+18.493520	-067.135883		AGUADILLA	72	005
00605	+18.465162	-067.141486	P	AGUADILLA	72	005
00606	+18.172947	-066.944111		MARICAO	72	093
00610	+18.288685	-067.139696		ANASCO	72	011
00611	+18.279531	-066.802170	P	ANGELES	72	141
00612	+18.450674	-066.698262		ARECIBO	72	013
00613	+18.458093	-066.732732	P	ARECIBO	72	013
00614	+18.429675	-066.674506	P	ARECIBO	72	013
00616	+18.444792	-066.640678		BAJADERO	72	013

Zip code database from the U.S. Census Bureau

```
00210    +43.005895    -071.013202    U    PORTSMOUTH    33    015
00211    +43.005895    -071.013202    U    PORTSMOUTH    33    015
00212    +43.005895    -071.013202    U    PORTSMOUTH    33    015
00213    +43.005895    -071.013202    U    PORTSMOUTH    33    015
00214    +43.005895    -071.013202    U    PORTSMOUTH    33    015
00215    +43.005895    -071.013202    U    PORTSMOUTH    33    015
00501    +40.922326    -072.637078    U    HOLTSVILLE    36    103
00544    +40.922326    -072.637078    U    HOLTSVILLE    36    103
00601    +18.165273    -066.722583         ADJUNTAS      72    001
00602    +18.393103    -067.180953         AGUADA        72    003
00603    +18.455913    -067.145780         AGUADILLA     72    005
00604    +18.493520    -067.135883         AGUADILLA     72    005
00605    +18.465162    -067.141486    P    AGUADILLA     72    005
00606    +18.172947    -066.944111         MARICAO       72    093
00610    +18.288685    -067.139696         ANASCO        72    011
00611    +18.279531    -066.802170    P    ANGELES       72    141
00612    +18.450674    -066.698262         ARECIBO       72    013
00613    +18.458093    -066.732732    P    ARECIBO       72    013
00614    +18.429675    -066.674506    P    ARECIBO       72    013
00616    +18.444792    -066.640678         BAJADERO      72    013
```

```
00210    +43.005895    -071.013202    U    PORTSMOUTH    33    015
```

string \t   float   \t   float   \t char \t   string   \t index \t index

ZIP CODE   **LATITUDE**   **LONGITUDE**   **CITY**   **STATE** ⟶

```
01⊠  ALABAMA         AL
02⊠  ALASKA          AK
04⊠  ARIZONA         AZ
05⊠  ARKANSAS⊠       AR
06⊠  CALIFORNIA⊠     CA
08⊠  COLORADO⊠⊠      CO
09⊠  CONNECTICUT⊠    CT
10⊠  DELAWARE⊠⊠      DE
12⊠  FLORIDA         FL
13⊠  GEORGIA         GA
15⊠  HAWAII          HI
16⊠  IDAHO           ID
17⊠  ILLINOIS⊠⊠      IL
18⊠  INDIANA         IN
19⊠  IOWA⊠           IA
20⊠  KANSAS          KS
```
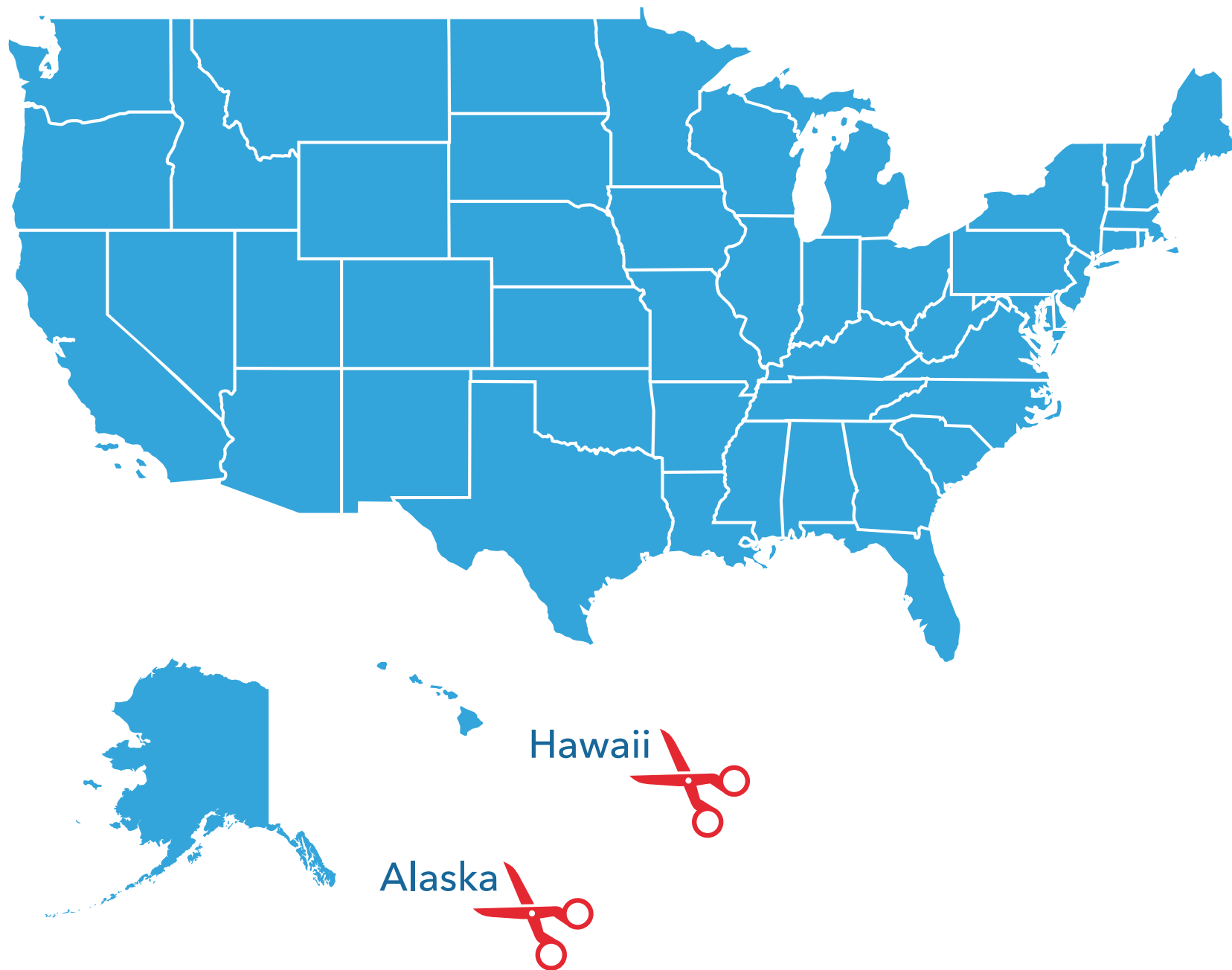
Hawaii

Alaska

00210⊠	43.005895⊠	-71.013202⊠	PORTSMOUTH⊠	NH
00211⊠	43.005895⊠	-71.013202⊠	PORTSMOUTH⊠	NH
00212⊠	43.005895⊠	-71.013202⊠	PORTSMOUTH⊠	NH
00213⊠	43.005895⊠	-71.013202⊠	PORTSMOUTH⊠	NH
00214⊠	43.005895⊠	-71.013202⊠	PORTSMOUTH⊠	NH
00215⊠	43.005895⊠	-71.013202⊠	PORTSMOUTH⊠	NH
00501⊠	40.922326⊠	-72.637078⊠	HOLTSVILLE⊠	NY
00544⊠	40.922326⊠	-72.637078⊠	HOLTSVILLE⊠	NY
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.

