Citizen Science Games

Education

[foam]

Appropriate Technology

Research in the Arts

Weaving codes/coding weaves

Alex McLean: University of Leeds

Ellen Harlizius-Klück: Danish Centre for Textile Research Copenhagen

Dave Griffiths/Francesca Sargent: Foam Kernow

Emma Cocker: Nottingham Trent University

Leslie Downs (Advisor on textile innovation)

2

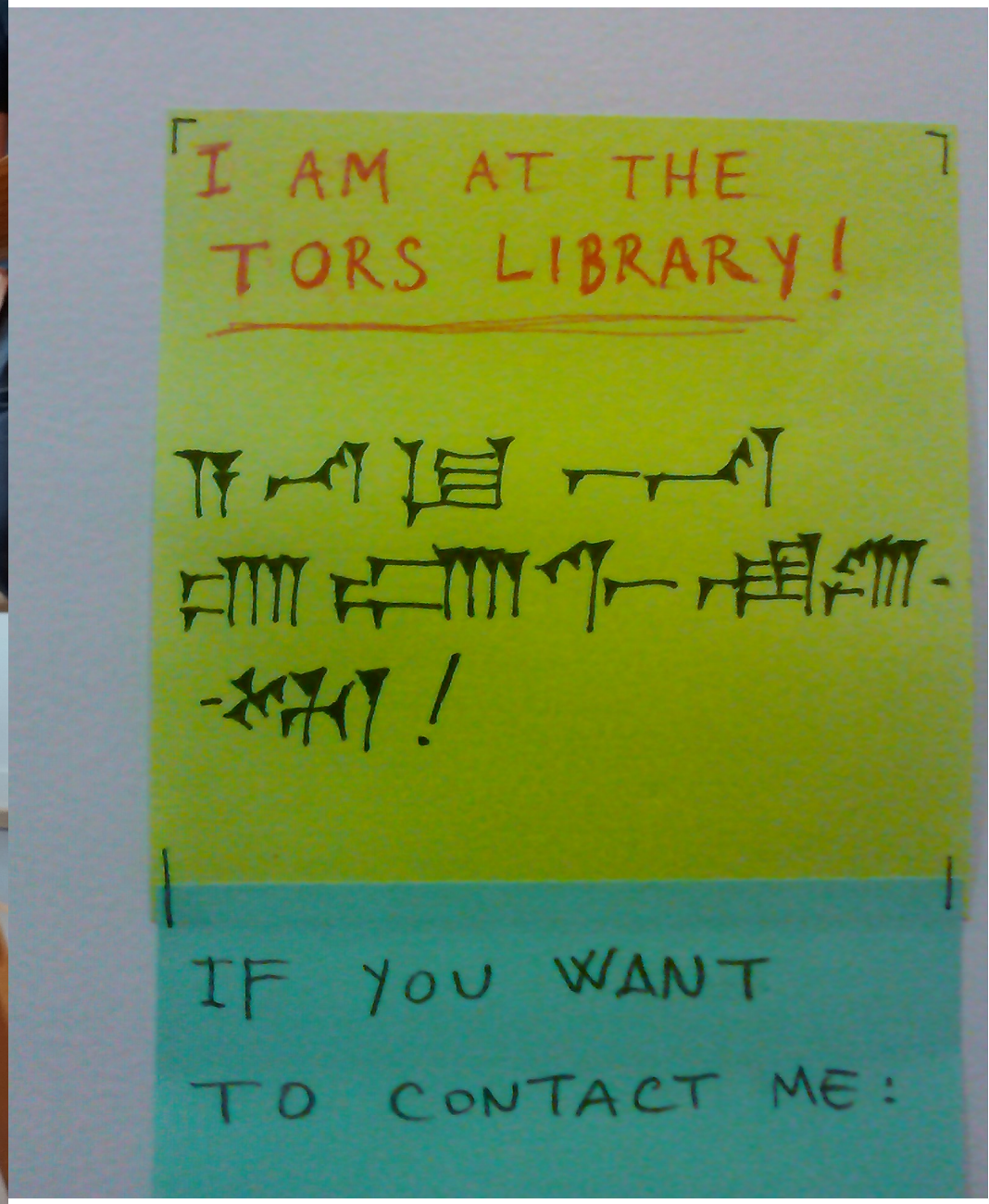
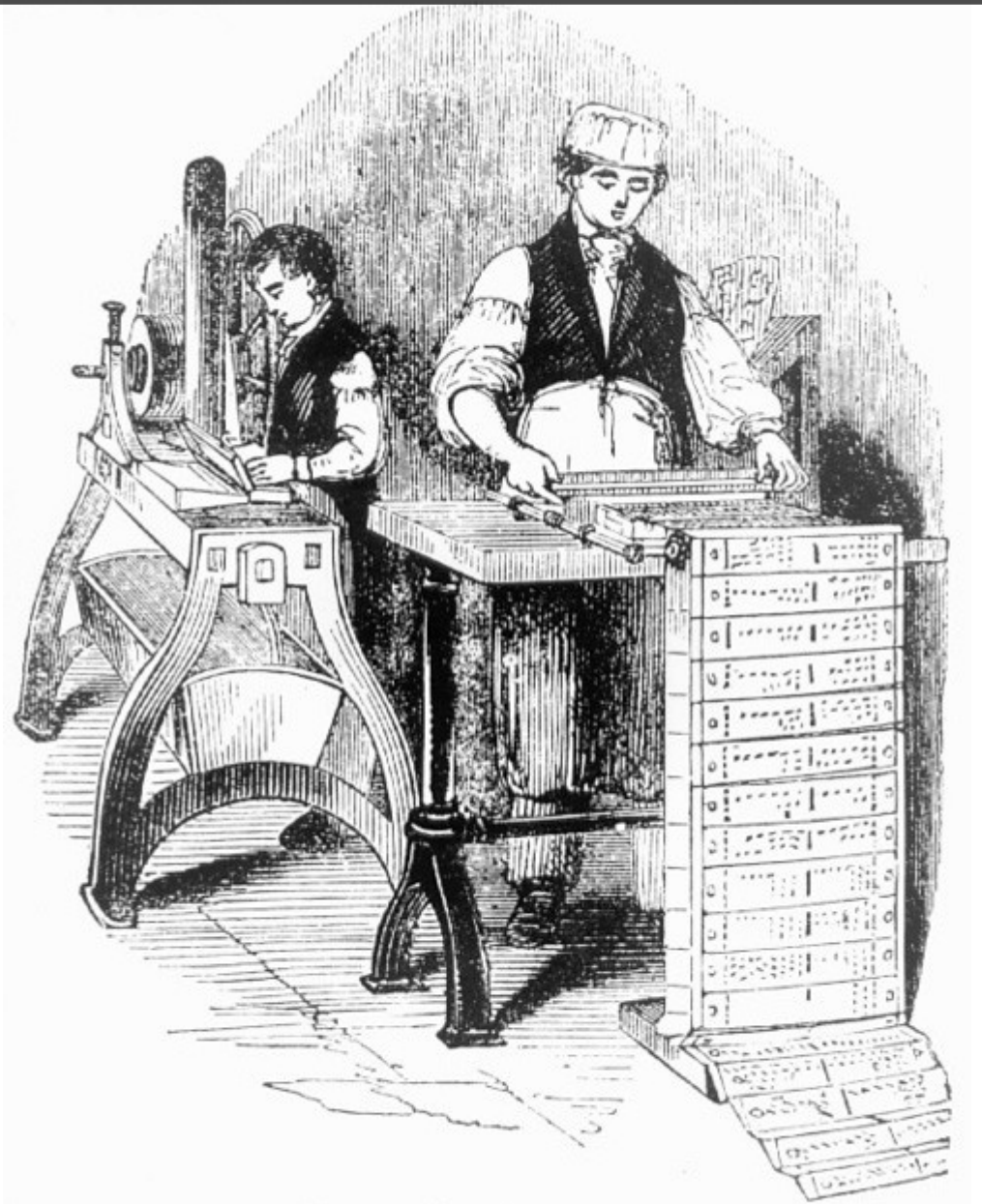


Plate from Cyprus with depiction of a warp-weighted loom, ca. 850-750 BCE, Antikensammlungen der Universität Bonn

4

Pattern making: computation's hidden histories

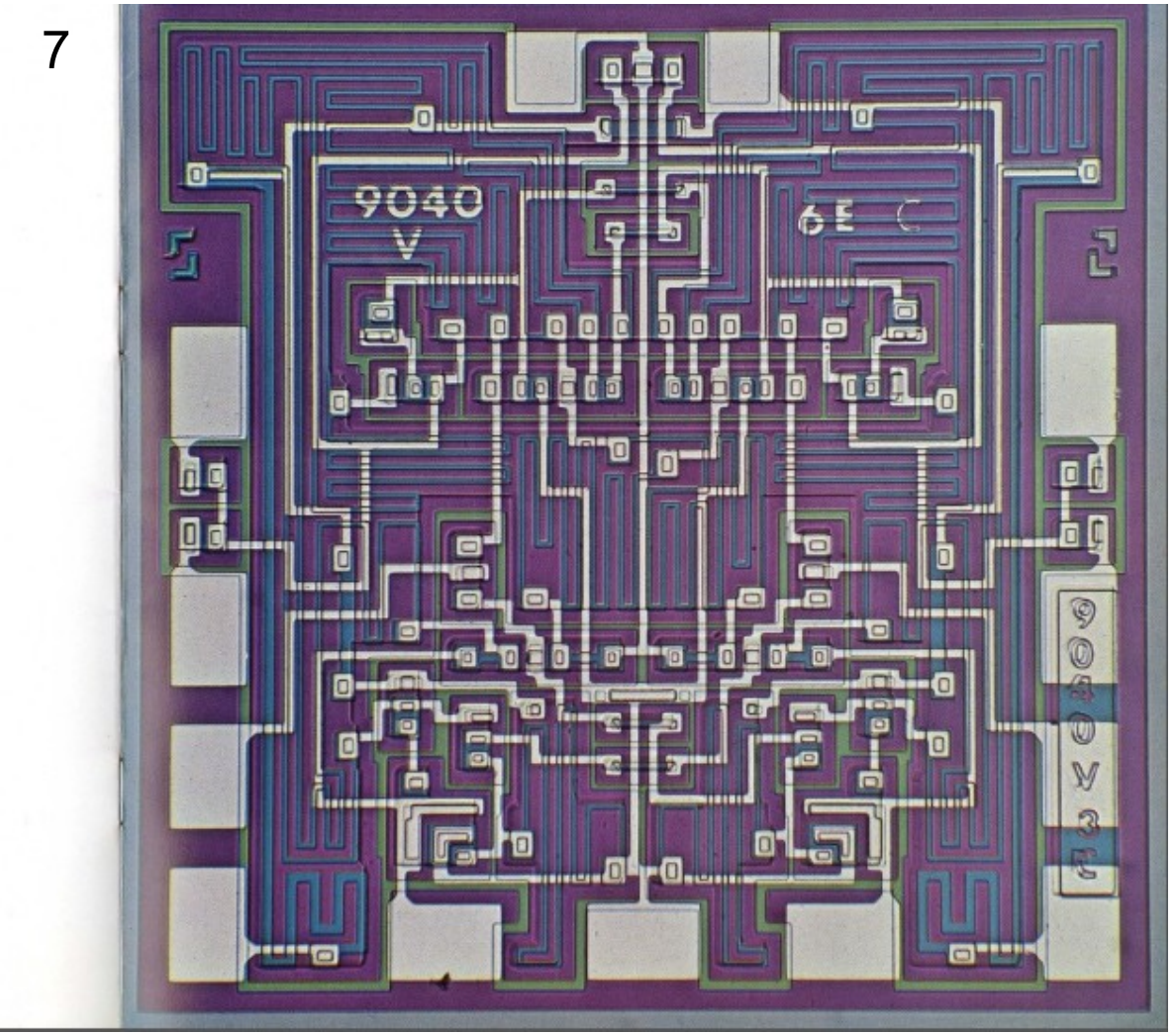


[Jacquard-card Making.]