min
24.655691

max
48.987385

min
-124.62608

max
-67.040764

latitude (y-axis, ranging from 24 to 49), longitude (x-axis, ranging from -120 to -65)

4

zoom
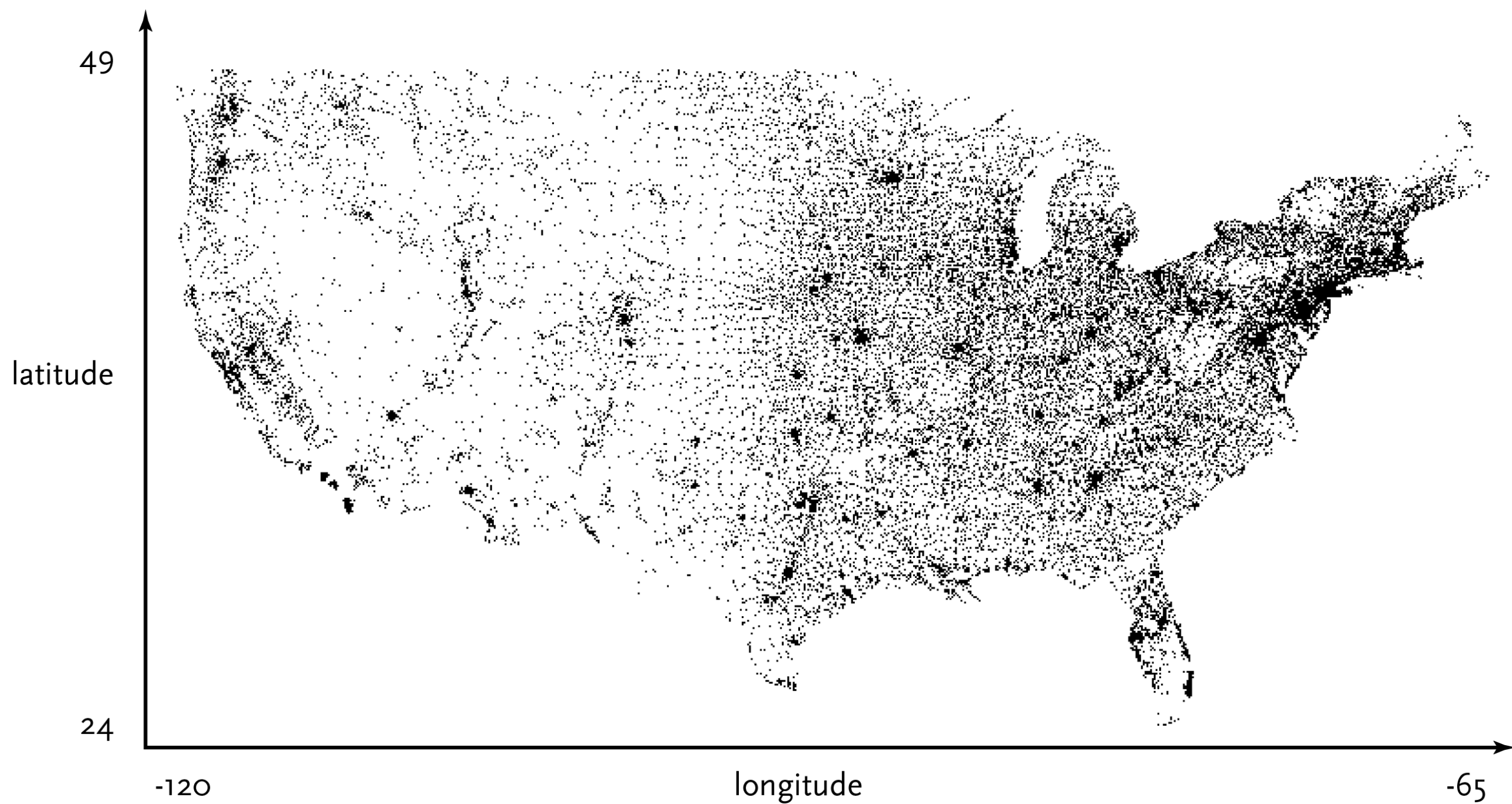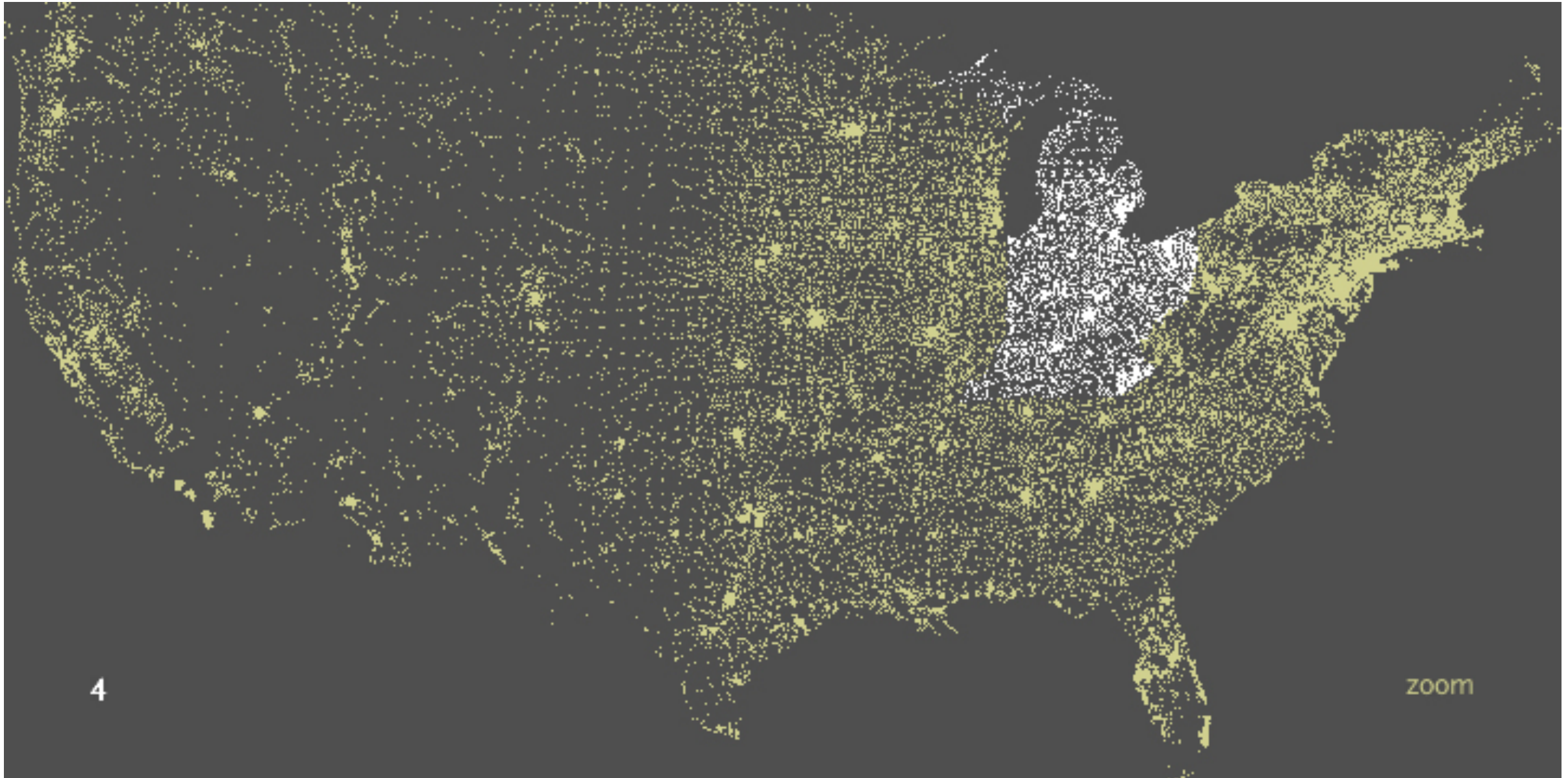
MY FELLOW CITIZENS

George W Bush's speech - Full Text: https://www.theguardian.com/world/2003/mar/18/usa.iraq

view > https://benfry.com/casualties/casualties-02.pdf

Excite Bike, Nintendo Cartridge Game

DISMAP, 2003

Entire code from a Nintendo cartridge game "Excite Bike", and how it operates

```
LC000:
    .DB $46,$C3,$95,$C3
    .DB $9A,$C9,$2C,$CB
    .DB $D0,$C4,$9A,$C9
    .DB $2C,$CB,$65,$C4
    .DB $BD,$C3,$7C,$C9
    .DB $9A,$C9,$2C,$CB
    .DB $3D,$C4,$1C,$C4

LC01C:
    .DB $00,$01,$02,$03
    .DB $04,$02,$03,$04
    .DB $06,$05,$02,$03
    .DB $07,$08

LC02A:
    .DB $3C,$40,$46,$52
    .DB $5C,$64,$70,$7A
    .DB $76

LC033:
    .DB $C0,$C0,$C0,$C0
    .DB $C0,$C0,$C0,$C0
    .DB $C0,$BD,$C2,$14
    .DB $C5,$5E,$C5,$F3
    .DB $C3,$14,$C5,$51
    .DB $C5,$69,$C8,$20
    .DB $C8,$A3,$C5,$66
    .DB $C5,$75,$C8,$5E
    .DB $C5,$6A,$C5,$55
    .DB $70,$C4,$C5,$85
    .DB $C4,$5E,$C5,$71
    .DB $C5,$AC,$C5,$14
    .DB $C5,$51,$C5,$69
    .DB $C8,$20,$C8,$A3
    .DB $C5,$62,$C5,$C2
    .DB $C5,$5E,$C5,$75
    .DB $C5,$14,$C5,$82
    .DB $DD,$18,$C5,$69
    .DB $C8,$86,$C5,$18
    .DB $C5

LC080:
    .DB $80,$90,$A0,$48
    .DB $60,$78,$90,$A8
    .DB $50,$48,$4C,$30
    .DB $48,$78,$90,$A8
    .DB $C0

LC091:
    .DB $01,$10,$00,$01
    .DB $10,$00,$01,$10
    .DB $00,$01,$0C,$00
    .DB $01,$06,$00,$00
    .DB $01,$18,$00,$01
    .DB $16,$00,$01,$0A
    .DB $00,$01,$14,$00
    .DB $01,$06,$00,$09
    .DB $0B,$0D,$0F,$0E
    .DB $1A,$26,$32,$38
    .DB $48,$58,$68,$18
    .DB $3F,$28,$20,$28
    .DB $38,$0C,$00,$3C
    .DB $1C,$C0,$7F,$06
    .DB $02,$0A,$0B,$01
    .DB $B0

LC0CE:
    .DB $20,$40,$7F,$03
    .DB $03,$01,$06,$04
    .DB $40,$58,$48,$48
    .DB $78,$70,$80,$B0
    .DB $37,$3F,$3F,$47
    .DB $B7,$B9,$B9,$01
    .DB $01,$41,$04,$0C
    .DB $14,$1C,$21,$F2
    .DB $23,$43,$22,$32