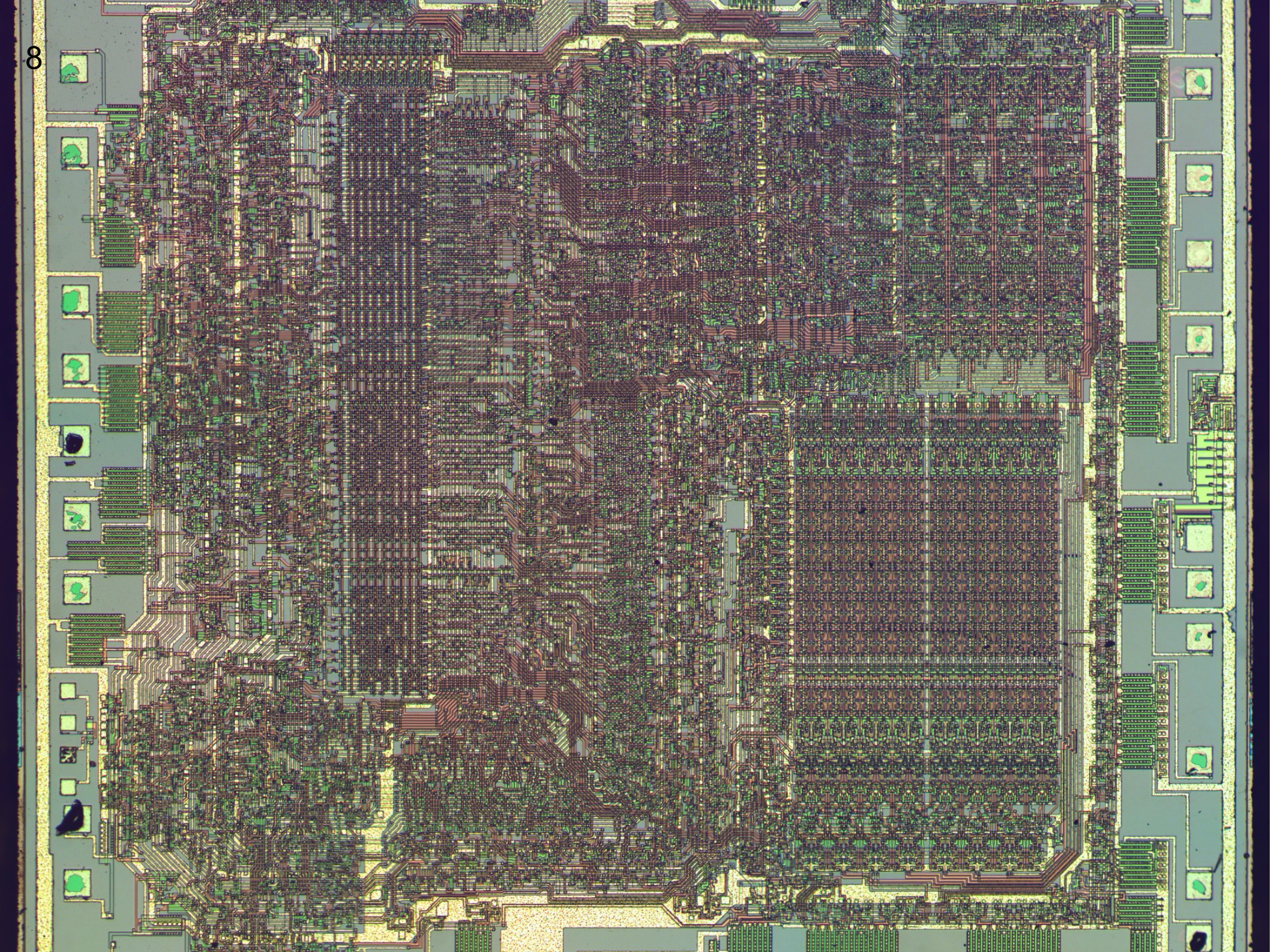
Lisa Nakamura: Indigenous circuits

"from 1965-1975 the Fairchild Corporation's Semiconductor Division operated a large integrated circuit manufacturing plant in Shiprock, New Mexico, on a Navajo reservation.

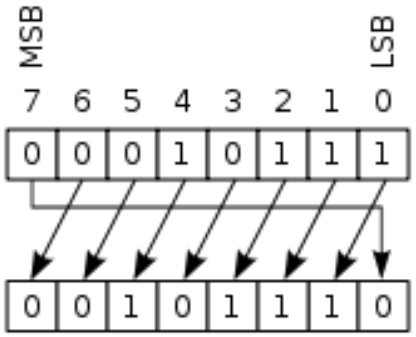
During this time the corporation was the largest private employer of Indian workers in the U.S. The circuits that the almost entirely female Navajo workers produced were used in devices such as calculators, missile guidance systems, and other early computing devices."

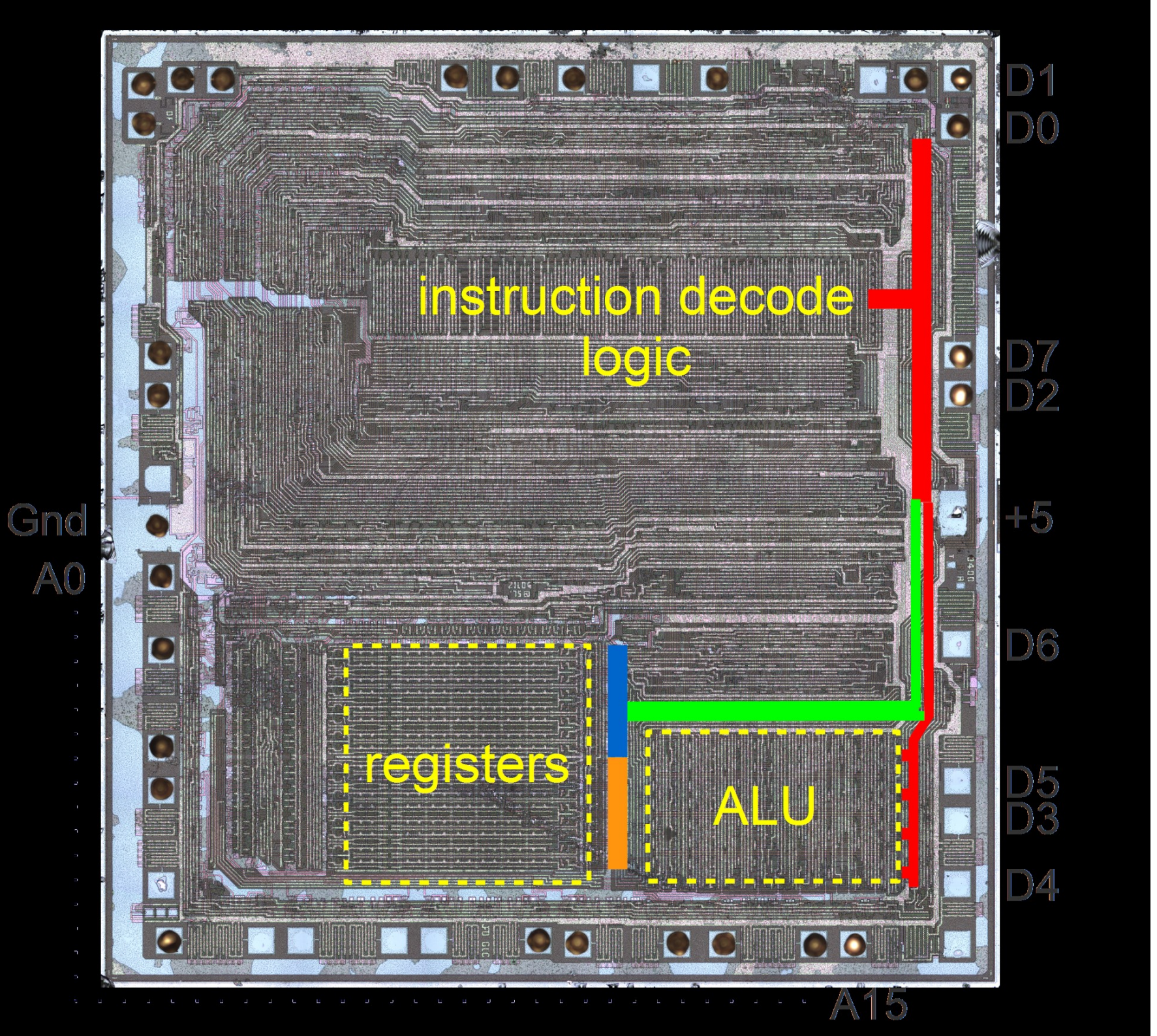


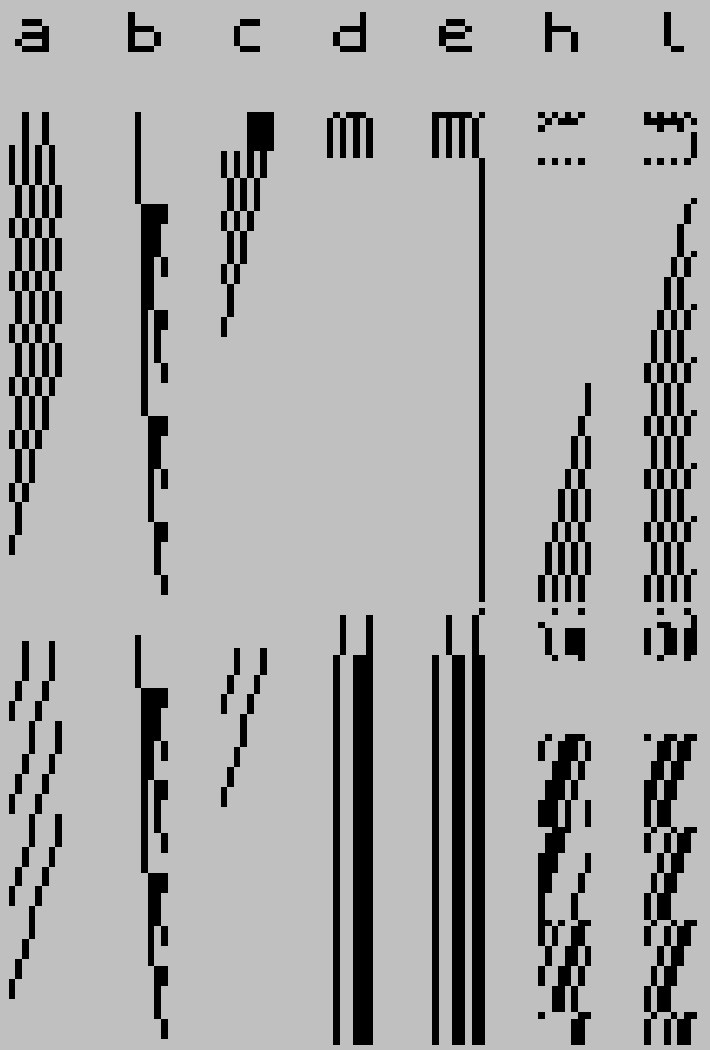
“Weaving, like all Navajo arts, is done with unique imagination and craftsmanship, and it has been done that way for centuries….[for] “building electronic devices, transistors and integrated circuits, also requires this same personal commitment to perfection.” - Fairchild catalogue



7 instructions for arithmetic (add, sub, inc, dec, compare)
vs
13 instructions for shifting/rotating data



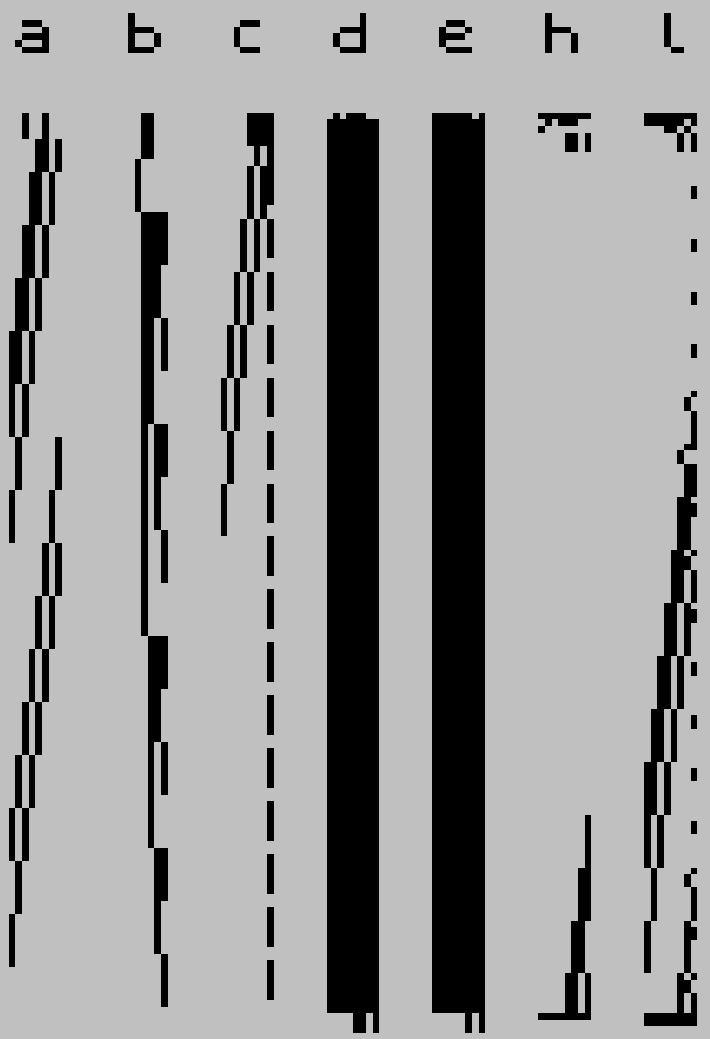

instruction decode logic
registers
ALU
D1
D0
D7
D2
+5
D6
D5
D3
D4
Gnd
A0
A15




```
MUL16  1*43690

MUL16  20123*8738

0  OK,  30:1
```



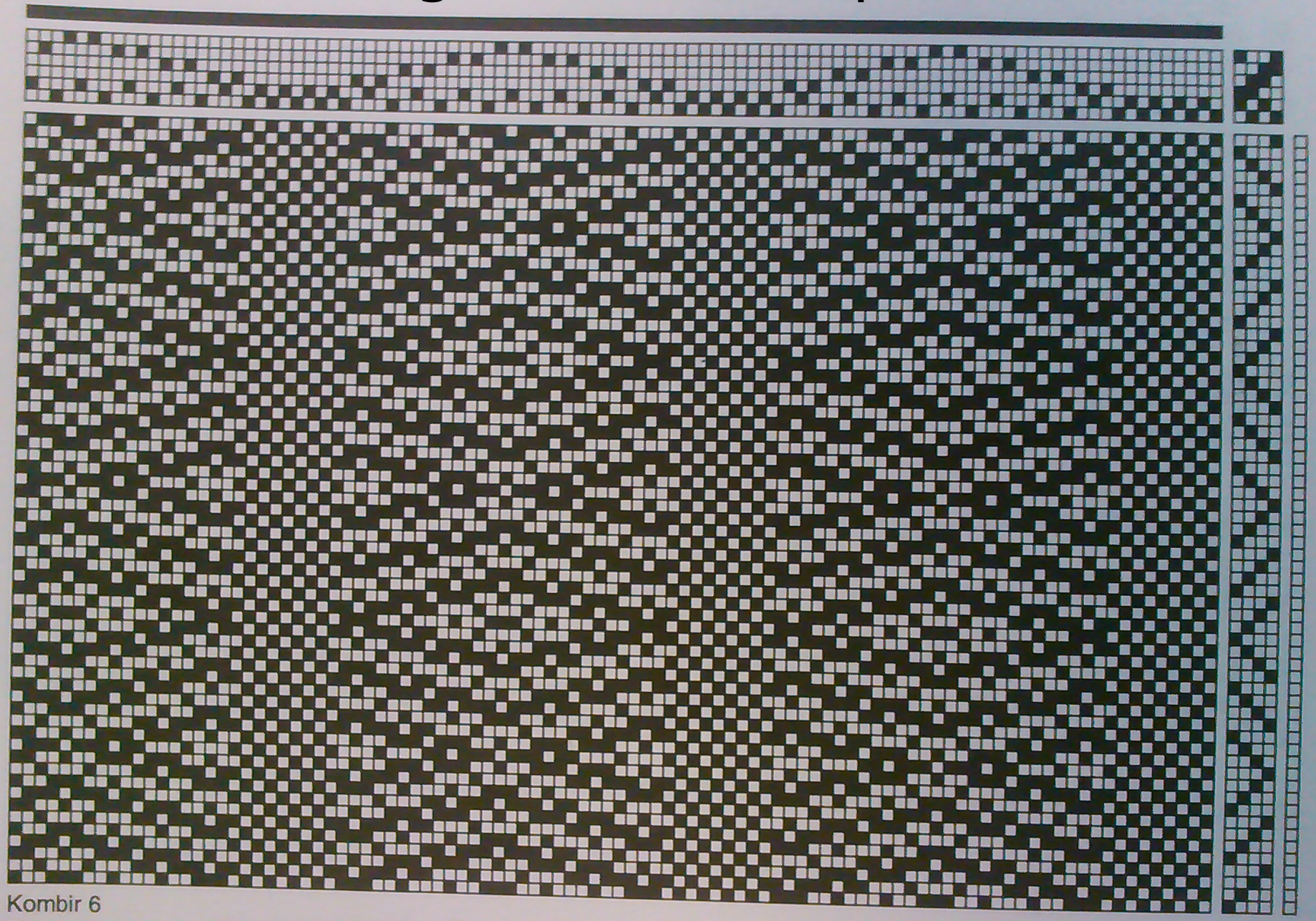
DIV16 65535/3333

0 OK, 30:1

```
DIV16 65535/65535

0 OK, 30:1
```

is weaving a form of computation?