    .DB $22,$8C,$24,$CF

LC0F6:
    .DB $01,$70,$4B,$D4
    .DB $17,$4A,$3A,$9E
    .DB $B4,$96,$C8,$DE
    .DB $EF,$05,$24,$FA
    .DB $23,$14,$D6,$E9
    .DB $FC,$0F,$22,$35
    .DB $50,$31,$A1

LC111:
    .DB $03,$D4,$D6,$D6
    .DB $D7,$D8,$D6,$D5
    .DB $D5,$D7,$D5,$D5
    .DB $D5,$D6,$D5,$D7
    .DB $D6,$D6,$D3,$D3
    .DB $D3,$D4,$D4,$D4
    .DB $D4,$D6,$D0,$3B
    .DB $77,$A4,$6B,$CB
    .DB $CB,$CB,$CC,$D0
    .DB $FC,$FC,$FC,$79
    .DB $04,$72,$22,$04
    .DB $21,$6F,$01,$00
    .DB $00,$60,$9F,$00
    .DB $17,$04,$DE,$DC
```

```
LC66E:
    JSR LC653
    LDX #$08
LC673:
    STA $00
    CLC
    ADC $00
    BCS LC681
    JSR LC64E
LC67D:
    DEX
    BNE LC673
    RTS

LC681:
    JSR LC653
    JSR LC68A
    JMP LC67D
LC68A:
    INC $08
    BNE LC690
    INC $09
LC690:
    RTS

LC691:
    JSR LC639
    LDA #$4E
    STA $01
LC698:
    DEC $01
    BNE LC698
    JSR LC62D
    LDA $4016
    AND #$02
    RTS

LC6A5:
    LDA #$08
    STA $03
    LDA #$00
    STA $04
LC6AD:
    LDA $04
    CLC
    ADC $04
    STA $04
    JSR LC691
    BNE LC6BE
    JSR LC68A
    INC $04
LC6BE:
    DEC $03
    BNE LC6AD
    JSR LC639
    LDA $04
    RTS

LC6C8:
    JSR LC716
    JSR LC6D1
    JSR LC726
LC6D1:
    LDA #$20
    STA $0A
    LDA #$4E
    STA $0B
LC6D9:
    JSR LC64E
    DEC $0A
    BNE LC6D9
    DEC $0B
    BNE LC6D9
LC6E4:
    JSR LC653
    DEC $05
    BNE LC6E4
LC6EB:
    JSR LC64E
    DEC $06
    BNE LC6EB
    JSR LC653
    LDA #$00
    STA $08
    STA $09
    LDY #$00
LC6FD:
    LDA ($0E),Y
    JSR LC66E
    INY
    CPY $0D
    BNE LC6FD
    LDA $09
    PHA
    LDA $08
    JSR LC66E
    PLA
    JSR LC66E
    JMP LC653
```

```
    .DB $0A,$B0,$02,$E6
    .DB $00,$20,$EE,$CD
    .DB $F0,$04,$B5,$94
    .DB $D0,$25,$A4,$00
    .DB $8A,$D0,$12,$B5
    .DB $94,$D9,$D1,$C0
    .DB $90,$0B,$D0,$16