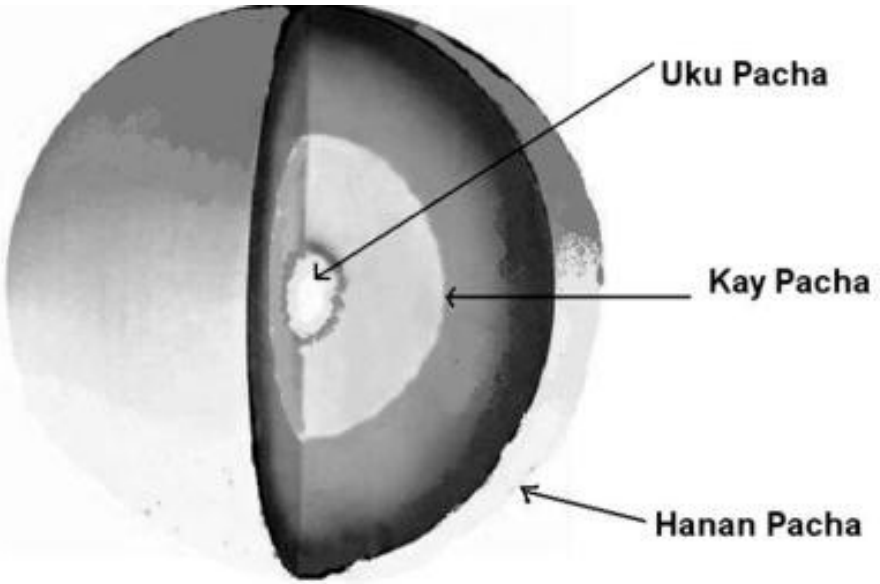
Kombir 6
Fig. 4-10

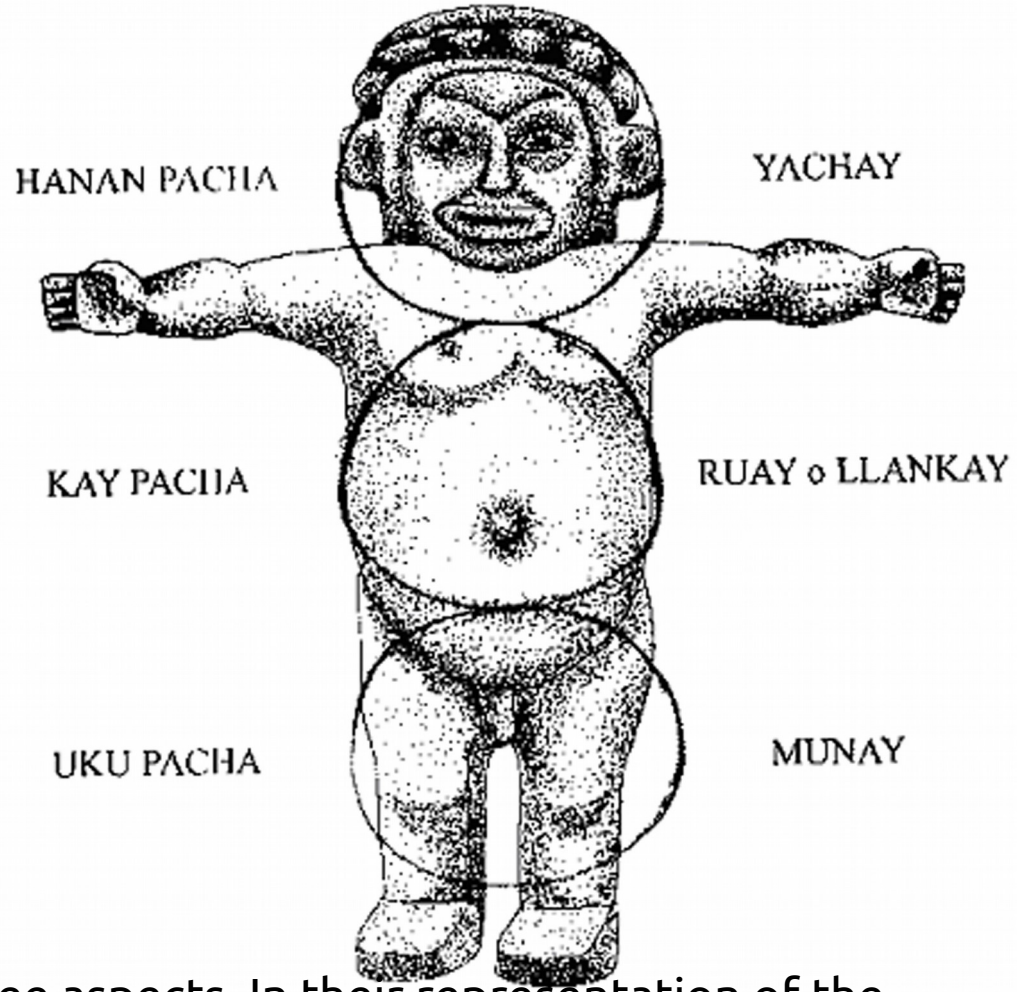
Decoding Inca Quipu with sound

Largest empire ever seen in the Americas
and the largest in the world at that time.

Moray: An agricultural Laboratory

By using their knowledge of the sun, wind, altitude, and irrigation, each step, about 3m/10ft tall, represents a temperature change of about 0.5 degrees Celcius/1 degree Fahrenheit.





They conceived the world as composed of three aspects. In their representation of the cosmos, for example they used the three words:

UKU PACHA (the past and the interior world),
KAY PACHA (the world of present and of here),
HANAN PACHA (the future and the supra world).

These worlds are represented as concentric circles. Each of these worlds are inhabited by spiritual beings. Once future, present and past are not conceived as a linear structure, human beings can access the three dimensions.

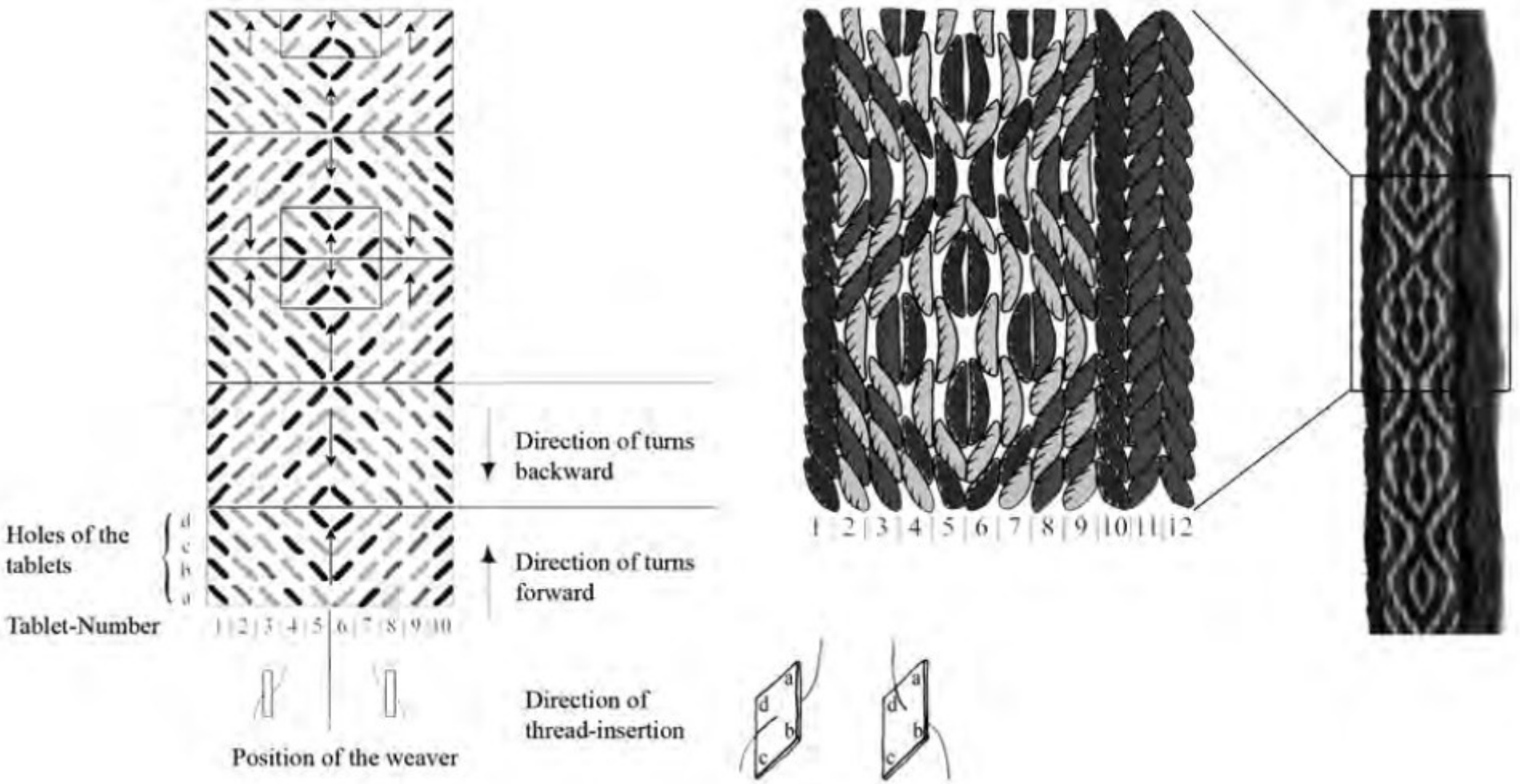
For the Aymara people living in the Andes, the past lies ahead and the future lies behind.

Sonification parameters

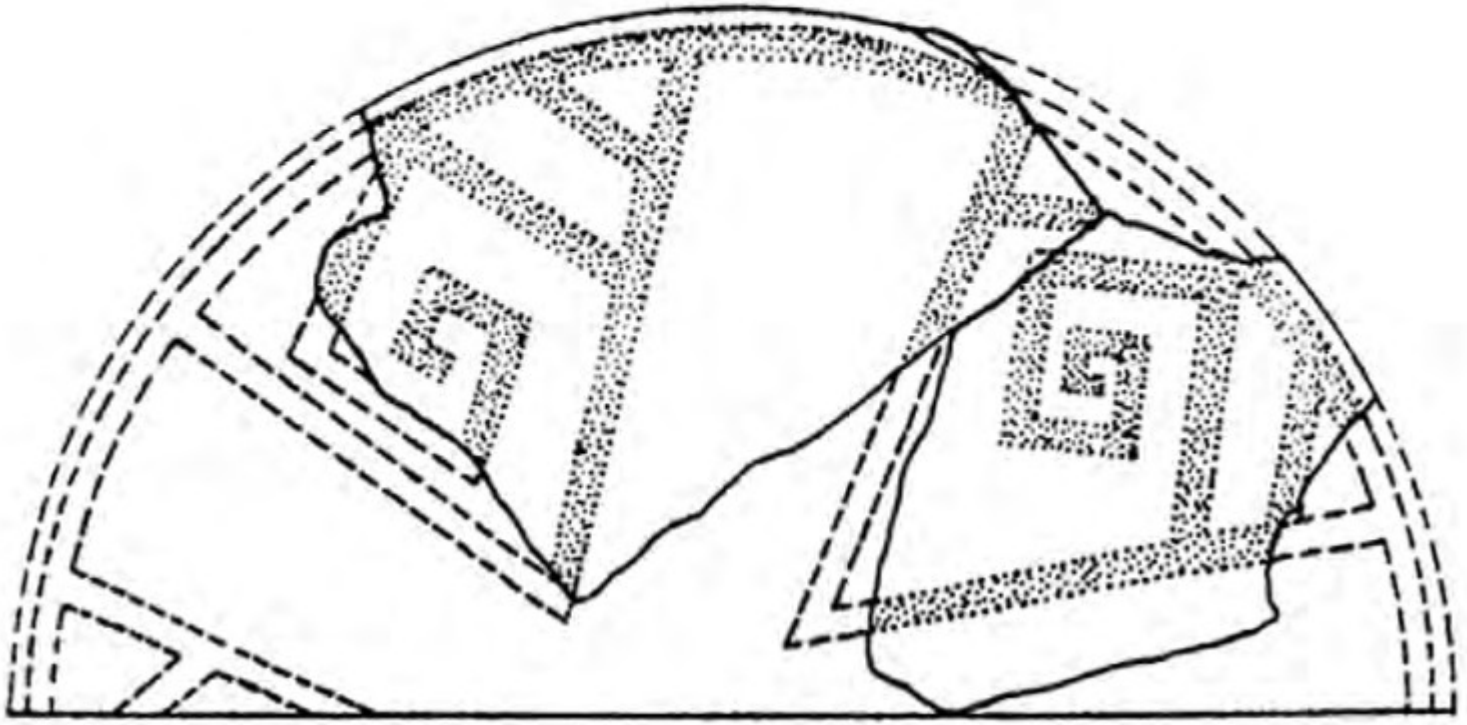
colour	sine tone spectrum of three partials
branching level	duration between sound grains (inter onset duration)
pendant length	duration of each sound grain (relative to inter onset time)
pendant attach (verso or recto)	pan position left or right channel
pendant ply (S or Z)	envelope shape (audible as “inversion effect”)
unknown values	are usually interpreted as neutral (pan) or low (colour)

a woven artefact is a representation of it's own making

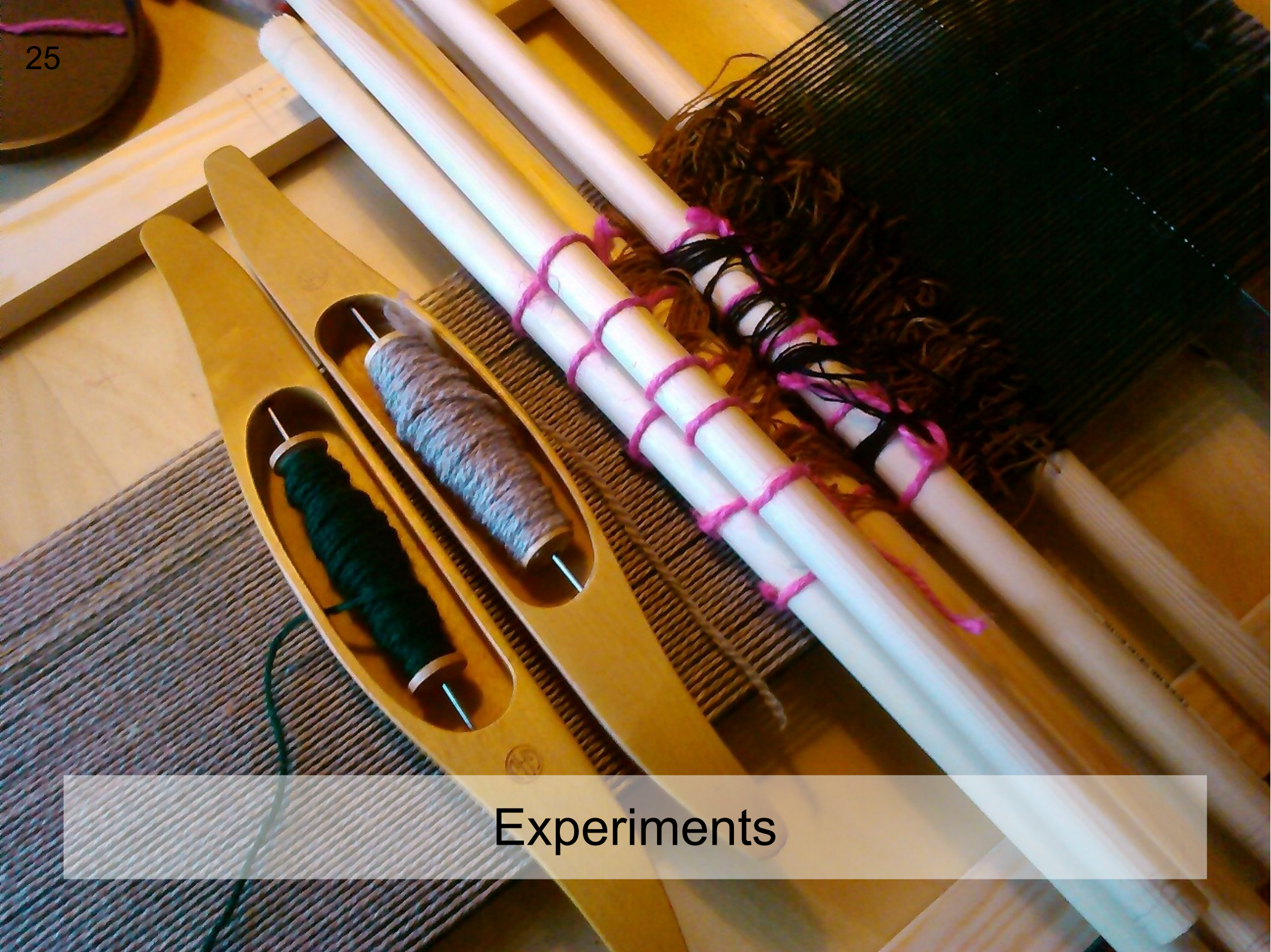
Hallstatt tablet weaving circa 800-400 BC


Direction of turns backward
Holes of the tablets
d
c
b
a
Direction of turns forward
Tablet-Number
1 2 3 4 5 6 7 8 9 10
Position of the weaver
Direction of thread-insertion
a
d
b
c
a
d
b
c
1 2 3 4 5 6 7 8 9 10 11 12

Hallstatt, ribbon No. 2 (reconstruction) 1

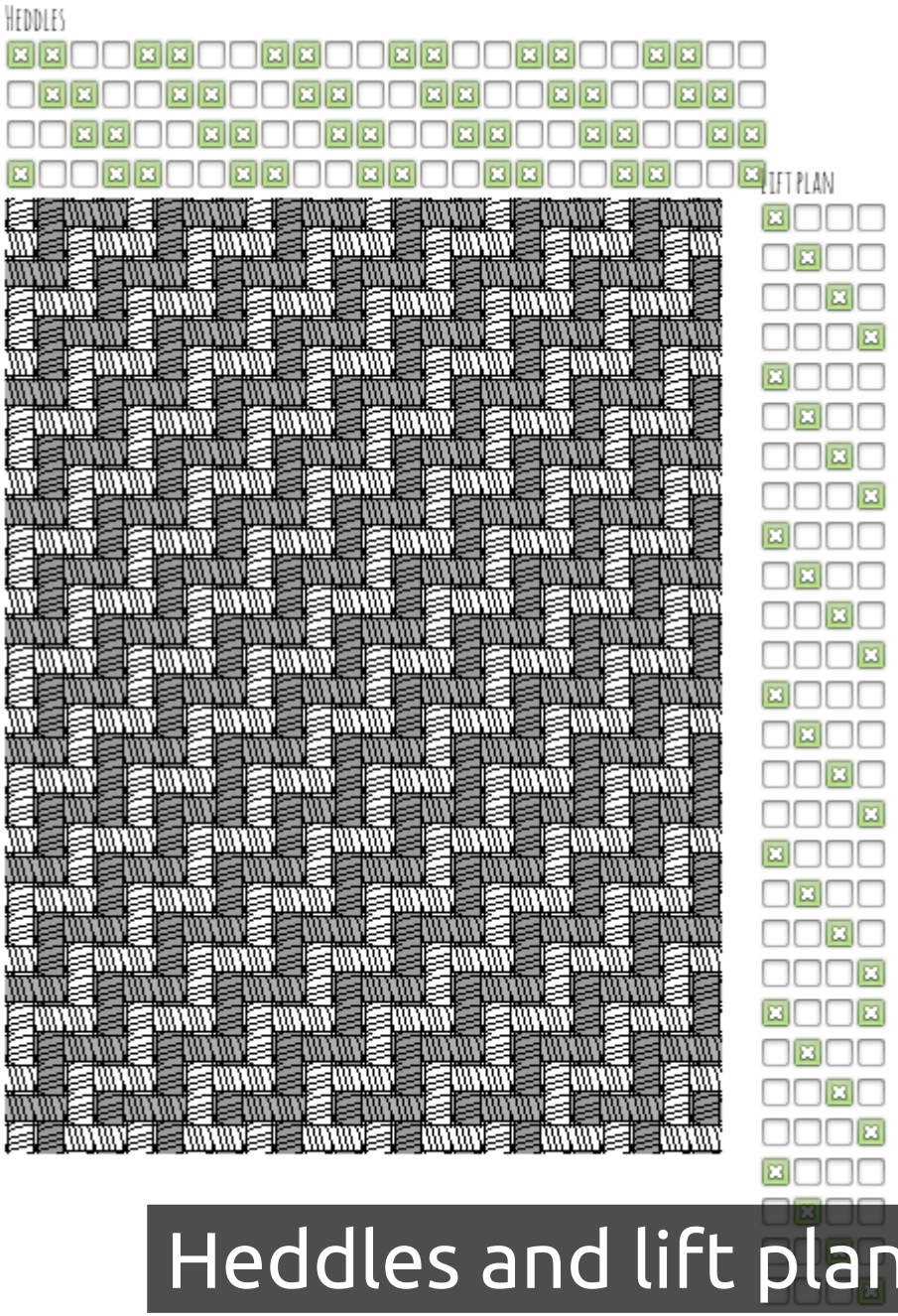


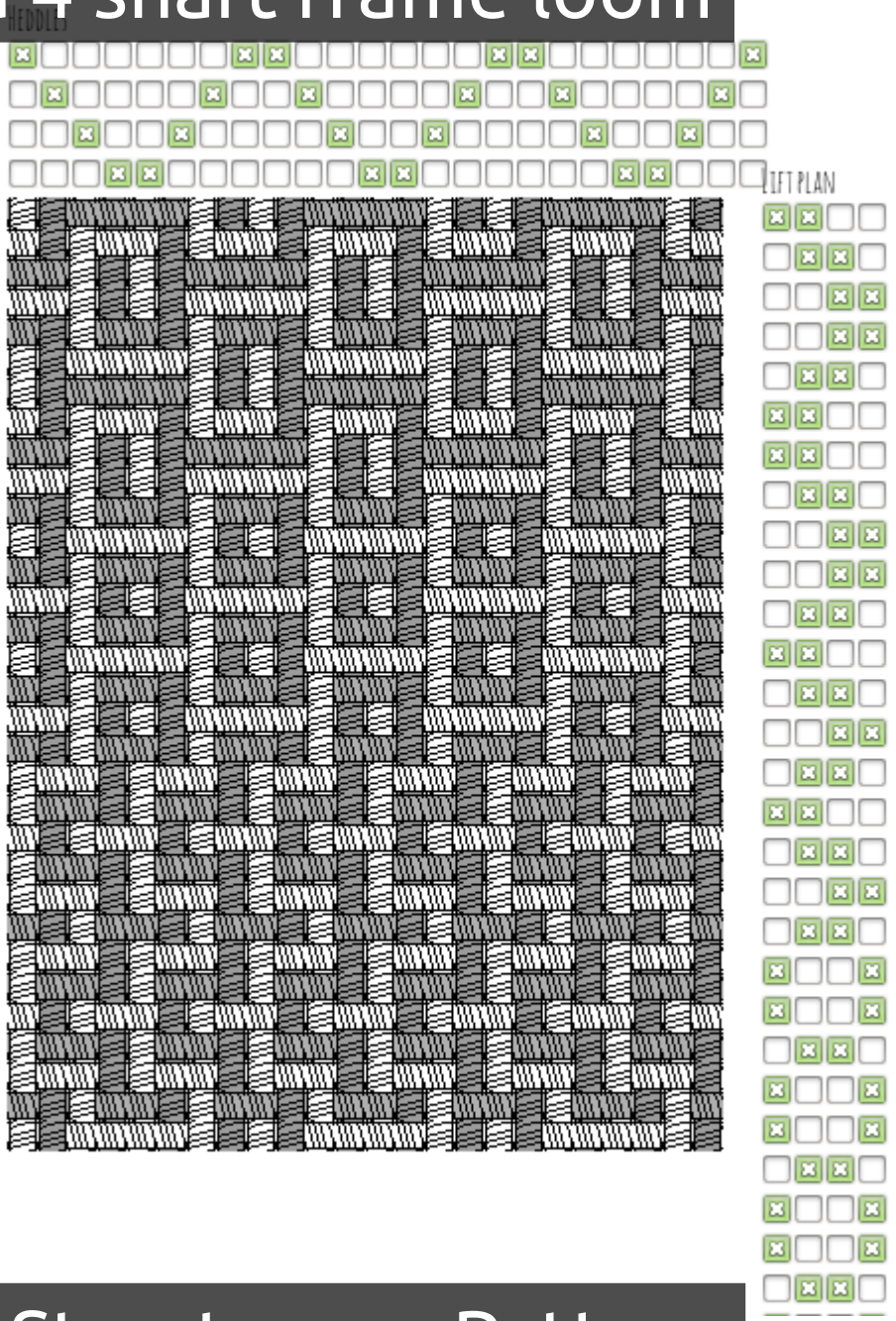
Ceramic vessel from Hoste, Slovakia for comparison with the pattern of ribbon No. 2 from Hallstatt. Both Hallstatt-Period (1: © K. Grömer. – 2: based on Griebl 1997)