    .DB $B5,$90,$D9,$CE
    .DB $C0,$F0,$13,$B0
    .DB $0D,$20,$29,$CE
    .DB $4C,$BD,$CD,$A0
    .DB $04,$A5,$0A,$F0
    .DB $02,$A8,$C8,$20
    .DB $58,$CE,$B5,$98
    .DB $D0,$5B,$B5,$B0
    .DB $D0,$10,$B5,$58
    .DB $05,$52,$D0,$13
    .DB $B5,$94,$D0,$06
    .DB $B5,$90,$C9,$A0
    .DB $90,$09,$A5,$0A
    .DB $F0,$05,$85,$00
    .DB $4C,$83,$CE,$B5
    .DB $B0,$D0,$3A,$BD
    .DB $68,$03,$D5,$AC
    .DB $F0,$33,$A0,$05
    .DB $4C,$C7,$DC,$B5
    .DB $C0,$C9,$E4,$F0
    .DB $16,$A9,$03,$D5
    .DB $A4,$D0,$06,$B5
    .DB $70,$C9,$03,$B0
    .DB $0A,$B5,$B8,$C9
    .DB $38,$B0,$04,$A9
    .DB $08,$B0,$13,$A9
    .DB $01,$DD,$6C,$03
    .DB $F0,$04,$0A,$9D
    .DB $6C,$03,$8A,$D0
    .DB $10,$A9,$04,$85
    .DB $FD,$60,$A9,$01
    .DB $DD,$6C,$03,$F0
    .DB $84,$03,$60,$A5
    .DB $04,$4A,$9D,$6C
    .DB $03,$60,$E4,$4C
    .DB $D0,$18,$B9,$BC
    .DB $C0,$18,$75,$90
    .DB $95,$90,$90,$02
    .DB $F6,$94,$8A,$D0
    .DB $D1,$C0,$F0,$03
    .DB $B0,$08,$60,$B5
    .DB $90,$D9,$CE,$C0
    .DB $90,$F8,$B9,$CE
    .DB $C0,$95,$90,$B9
    .DB $D1,$C0,$95,$94
    .DB $60,$E4,$4C,$D0
    .DB $26,$84,$00,$B5
    .DB $94,$D0,$0B,$B5
    .DB $B0,$4A,$A8,$B5
    .DB $90,$D9,$CC,$C0
    .DB $90,$15,$A4,$00
    .DB $B5,$90,$38,$F9
    .DB $C1,$C0,$95,$90
    .DB $B0,$09,$B5,$94
    .DB $F0,$03,$D6,$94
    .DB $60,$95,$90,$60
    .DB $B5,$26,$D0,$18
    .DB $B5,$B0,$4A,$A8
    .DB $B9,$D4,$C0,$95
    .DB $26,$46,$00,$90
    .DB $0C,$B5,$AC,$D9
    .DB $C8,$C0,$F0,$04
    .DB $90,$12,$D6,$AC
    .DB $60,$BD,$88,$03
    .DB $29,$02,$9D,$88
    .DB $03,$B5,$AC,$D9
    .DB $CA,$C0,$B0,$03
    .DB $F6,$AC,$60,$B5
    .DB $5C,$29,$C0,$F0
    .DB $17,$B5,$B0,$D0
    .DB $13,$F6,$AC,$A9
    .DB $0D,$95,$26,$B5
    .DB $AC,$C9,$0D,$90
    .DB $07,$A9,$01,$95
    .DB $98,$0A,$95,$26
    .DB $60,$A6,$4A,$86