Experiments

1. Start by modelling a 4 shaft frame loom

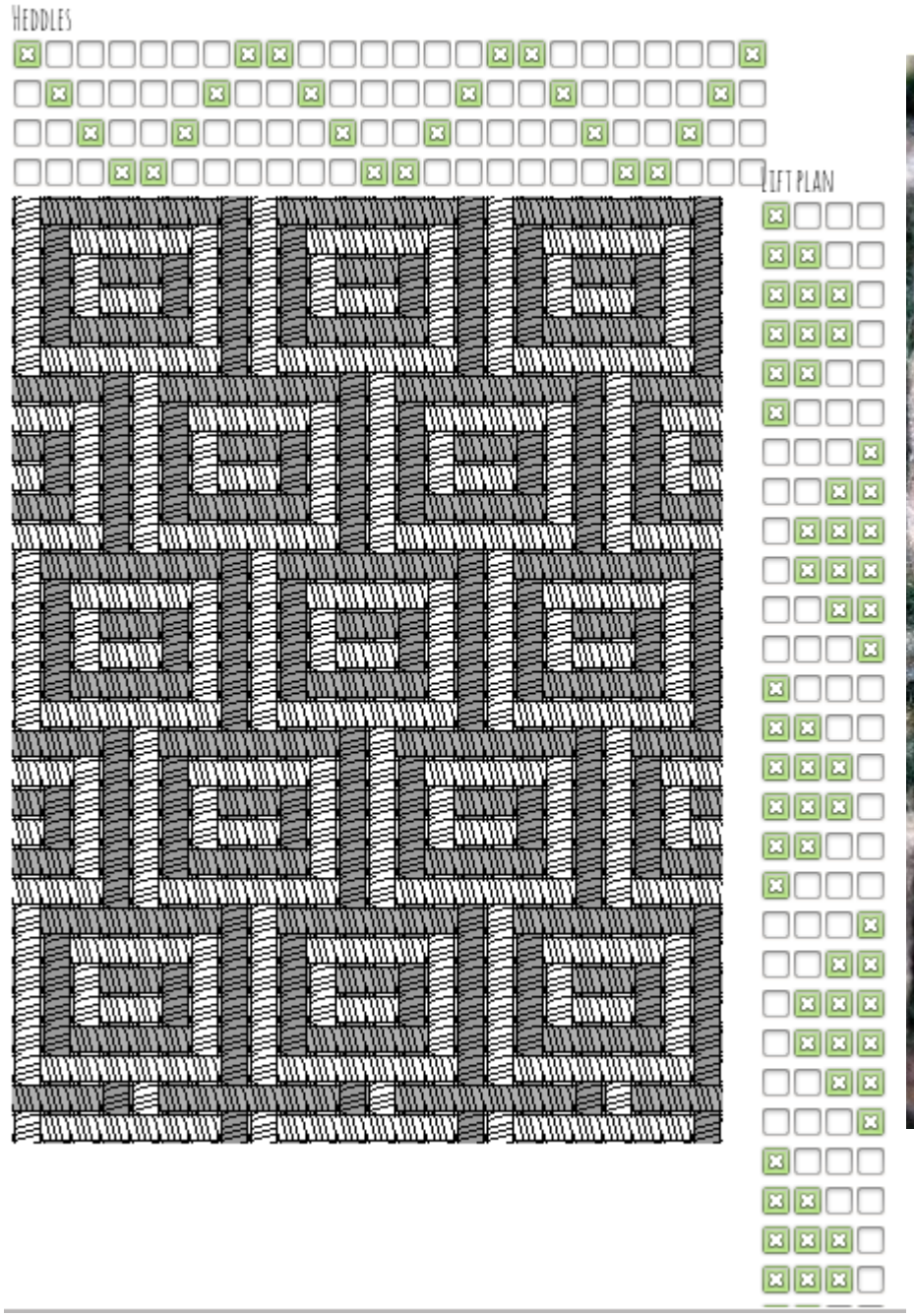




Heddles and lift plan → Structure → Pattern

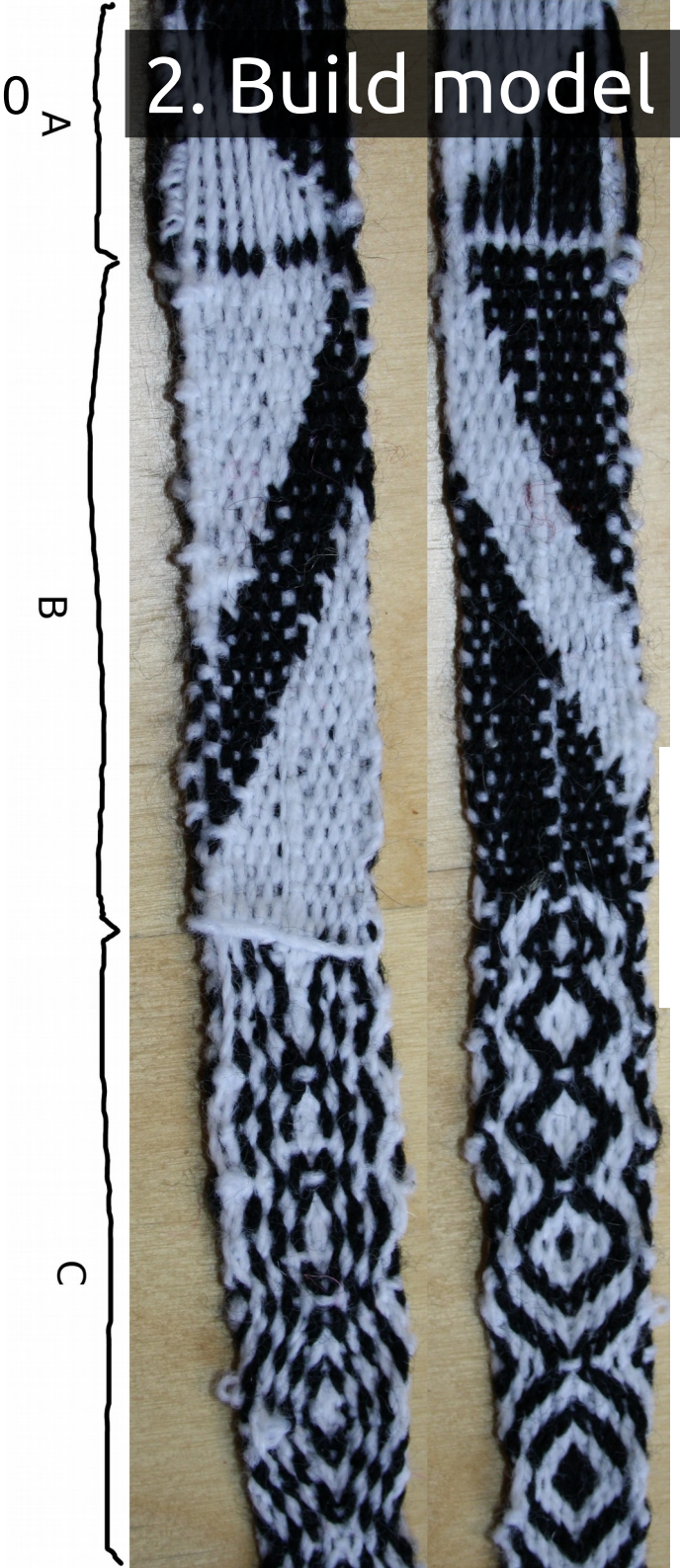
2. Building & warping a real one

3. Testing the model/hypothesis



Tablet loom
1. Start by learning to weave with tablets

2. Build model (and a language) from observation



```
(define (card-flip c)
  (list
   (flip (card-angle c))
   (card-b c) (card-a c)
   (card-c c) (card-d c)
   (card-memory c)
   (card-previous-memory c)))

;;      loom setup
;;  warp        weave
;;        ___
;; /----|o o|---####\
;; \----|o o|---####/
;;        ---

;; weaving (this took a while to figure out)
;;
;; turn   f    f    f     b    f     b     b
;; top->  a[b] d[a] c[d] [d]a  c[d] [d]a [a]b
;; bot-> [d]c [c]b [b]a   c[b][b]a   c[b] d[c]

(define (card-weave c)
  (if (equal? (card-memory c) "f")
      (list (card-b c) (card-d c))
      (list (card-a c) (card-c c))))

(define (card-loom cards) (list cards))
(define (card-loom-cards c) (list-ref c 0))

(define (card-loom-all-forward c)
  (card-loom
   (map
    (lambda (card)
      (card-forward card))
    (card-loom-cards c))))

(define (card-loom-all-back c)
  (card-loom
   (map
    (lambda (card)
```

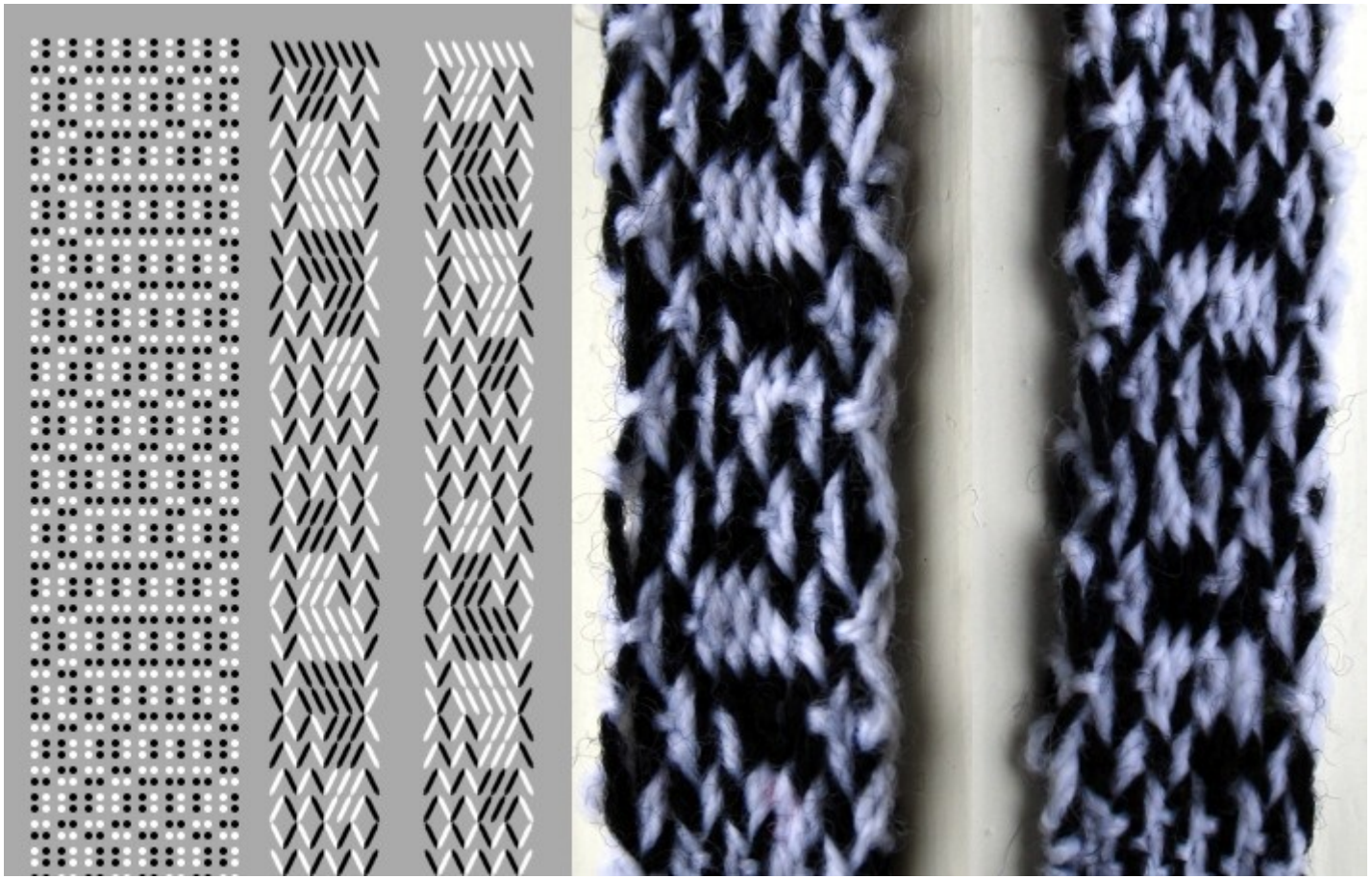
3. Testing the language/model hypothesis

Language

Model

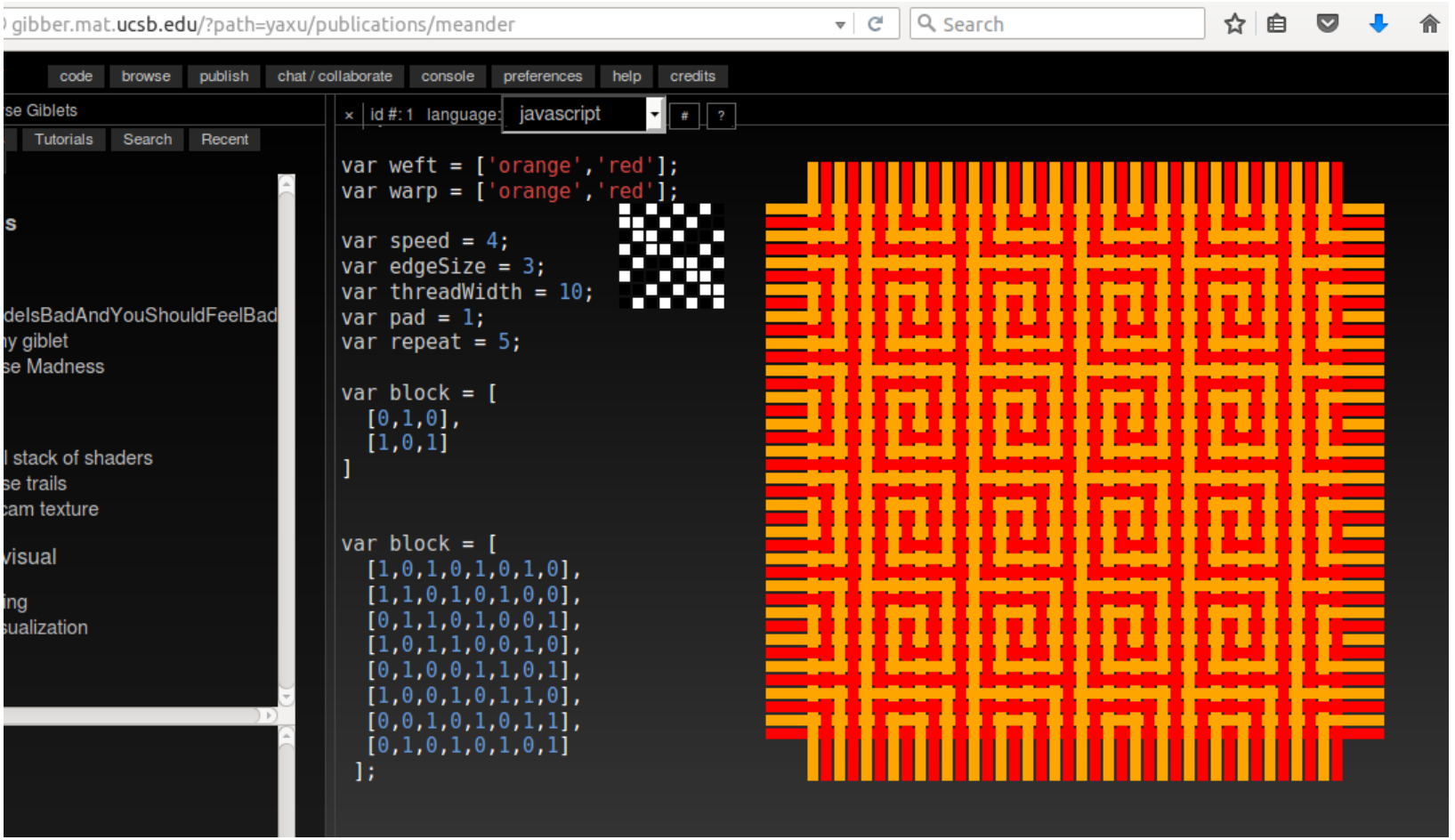
Weaving

```
(weave-forward 1)
(twist 0 2 4 6)
(repeat 4
  (twist 3)
  (weave-forward 4)
  (twist 5)
  (weave-back 4))
```



simulating weaves

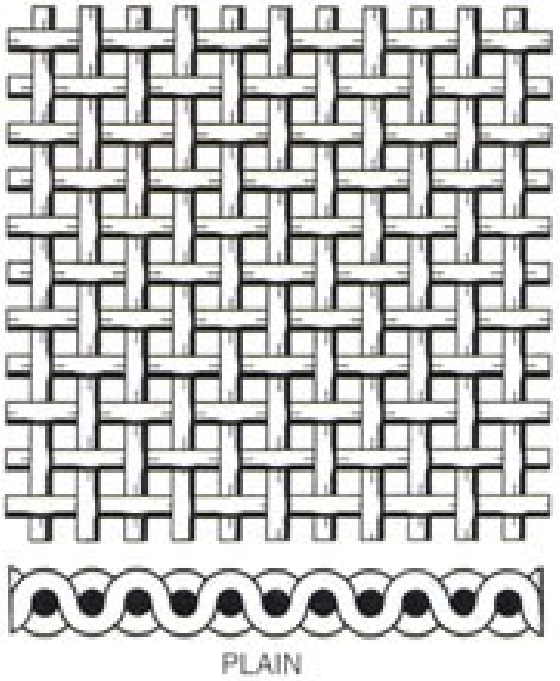
draft plan → weaving sketch

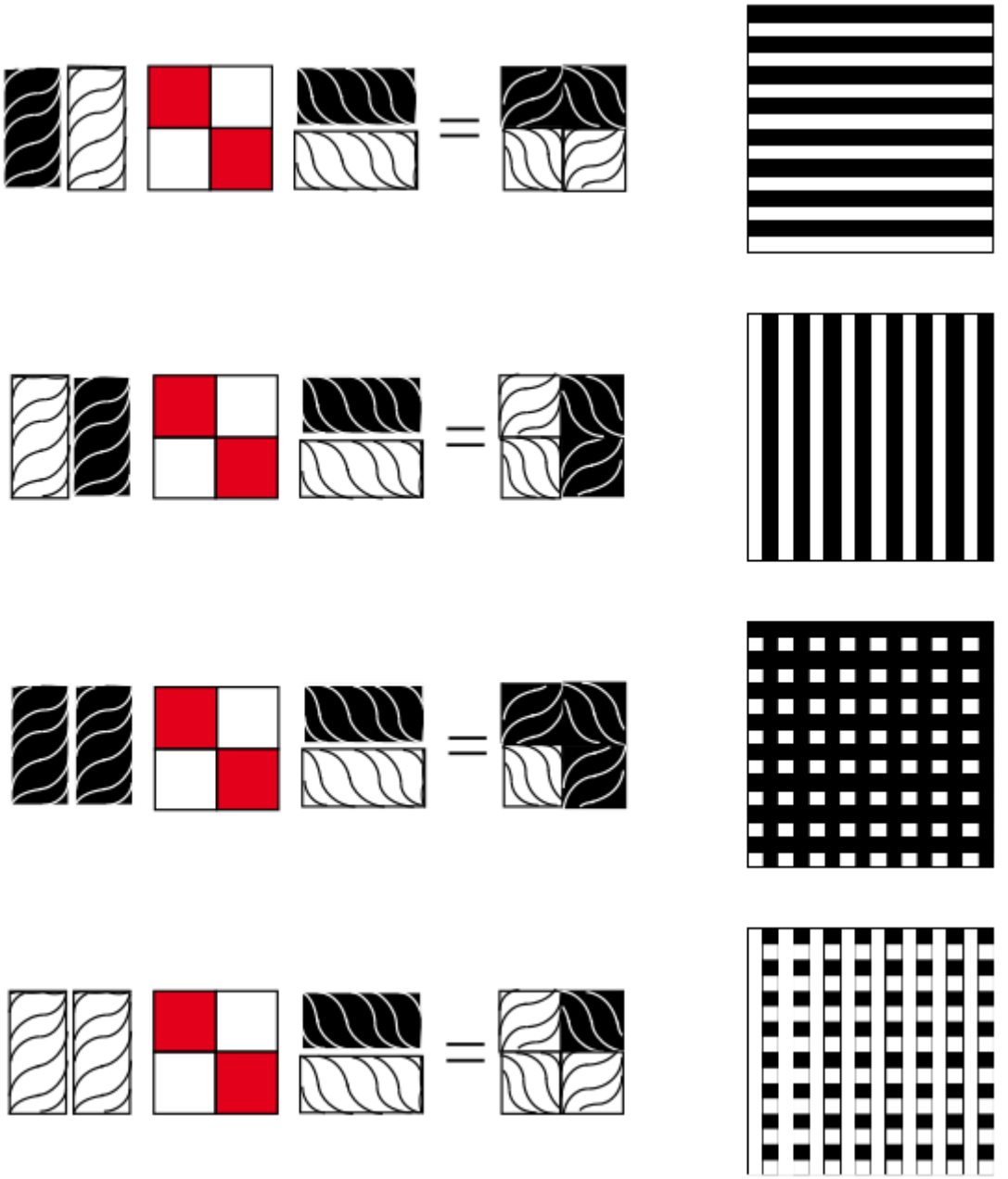


http://gibber.mat.ucsb.edu/?path=yaxu/publications/meander

Tabby weave:

0 1 0 1
1 0 1 0
0 1 0 1
1 0 1 0



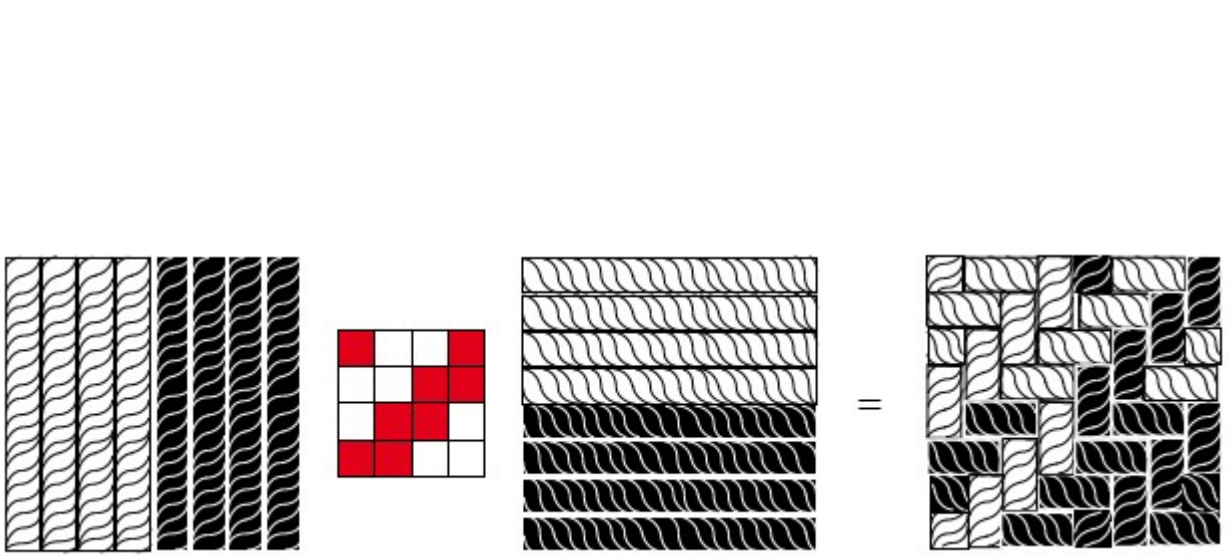


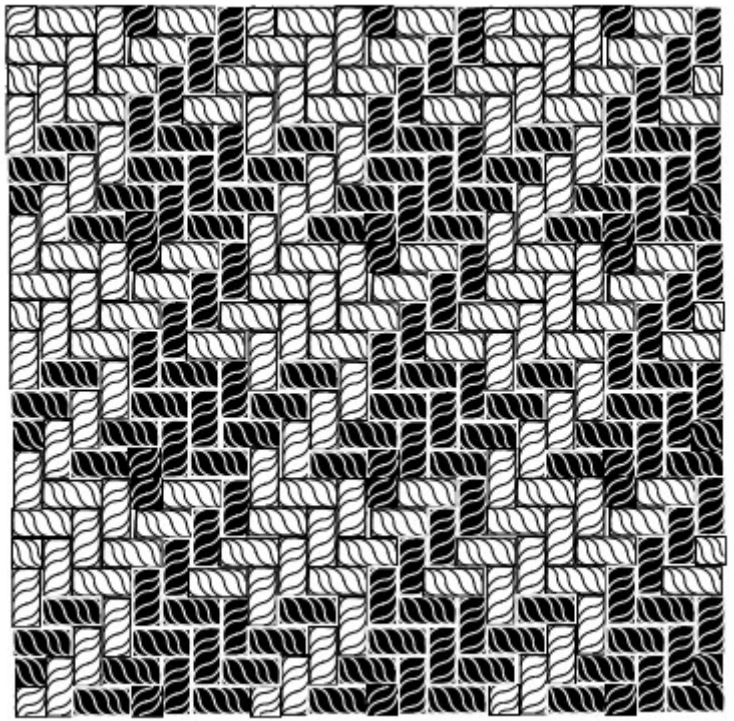
Twill (1:3):

0 0 0 1
0 0 1 0
0 1 0 0
1 0 0 0

Twill (2:2):