    .DB $0F,$B5,$A8,$F0
    .DB $2C,$B5,$98,$15
    .DB $9C,$D0,$26,$20
    .DB $EA,$CF,$B5,$B0
    .DB $D0,$1A,$20,$CB
    .DB $CF,$20,$18,$D0
    .DB $D0,$17,$AD,$A6
    .DB $03,$F0,$12,$20
    .DB $00,$D0,$A5,$52
    .DB $D0,$0B,$20,$0C
    .DB $CF,$4C,$04,$CF
    .DB $BD,$68,$03,$95
    .DB $7C,$A6,$0F,$E8
    .DB $E0,$04,$90,$C7
    .DB $60,$B5,$A4,$B5
    .DB $90,$70,$04,$A9
    .DB $85,$02,$A0,$02
    .DB $20,$96,$CF,$90
    .DB $0F,$20,$BB,$CF
    .DB $B5,$80,$0A,$90
```

```
    LDA $10
    ORA #$04
    BCS LD39D
    AND #$FB
LD39D:
    JSR LC333
    PLA
    ASL
    BCC LD3A7
    ORA #$02
    INY
LD3A7:
    LSR
    LSR
    TAX
LD3AA:
    BCS LD3AD
    INY
LD3AD:
    LDA ($00),Y
    STA $2007
    DEX
    BNE LD3AA
    SEC
    TYA
    ADC $00
    STA $00
    LDA #$00
    ADC $01
    STA $01
LD3C1:
    LDX $2002
    LDY #$00
    LDA ($00),Y
    BNE LD387
    LDA $2002
    LDA #$00
    STA $2005
    STA $2005
    RTS

LD3D6:
    .DB $3F,$00,$08,$29
    .DB $27,$22,$30,$29
    .DB $27,$18,$36,$3F
    .DB $10,$04,$29,$20
    .DB $16,$0F,$00,$3F
    .DB $00,$00,$01,$1A
    .DB $26,$33,$01,$11
    .DB $0C,$C2,$C3F,$10
    .DB $04,$01,$20,$16
    .DB $0F,$00,$03,$F,$00
    .DB $08,$02,$26,$1C
    .DB $30,$02,$29,$19
    .DB $39,$3F,$10,$04
    .DB $02,$20,$16,$0F
    .DB $00,$26,$22,$30
    .DB $00,$27,$18,$37
    .DB $3F,$10,$04,$00
    .DB $20,$16,$0F,$00
    .DB $3F,$00,$08,$02
    .DB $19,$22,$30,$02
    .DB $00,$2D,$10,$3F
    .DB $10,$04,$02,$00
    .DB $16,$0F,$00,$3F
    .DB $08,$08,$29,$22
    .DB $29,$B5,$B0,$15
    .DB $0C,$29,$13,$20
    .DB $0F,$29,$31,$1C
    .DB $0F,$29,$20,$19
    .DB $0F,$00,$3F,$00
    .DB $1C,$02,$0F,$30
    .DB $21,$02,$15,$02
    .DB $2A,$02,$3C,$02
    .DB $30,$02,$30,$02
    .DB $27,$02,$20,$16
    .DB $0F,$02,$27,$13
    .DB $3C,$02,$27,$16
    .DB $30,$00,$23,$D0