1 0 0 1
0 0 1 1
0 1 1 0
1 1 0 0

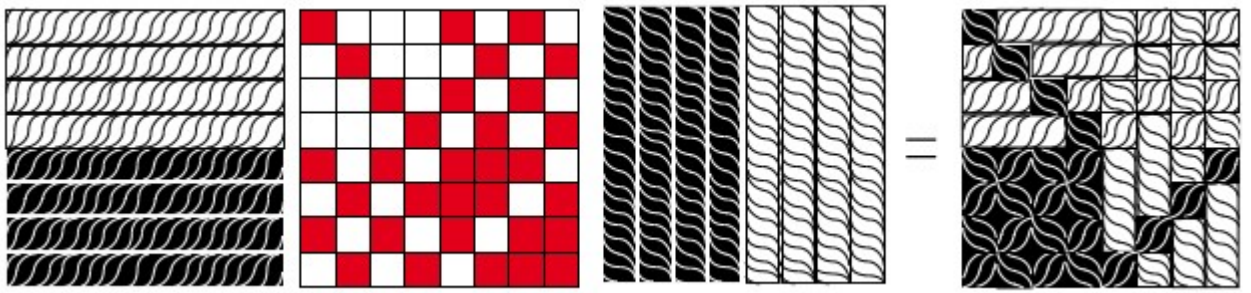




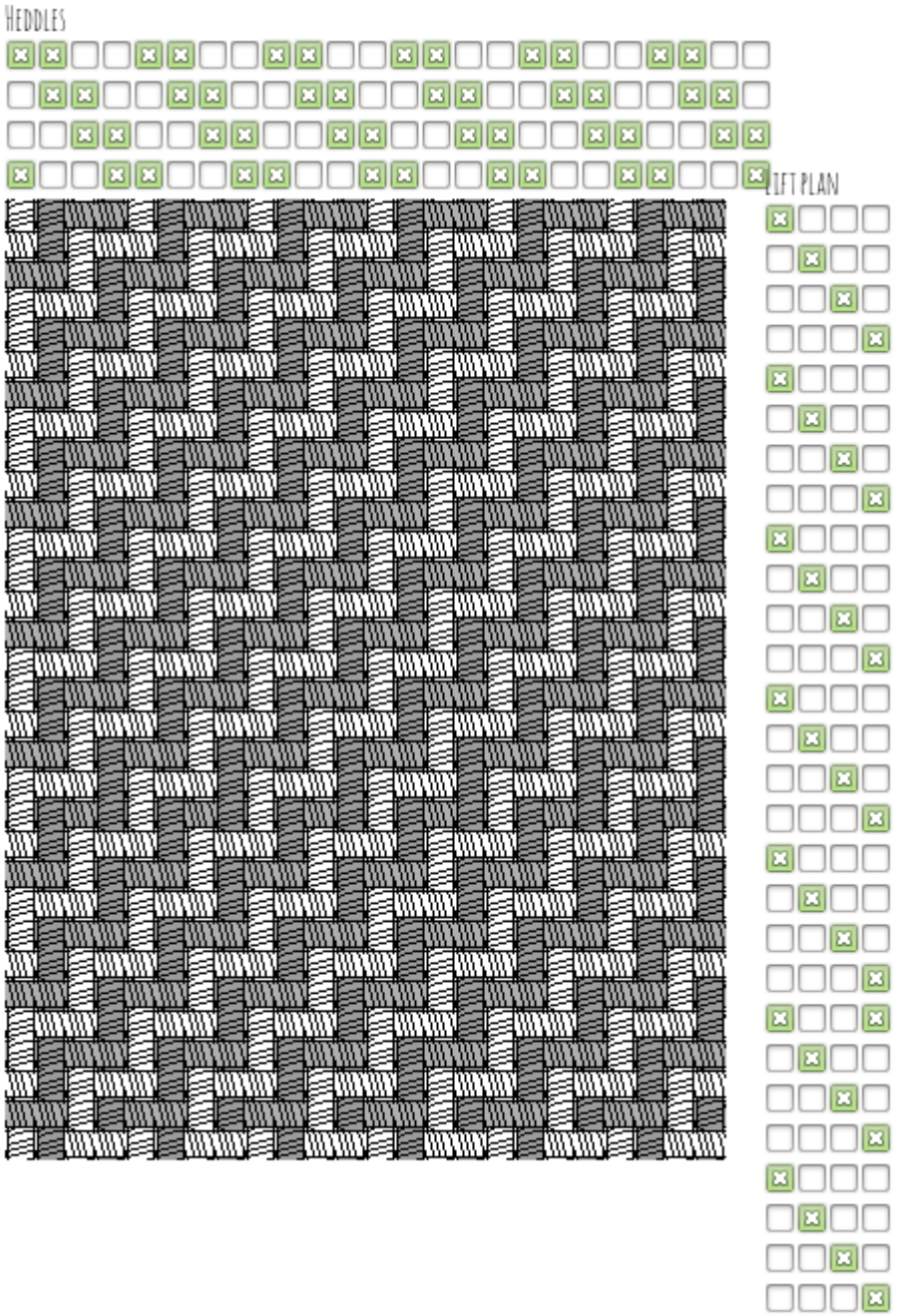
Mix:

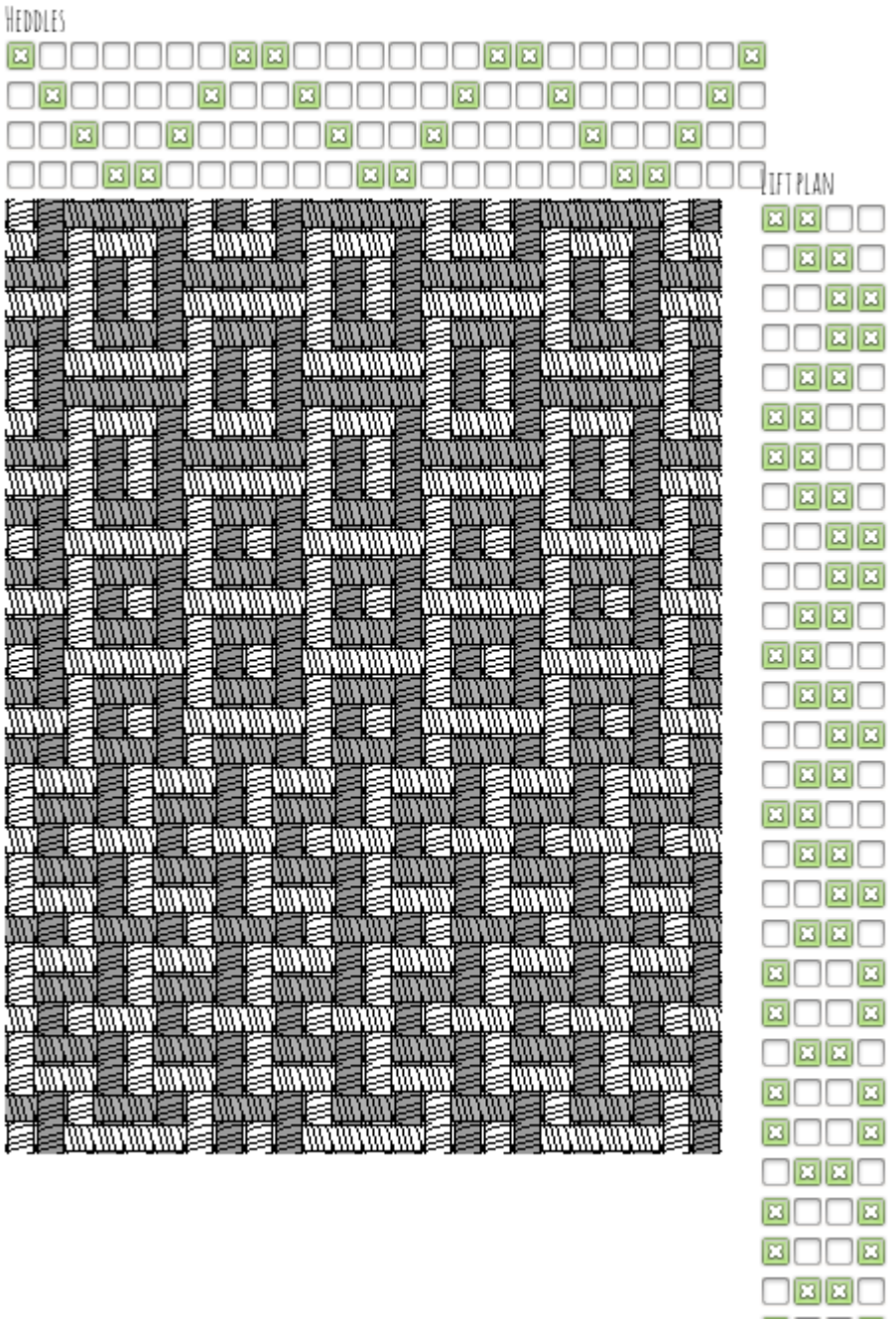
1 0 0 0 1 0 1 0
0 1 0 0 0 1 0 1
0 0 1 0 1 0 1 0
0 0 0 1 0 1 0 1

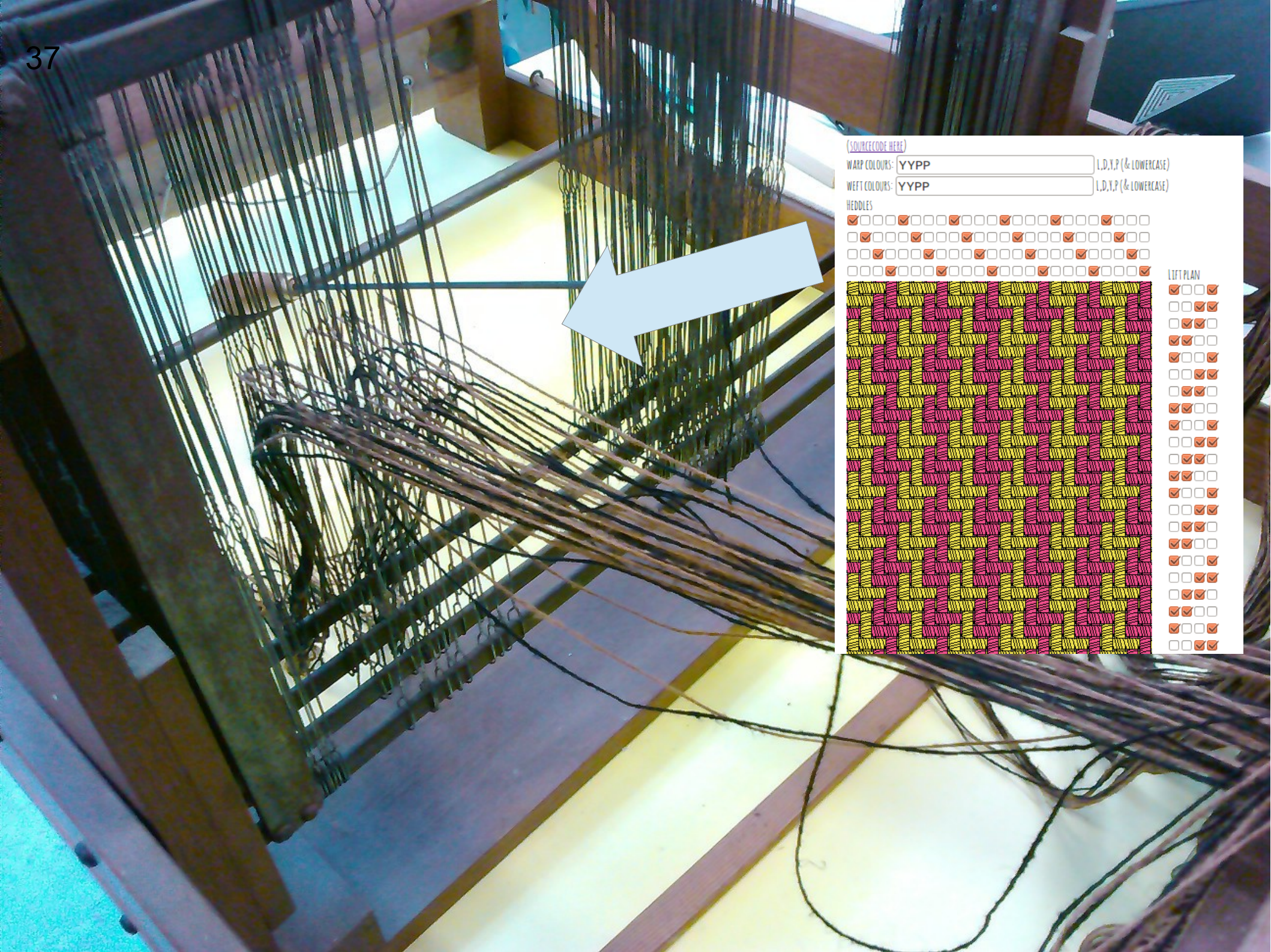
1 0 1 0 1 1 1 0
0 1 0 1 1 1 0 1
1 0 1 0 1 0 1 1
0 1 0 1 0 1 1 1

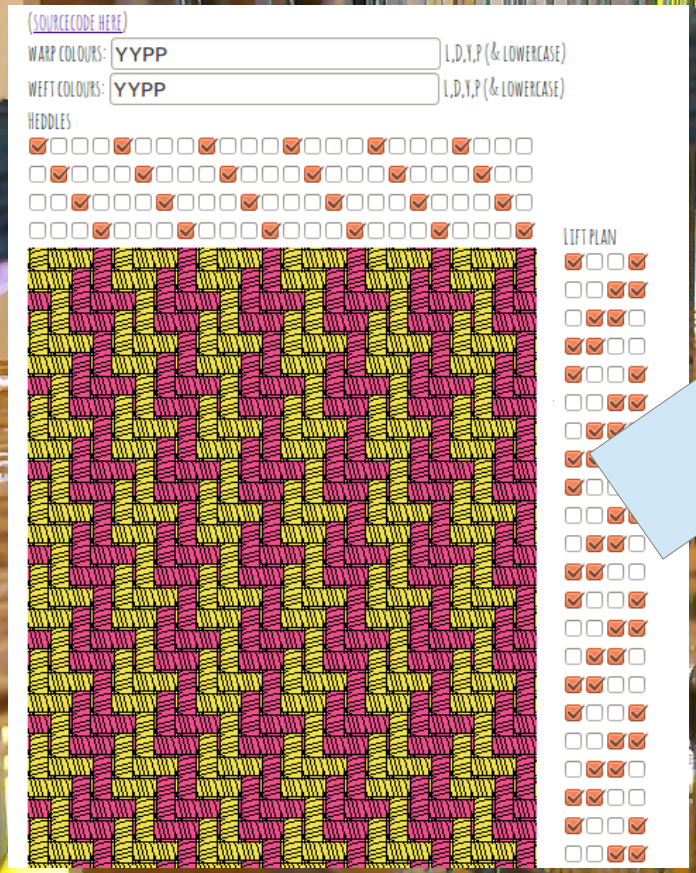


4 shaft loom simulation
http://dyadic.borrowed-scenery.net/






(SOURCECODE HERE)
WARP COLOURS: YYPP L,D,Y,P (& LOWERCASE)
WEFT COLOURS: YYPP L,D,Y,P (& LOWERCASE)
HEDDLES
LIFT PLAN

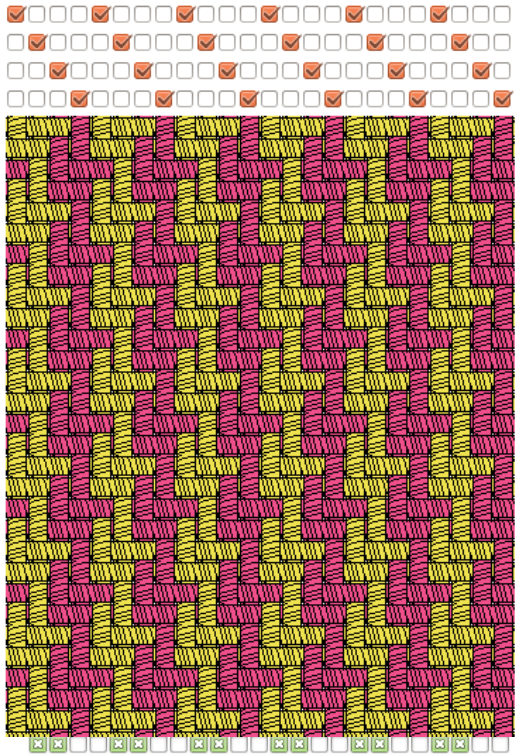

(SOURCECODE HERE)
WARP COLOURS: YYPP
L,D,Y,P (& LOWERCASE)
WEFT COLOURS: YYPP
L,D,Y,P (& LOWERCASE)
HEDDLES
LIFT PLAN

(SOURCECODE HERE)

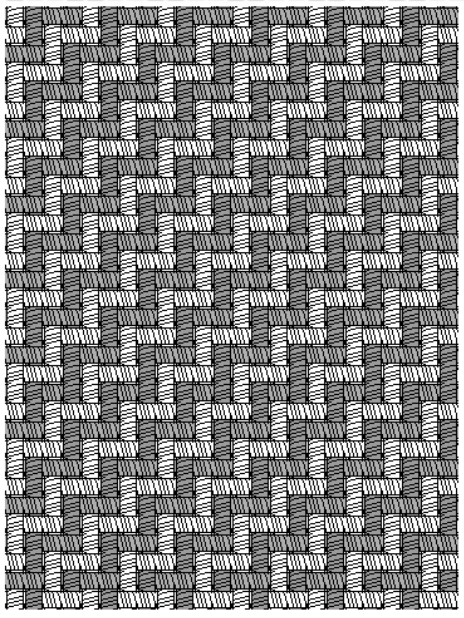
WARP COLOURS: YYPP L,D,Y,P (& LOWERCASE)

WEFT COLOURS: YYPP L,D,Y,P (& LOWERCASE)

HEDDLES



LIFT PLAN



LIFT PLAN

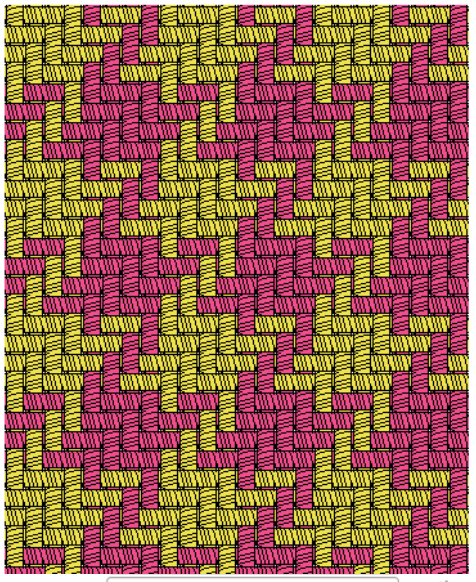
(SOURCECODE HERE)

WARP COLOURS: YYYYPPPP L,D,Y,P (& LOWERCASE)

WEFT COLOURS: YYYYPPPP L,D,Y,P (& LOWERCASE)

HEDDLES

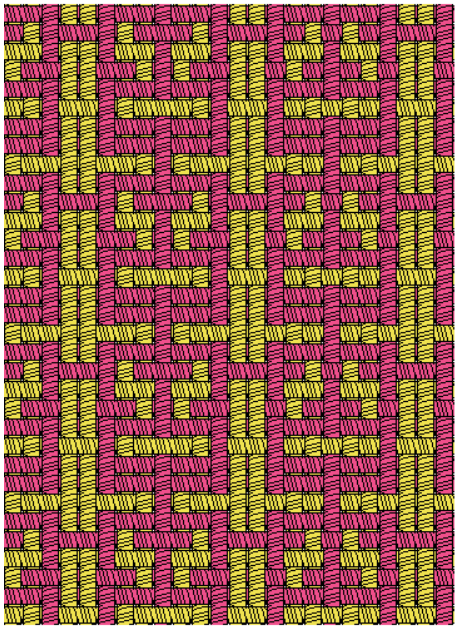
LIFT PLAN



WEFT COLOURS: PPY L,D,Y,P (& LOWERCASE)

HEDDLES

LIFT PLAN



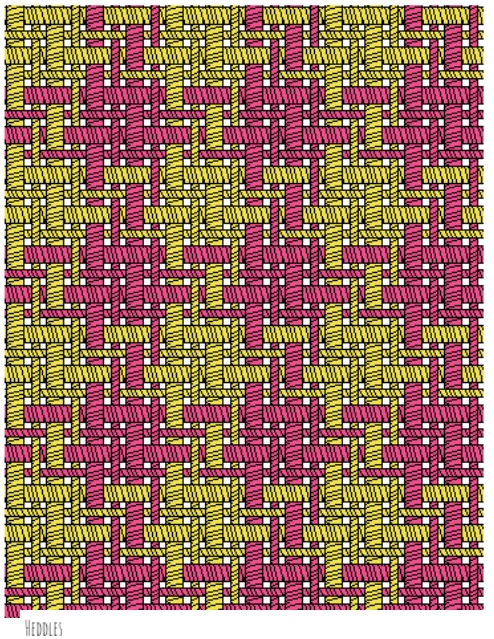
(SOURCECODE HERE)

WARP COLOURS: YyYyPpPp L,D,Y,P (& LOWERCASE)

WEFT COLOURS: YyYyPpPp L,D,Y,P (& LOWERCASE)

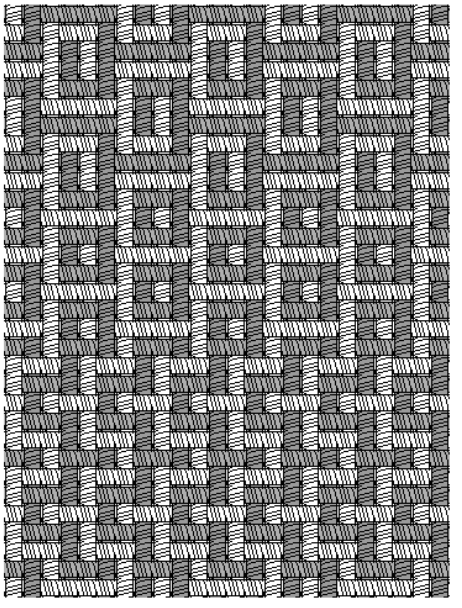
HEDDLES

LIFT PLAN



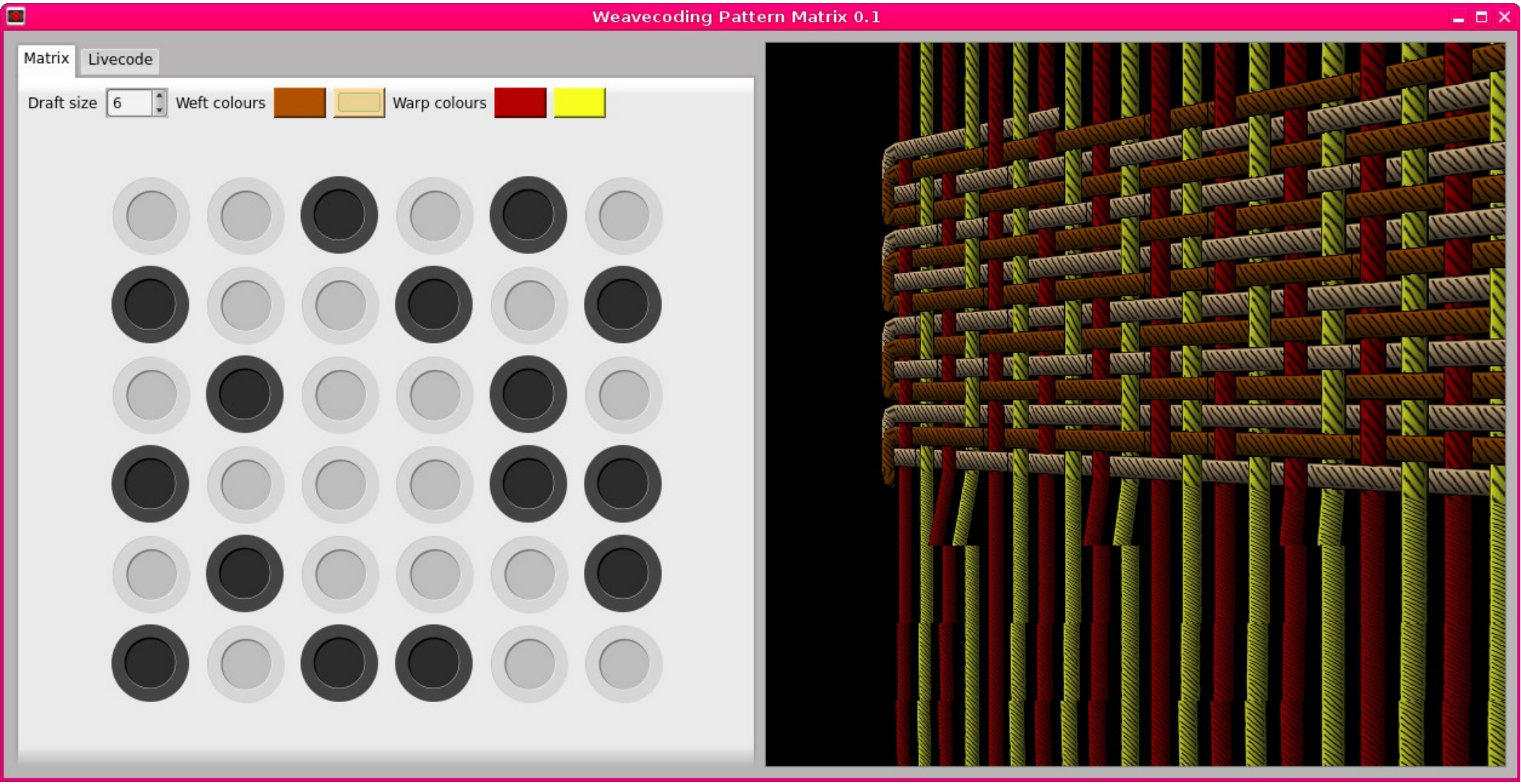
HEDDLES

LIFT PLAN



Pattern Matrix: Warp weighted loom simulation

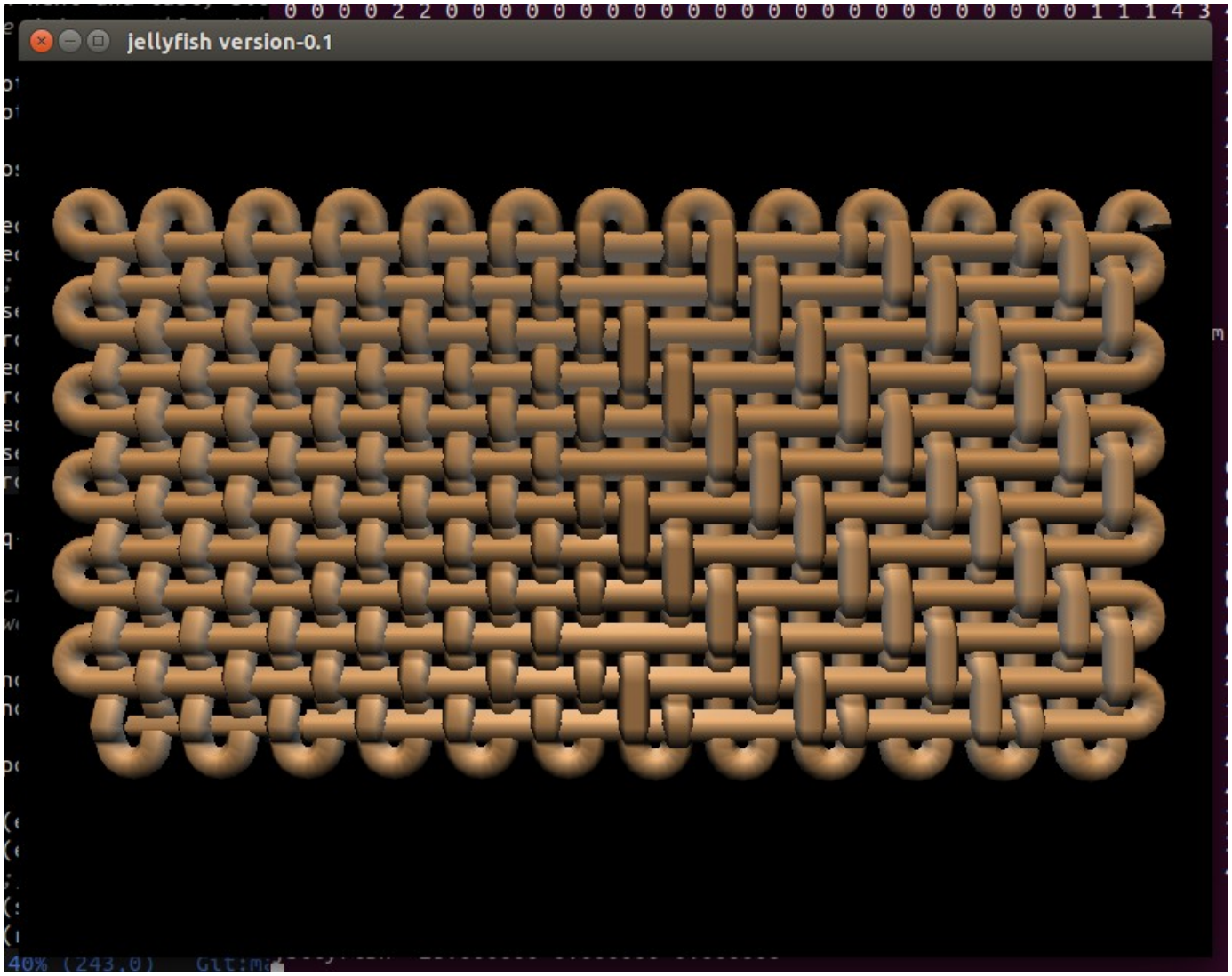
Warp weighted loom simulation



http://www/pawfal.org/dave/files/pattern-matrix.zip
(OSX binary)

Future stuff: a weaving modelled as a single thread

(needed to model ancient greek techniques)




```
warp 12 24 ++ [TurnIn] ++ threadWeftBy'' Odd (rot 3)
([Over,Under]) 12 12 ++ threadWeftBy'' Odd (rot 3)
([Over,Over,Under,Under]) 12 12
```