    .DB $60,$55,$23,$F0
    .DB $50,$AA,$27,$D0
    .DB $60,$55,$27,$20
    .DB $50,$AA,$20,$00
    .DB $60,$3F,$20,$20
    .DB $60,$3E,$20,$40
    .DB $60,$3F,$20,$60
    .DB $60,$3E,$20,$80
    .DB $60,$3F,$24,$00
    .DB $60,$3E,$24,$40
    .DB $60,$3F,$24,$60
    .DB $60,$3E,$24,$80
    .DB $60,$3F,$20,$A0
    .DB $60,$3E,$20,$C0
    .DB $60,$55,$23,$F0
    .DB $60,$30,$20,$C0
    .DB $60,$FE,$24,$E0
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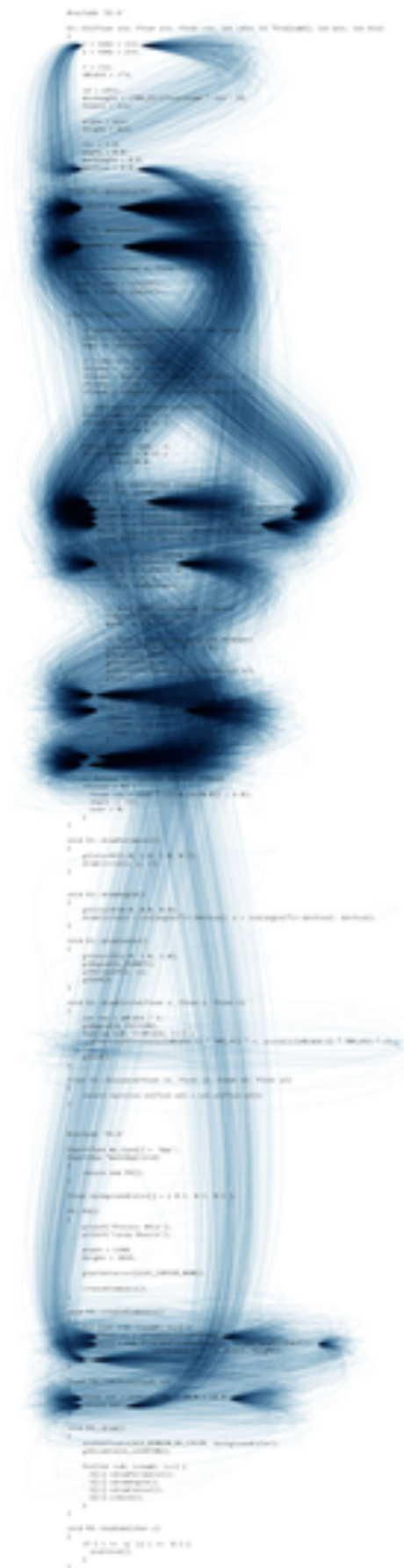
https://benfry.com/phd/dissertation/7.html

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    .DB $9D,$8C,$03,$B5
    .DB $8C,$85,$01,$20
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    .DB $B5,$CC,$D0,$05
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    .DB $03,$60,$A9,$02
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    .DB $90,$18,$69,$AF
    .DB $9D,$78,$03,$B5
    .DB $94,$69,$00,$9D
    .DB $7C,$03,$BD,$88
    .DB $03,$C9,$02,$D0
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    .DB $7E,$78,$03,$8A
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    .DB $0A,$0A,$0A,$0A
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    .DB $A9,$08,$85,$FF
    .DB $60,$B5,$B0,$03
    .DB $7D,$8C,$03,$9D
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    .DB $FD,$7C,$03,$85
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    .DB $F0,$F8,$A5,$5C
    .DB $C9,$08,$F0,$25
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    .DB $A5,$B8,$CD,$C4
    .DB $D8,$D0,$01,$CA
    .DB $86,$DC,$4C,$0D
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    .DB $D0,$12,$8D,$A9
    .DB $03,$85,$FC,$A5
    .DB $01,$85,$FD,$A5
    .DB $1B,$29,$03,$A8
    .DB $98,$9D,$E4,$03
    .DB $A5,$4C,$4A,$A5
    .DB $36,$B5,$94,$D0
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    .DB $29,$C0,$F0,$04
    .DB $A9,$01,$85,$FE
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    .DB $A0,$F2,$C9,$08
    .DB $B0,$02,$A0,$F4
    .DB $C9,$72,$D0,$04
    .DB $A9,$20,$85,$FB
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    .DB $AA,$B9,$E7,$D8
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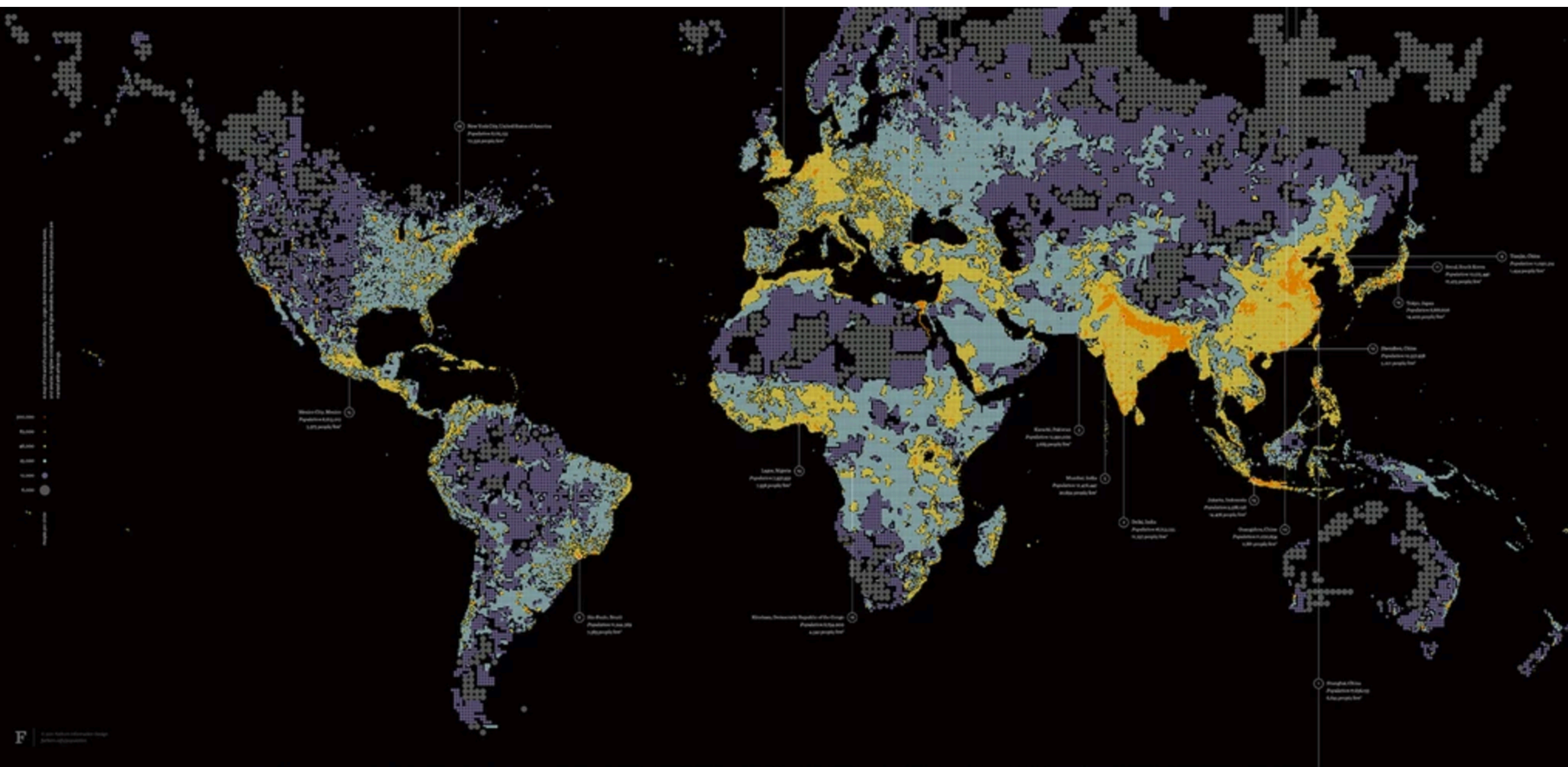
VALENCE, 1999, 2002 ->

PROJECTS BY

FATHOM
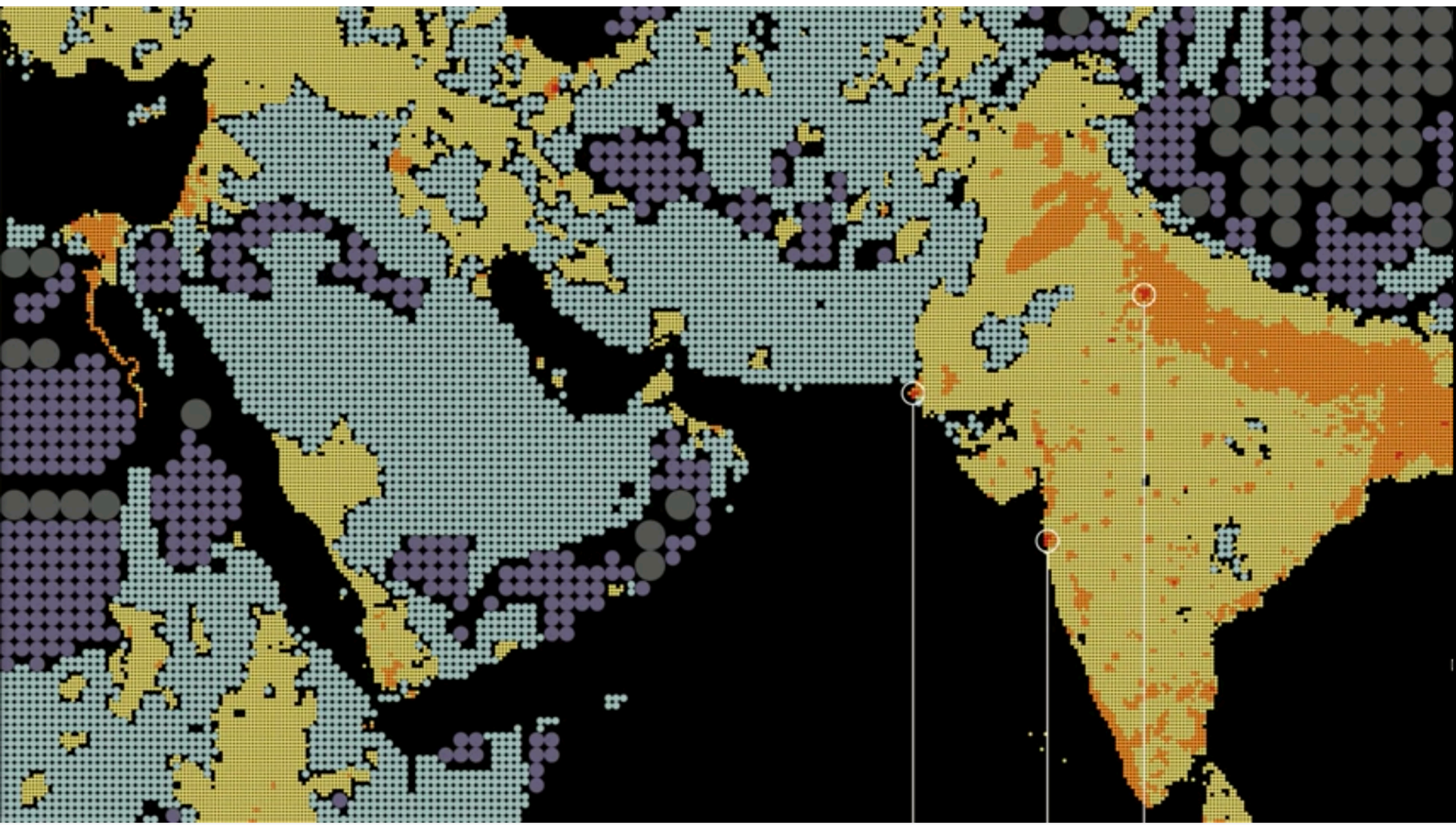
Information Design
Since 2010
Boson, MA

DENCITY, 2011–2012

A map of global population density, Poster, https://fathom.info/notebook/1981/

New York City, United States of America
Population 8,175,133
10,356 people/km²

Mexico City, Mexico
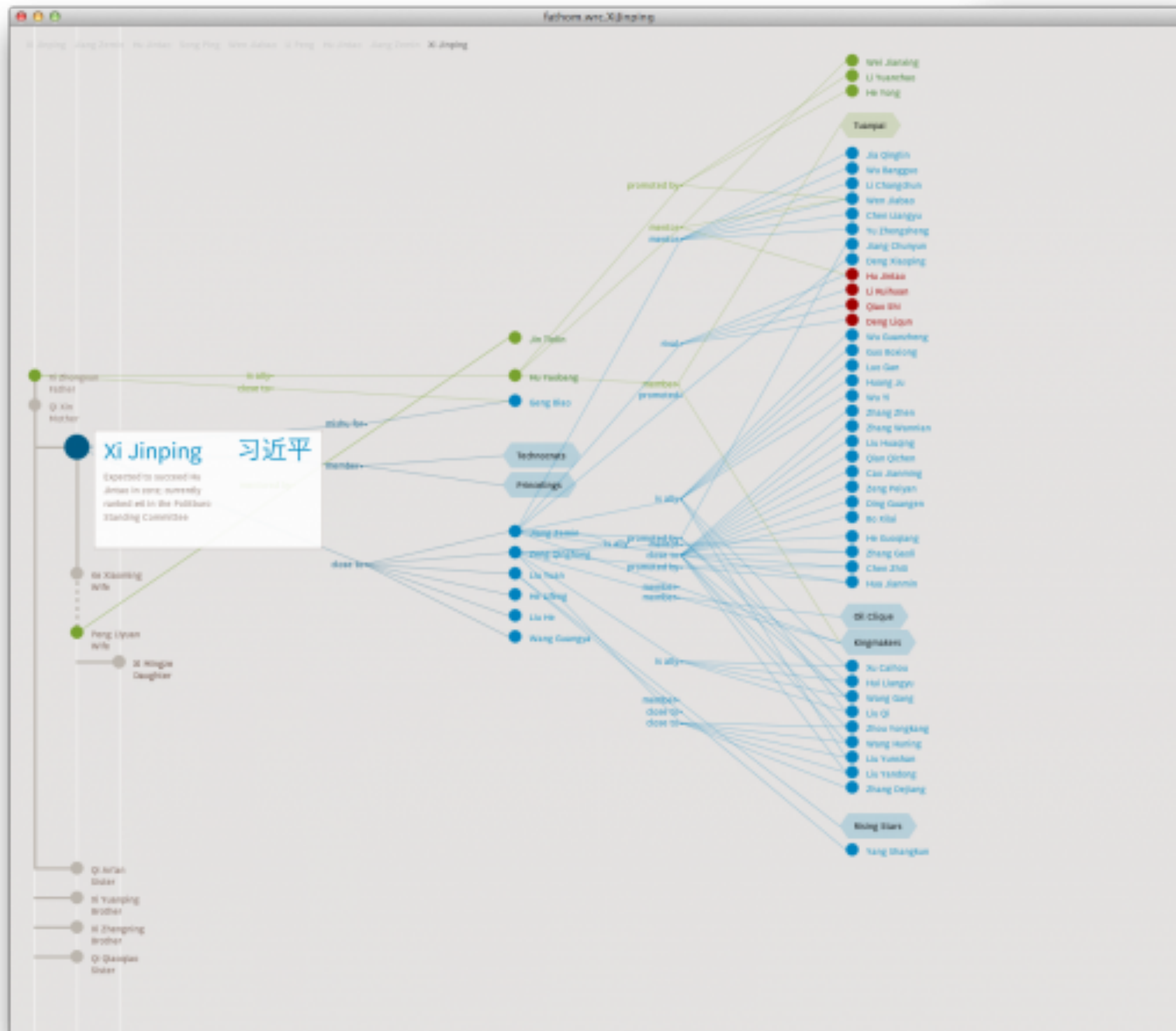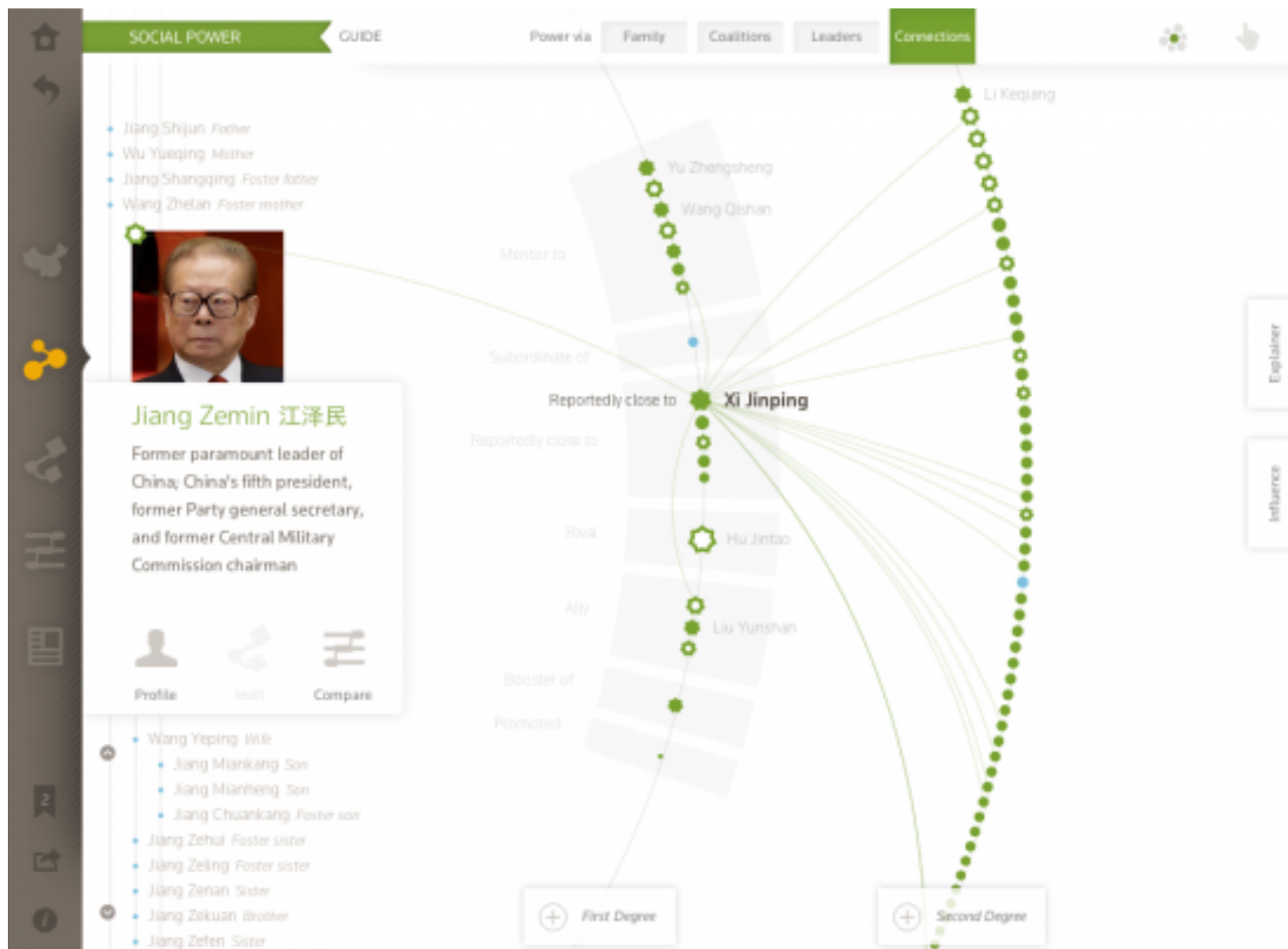*Population 8,873,017*
5,973 people/km²
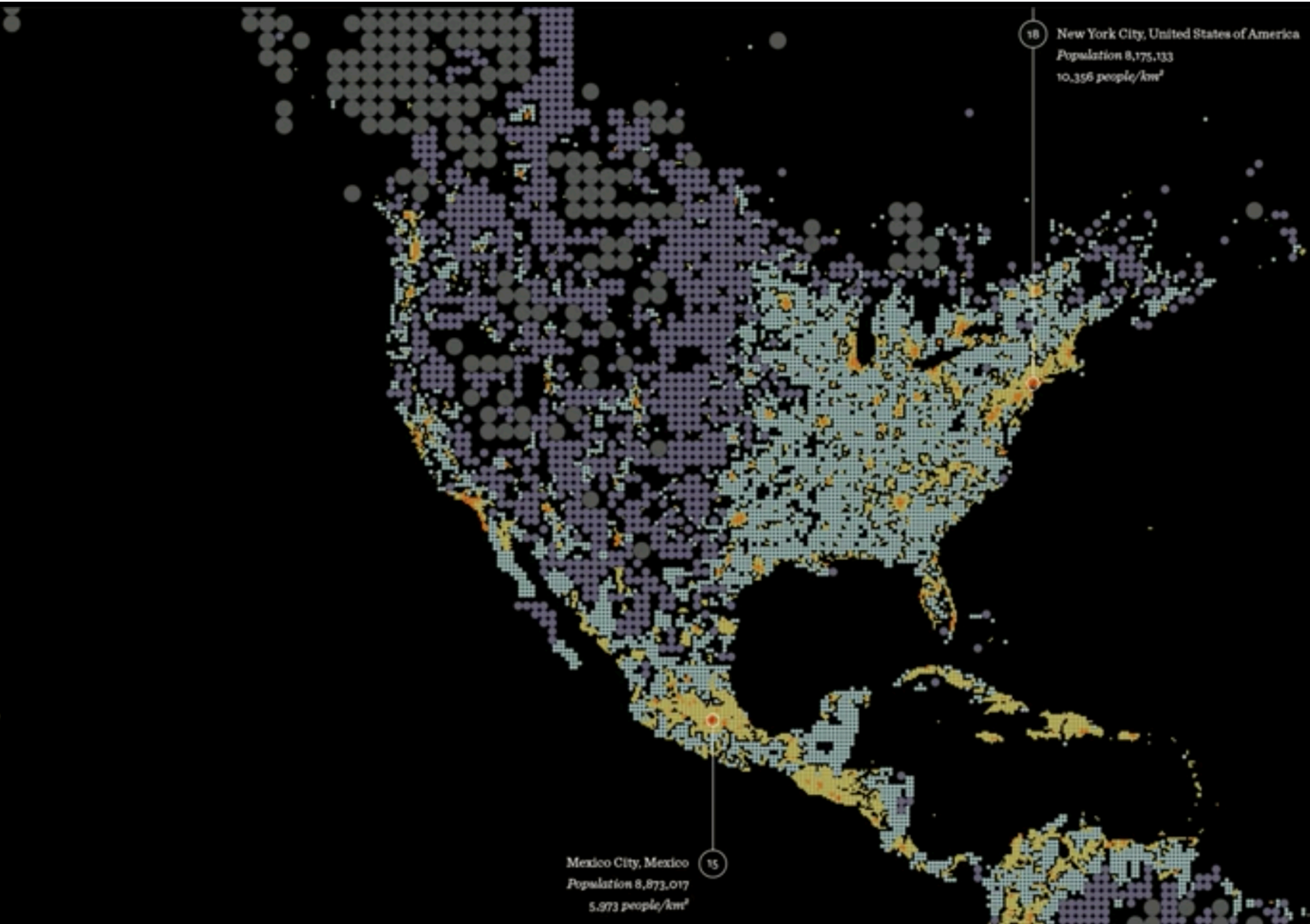
CONNECTED CHINA, 2013

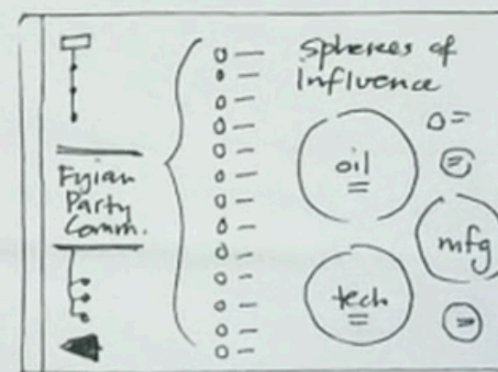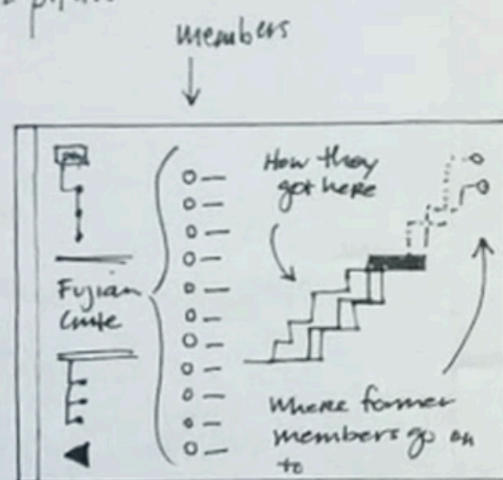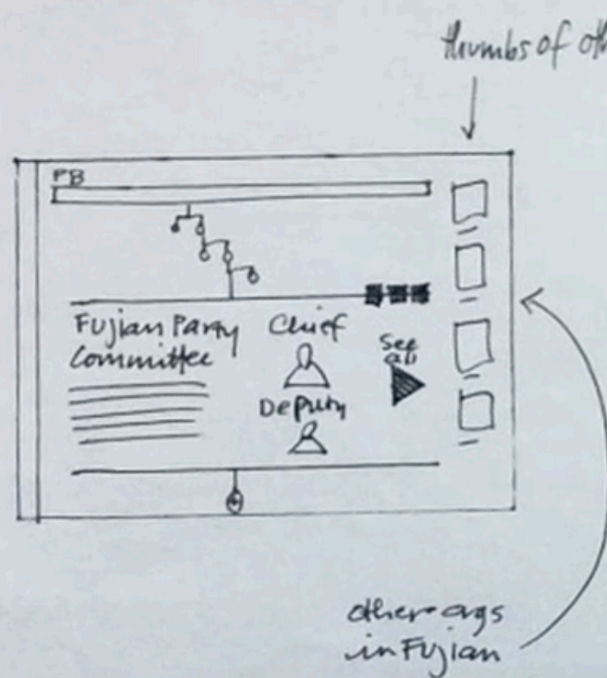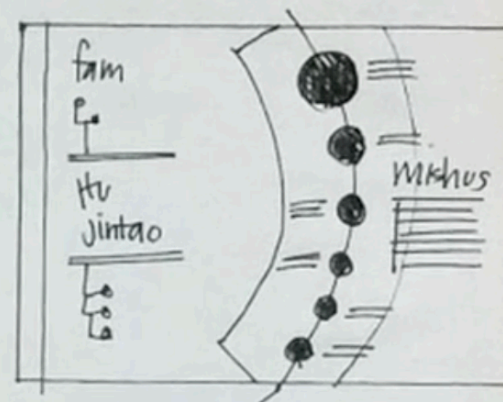Tens of thousands of entities... 30,000 relationships... 1.5 million words

30 nodes
29 edges

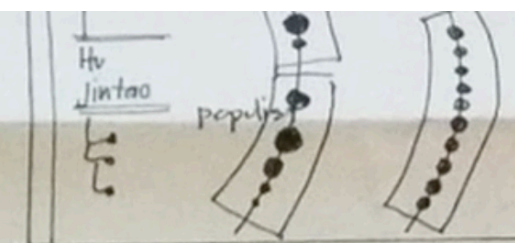Final version. https://fathom.info/notebook/3871/

view > http://china.fathom.info/
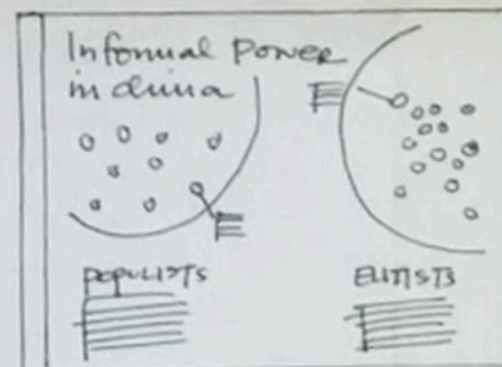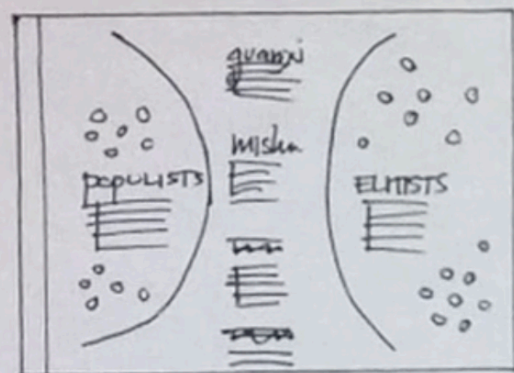
Factions. Social/Informal power
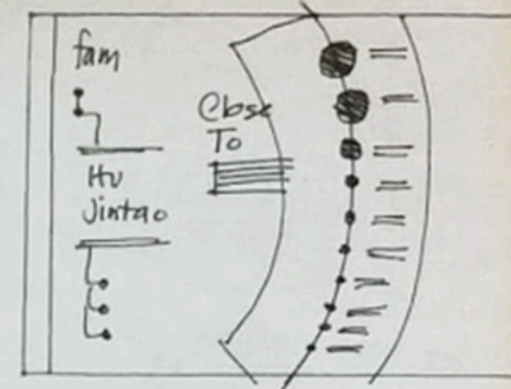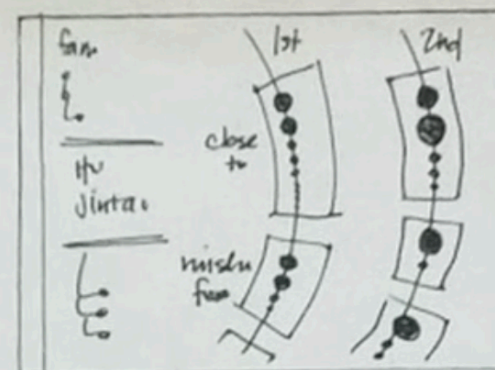
CONSIDER

WAYS TO OVERVIEW A LARGE SET OF DATA

CONDENSE

PUTTING THE DATA INTO A SPACE THAT IS MUCH MORE MANAGEABLE THAT YOU CAN ACTUALLY EXPLORE.

CONCEIVE

EXPLORING TO NAVIGATE INFORMATION IN A WAY THAT IS MORE EFFECTIVE.

Ben Fry at State Street LIVE, https://vimeo.com/287668907

ALL WE REALLY NEED IS SOMETHING TO BE ENTHUSIASTIC ABOUT

THANK YOU!

Inhye Lee